**UNIVERSITY OF EDUCATION, WINNEBA**

**COLLEGE OF TECHNOLOGY EDUCATION-KUMASI**

# ASSESSING THE IMPACT OF THE AMATROL TRAINING PROGRAMME ON TEACHING AND LEARNING OF ENGINEERING IN POLYTECHNICS IN GHANA:

## (A CASE STUDY OF TAKORADI POLYTECHNIC)

**MOHAMMED OKOE ALHASSAN**

**NOVEMBER, 2016**

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**(7141220005)**

**A Dissertation in the Department of Mechanical Technology, Faculty of Technical and Vocational Education, submitted to the School of Graduate Studies, University of Education, Winneba in partial fulfilment of the requirements for award of the Master of Technology Education (Mechanical) degree.**

**NOVEMBER, 2016**

# DECLARATION

## STUDENT'S DECLARATION

I, Mohammed Okoe Alhassan declare that this Dissertation with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my own original work, and it has not been submitted, either in part or whole, for another degree elsewhere.

SIGNATURE:.....

DATE:.....

## SUPERVISOR'S DECLARATION

I hereby declare that the preparation and presentation of this work was supervised in accordance with the guidelines for supervision of Dissertation as laid down by the University of Education, Winneba.

NAME OF SUPERVISOR: DR. EMMANUEL SYLVESTER DUODU AFRIFA

SIGNATURE:.....

DATE:.....

## ACKNOWLEGDMENT

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## DEDICATION

I dedicate this work to the Almighty Allah for keeping me through the years of my course, with his protection, guidance, and support.

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## ABSTRACT

The research looked at the impact of the AMATROL Training Programme on teaching and Learning of Engineering in Polytechnics in Ghana (with Takoradi Polytechnic as a case study) since its introduction from 2012. The objectives were to examine the perception of students and lecturers towards the AMATROL Training Programme; to identify the challenges, associated with the use of the AMATROL Training Programme, to the students and the lecturers and to identify the benefits AMATROL Training Programme brings to the students and lecturers in their learning and teaching respectively. Random sampling and stratified sampling techniques was employed to select the students and lecturers. A structured questionnaire was developed, pretested and administered to a sample of 280 and 25 in respect of students and lecturers respectively. Descriptive statistics was used to analyse the data. The study showed that both students and lecturers accept the Training Programme as good for engineering training. The study also found out that there was inadequate time allocated for the AMATROL Training Programme. More Technicians are needed to be engaged to support the lecturers, since most lecturers find it difficult without the help of technicians in using the laboratories for teaching. The study further showed that the laboratories were not fully utilized in training programmes for students and could therefore be used for training those in the industries as well. Based on the findings from the study, it is recommended that for the AMATROL Training Programme to be more effective there is the need to increase the contact hours' students spend on the programme. Technicians and Lecturers who are engaged in teaching using the AMATROL should be encouraged with better attractive motivational packages. Furthermore, Government must enact a policy to involve all the Polytechnics involved in technical training to adopt AMATROL Training Programme for training engineering students.

# CHAPTER ONE

# INTRODUCTION

This chapter explains what the problem is and why it is important to assess the impact of the Automated Machines Control (AMATROL) Training Programme on teaching and learning of Engineering in Polytechnics in Ghana. It covers the background of the study, the statement of the problem, the purpose of the study, objectives of the study, the research questions, and significance of the study, limitations of the study, delimitations and the organisation of the Study.

## 1.1 Background of the Study

For a country to industrialize there is the need to develop the human resources that are gained through technical and vocational training to satisfy the needs of the labour market (Antwi, 1992).

A country's economic growth depends on the positive drive of its industries engaging graduates with practical technical skills. For this reason competency based training should be given much priority in our technical educational system in Ghana. Avoiding competency training in our education will only give way to incompetent graduates with no skills to work in the industries and eventually affect the quality of graduates to boost the productivity of the industries, hence the economy will grow negatively and poverty could set in.

The industries perception about the fresh graduates from the training institutions is that, the graduates are not competent enough to fit into the job market straight away (Van-Adams, 2007). This calls for re - training of these graduates if only they are to be employed to work in the industries.

When human skills and talent are developed to a high degree, it increases the production of goods and services with resultant effect of creation of wealth.

Technology is one of the tools that human beings use to stimulate productivity and a country that fails to recognize the essential role of science and modern technology in the socio-economic transformation of the nation, cannot escape the clutches of poverty (Afeti, 1998).

Developing countries (such as Ghana) are grappling with several problems in the era of technological advancement. Skilled human resource has been identified as a means through which some of these problems can be solved. The Polytechnics in Ghana like the School of Engineering of Takoradi Polytechnic can contribute immensely in solving this problem by training the students with human technological skills. However, the performance (theoretical and practical) of graduates of the School has been assessed as inadequate according to reports from the Accreditation Board (NABTEX) between (2012 to 2015). Hence, there is the need to improve students' performance, so that they can live-up to the expectations of society and industry. Ways must be found to solve problems of poor performances and unskilled students of the School of Engineering, Takoradi Polytechnic and other Polytechnics so that they can contribute their quota to the economy growth of this nation.

The word 'training' is covered with many definitions. Distilling all of them, one can say that training means to guide or lead a person in the process of growth and development.

It is a dynamic process which leads to a change, improvement and greater competence helping the trainee to become more effective in daily tasks. ''Training therefore, may have many goals which will include reduced learning time, better performance, reduced supervision and standardization to increase high levels of performance, efficiency,

economic use of materials and equipment, filling manpower need, better management and organizational stability and flexibility" (Ahuja,1988;145-147).

Most people believe that training institutions have the responsibility to the world of work. Therefore, a curriculum that fails to meet this objective of facilitating entry into a job or an institution of higher learning will have little or no social support.

Within this context the University Rationalization Committee (URC) proposed a reform to cover a significant expansion of the Tertiary Education System in Ghana in order to meet the demands of school learner's needs of employers.

The expansion was to be achieved firstly by upgrading certain existing post-secondary institutions to polytechnic or university college status. Secondly, it is to considerably increase enrolment in tertiary education (Girdwood, 1999).

One of the aims of government in running tertiary programmes at the polytechnic is to fill the gap of middle level human resources with people who have been groomed with an interplay of equal levels of both cognitive psychomotor skills thereby developing and industrializing the nation with better level of human capital to form a viable work force that is strong, energetic and skilful enough to stand, sustain and face the future challenges of society. This goes to confirm what Napier (2000) cited in Harbison (1973) that, 'human resources development is a process of increasing the knowledge, skills and competence of all people in the society'.

Takoradi Polytechnic started as Takoradi Technical Institute and it admitted its pioneer student trainees in 1955. The pioneer students at that time pursued courses in construction crafts, engineering crafts, cookery, dressmaking and commercial subjects among others. In 1959, the Advanced / final crafts course of some of the courses were introduced together with the ordinary national certificate course in building. Other technician courses followed after this period. By the early 1960s the basic technician

courses like the General Course in Construction, General Engineering were started leading to the technician series certification awarded by the City and Guilds of London Institute (CGLI). The institution could be said to have gone through certain stages in its development to date. The first stage of development is the period between 1955 and 1958.

From 1959 various Advanced crafts and other technician courses were also developed. The second stage of the development is the period from 1972 to 1992. The ordinary crafts courses were removed from technical institutes and emphasis during this period was centred on the advanced and technician courses at the Polytechnics.

The third stage of the development started in the years of 1992/1993 session, during which the Ministry of Education formally declared the Polytechnics as tertiary institutions. Following the promulgation of the Polytechnic law (Act 745), most of the original programmes in the Polytechnics have subsequently been upgraded to Higher National Diploma (HND) level. The Polytechnics which are currently running the HND engineering programmes are Accra, Cape Coast, Ho, Kumasi, Sunyani, Takoradi and Tamale. In Takoradi Polytechnic, the programmes include Mechanical Engineering, Building Technology, Furniture Design, Electrical and Electronic Engineering and Civil Engineering.

It is believed that the polytechnic graduates have a major role to play in the development of infrastructure, maintenance of equipment and imparting acquired knowledge of skills to the younger generation. The government's new intervention has replaced the previous non – tertiary vocations that were mainly geared towards the achievement of technician certificate at the polytechnics. Holders of this technician certificate cannot adequately withstand or face the challenges of the present technological advancement. It is therefore imperative that lectures and authorities at the

polytechnics look out for effective ways of enhancing and improving student performance on practical engineering works by using intensive and extensive training methods to buttress their motor skills.

Hence the introduction of the Automated Machines Control (AMATROL) Training Programme in the Mechanical and Electrical Engineering Departments of Takoradi and Kumasi Polytechnics in Ghana on pilot basis in 2012. The Researcher being part of the pilot AMTROL Training realised the need to make an in-depth investigation into how the AMATROL Training Programme has had an impact on teaching and learning in the Mechanical and Electrical Engineering Departments of Takoradi Polytechnic since its introduction in 2012.

**1.2 Statement of the Problem**

The introduction of the Automated Machines Control (AMATROL) Training in Ghana is said to be the first outside the United States of America. Fortunately, the first training modules have been installed (June to August, 2012) in the Mechanical and Electrical Engineering Department of Takoradi Polytechnic for training engineering students. Similar training modules have also been installed at Kumasi Polytechnic's Engineering Department.

The training modules where introduced to help develop competent individuals with transferable skills, link education and training to skills needed by the employer among others. The AMATROL training has been developed into a Programme which is used to impact practical engineering laboratory skills. It has been running on pilot basis since 2012 till date to train engineering students (Mechanical and Electrical).There has, however, not been any study to investigate the impacts. In the light of this, there was the need for the research to ascertain its likely impact on teaching and learning on

Polytechnic (Takoradi Polytechnic) Engineering Education generally and specifically on the lecturers and students.

### 1.3 Purpose of the Study

The research was meant to investigate the impact AMATROL training programme has had in the polytechnic (Takoradi Polytechnic)on teaching and learning of Engineering since its introduction from 2012 to 2016.

### 1.4 Objectives of the Study

The study focused on the following specific objectives:

1. To examine the perception of students and lecturers towards the AMATROL Training Programme.
2. To identify the challenges associated with the use of the AMATROL Training Programme to the students and the lecturers.
3. To identify the benefits of AMATROL Training Programme to the students and lecturers.

### 1.5 Research Questions

These are questions used to look for information to enable the researcher make more investigation into the existing problems. Questions that will require answers for the analysis of the impact of the AMATROL training programme in the Polytechnic education are:

1. What is the perception of students and lecturers towards AMATROL Training Programme?
2. What are the challenges associated with the use of AMATROL Training Programme?

3. What are the benefits of AMATROL Training Programme to teaching and learning of Engineering Programmes?

### 1.6 Significance of the Study

The results of the study add to the stock of knowledge already established in the area of study and will:

- Be useful to the Polytechnic Institutions since the research work will reveal a lot about the relevance of AMATROL Training Programme which is used by some of the institutions (Kumasi Polytechnic, Ho Polytechnic, Koforidua Polytechnic).
- Help the Ministry of Education, National Council for Technical Education (NTCE) and the Accreditation Boards (NAB, NABPTEX) to be aware of the strengths, weaknesses and the impact of the AMATROL training programme in training engineering students and whether this approach of teaching practical skills should be adopted in all the Polytechnics involved in engineering training as they change to Technical Universities.

### 1.7 Limitations of the Study

The following affected the results of the study:

- Since the researcher is on the sandwich programme, combining research work with lectures was tedious and time consuming.

### 1.8 Delimitations of the Study

Though there are ten polytechnics in the country, to which four (Takoradi Polytechnic, Kumasi Polytechnic, Ho Polytechnic, Koforidua Polytechnic) are currently using the

AMATROL system, the researcher decided to restrict the study to the first Polytechnic (Takoradi Polytechnic) that started with the training programme.

### 1.9 Organization of the Study

Chapter one covers a general introduction to the study including aspects such as the background to the study, statement of the problem, purpose of the study, objectives of the study, research questions, significance of the study, limitations, delimitations of the study and the organization of the study.

Chapter two considers the relevant literatures of related works that have been carried out by other researchers on the topic area (both theoretical and empirical) to the study.

Chapter three discusses the methodology of the study. It focuses on the research design, population, sample and sampling technique, sources of data, instrumentation, data processing and analysis procedure.

Chapter four presents the result and findings of the study while Chapter five presents a discussion of the results and findings. Finally, Chapter six presents the summary, conclusions and recommendations of the study and suggestions for further research.

# CHAPTER TWO

# LITERATURE REVIEW

In this chapter, the researcher attempts to search for relevant information from documented data and sources on the subject matter of the study. It was envisaged that; the literature search would put the reader in a better perspective of the issues at stake to enhance better understanding. The various views from literature have been enumerated for consideration.

## 2.1 Polytechnic Education in Ghana

Successive Governments in Ghana from the pre-independence era till today have all emphasized the importance of formal education as a catalyst to rapid national development. Hence, the colonial government placed a premium on education, especially, technical education. This explains the establishments of technical institutes in the 1950s to train the needed technicians and technologists for the accelerated development of the country. It is worthy to note that, to meet the needs of the rapidly expanding railway lines and mining activities in Ghana, technical institutes were established in Accra, Takoradi and Kumasi.

In 1963, the Accra, Takoradi and Kumasi Technical Institutes were re-designated as Polytechnics. Two others at Tamale and Ho enjoyed the polytechnic status in 1984 and 1986 respectively. Cape Coast Polytechnic which was planned as a Polytechnic from inception was opened in 1986 (Nsiah-Gyabaah, 2005). These six second-cycle Polytechnics were elevated to tertiary status under the Polytechnic Law of 1992, without any upgrading in terms of facilities or staff. Later, in 1997, Sunyani and Koforidua Technical Institutes became a Polytechnic and enjoyed similar tertiary status. The establishment of Bolgatanga and Wa Polytechnics (in 1999 and 2000 respectively) ensured that there is a Polytechnic in each of the ten administrative regions of Ghana.

**Table 1: Polytechnic Institutions in Ghana**

| No | Region | Name of Polytechnic | Year Established |
|---|---|---|---|
| 1 | Greater Accra | Accra Polytechnic | 1963 |
| 2 | Ashanti | Kumasi Polytechnic | 1963 |
| 3 | Western | Takoradi Polytechnic | 1963 |
| 4 | Northern | Tamale Polytechnic | 1984 |
| 5 | Volta | Ho Polytechnic | 1986 |
| 6 | Central | Cape Coast Polytechnic | 1986 |
| 7 | Eastern | Koforidua Polytechnic | 1997 |
| 8 | Brong –Ahafo | Sunyani Polytechnic | 1997 |
| 9 | Upper East | Bolgatanga Polytechnic | 1999 |
| 10 | Upper West | Wa Polytechnic | 2000 |

### 2.1.1Objectives of the Polytechnics

The Polytechnic Law (PNDCL 321, 1992) has since 2007 been replaced by the Polytechnics Law (Act 745). This gives a clear mandate to the Polytechnics stating their aims and objectives as follows:

a. Provide tertiary education in the fields of manufacturing, commerce, science, technology, applied social sciences and applied arts, etc.

b. Provide opportunities for skills development, applied research and publication of research findings.

c. Encourage study in technical subjects at tertiary level. The above clearly indicates that the central focus of Polytechnic education is its career-oriented nature. The Polytechnic Law also gives legal backing to desirable changes in Polytechnic administration, course structure, grading, certification and staffing. The Polytechnics in Ghana now, have their own governing boards or councils and the right to design their own curricula, plan their management and development activities.

### 2.1.2 Process of teaching and learning of acquiring skills

Annor (1998) defined learning as the acquisition, retention and application of attitudes, skills and knowledge. He spells out five conditions necessary for learning to take place as follows: Readiness, Intelligence, Motivation, Mental Health and Effective Teaching. Effective teaching according to Annor (1998) includes the use of instructional aides to make material concerte, real and meaningful. This means that teaching must be made as practical as possible so that students can derive maximum benefits from the process. Products of polytechnics are being prepared for both self-employment and industry.

According to Roy (1994) the industry expects education to impart to students' practical skill base to meet the technological requirement of the new workforce. He says further that vocational education must provide this skills base by offering training that helps students to develop industry-verified competencies as well as the non-technical transferable skills that relate to higher order thinking and high performance like problem solving, team work and work place adaptability. This means that industry places emphasis on good training of the student. Training a student makes him to be equipped to meet the challenges of industry.

Provision, therefore has to be made for the learners to apply what they learn in theory class to real life situation.

Beane (1998) then says the focus of teaching is on empowering learners to construct new knowledge by providing opportunities for them to test academic theories through real-world application of knowledge in settings that are surely relevant to their lives.

Pisapia and Riggins (1997) say that their call for curriculum integration, the fusion of academic content into vocational programmes which they refer to as 'enhanced relevant' is achieved when students engage in learning experiences that are situated in real life contexts and that afford in depth understanding and the development of higher order thinking skills.

West and Watson (1996) say that the focus of all educational endeavours is the student learner. They continue by saying that problem-based learning models must reflect the changing external environment of the work place and society including curriculum designed to match with the environment. Such activities according to them encourage inter-departmental and inter-disciplinary cultural milieus which create positive energies for the faculty, student and business community.

Since the understanding of the student learner is a basic reason for instruction and the fact that without this understanding on the part of the learner all effort put into the educational process become a waste, a lot of strategies need to be adopted to achieve it. It would therefore be important to make use of educational technology in the instructional process to make learning easier for the student. Hopey (1998) says educational technology can serve as a means of supporting and enhancing instruction. He noted that educational technology can among other things improve educational attainment and skill acquisition motivate and sustain learning.

Burge and Roberts (1993) on the other hand say that technology does not determine learning outcome, neither does it teach students. Rather teachers in collaboration with learning, make the choices that determine learning outcomes and manage the teaching

and learning process. The role of technology according to Ehrmann (1998) therefore is to expand teaching techniques.

Gillespie and Glisson (1999) posit that educational technology has many advantages if properly used. He enumerated some of these advantages as: the ability to support new ways of teaching and learning by providing opportunities for more learner-centered instruction; permitting institution to be contextualized; allowing students to explore, make mistakes and learn from mistakes; learning to a more active and interactive modes of instruction; and it results in a greater collaboration, cooperation and small group work.

Koehler (1997) therefore, says that these characteristics if teaching and learning should be particularly attractive to vocational education. They must be frequently associated with good educational practices in those fields. According to him the key is using the technologies in ways that would enhance learning. Koehler (1997) finally says that educational technology must be accorded presence in the classroom in its own right and used in ways that maximize different strength what it has to offer. Ginsburg (1998) shows four basic approaches to integrate technology into learning which is also applicable to vocational education. These are:

- Technology as curriculum
- Delivery mechanism
- Instructional materials to compliment learning
- Instructional tools

Here, however, emphasis is on its use as an instructional tool. It is important to realize that the role of the teacher in the instructional process cannot be overlooked if any meaningful process would be made. This is because if all the materials are available

including educational technology materials and students are also eager to learn, it will still take a qualified and dedicated teacher time to help students to learn to acquire skills.

It is important also to realize that new methods of teaching are developed constantly indicating that the teacher must constantly upgrade his skills in teaching. A lot of changes are also taking place in industry and workplace. These changes also require continual and constant professional development of the teacher to upgrade his skills so that he can be abreast with the changing trends.

This is even more important to teachers who have degrees in teaching. If the professional teacher still requires training, then the non-professional teacher cannot fit into the teaching profession. According to them such real-world experience provides a basis from which teachers can begin to create student learning experience that is authentic and engage students in the use of complex reasoning skills, work related attitude, cooperatives skills, specific knowledge and academics competencies required in the workplace.

### 2.1.3 Vocational and Technical Education in Ghana

Vocational and Technical Education in Ghana was viewed as a separate system of education that was intended to meet the nations' labour needs by providing only skills training for specific occupation and should not lead to any University education (Lynch, 1997). This view is, however, beginning to change with the introduction of the 1981 educational reforms and the promulgation of the polytechnic law in 1993 that integrates both academic and vocational programmes in the country. The vocational/technical teacher, therefore, has to change to follow modern trends of technology change. In this context Gregson (1992) contends that vocational teacher educators must learn to

produce teachers capable of transforming their students into critical thinkers and problem solvers needed to make workplace more democratic and emancipator. They are supported by Sharp (1996) in his blurring of traditional differences between mental and manual occupations, between academic and vocational education which necessitates changes in the vocational teacher education in order that future teachers can develop a new core of workplace. Miller (1985) also asserts that the mission of constructivism, a cognitive approach that emphasizes "constructing" knowledge through a problem – solving process designed to produce learners, collaborators and change agents who can also change practitioners of democratic system in a community.

In this regard Hartley et al (1996) proposes a restructuring of teacher preparation programmes to incorporate integrated content and academic and work-based learning, partnership with business/industry, full range of clinical experience and applied instructional and curriculum technology and degree required teaching.

Cops and Plishal (1996) question whether the vocational curriculum should remain a collection of separate fields or be restructured into a comprehensive tool for learning about work family and community roles. Biggs, Hinton and Duncan (1996), contemporary approaches to education require teachers to develop new methods suitable to their new roles as collaborates, facilitators of learning and familiar with the workplace and with the school setting also reflecting workplace environment process. Inman and Vernon (1997) say that the globalization of the economy and rapid technological changes in vocation poses a challenge to the work force of today to prepare for a continuous change. Tozer and Nelson (1988) urge that vocational teacher educators should teach prospective teachers to provide students with generalized higher-order skills by teaching through grammar courses and not only vocational courses.

In view of the unpredictable nature of the public and the important role the vocational teacher plays, his skill needs to be sharpened regularly. Rudolph, et al (1988) says that the changing audience of vocational education has been another impetus for changes in vocational teacher education programmes. Nolan and Vanable (1998) therefore, underscore the importance of developing pre-service and in-service educational activities to equip vocational teachers with the knowledge and skills required to serve the growing number of minorities at risk and students enrolled in vocational education programmes. As a result of technological innovation and the restriction of the workplace, many workers have found that their current technical skills are out of date. This is even more so because international corporate competitor has become more dependent on the problem – solving abilities of the workers. Zehr (1998) says shortage of certified vocational teachers leads to the hiring of people from industry to fill teaching vacancies. He continues by saying that these industries based teachers have the technical skills required in the workplace but lack the instructional background that would enable them to manage the classroom and inspire learning. Here, he is putting up a very strongpoint that the teaching profession is very unique. Having all the knowledge and skill required in the workplace does not necessarily make one a teacher. One still has to acquire the skill of teaching. It is therefore important to realize that no just anyone can be taken to teach. The educators and policy makers should be aware of this. Giddens and Stasz (1999) hold the view that for the vocational teacher, work side experiences afford the opportunity for him to gain first-hand knowledge of what is happening in the workplace and observe ways that workers are integrating knowledge, concepts and skills from a variety of disciplines to solve problems of their industry.

Members of the work force must therefore, commit themselves to life-long learning to update their technical skill and develop their problem – solving skills in order to address these problems. If this is the picture in the workplace then the polytechnics now have a

challenge, to produce a student who can adapt to the changing trends of the contemporary workplace. This underscores the urgent need for good instructional procedures and well-qualified professional vocational teachers with good practical skills.

### 2.1.4 The need to train

Problems being grappled with in the developing countries are unemployment, rapid population growth and illiteracy. The solution to all these problems, however, lies in a very good educational system. Heubison and Myers (1964) continue to assert that, the rate of modernization and economic development of a country is associated with both its stock and rate of accumulation of human capital where they should be able to work with skills and proficiency using techniques, tools and equipment on their own. One may now ask, "Why has it taken Ghana such a long time to realize the importance of technical/vocational education?". He says the Basel Mission for instance opened trade schools at Abokobi, Aburi and Akropong in 1850 and the government also opened same at Yendi, Mampong, Kibi and Asuansi in 1874. He says, however, that technical education could not gain good ground because of the people's attitude. He says further that the people regarded office work as prestigious compared to practical workmanship.

This view is supported by Harbison (1973) when he says that a country which is unable to develop the skill and knowledge of its people and to utilize them effectively in the national economy will be unable to develop. What he means is that developing human resources is synonymous with economic development. From this, it is clear that human resources are needed to develop the economy of a country but resources must be developed. The development of human resources takes place in the institutions like the polytechnics, universities and other tertiary institutions. Harbison (1973) further defines

human resource as the energies, skills, talents and knowledge of people which are or which can or should be applied to the production of goods and services or rending of useful services. Human resource development is thus crucial to the economic development of nations.

This goes to confirm that Napier (2000) cited from Harbison (1973) that "human resource development is a process of increasing the knowledge, skills and competencies of all people in the society". This belief is not held by only Ghanaians alone. Stone (1993) says in America the most enduring belief about vocational education is that it is only for the non-college bound, the potential dropouts or other students with special needs. According to studies done by Stone (1993) technical/vocational graduates are more likely to be employed and earn more than their non-vocational counterparts, particularly vocational graduates who worked part time during high school. Bishop (1995) in his contribution says that there is strong evidence that the generic technical skill and occupationally specific skills provided in vocational education increase worker productivity, skill transfer, and job access and job stability when vocational/technical graduates find training related jobs. West (1996) says that the belief was not held by the students and their parents alone but also shared by other educators and policy makers.

If policy makers do not realize the importance of technical/vocational education, then it should not surprise anyone if the sector has been neglected for far too long. In their contribution Berliner and Biddle (1996) say that such beliefs are often attributed to numerous reports in the 1980s that the American industry would suffer severely in the 21st century from shortage of scientists, engineers and technicians. The reports have a foundation and are very important because they draw awareness to the dangers that the manufacturing industry face in the near future as a result of the attitude of people towards vocational/technical education. Governments could then take steps to avert an

eminent disaster. One way of developing the human resource of a nation is the establishment of vocational/technical education. Its role in the development of a nation cannot be over emphasized.

Technical employment is the fastest growing segment in the labour market According to the draft policy frame work for technical/vocational and training (2000), such education plays a vital role in development through the production of essential middle-level labour required by the economy in almost every field.

Technical/vocational institutions train skilled technicians and craft workers who support the professional personnel. They constitute the vital link responsible for actual execution in the workshop or factory. They also direct and supervise the skilled and unskilled workers towards the achievement of organizational goals. This means that developing countries must focus on technical education in order to develop their human resources if they are to make a meaningful progress.

The vision of Ghana to become middle level income earner has outlined policy objectives for technical/vocational education and upgrading of the polytechnics. The overall objective of the polytechnics is to train middle level human resource to supervise and execute acquired skills for the development of the nation. One of the aims of the government to run tertiary programmes at the polytechnics is to fill the gap at middle level human resources with people who have been groomed with an interplay of equal levels both cognitive and psychomotor skills. Thereby developing and industrializing the nation with a better level of human capital to form a viable workforce that is strong, energetic and skilful enough to stand, sustain and face the future challenges of society. In supporting this stance of people in America, emphasis has always been a class or a nice professional job like accounting and business to the

neglect of the technical/vocational sector (Grey, 1997). He says there is indeed a widespread belief among parents that a four-year degree will guarantee their children a good place in the middle class.

He says further that students themselves are quite often confident on a point. According to Grey (1997) (50%) of male students and (68%) of female students in a high school believed that with a four-year degree they would have a nice job by the time they are thirty years old. Vo (1997) says that parents want their children to go to college and get a four-year degree because they believe it will assure them a job.

Contrary to the views held by people about the sector, technical/vocational education rather has many advantages over the processional carriers in many respects. Grey (1997) says that the reality in the labour market is quite different. According to him, a closer look at the four years' college degree is a tickle to success. He says professional occupation make up only 20% of all jobs. This means that it will be very difficult to get professional job than it would be in the technical/vocational sector which apparently makes up the extra (80%) of jobs. He gives the following analysis to support his claim.

- Among college students who graduate with a four-year degree, only two of three will find work related to the study.
- Among college students who graduate with a professional credential only one in two find jobs related to their profession.
- A four-year degree does not guarantee high income.
- In the U.S Department of Labour, a managerial/professional job growing is indeed at the top of the salary ladder. But the next rank down on the ladder is craft, precision metal and specialized repair-occupation in virtually every industry and every work environment. Technical employment is the fastest

growing segment in the labour market (Grey, 1997) and Brandy (1996) say one million new programming jobs will be opened in the next nine years and that one million is only the beginning. There are still many more million positions that are going begging for skilled welders, machinists, electricians, plumbers, healthcare workers and repairers of all kinds of people at it is hoped that the citizenry will get the picture clear in the near future. A research conducted by the European Community under Professor K Frey of Technical University of Berlin on behalf of the National Training Board of South Africa, indicates that countries that are considered economically successful possess education and training (Charway, 2001). This means that developing countries must focus on education and training in order to develop their human resources if they are to make a meaningful progress. Nations are said to gain tremendously by embarking on technical/vocational education and training. Charway (2001) again says Ghana's transition to middle level income earner will exert a major pressure on the demand and supply situation for skills and multi-skilling from labour. Giving reasons he says among other things that:

- The increasing level of unemployment among school leavers and the need to reduce it through socio-economic development, thus creating more jobs to provide a higher level standard for the majority of Ghanaians.
- The growth in the number of small and medium scale enterprises and industries becoming the major source of employment makes it imperative to target technical and vocational education and training.
- The low productivity in the workplace and industry calls for a review of vocational education and training in this country to bring it in line with modern practices and international benchmark. He rounds up with emphasis on the

importance of the sector by citing countries like Singapore, Malaysia, Australia, Brazil, Germany and the United Kingdom which economic analysis have shown to be successful because of vocational and training systems.

In conclusion, it is to be noted that technical/vocational education holds the key to the first floor of development. Stifling the sector amounts to killing the goose that lays the golden egg. No stone should therefore be left unturned in an effort to assist the sector to grow, after all there is enough evidence to prove that the negative image given to technical/vocational sector is no more tenable and so cannot continue to be trampled upon. It is time for developing nations to develop through vocational/technical education and through the use of modern technological means of training through the usage of Automated machine controls (AMATROL) skills –training.

## 2.2 History of AMATROL

AMATROL has a rich history beginning in 1964, when Don and Roberta Perkins founded its original parent company; Dynafluid, Inc. Dynafluid was an industrial automation systems manufacturer that designed systems for many Fortune 500 companies including Coca Cola, General Electric, Alcoa, Ford, Chrysler, and others. AMATROL was created as the educational division of Dynafluid to provide training to industrial clients for new technologies like those being implemented in Dynafluid's systems. Dynafluid was in a unique position to effectively develop training programs for these technologies because its engineers and technicians were thoroughly familiar with the design, application and maintenance of them. AMATROL, short for *Automated Machine Controls,* was founded in 1978 as a division and was formally incorporated as a separate company in 1981. Since that time, AMATROL has grown significantly, becoming the leading company in its primary market segments.

AMATROL develops strategic partnerships with outstanding and recognized companies and organizations. This allows AMATROL to further its technology endeavours in high school, college, polytechnics, universities, and industry settings.

AMATROL offers excellent products for a wide range of technical education needs. At the core of their product offerings are learning systems. An AMATROL learning system contains everything one needs to teach the subject, a trainer, either equipment based or virtual, curriculum; teacher's assessment guide; installation guide; and software as appropriate. In today's fast paced, global economy, technical training demands are higher than ever.

In a 24/7 world of complex and sophisticated technology, workers need skills in complex areas like process control, computer integrated manufacturing, mechatronics, and more. The e-Learning is the only hands-on, interactive, skills-based technical training available via the web to help you truly extend your learning opportunities well beyond the boundaries of a traditional classroom. (Source: www.amatrolinc/histrory.com)

### 2.2.1 AMATROL Competency Training

AMATROL Competency Training is a structured approach to training and assessment that is directed towards achieving specific outcomes. It is about assisting individuals to acquire skills and knowledge so they are able to perform a task to a specified standard under certain conditions. In the training, the outcomes to be achieved are clearly stated so that learners know exactly what they have to be able to do, trainers know what training or learning is to be provided and Trainers know the skill levels required of their people to meet the standards of industry.

The emphasis in AMATROL Competency Training is on "performing" rather than just "knowing". A competency is defined in terms of what a person is required to do

(performance), under what conditions it is to be done (conditions) and how well it is to be done (standards).

In a traditional educational system, the unit of progression is time and it is teacher-centered. In AMATROL training system, the unit of progression is mastery of specific knowledge and skills and is learner-centered. Two key terms used in AMATROL training are Skill and Competency.

*Skill:* A task or group of tasks performed to a specific level of competency or proficiency which often use motor functions and typically, require the manipulation of instruments and equipment. (Some skills, however, such as counselling, are knowledge and attitude-based.)

*Competency:* A skill performed to a specific standard under specific conditions.

Competency comprises the specification of knowledge and skill and the application of that knowledge and skill within an occupational industry level to the standard of performance required in employment'.

Competency-based education is perceived by some as the answer, by others as the wrong answer, to the improvement of education and training for the complex contemporary world (Harris et al., 1995). Some critics argue that, the approach is conceptually confused, empirically flawed, and inadequate for the needs of a learning society (Chappell, 1996; Hyland, 1994).

There are several debates taking place in Britain, USA and Australia, where there has been more time to examine the impact of the competency approach, and this review therefore focuses on literature from those countries. AMATROL Competency Training is an avenue to achieve a highly knowledgeable and skilled workforce. A systematic

approach to training that is monitored and revised in the light of performance and outcome is the hallmark of AMATROL Training Programme.

Clear and detailed outcomes or competency statements are used to develop the training curriculum and measure learners' competence. Competency statements are derived from a thorough job analysis of the learner's duties, which contributes to the training goal of meeting individual learners' needs as they master various skills levels.

Proponents of Competency Training promote it as a way to improve the correspondence between education/training and workplace requirements (Harris et al., 1995). It is individualized, emphasizes outcomes (what individuals know and can do), and allows flexible pathways for achieving the outcomes. It makes as clear as possible what is to be achieved and the standards for measuring achievement. In theory, it overcomes the divide between hands and mind, theory and practice, general and vocational education.

Competency Training has had a major impact on the evolution of Vocational Education and Training (VET) (Waymark, 1997). Decisions concerning methods of delivery, teaching and learning, assessment, and transferability of qualifications have been strongly influenced by a Competency Training environment (Lowrie et al, 1999). In Australia, Competency Training has been legislated to a greater extent than most other countries. Policy directives at the national level in the early 1990's have ensured that Competency Training would become the preferred method of delivery of vocational education and training (VET) in Australia, with substantial implementation occurring by 1993. Today, when one mentions Competency Training, what comes to mind is the training in Australia. There appears to be substantial support for Competency Training.

Norton (1987) believes that Competency Training should be used as opposed to the "medieval concept of time-based learning."

Foyster (1990) argues that using the traditional "school" model for training is inefficient. After in-depth examinations of three competency-based programmes, Watson (1990) concluded that competency-based instruction has tremendous potential for training in industry.

Moreover, in a 1990 study of basic skills education programs in business and industry, Delker (1990) found that successful training programs were competency-based. In general terms, however, Competency Training can be explained as having a focus on the outcome of training (ANTA, 1997). These outcomes are measured against specific standards and not against other students and the standards are directly related to industry. It is reasonable to assume that Competency Training approaches have affected individuals in different ways considering the diverse nature of the sector.

The implementation of the Competency Training model of teaching and training in the TVET sector has been a difficult one. It has involved changes in the relationship between TVET and industry, particularly in the introduction of industry competency standards as the basis for TVET curriculum, in the way in which curriculum is delivered and assessed. Although the definition of Competency Training is contested and its practice varies from provider to provider, and from teacher to teacher (Smith et al 1997), there are enough common elements to enable Competency Training to be studied as a single phenomenon.

Smith et al. (1997), for example, developed a set of key points that were common in most definitions of Competency Training. These points included:

- The focus of training is one of the outcome of the training;
- The outcome is measured against specific standards not against other students;
- The standards relate to industry.

The changes introduced into the technical institutions during the 1990s, by the adoption of Competency Training, have impacted upon everyone working in the vocational education and training (VET) sector. It can be argued, however, that the greatest effects have been upon TVET teachers and trainers, since they have had to change their everyday practice to accommodate Competency Training. Moreover, they hold the ultimate responsibility for ensuring that Competency Training makes a difference to TVET outcomes.

### 2.2.2 Objectives of AMATROL Competency Training

The objectives of AMATROL Competency Training in the Polytechnics are as follows:

- Select clear standards which can be measured
- Develop competent individuals with transferable skills
- Link education and training to skills needed by employers
- Provide objective quality assured system which will have the confidence of all users
- Individuals potential is fully developed, and
- Promote the concept of lifelong learning.

### 2.2.3 Elements of Competency Training System

Norton (1987) describes five essential elements of a CBT system:

- Competencies to be achieved are carefully identified, verified and made public in advance.
- Criteria to be used in assessing achievement and the conditions under which achievement will be assessed are explicitly stated and made public in advance.
- The instructional programme provides for the individual development and evaluation of each of the competencies specified.

- Assessment of competency takes the participant's knowledge and attitudes into account but requires actual performance of the competency as the primary source of evidence.
- Participants progress through the instructional programme at their own rate by demonstrating the attainment of the specified competencies.

### 2.2.4 Characteristics of Competency Training

How does one identify a Competency Training programme? According to Foyster (1990), Delker (1990) and Norton (1987) there are a number of characteristics of competency-based programmes. The key ones are summarized as follows:

- Competencies to be learned are carefully selected.
- Supporting theory is integrated with skill practice. Essential knowledge is learned to support the performance of skills.
- Detailed training materials are keyed to the competencies to be achieved and are designed to support the acquisition of knowledge and skills.
- Methods of instruction involve mastery learning, the premise that all participants can master the required knowledge or skill, provided sufficient time and appropriate training methods are used.
- Participants' knowledge and skills are assessed as they enter the programme and those with satisfactory knowledge and skills may bypass training or competencies already attained.
- Learning should be self-paced.
- Flexible training approaches including large group methods, small group activities and individual study are essential components.

- A variety of support materials including print, audiovisual and simulations (models) keyed to the skills being mastered is used.
- Its assessments relate to the standards and are normally done on a continuous basis.
- Competency Training is based on the involvement of a wide range of stakeholders, namely education and training practitioners, business leaders and industry in determining the required standards.
- Satisfactory completion of training is based on achievement of all specified competencies.

### 2.2.5 Advantages and Limitations of AMATROL Competency Training

One of the primary advantages of AMATROL Competency Training is that the focus is on the success of each participant. Watson (1990) states that, the competency-based approach "appears especially useful in training situations where trainees have to attain a small number of specific and job-related competencies". Benefits of Competency Training identified by Norton (1987) include:

- Increase motivation amongst learners
- Competency Training encourage flexible delivery and learning
- Focusing on skill, knowledge and attitude
- Competency Training produces competent graduates with transferable skills
- It also encourages team work.
- Participants will achieve competencies required in the performance of their jobs.
- Participants build confidence as they succeed in mastering specific competencies.
- Participants receive a transcript or list of the competencies they have achieved.

- Training time is used more efficiently and effectively as the trainer is facilitator of learning as opposed to a provider of information.
- More training time is devoted to working with participants individually or in small groups as opposed to presenting lectures.
- More training time is devoted to evaluating each participant's ability to perform essential job skills.

**For lecturers and trainers:**

- Competency Training makes assessment a simpler process as it requires that trainees achieve stated training outcomes by reaching or bettering the specified standard
- Various delivery methods can be used, such as self-paced learning.
- Lecturers and learners can be more confident about whether or not a trainee can do a task because trainees are assessed individually.
- Evidence of competence allows trainees to move between industry, training programme and the institution more effectively.
- The competencies needed for the job can be aligned with training outcomes.

**For trainees:**

- Competency Training allows them to accept responsibility for their own learning.
- Competency Training programme can reduce time of training for some trainees.
- Self-paced learning gives trainees time to master a competency before proceeding to the next and takes into account the needs for individual trainees.
- Competency Training improves trainees' chance of doing well in a course.
- Trainees are better motivated and focused on learning.
- Career paths are more related to skills and multi-skilled development.

While there are a number of advantages of Competency Training, there are also some potential limitations. Prior to implementation of Competency Training, it is important to consider these limitations:

- Unless initial training and follow-up assistance is provided for the trainers, there is a tendency to "teach as we were taught'' and Competency Training trainers quickly slip back into the role of the traditional teacher.
- An AMATROL Competency Training course is only as effective as the process used to identify the competencies. When little or no attention is given to identification of the essential job skills, then the resulting training course is likely to be ineffective.
- A course may be classified as competency-based, but unless the specified Competency Training materials and training approaches (e.g., Learning Activity Package (LAPs)) are designed to be used as part of Competency Training approach, it is unlikely that the resulting course will be truly competency-based.

**2.3 Use of Learning Materials, Models and Simulations in AMATROL Training**

In order to achieve the aims of the AMATROL Competency Training programme in any institution, facilitating and learning approaches must be adapted accordingly. A shift in emphasis from `instructing' to facilitating 'reflect the changing role of the lecturer. Learners are expected to interact with the facilitators and with each other as a more effective way of learning than passively listening and producing copious notes and regurgitate later during a formal written examination. Lecturers are expected to take a greater responsibility for their own learning; to show increasing level of initiative and to develop their own skills in communication, numeracy, computing and personal and interpersonal relationship and business acumen, alongside the development of their respective technical and vocational skills. Learners under the AMATROL Training

program are expected to reflect continuously on their performance and assisted in this process by an assigned facilitator.

To enable this process, greater emphasis is placed on the role of the facilitator as an organizer or facilitator of learning. Learning materials becomes the order of the day rather than teaching notes.

Indeed, new emphasis is placed on the development of these learning materials which should encourage the learner to work independently as possible out of laboratory and while in laboratory. Materials should emphasize active participation in learning through group, pair or whole class interaction.

Models and systems are used extensively in Competency Training courses. Airplane pilot first learn to fly in a simulator. Satur and Gupta (1994) developed a model which facilitates skill development in performing evaluating coronary anastomoses with an angioscope. From the above discussion on simulators, it can be seen clearly that, models are proven invaluable as a training tool.

Buck (1991) in a historical review in the use of simulators in medical education concluded that 'given will increase in the future, should the need arise to teach new concepts and procedures as set times to large group of individuals''.

Norton (1987) believes that participant in a Competency Training should learn in an environment that duplicates or simulates the work place. Richards (1985) in writing about performance testing indicates the assessment of skills requires using simulations (e.g., models and role plays) or work samples (i.e., performing actual task under controlled conditions in either a laboratory, workshop or a job setting). Finally, Delker (1990) in a study of business and industry found that the best approach involved learner- centered instruction using print, instructional technology and simulations.

### 2.3.1 Assessment of AMATROL Competency Training

AMATROL Competency Training assessment is the process of collecting evidence of a learner's performance, upon which an assessor judges whether or not, or the extent to which a learner has met the performance requirement of the learning outcome laid in a particular unit and then making a decision, based on these judgments as to whether a learner has achieved the learning as a whole or not.

AMATROL Competency Training assessment is the process of measuring learner's skills, knowledge and understanding against the standards (occupational standards) laid down for a particular unit. If the learner can show, by generating sufficient evidence of their competence, that they may meet the standards, they qualify for the units. if they do not meet the standards they must develop their skills and knowledge further, after which they can be assessed again.

Evaluation in traditional courses typically involves administering knowledge-based tests. While knowledge-based assessments can certainly be used in AMATROL Competency Training to measure mastery of information, the primary focus is on measuring mastery of skills. Thomson (1991) reports that, the decision to recognize a performance as satisfactory and determine competence should be the basis for success of a competency-based programme. Moreover, Foyster (1990) argues that, assessment in competency- based programmes must be criterion-referenced with the criterion being the competencies upon which the programme is based. Finally, Richards (1985) indicates that simulation and work sample performance tests should include a checklist or some type of rating scale.

In a nutshell, the way in which the outcome of an AMATROL Competency Training can be assessed depends on the outcome themselves. The standards indicate the type of assessment which are more appropriate. Validity and reliability of assessment have to be combined with practicability.

An AMATROL Competency Training system can incorporate continuous assessment easily. The judgment of the assessor must be based on whether learners have achieved the standards, not achieved or not ready.

AMATROL Competency Training emphasizes assessment of theoretical understanding as well as of performance in the laboratory on skills. Wood and Power (1987) point out one of the core difficulties of Competency Training assessment when they observe the assessment of observable performance does not capture fully the degree of 'competence' that incorporates unobserved knowledge and dispositions. Validity of the performance assessments needs to be enhanced through questioning students about the principles explaining the nature of the performance. In accordance with Wood and Power's observation Jessup (1991) maintains that the ideal is to assess the understanding simultaneously with the performance rather than separately.

According to Bowden (2000), citing Gonczi et al (1990) this integrative assessment is on a higher level as `addictive' where knowledge assessment is usually undertaken separately from performance assessment. That competence is not a trained behaviour but thoughtful capabilities. (Kerka, 2000). Once students have proven their competence level in particular areas, these skills and knowledge are not restated again and effort for all involved assessment saved. The participation of students, lecturers and departmental heads in the assessment of students during the AMATROL Competency Training is required. If these students or lecturers are not trained in the application of AMATROL Competency Training assessment, the validity of the assessment could be low.

### 2.3.2 Difference between Traditional and Competency-Based Assessment

Competency-Based assessment is not a set of exams; it is the basis for the certification of and knowledge of individual in relation to competence standard. This grant is a very applicable role as an instrument of diagnosis, both for worker and employer.

**Competency-Based Assessment:** This is the assessment that measures whether a learner is competent or not competent. Only two possible outcomes can be the result of the standard process, i.e. they are competent (can perform what is stated in the standard) or they are not yet competent (they cannot perform yet what is stated in the standard). The assessment is not designed to measure a learner who is 30%, 50% or 80% etc. competent.

**Norm Reference Assessment:** This is an assessment that measures how learners compare with each other. The result of the test is given in percentages (50%, 80% and 90%) or sometimes these are translated into a range (pass, merit and distinction).

**Table 2: Difference between Traditional and the Competency Training Assessment**

| TRADITIONAL ASSESSMENT(Norm Reference) | COMPETENCY TRAINING ASSESSMENT(Criteria Reference) |
|---|---|
| Assessment is used to make selection from individuals competing for something. | Tests are stopping points to determine if a student has gained the knowledge and/or the skills to proceed to the next stage. |
| The teacher conducting a course may have decided the content and described it with general objectives. | Course content is defined by specific objectives and standards. |
| Tests results provide information about how a learner performs compared with others in a group and indicate what a student can do. | Scores give an accurate indication of what a student can do and cannot do. |
| High scores indicate excellence of performance | Identification of excellence performance often is not appropriate. |
| Grades of students vary where scores differ. | Grades are not necessary as achievement of standards is the goal |
| Questions distinguish between individuals when it is necessary to compare the performances of different individuals. | Questions must match the objectives and are required to obtain information about what a student can do and cannot do. |

# CHAPTER THREE

# RESEARCH METHODOLOGY

## 3.1 Introduction

This chapter describes the approach, techniques and methods that were used to select respondents and how the data was analysed. To conduct any research project a selected methodology should be followed to meet the research objectives. Blaxter et al (2006) explain that ‘‘methodology’’ usually refers to the approach or paradigm that underpins the research. The methodology followed and discussed are the research design, population, sampling techniques, sample size, sources of data, instrumentation. In addition, it includes the data processing and analysis procedure.

## 3.2 Research Design

The study is non-interventional, descriptive and to establish the relationship between practical training and its impact on teaching and learning of engineering courses. It was non-interventional because it does not allow for any manipulation of the key variables. A descriptive design describes and interprets what exists.

The descriptive survey according to Best and Kham (1989) as cited by Cohen and Manion (1995) is concerned with conditions or relationship that exist, practices that prevail, beliefs, point of views or attitudes that are held; processes that are going on; effects that are being felt; or trends that are developing. The study is descriptive because it facilitates the collection of views of respondents on technical training programmes and how, effective this programme is affecting teaching and learning positively on lecturers and students.

### 3.3 Population

The study was carried out at Takoradi Polytechnic School of Engineering. The target population for the study were lecturers and students of the Mechanical and Electrical Engineering Departments of the Schoolof Engineering of Takoradi Polytechnic. Mechanical and Electrical Engineering Departments were considered among the other Engineering Departments (Furniture Design, Building Technology and Civil) in the School of Engineering because they are the departments involved in the practical skills training of students using the AMATROL modules.

**Table 3: Results of the Lecturers and Students of the Mechanical and Electrical Engineering Departments.**

| Designation | Number |
|---|---|
| Lecturers of Mechanical Engineering | 18 |
| Lecturers of Electrical Engineering | 16 |
| Students of Mechanical Engineering | 624 |
| Students of Electrical Engineering | 440 |
| **Total** | **1, 098** |

**Source: Field Work, (2016)**

### 3.4 Sample and Sampling Technique

The population of lecturers at the Mechanical and Electrical Engineering Departments at Takoradi Polytechnic was 34. Out of this, 25 (74%) respondents were selected for the study. Out of the 25 lecturers, 14 (52.3%) were from the mechanical engineering department, and 11 (47.7%) from the electrical engineering department. The researcher selected 25 because some of the lecturers teach related courses that do not link with the AMATROL Training Programme modules.

The student's population was 1064, out of which 280 (26.3%) respondents were also sampled for the study. Out of the 280 students, 160 (57%) were from the mechanical engineering department, 120 (43%) from the electrical engineering department. The determination of the sample size was taking from a sampling table according to Krejcie and Morgan (1970).

The study employed stratified sampling technique and random sampling technique. The sampling technique used for selecting the respondents was the stratified random sampling method. The technique of stratified sampling, involves selecting respondents from each division (Mechanical Engineering Department and Electrical Engineering Departments). This technique was used because the target population was divided into sub groups while the random sampling technique ensures that every member of the target population have equal chance of being selected.

### 3.5 Sources of Data

In order to source reliable and accurate information for the study, both primary and secondary data were used.

#### 3.5.1 Primary Data

The main instrument used for the collection of primary data was a set of questions developed by the researcher. The primary data was collected through questionnaires. The questionnaires were drafted and administered to the target population.

#### 3.5.2 Secondary Data

The secondary data was obtained from the journals, textbooks, articles, magazines, and the internet. Some data were obtained through personal reading and library search at the Takoradi Polytechnic and the University of Education, Winneba – Kumasi Campus.

Others included documents on the reforms of the Polytechnic and documents on the Conversion of Polytechnics into Technical Universities.

### 3.6 Instrumentation

For the purpose of this study, the quantitative data was collected using self-administered Questionnaires. The questionnaires were administered to the target groups who are being appraised. The questionnaire consisted of detailed, precise and logical construction of both open and close-ended questions with a five (5) point Likert scale measuring respondents' extent of agreement on various issues or otherwise. Two sets of questionnaires were designed for data collection. One set of questionnaires was set to collect data from lecturers (Appendix I) whiles the other set was used to collect data from the students (Appendix II).

There was the need to set questionnaire for each group because the lecturers have to teach and train students whiles students must go with the procedures being taught by the lecturers. Each group had to bring out its views for the researcher to seek out the views to obtain the research output.

The questionnaire was divided into four (4) main sections, with each section examining different issues in the study. Section A looked at Socio-demographic characteristics of student's and lecturer's respondents, Section B looked at the perception of students and lecturers towards AMATROL Training Programme. Section C looks at challenges associated with the use of AMATROL Training Programme. Section D looks at the benefits of AMATROL Training Programme. Kerlinger (1973) observed that the questionnaire is widely used for collecting data in educational research because it is very effective for securing functional information about practices and conditions for enquiring into the opinions and attitudes of respondents.

To ensure that the language of the questionnaire was unambiguous in soliciting what the researcher wanted, the questionnaire was subjected to close scrutiny. The questionnaire for both lecturers and students were pre-tested three times at Takoradi Polytechnic, School of Engineering. The departments chosen for the pre-testing were Mechanical Engineering and Electrical Engineering for objectivity, relevance and suitability of the problem under research. Each time the questionnaire was pre-tested; there were some suggestions for refining some of the questions. The respondents to the questionnaire during the pre-testing stages were Mechanical Engineering and Electrical Engineering students and lecturers. The contribution of ideas helped the researcher to prepare the final questionnaire.

### 3.7 Data Processing and Analysis procedure

The questionnaires were analysed using Statistical Package for Social Sciences (SPSS), software for Windows version 21.0. The data obtained from the field were screened to ensure that the questionnaire were filled, uncompleted ones were removed.

Data were sorted out, coded and organised according to how lecturers and students answered the questionnaire leading to the objectives set for the study.

Descriptive statistics was used for the data collected, where it was edited for consistency after which frequency and percentage values were calculated. Item by item analysis was done after which the sources of each factor were summarized to determine the outcome.

# CHAPTER FOUR

# RESULTS/FINDINGS

## 4.1 Introduction

This chapter presents the results of data analysis of the variables. The study sought to find out the impact of AMATROL training programme on teaching and learning of engineering in the Mechanical and Electrical Engineering Departments at Takoradi Polytechnic School of Engineering. In all, 305 completed questionnaires were subjected to Statistical Package for the Social Sciences (SPSS) for Windows version 21.0, and Microsoft office Excel 2007. Actually, 280 of the questionnaires were administered to students of the polytechnic (mechanical and electrical engineering departments) while 25 of the questionnaires were administered to lecturers (mechanical and electrical engineering departments). The findings are presented in Tables.

## 4.2 Demographic Profile of Respondents

This section presents background information or demographic profile of the respondents (Engineering Students and Lecturers of Takoradi Polytechnic School of Engineering).

### 4.2.1 Gender respondents

**Table 4.1: Gender respondents**

| | | STUDENTS | | LECTURERS | | TOTAL | |
|---|---|---|---|---|---|---|---|
| | | Frequency | % | Frequency | % | Frequency | % |
| Valid | Male | 265 | 94.6% | 24 | 96.0% | 289 | 94.75% |
| | Female | 15 | 5.4% | 1 | 4.0% | 16 | 5.25% |
| | Total | 280 | 100.0% | 25 | 100.0% | 305 | 100.0% |

**Source: Field Work, 2016**

Both male and female respondents participated in the study. As shown in Table 4.1, relatively, majority of the male students (94.6%), lecturers (96.0%) participated in the research work than the females since mostly males are engaged in the field of engineering. For example, the two specialized areas at the School of Engineering (Mechanical and Electrical Engineering Departments) are made up of approximately all males.

### 4.2.2 Age group of respondents

**Table 4.2: Age Groups**

| | | STUDENTS | | LECTURERS | | TOTAL | |
|---|---|---|---|---|---|---|---|
| | | **Frequency** | **%** | **Frequency** | **%** | **Frequency** | **%** |
| Valid | Below 18 Years | 20 | 7.1% | | | 20 | 6.6% |
| | 18-20 Years | 14 | 5% | | | 14 | 4.6% |
| | 20-29 Years | 201 | 71.8% | 2 | 8.0% | 203 | 72.5% |
| | 30-39 Years | 42 | 15% | 10 | 40.0% | 52 | 18.6% |
| | 40-49 Years | 3 | 1% | 8 | 32.0% | 11 | 3.9% |
| | 50-59 Years | 0 | 0% | 5 | 20% | 5 | 1.8% |
| | Total | 280 | 100.0% | 25 | 100.0% | 305 | 100.0% |

**Source: Field Work, 2016**

Table 4.2 shows that a good number of the students were within the age group of 20-29 (71.8%) while majority (72%) of the lecturers, were in the economically active age group 30 – 49.

### 4.2.3 Level of studies

**Table 4.3: Level**

| | | Frequency | % | Valid % | Cumulative % |
|---|---|---|---|---|---|
| Valid | Year 2 | 82 | 29.3% | 29.3% | 29.3% |
| | Year 3 | 198 | 70.7% | 70.7% | 100.0% |
| | Total | 280 | 100.0% | 100.0% | |

**Source: Field Work, 2016**

Students who participated in the study were either in their 2nd year of studies or 3rd year of studies. Table 4.3 shows that 82 students (29.3%) who responded to the questionnaire were in their 2nd Year while 198 students (70.7%) who responded to the questionnaire were in their 3rd Year. The first years did not take part because the Laboratory work starts from second year.

### 4.2.4 Entry qualification of Student respondents

**Table 4.4: Entry Qualification**

| | | Frequency | % | Valid % | Cumulative % |
|---|---|---|---|---|---|
| Valid | Secondary Certificate | 183 | 65.4% | 65.4% | 65.4% |
| | Technical Certificate | 82 | 29.3% | 29.3% | 94.7% |
| | Access | 15 | 5.3% | 5.3% | 100% |
| | Total | 280 | 100.0% | 100.0% | |

**Source: Field Work, 2016**

Most of the Student respondents gained admission to their respective engineering programme either with Secondary School Certificate or Technical School Certificate. As shown in Table 4.4, 183 students (65.4%) had gained admission with Secondary School Certificate while 82 students (29.3%) had gained admission with Technical School Certificate as compared to 15 (5.3%) who entered the school through an Access Programme Certificate.

### 4.2.5 Learnt trade before enrolling into Takoradi Polytechnic

**Table 4.5: Learnt trade before enrolling into Polytechnic**

| | Frequency | % | Valid % | Cumulative % |
|---|---|---|---|---|
| Yes | 77 | 27.5% | 27.5% | 27.5% |
| No | 203 | 72.5% | 72.5% | 100.0% |
| Total | 280 | 100.0% | 100.0% | |

**Source: Field Work, 2016**

Table 4.5 shows that majority (72.5%) of student respondents did not learn a trade before enrolling into Takoradi Polytechnic as compared to (27.50%) who responded "Yes" that they learnt a trade before enrolling into Takoradi Polytechnic. Some of the students stated that they learnt trades like Auto – mechanic, Auto – Electrician, Welding and Electrician works before enrolling into Takoradi Polytechnic.

### 4.2.6 Programme of study

**Table 4.6: Programme of Study**

| | Frequency | % | Valid % | Cumulative % |
|---|---|---|---|---|
| Mechanical Engineering | 160 | 57% | 57% | 57% |
| Electrical Engineering | 120 | 43% | 43% | 100.0% |
| Total | 280 | 100.0% | 100.0% | |

**Source: Field Work, 2016**

Table 4.6 indicates that majority of the student respondents 160 (57%) were Mechanical Engineering students and the remaining 120(43%) were Electrical Engineering students.

### 4.2.7 Educational level of lecturer's respondents

**Table 4.7: Educational Level**

| | Frequency | % | Valid % | Cumulative % |
|---|---|---|---|---|
| HND | 4 | 16% | 16% | 16% |
| Bachelor Degree | 5 | 20% | 20% | 36% |
| Master Degree | 16 | 64% | 64% | 100.0% |
| PH. D | 0 | 0% | 0% | 100% |
| Total | 25 | 100.0% | 100.0% | |

**Source: Field Work, 2016**

Considering the educational level of the lecturer's respondents, Table 4.7, shows that majority of the lecturers (64%) in the two departments have a Master's Degree. Nevertheless, only few have Bachelor's Degree (20%) and HND (16%) and none of the lecturers have a PH.D.

### 4.2.8Area of specialization of Lecturers respondents

**Table 4.8: Area of specialization**

| | | Frequency | % | Valid % | Cumulative % |
|---|---|---|---|---|---|
| Valid | Mechanical Engineering | 15 | 60.0% | 60.0% | 60.0% |
| | Electrical Engineering | 10 | 40.0% | 40.0% | 100.0% |
| | Total | 25 | 100.0% | 100.0% | |

**Source: Field Work, 2016**

Table 4.8, shows that more than half of the lecturers who took part in the study are from the Department of Mechanical Engineering (60%) while the remaining are from the Department of Electrical Engineering (40%).

### 4.2.9 Period of service of lecturer's respondents

**Table 4.9: Period of service**

| | | Frequency | % | Valid % | Cumulative % |
|---|---|---|---|---|---|
| Valid | 1-2 Years | 3 | 12.0% | 12.0% | 12.0% |
| | 3-5 Years | 6 | 24.0% | 24.0% | 36.0% |
| | 6-10 Years | 8 | 32.0% | 32.0% | 68.0% |
| | 11-15 Years | 4 | 16.0% | 16.0% | 84.0% |
| | 16-20 Years | 2 | 8.0% | 8.0% | 92.0% |
| | Above 20 Years | 2 | 8.0% | 8.0% | 100.0% |
| | Total | 25 | 100.0% | 100.0% | |

**Source: Field Work, 2016**

Lecturers have served in the polytechnic for couple of years. Table 4.9 shows that greater part of the lecturers (56%) have been with the polytechnic between 3 –10 years,

(16%) have been with the polytechnic on an average of 11 – 15 years, (16%) have been with the polytechnic on average of 16 – 20 years and above, and a small percentage have been with the polytechnic on an average of 1 – 2 years making (12%) of the whole lecturer's population.

### 4.3 Results for Perception towards AMATROL Training Programme

Key: SA - Strongly Agree, A – Agree, N - Neutral, D – Disagree, SD – Strongly Disagree

**Table 4.10: Responses for Perception towards AMATROL Training (Students)**

| **Perception Towards AMATROL Training Programme** | **Students** | | | | | |
|---|---|---|---|---|---|---|
| | SA [5] No% | A [4] No% | N [3] No% | D [2] | SD [1] No% | Total |
| AMATROL Training Programme is an effective instructional method | 14 (5%) | 198 (70.7%) | 0 (0%) | 42 (15%) | 26 (9.3%) | 280 (100%) |
| AMATROL Training Programme makes learning flexible | 51 (18%) | 164 (58.6%) | 0 (0%) | 53 (18.9%) | 12 (4.9%) | 280 (100%) |
| AMATROL Training Programme makes learning easy | 69 (24.6%) | 187 (66.8%) | 0(0%) | 11 (3.93%) | 13 (4.6%) | 280 (100%) |
| AMATROL Training Programme makes learning practical | 58 (20.7%) | 169 (60.4%) | 0(0%) | 41 (14.6%) | 12 (4.9%) | 280 (100%) |
| AMATROL Training Programme makes learning effective | 66 (23.6%) | 184 (65.7%) | 0(0%) | 21 (7.5%) | 9 (3.2%) | 280 (100%) |
| AMATROL Training Programme makes learning difficult | 22 (7.9%) | 43 (15.4%) | 4(1.5%) | 99 (35.4%) | 112 (40%) | 280 (100%) |
| AMATROL Training Programme makes learning ineffective | 18 (6.4%) | 36 (12.9%) | 4(1.5%) | 120 (42.9%) | 102 (36.4%) | 280 (100%) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Makes one learn the act of working independently | 42 (15%) | 199 (71.1%) | 0(0%) | 27 (9.6%) | 12 (4.3%) | 280 (100%) |
| Makes one skilfully equipped to work confidently in the industry. | 57 (20.4%) | 184 (65.7%) | 2(0.7%) | 24 (8.6%) | 13 (4.6%) | 280 (100%) |
| Total | 397 (15.8%) | 1364 (54.9%) | 10(0.4%) | 438 (17.4%) | 311(12.3%) | |

**Source: Field Work, 2016**

Respondents were requested to answer questions on the perception towards the AMATROL Training Programme.

Table 4.10 indicates that greater part of the students (70.7%) "Strongly Agree and Agree" with the perception that the AMATROL Training Programme is an effective instructional method, makes learning; flexible, easy, practical, effective and also helps one learn the act of working independently, makes one skillfully equipped to work in the industry. However, only few of the students (29.7%) "Strongly Disagree and Disagree" with the perception that the AMATROL Training Programme is an effective instructional method, makes learning; flexible, easy, practical, effective and also helps one learn the act of working independently, makes one skillfully equipped to work in the industry. Some students (0.4%) did not take sides in answering some of the questions especially, on whether the training programme makes learning; difficult, ineffective, or makes one skilfully equipped to work confidently in the industry. From the analysis it could be said that the perception of students towards the training programme is good.

**Table 4.11: Responses for Perception towards AMATROL Training (Lecturers)**

| Perception Towards AMATROL Training Programme | Lecturers | | | | | |
|---|---|---|---|---|---|---|
| | SA [5] No% | A [4] No% | N [3] No% | D [2] No% | SD [1] No% | Total |
| AMATROL Training Programme makes teaching effective | 6 (24%) | 12 (48%) | 0(0%) | 5 (20%) | 4 (16%) | 25 (100%) |
| AMATROL Training Programme offers several benefits over traditional teaching methods | 7 (28%) | (52%) | 1 (4%) | 3 (12%) | 1 (4%) | 25 (100%) |
| AMATROL Training Programme makes teaching difficult | 2 (8%) | 4 (16%) | 1(4%) | 11 (44%) | 7 (28%) | 25 (100%) |
| AMATROL Training Programme makes teaching practical | 8 (32%) | 12 (48%) | 0(0%) | 3 (12%) | 2 (8%) | 25 (100%) |
| AMATROL Training Programme makes teaching easy | 9 (36%) | 12 (48%) | 0(0%) | 3 (12%) | 1 (4%) | 25 (100%) |
| AMATROL Training Programme provides effective student evaluation | 8 (32%) | 11 (44%) | 0(0%) | 4 (16%) | 2 (8%) | 25 (100%) |
| AMATROL Training Programme achieves learning outcomes | 7 (28%) | 13 (52%) | 0(0%) | 6 (24%) | 4 (16%) | 25 (100%) |
| Develops students with the act of working independently | 8 (32%) | 12 (48%) | 0(0%) | 5 (20%) | 2 (8%) | 25 (100%) |
| Enhances students' skills to work confidently in the industry. | 5 (20%) | 18 (72%) | 0(0%) | 1 (4%) | 1 (4%) | 25 (100%) |
| Total | 60 (25.6%) | 107 (45.7%) | 2 (0.9%) | 41 (17.5%) | 24 (10.3%) | |

**Source: Field Work, 2016**

Table 4.11, indicates that lecturers also have a good perception towards the AMATROL Training Programme. With majority of the lecturers (71.3%) "Strongly Agree and Agree" with the perception that the AMATROL Training Programme offers several

benefits over traditional teaching methods, makes teaching; easy, practical, effective and also helps develops students with the act of working independently, provides effective student evaluation, achieves learning outcomes, enhances students' skills to work confidently in the industrywhile (27.8%) of the lecturers "Strongly Disagree and Disagree" to this perceptions. (0.9%) of the lecturers did not take side in answering some of the questions particularly, on whether the AMATROL Training Programme offers several benefits over traditional teaching methods, AMATROL Training Programme makes teaching difficult.

### 4.4 Results for challenges associated with the AMATROL training programme

**Table 4.12: Responses for challenges associated with the AMATROL training programme (Students)**

| Challenges Associated with the AMATROL Training Programme | Students | | | | | |
|---|---|---|---|---|---|---|
| | SA [5] No% | A [4] No% | N [3] | D [2] No% | SD [1] No% | Total |
| Inadequate qualified instructors to teach using the AMATROL | 13 (4.6%) | 28 (10%) | 0(0%) | 179 (63.9%) | 60 (21.4%) | 280 (100%) |
| Break down of AMATROL equipment | 11 (3.9%) | 17 (16%) | 0(0%) | 203 (72.5%) | 49(17.5%) | 280 (100%) |
| Insufficient AMATROL equipment | 8 (2.9%) | 14 (5%) | 0(0%) | 201 (71.8%) | 57 (20.4%) | 280 (100%) |
| Majority of AMATROL modules did not | 13 (4.6%) | 27 (9.6%) | 0(0%) | 175 (62.5%) | 65 (23.2%) | 280 (100%) |

| | | | | | | |
|---|---|---|---|---|---|---|
| relate with the theories learnt | | | | | | |
| Lack of lecturer's commitment to teaching using AMATROL | 79 (28.2%) | 150 (53.9%) | | 38 (13.6%) | 13 (4.6%) | 280 (100%) |
| Time allocated for teaching using AMATROL was not enough | 88 (31.4%) | 164 (58.6%) | 0(0%) | 18 (6.4%) | 10 (3.6%) | 280 (100%) |
| Ratio of machines to students was not adequate | 8 (2.9%) | 14 (5%) | 0(0%) | 201 (71.8%) | 57 (20.4%) | 280 (100%) |
| Number of workstations to students' ratio was not adequate | 24 (8.6%) | 44 (15.7%) | 0(0%) | 134 (47.9%) | 78 (27.9%) | 280 (100%) |
| AMATROL laboratories were not fully utilized | 56 (20%) | 94 (33.6%) | 0(0%) | 74 (26.4%) | (19.3%) | 280 (100%) |
| Total | 300 (11.9%) | 552 (21.9%) | 0(0%) | 1223 (48.6%) | 443 (17.6%) | |

**Source: Field Work, 2016**

The opinion of the students reveals that majority of them (66.2%) "Strongly Disagree and Disagree" to the reality that there are challenges associated with the AMATROL training programme. However, (33.8%) "Strongly Agree and Agree" to the fact that there some challenges associated in the running of the AMATROL Training Programme. This is depicted in Table 4.12.

**Table 4.13: Responses for challenges associated with the AMATROL training programme (Lecturers)**

| Challenges Associated with the AMATROL Training Programme | Lecturers | | | | | |
|---|---|---|---|---|---|---|
| | SA [5] No% | A [4] No% | N [3] No% | D [2] No% | SD [1] No% | Total |
| Lack of skills to teach using AMATROL module | 1 (4%) | 2 (8%) | 0(0%) | 13 (52%) | 9 (36%) | 25 (100%) |
| Break down of AMATROL equipment | 1 (4%) | 2 (8%) | 0(0%) | 17 (68%) | 5 (20%) | 25 (100%) |
| Insufficient AMATROL equipment and tools | 2 (8%) | 3 (12%) | 0(0%) | 13 (52%) | 7 (28%) | 25 (100%) |
| Majority of AMATROL modules did not relate with the theories taught | 1 (4%) | 2 (8%) | 0(0%) | 17 (68%) | 5 (20%) | 25 (100%) |
| Lack of students' commitment to learning using AMATROL module | 1 (4%) | 2 (8%) | 0(0%) | 13 (52%) | 9 (36%) | 25 (100%) |
| Time allocated for teaching using AMATROL was not enough | 8 (32%) | 12 (48%) | 0(0%) | 2 (8%) | 1 (4%) | 25 (100%) |
| Ratio of machines to students was not adequate | 1 (4%) | 2 (8%) | 0(0%) | 16 (64%) | 6 (24%) | 25 (100%) |
| Number of workstations to student's ratio was not adequate | 2 (8%) | 3 (12%) | 1(4%) | 13 (52%) | 6 (24%) | 25 (100%) |
| AMATROL laboratories were not fully utilized | 9 (36%) | 11 (44%) | 1(4%) | 3 (12%) | 1 (4%) | 25 (100%) |
| Total | 26 (11.7%) | 39 (17.5%) | 2 (0.9%) | 107 (48.0%) | 49 (21.9%) | |

**Source: Field Work, 2016**

Comparatively, lecturers gave the same view that there not much challenges associated with the AMATROL Training Programme since (69.9%) "Strongly Disagree and Disagree" to the fact. Nevertheless, (29.2%) of the lecturers "Strongly Agree and Agree" that there are some challenges associated with the AMATROL Training Programme. (0.9%) of the lecturers did not take side in answering some of the questions especially, on the number of workstations to student's ratio was not adequate, laboratories were not fully utilized as shown in Table 4.13.

### 4.4 Results for the benefits of AMATROL training programme

**Table 4.14: Responses for the benefits of AMATROL training programme (Students)**

| Benefits of AMATROL Training Programme | Students | | | | | |
|---|---|---|---|---|---|---|
| | SA [5] No% | A [4] No% | N [3] No% | D [2] No% | SD [1] No% | Total |
| AMATROL Training Programme brings out the creativity in students | 54 (19.3%) | 220 (78.6%) | 0(0%) | 10(3.6%) | 6 (2.1%) | 280 (100%) |
| AMATROL Training Programme provides effective feedback on student performance | 47 (16.8%) | 196 (70%) | 7(2.5%) | 14 (5%) | 16 (5.7%) | 280 (100%) |
| AMATROL Training Programme enhances student academic performance | 67 (23.9%) | 192 (68.6%) | 0(0%) | 15 (5.4%) | 6 (2.1%) | 280 (100%) |
| AMATROL Training Programme enhances student learning experiences | 62 (22.1%) | 192 (68.6%) | 0(0%) | 19 (6.8%) | 7 (2.5%) | 280 (100%) |

| | | | | | | |
|---|---|---|---|---|---|---|
| AMATROL Training Programme promotes effective assessment | 54 (19.3%) | 180 (64.3%) | 5 (1.8%) | 25 (8.9%) | 16 (5.7%) | 280 (100%) |
| It develops students to follow directions, instructions and plans | 58 (20.7%) | 210 (75%) | 0(0%) | 8 (2.9%) | 4 (1.4%) | 280 (100%) |
| It provides the opportunity to achieving the objectives of pursuing the programme as far as practical works are concerned. | 69 (24.6%) | 204 (72.9%) | 0(0%) | 4 (1.4%) | 3 (1.1%) | 280 (100%) |
| It prepares students skilfully to meet the expectations of industry. | 58 (20.7%) | 199 (71.1%) | 1(0.4%) | 18 (6.4%) | 4 (1.4%) | 280 (100%) |
| Total | 469 (20.8%) | 1593 (70.8%) | 13 (0.6%) | 113 (5%) | 62 (2.8%) | |

**Source: Field Work, 2016**

Table 4.14, indicates that majority of the students (91.6%) "Strongly Agree and Agree" to the fact that the AMATROL Training Programme is of much benefit to their Engineering training. From the analysis it could be said that majority of the students find it more useful to be engaged in high technological practical skills training.

**Table 4.15: Responses for the benefits of AMATROL training programme (Lecturers)**

| Benefits of AMATROL Training Programme | Lecturers | | | | | |
|---|---|---|---|---|---|---|
| | SA [5] No% | A [4] No% | N [3] No% | D [2] No% | SD [1] No% | Total |
| AMATROL Training Programme equips students with practical skills | 7 (28%) | 16 (64%) | 0(0%) | 1(4%) | 1(4%) (100%) | 25 |
| AMATROL Training Programme brings out the creativity in students | 6 (24%) | 17 (68%) | 0(0%) | 1(4%) | 1(4%) (100%) | 25 |
| AMATROL Training Programme provides effective feedback on student performance | 6 (24%) | 14 (56%) | 2(8%) | 2(8%) | 1(4%) (100%) | 25 |
| AMATROL Training Programme enhances students' academic performance | 7 (28%) | 16 (64%) | 0(0%) | 1(4%) | 1(4%) (100%) | 25 |
| AMATROL Training Programme enhances student learning experiences | 5 (20%) | 16 (64%) | 0(0%) | 2(8%) | 2(8%) (100%) | 25 |
| AMATROL Training Programme promotes effective teaching | 7 (28%) | 15 (60%) | 0(0%) | 2(8%) | 1(4%) (100%) | 25 |
| AMATROL Training Programme promotes effective assessment | 8 (32%) | 15 (60%) | 0(0%) | 1(4%) | 1(4%) (100%) | 25 |
| It develops students to follow directions, instructions and plans | 7 (28%) | 16 (64%) | 0(0%) | 2(8%) | 1(4%) (100%) | 25 |

| | | | | | | |
|---|---|---|---|---|---|---|
| It provides the opportunity for students to achieve their objectives of pursuing the program as far as practical works are concern | 6 (24%) | 17 (68%) | 0(0%) | 1(4%) | 1(4%) | 25 (100%) |
| It prepares students skilfully to meet the expectations of industry | 8 (32%) | 15 (60%) | 0(0%) | 1(4%) | 1(4%) | 25 (100%) |
| Total | 67 (26.7%) | 157 (62.5%) | 2 (0.8%) | 14 (5.6%) | 11 (4.4%) | |

**Source: Field Work, 2016**

Lecturers on the other hand, also think that the AMATROL Training Programme is of much benefit to their teaching for the reason that (89.2%) "Strongly Agree and Agree" to the fact that AMATROL Training Programme is beneficial for impacting engineering knowledge and skills. Unfortunately, not all of them think the same, some (10%) "Strongly Disagree and Disagree" that the AMATROL Training Programme is of any benefit to their teaching as shown in Table 4.15.

# CHAPTER FIVE

# DISCUSSION

## 5.1 Introduction

This chapter discusses significant findings, presents the interpretations within the study and makes inferences to previous related studies.

The research sought to find out how the AMATROL training programme is having impact on teaching and learning of Engineering in the Mechanical and Electrical Engineering Departments at Takoradi Polytechnic School of Engineering. Both students and lecturers were provided with the same set of questionnaires to ascertain the concern of them.

On some particular questions, both the students and the lecturers gave the same concern but on few questions their concern differed. In most cases, the respondents were asked to give their suggestions as to whether they agree, strongly agree, neutral, disagree and strongly disagree. In this discussion, percentages on agree and strongly agree, strongly disagree and disagree would be put together and interpretated.

## 5.2 Discussion of Findings

In Table 4.10, for instance, students gave their view on the perception towards AMATROL training programme. It was found that majority of the students (75.7%) agreed to the perception that the AMATROL Training Programme is an effective instructional method with (24.3%) of them not agreeing to the perception that the AMATROL Training Programme is an effective instructional method.

Again on the aspect of whether the AMATROL Training Programme makes learning; flexible, easy, practical and effective, (76.6%), (91.4%), (81.1%) and (89.3%) respectively of the students agreed to the fact that the AMATROL Training Programme

makes learning; flexible, easy, practical and effective, while the remaining (23.4%), (8.6%), (18.9%) and (10.7%) respectively also thought otherwise.

Also, on whether the training programme makes one learn the act of working independently and makes one skilfully equipped to work confidently in the industry were not much different from the other perceptions because (86.1%) and (86.8) respectively of the students agreed to the perceptions that the training helps to learn the act of working independently and makes one skilfully equipped to work confidently in the industry with (13.9%) and (13.2%) respectively thinking otherwise.

Furthermore, on the issue of whether the AMATROL Training Programme makes learning difficult and if the AMATROL Training Programme makes learning ineffective most of the students (75.4%) and (79.4%) respectively disagreed to this perception with few of the students (23.3%) and (19.4%) respectively agreeing to the fact that the AMATROL Training Programme makes learning difficult and the AMATROL Training Programme makes learning ineffective. It was surprising that (3.7%) of the students did not know whether to agree or disagree.

This can be confirmed by (Harris et al., 1995) that Competency-based education is perceived by some as the answer, by others as the wrong answer, to the improvement of education and training for the complex contemporary world. Some critics argue that, the approach is conceptually confused, empirically flawed, and inadequate for the needs of a learning society (Chappell, 1996; Hyland, 1994).

In Table 4.11, lecturers answered similar questions as that of Table 4.10, and lecturers on the other hand did not say something dissimilar. Probably, it may be due to the fact that they are aware of what the students are experiencing. For instance, more than 70% agreed to the various perceptions towards the AMATROL training programme that it

makes their teaching effective, practical, easy, and also help them their teaching objectives.

Moreover, (80%) and (92%) agreed that the AMATROL training programme offers several benefits over the traditional teaching methods and provides effective student evaluation respectively at the Takoradi Polytechnic School of Engineering (Mechanical and Electrical Engineering Departments). However, (72%) of the lecturers forming the majority disagreed that the AMATROL training programme makes teaching difficult. Beane (1998) confirms this by saying that the focus of teaching is on empowering learners to construct new knowledge by providing opportunities for them to test academic theories through real-world application of knowledge in settings that are surely relevant to their lives.

The section of students' response on the challenges associated with the AMATROL training programme, for the students to ascertain whether they were faced with certain challenges in the during their training. In fact, it was unfortunate that most of the students disagreed to the fact they faced a lot of challenges during their training. For example, in Table 4.12, over (70%) of the students disagreed that there are serious challenges associated with the AMATROL training programme in most of the challenges stated. However, almost all the students (82.1%) and (90%) agreed that there were lack of lecturer's commitment to teaching using AMATROL and the time allocated for teaching AMATROL was not enough. Possibly, the Head of Departments, Administrators and the Management should put measures in place in order to increase the AMATROL Laboratory Training time for the students to have enough time to gain the practical aspect of their study at the polytechnic. Most of the polytechnic courses are practical and employers expect them to know the practical before they are employed. Most of the students were not so sure what is causing the lecturers not to be much committed to using the AMATROL in teaching.

Norton (1987) observed that prior to implementation of Competency Training, it is important to consider the following limitations: Unless initial training and follow-up assistance is provided for the trainers, there is a tendency to "teach as we were taught'' and Competency Training trainers quickly slip back into the role of the traditional teacher; AMATROL Competency Training course is only as effective as the process used to identify the competencies. When little or no attention is given to identification of the essential job skills, then the resulting training course is likely to be ineffective;

More than half of the students ((53.6%) feels that the AMATROL laboratories were not fully utilized.

It is interesting to know that the concern of the lecturers are much similar to that of the students because majority of them (75%) and more also agreed to the fact that there are not much challenges associated to the AMATROL Training Programme. Surprisingly, majority of the lecturers (88%) agreed that student's showed much commitment to learn using the AMATROL modules as compared to the students who agreed that the lecturers are not committed to teaching using the AMATROL modules. Some of the full time lecturers (Master's Degree holders) gave reasons that, it is an extra work for them teaching practical's using the AMATROL modules, they expect only Technicians to engage the students in the AMATROL Training Programme. Possibly, Management should try and employ more Technicians make provisions for periodic refresher training for the Technicians to curb this problem. Furthermore, Majority of the lecturers (80%) also accepted that the time allocated for the AMATROL Training Programme was not enough and (80%) also agreed that the AMATROL laboratories were not fully utilized.

More activities (example, short courses for industrial workers) should be engaged to make full utilization of AMATROL laboratories.It was also surprising that (8%) of the lecturers did not know whether to agree or disagree to some of the statements.

In Table 4.14 and Table 4.15 students and lecturers respectively gave their view on the benefits of the AMATROL Training Programme. Undoubtedly, almost all the students (91.6%) and lecturers (89.2%) agreed to the fact that the AMATROL Training Programme is of much benefit to their engineering learning and teaching. Only few students (0.6%) and lecturers (0.8%) agree or disagree, with the remaining students (7.8%) and lecturers (10%) not agreeing to the fact that there is a benefits of the AMATROL Training Programme to their learning and teaching of engineering. The believes of both lecturers and students

Norton (1987) identified the benefits of competency training to include increase motivation amongst learners; flexible delivery and learning; focus on skill, knowledge and attitude; trained competent graduates with transferable skills; promotion of team work; and trained graduates acquire competencies required in the performance of jobs

# CHAPTER SIX

# SUMMARY OF RESULTS, CONCLUSIONS AND RECOMMENDATIONS

## 6.1 Introduction

This study examined the AMATROL Training Programme and its impact on teaching and learning for lecturers and students at Takoradi Polytechnic School of Engineering. The chapter presents a summary of the results, the conclusions drawn from the analysis of this research. Recommendations and limitations of the study including suggestions for future research work are stated.

## 6.2 Summary of Results

- It was observed that majority of the students engaged in Polytechnic Engineering Training were males. The females will rather prefer the humanity courses which they find easier.
- The AMATROL Training Programme have received massive acceptance for engineering training in Takoradi Polytechnic. Majority of the lecturers and students accepted to the fact that the AMATROL Training is an effective instructional method for engineering training than the traditional method of teaching and learning.
- For students to be skilfully equipped practically to work confidently and independently in today's industries, they need to have much technological skills training.
- To have effective evaluation of student's practical performance and achieve teaching and learning outcomes, it depends on the frequent engagement of

student's practical skills training. Hence, allocating more time for practical skills training.

- There are trained lecturers who handles students practical work but they need more motivational packages to boost their commitment in using the AMATROL modules to teach. More qualified Technicians can be employed to support the lecturers.
- The AMATROL modules relates to the theories taught in class. This tends to reflect positively in their academic performance.
- The AMATROL training helps the students to follow standard directions, instructions and plans in engineering training. That is what employers look for in students when they graduate.
- Majority of the people feels that, the AMATROL laboratories have not been utilized to the fullest.

It is obvious from this study that practical experience assists the students to learn and understand the engineering courses with ease since engineering is seen by most as abstract. This will make the students professional, resourceful, effective and have the requisite qualifications to be employed or self-employed after completion of school. Furthermore, helps lecturers to also achieve their objectives in teaching as well as get excellent evaluation feedback from students.

### 6.3 Conclusions

Extending the reach of real industrial skill training beyond the borders of a traditional classroom has become essential as the skilled worker shortage continues to grow. Modern industry increasingly requires a technically sophisticated worker at a time when supply falls far short of the demand.

In our fast paced society, developing new skills requires flexible, easily accessed educational material that is available whenever and wherever a student needs it. AMATROL's training program meets the challenge for flexible technical training by offering excellent technical content depth as well as breadth, strong interactivity for skill development, and excellent assessment and student tracking through an intuitive, easy-to-use web portal. AMATROL's training program creates easy access to educational opportunities for technical skill development previously restricted to the classroom.

The material is self-paced, making it ideal for individual use, traditional class settings, or a blended approach. AMATROL's proven curriculum is problem-solving oriented and teaches technical skills in a wide range of industrially-relevant technologies.

In all, there is a good perception towards the use of the AMATROL Training Programme which is a good sign for Takoradi Polytechnic School of Engineering for technological training of students for the industries. Unfortunately, the low enrolment figures of females, the time allocated for the training sessions and boosting the commitment of the lecturers to teaching using the AMATROL modules must be improved by the authorities and the management.

### 6.4 Recommendations

Based on the findings from the study the following recommendations and suggestions are offered about the means of giving proper training to students to acquire practical skills that can make them self-employed or give confidence to employers to employ the students from the Polytechnics.

### 6.41 Lack of lecturer's commitment to teaching using AMATROL module

Management should attract qualified staff with requisite knowledge in AMATROL. Attractive motivational packages be made available for lecturers who engage students using the AMATROL modules.

### 6.42 Inadequate time allocated to teaching AMATROL modules

Management should allocate sufficient time to modules and courses taught using AMATROL.

### 6.43 AMATROL laboratories were not fully utilized

More activities should be engaged to make full utilization of AMATROL laboratories. More modules and courses should be taught using AMATROL. Other engineering programmes which are not currently integrated with AMATROL should be introduced to AMATROL training programme.

### 6.45 Governments promotion of AMATROL Training Programme

The promotion of the AMATROL Training Programme by the Government through the Ministry of Education, NTCE and NAB to be adapted nationwide in all the ten (10) Polytechnics in Ghana as they change to Technical Universities. One of Government's Strategyfor Converting the Polytechnics to Technical Universities is;"repositioning the polytechnics as strategic institutions for the training of highly-skilled human resource to drive economic growth".

## 6.5 Suggestions for further studies

The study has some limitations that further research should overcome. Despite Takoradi Polytechnic been the first to acquire the state of the art AMATROL

equipment's for the training. Other polytechnics (Kumasi Polytechnic, Ho Polytechnic and Koforidua Polytechnic) have currently also acquired some of the AMATROL equipment's for their training. Future research is encouraged to also looks into how their training is impacting positively or otherwise in their teaching and learning in the institutions.

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**APPENDIX I**

**UNIVERSITY OF EDUCATION, WINNEBA – KUMASI CAMPUS**

**DEPARTMENT OF MECHANICAL TECHNOLOGY**

**QUESTIONNAIRE FOR LECTURERS**

**ASSESSING THE IMPACT OF THE AMATROL TRAINING PROGRAMME ON TEACHING AND LEARNING OF ENGINEERING IN POLYTECHNICS IN GHANA:**

**(A CASE STUDY OF TAKORADI POLYTECHNIC)**

This questionnaire is designed to collect data to be used purely for an academic purpose. The data will help the researcher to meet part of the requirements for the award of Master of Technology (M. Tech) degree from University of Education Winneba Kumasi (UEW- K). I wish to assure you that all responses to these questions will be strictly confidential. Thank you for your cooperation and time.

**Please tick (√) one where multiple answers have been provided.**

**SECTION A: PERSONAL INFORMATION**

1. Gender

Male [ ] Female [ ]

2. Age Group

Below 20 years [ ] 20 – 29 years [ ] 30 – 39 years [ ] 40 – 49 years [ ] Above 50 years [ ]

3. Educational Level

HND [ ]FIRST DEGREE [ ] MASTERS [ ] PH.D [ ]Other

(Specify)……

4. Area of Specialization

Mechanical Engineering [ ] Electrical Engineering [ ] Other (Specify)……

5. Period of service

1-2 Years [ ] 3-5 Years [ ] 6 –10 Years [ ] 11-15 Years [ ] 16-20 Years [ ] above 20 years [ ]

**SECTION B: LECTURERS'PERCEPTION TOWARDS AMATROL TRAINING PROGRAMME**

**To what extent do you agree or disagree with the following statement.**

Please indicate your level of agreement or disagreement by ticking (√) in the right box.

**Key: SA - Strongly Agree, A – Agree, N - Neutral, D – Disagree, SD – Strongly Disagree**

| | **Statement** | **SA [5]** | **A [4]** | **N [3]** | **D [2]** | **SD [1]** |
|---|---|---|---|---|---|---|
| 6 | AMATROL Training Programme makes teaching effective | | | | | |
| 7 | AMATROL Training Programme offers several benefits over traditional teaching methods | | | | | |
| 8 | AMATROL Training | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Programme makes teaching difficult | | | | | |
| 9 | AMATROL Training Programme makes teaching practical | | | | | |
| 10 | AMATROL Training Programme makes teaching easy | | | | | |
| 11 | AMATROL Training Programme provides effective student evaluation | | | | | |
| 12 | AMATROL Training Programme achieves learning outcomes | | | | | |
| 13 | Develops students with the act of working independently | | | | | |
| 14 | Enhances students' skills to work confidently in the industry. | | | | | |

## SECTION C: CHALLENGES ASSOCIATED WITH THE USE OF AMATROL TRAINING PROGRAMME

**To what extent do you agree or disagree with the following statement.**

Please indicate your level of agreement or disagreement by ticking (√) in the right box.

**Key: SA - Strongly Agree, A – Agree, N - Neutral, D – Disagree, SD – Strongly Disagree**

| | Statement | SA [5] | A [4] | N [3] | D [2] | SD [1] |
|---|---|---|---|---|---|---|
| 15 | Lack of skills to teach using AMATROL module | | | | | |
| 16 | Break down of AMATROL equipment | | | | | |
| 17 | Insufficient AMATROL equipment and tools | | | | | |
| 18 | Majority of AMATROL modules did not relate with the theories taught | | | | | |
| 19 | Lack of students' commitment to learning using AMATROL module | | | | | |
| 20 | Time allocated for teaching using AMATROL was not enough | | | | | |
| 21 | Ratio of machines to students was not adequate | | | | | |
| 22 | Number of workstations to student's ratio was not adequate | | | | | |
| 23 | AMATROL laboratories were not fully utilized | | | | | |

**SECTION D: BENEFITS OF AMATROL TRAINING PROGRAMME**

**To what extent do you agree or disagree with the following statement.**

Please indicate your level of agreement or disagreement by ticking (√) in the right box.

**Key: SA - Strongly Agree, A – Agree, N - Neutral, D – Disagree, SD – Strongly Disagree**

| | Statement | SA [5] | A [4] | N [3] | D [2] | SD [1] |
|---|---|---|---|---|---|---|
| 24 | AMATROL Training Programme equips students with practical skills | | | | | |
| 25 | AMATROL Training Programme brings out the creativity in students | | | | | |
| 26 | AMATROL Training Programme provides effective feedback on student performance | | | | | |
| 27 | AMATROL Training Programme enhances student academic performance | | | | | |
| 28 | AMATROL Training Programme enhances student learning experiences | | | | | |
| 29 | AMATROL Training Programme promotes effective teaching | | | | | |
| 30 | AMATROL Training Programme promotes effective assessment | | | | | |
| 31 | It develops students to follow | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | directions, instructions and plans | | | | | |
| 32 | It provides the opportunity for students to achieve their objectives of pursuing the program as far as practical works are concern | | | | | |
| 33 | It prepares students skilfully to meet the expectations of industry | | | | | |

Please state any comments/suggestions you have on the AMATROL Training Programme:

……

……

……

**Thank you very much for participating**

**APPENDIX II**

**UNIVERSITY OF EDUCATION, WINNEBA – KUMASI CAMPUS (UEW – K)**

**DEPARTMENT OF MECHANICAL TECHNOLOGY**

**QUESTIONNAIRE FOR STUDENTS**

**ASSESSING THE IMPACT OF THE AMATROL TRAINING PROGRAMME ON TEACHING AND LEARNING OF ENGINEERING IN POLYTECHNICS IN GHANA:**

**(A CASE STUDY OF TAKORADI POLYTECHNIC)**

This questionnaire is designed to collect data to be used purely for an academic purpose. The data will help the researcher to meet part of the requirements for the award of Master of Technology (M. Tech) degree from University of Education Winneba Kumasi (UEW- K). I wish to assure you that all responses to these questions will be strictly confidential. Thank you for your cooperation and time.

**Please tick (√) one where multiple answers have been provided.**

**SECTION A: PERSONAL INFORMATION**

1. Gender

Male [ ] Female [ ]

2. Age Group

Below 18 years [ ] 18 – 29 years [ ] 30 – 39 years [ ] 40 – 49 years [ ] Above 50 years [ ]

3. Level

Year One [ ] Year Two [ ] Year Three [ ]

4. Entry qualification to the school

Secondary [ ] Technical [ ] Other (Specify)……

5. Did you learn any trade before getting admission to the polytechnic? Yes[ ]No [ ]

6. If you indicated 'YES' in Question 5, please state the trade

……

7. Which of the trade did you learn before getting admission to the polytechnic?

Auto Mechanic [ ] Welding [ ] Electricals [ ] Carpentry [ ] Ref & Aircon [ ] Brick Laying [ ]

8.Programme of study

Mechanical Engineering [ ] Electrical Engineering [ ] Other (Specify)……

## SECTION B: STUDENTS' PERCEPTION TOWARDS AMATROL TRAINING PROGRAMME

**To what extent do you agree or disagree with the following statement.**

Please indicate your level of agreement or disagreement by ticking (√)in the right box.

**Key: SA - Strongly Agree, A – Agree, N - Neutral, D – Disagree, SD – Strongly Disagree**

| | Statement | SA [5] | A[4] | N [3] | D [2] | SD [1] |
|---|---|---|---|---|---|---|
| 9 | AMATROL Training Programme is an effective instructional method | | | | | |
| 10 | AMATROL Training Programme makes learning flexible | | | | | |
| 11 | AMATROL Training Programme makes learning easy | | | | | |
| 12 | AMATROL Training Programme makes learning practical | | | | | |
| 13 | AMATROL Training Programme makes learning effective | | | | | |
| 14 | AMATROL Training Programme makes learning difficult | | | | | |
| 15 | AMATROL Training Programme makes learning ineffective | | | | | |
| 16 | Makes one learn the act of working independently | | | | | |
| 17 | Makes one skilfully equipped to work confidently in the industry. | | | | | |

## SECTION C: CHALLENGES ASSOCIATED WITH THE USE OF AMATROL TRAININGPROGRAMME

**To what extent do you agree or disagree with the following statement.**

Please indicate your level of agreement or disagreement by ticking (√)in the right box.

**Key: SA - Strongly Agree, A – Agree, N - Neutral, D – Disagree, SD – Strongly Disagree**

| | Statement | SA [5] | A [4] | N [3] | D [2] | SD [1] |
|---|---|---|---|---|---|---|
| 18 | Inadequate qualified instructors to teach using AMATROL | | | | | |
| 19 | Break down of AMATROL equipment | | | | | |
| 20 | Insufficient AMATROL equipment | | | | | |
| 21 | Majority of AMATROL modules did not relate with the theories learned | | | | | |
| 22 | Lack of lecturer's commitment to teaching using AMATROL | | | | | |
| 23 | Time allocated for teaching using AMATROL was not enough | | | | | |
| 24 | Ratio of machines to students was not adequate | | | | | |
| 25 | Number of workstations to student's ratio was not adequate | | | | | |
| 26 | AMATROL laboratories were not fully utilized | | | | | |

## SECTION D: BENEFITS OF AMATROL TRAINING PROGRAM

**To what extent do you agree or disagree with the following statement.**

Please indicate your level of agreement or disagreement by ticking (√)in the right box.

**Key: SA - Strongly Agree, A – Agree, N - Neutral, D – Disagree, SD – Strongly Disagree**

| | Statement | SA [5] | A [4] | N [3] | D [2] | SD [1] |
|---|---|---|---|---|---|---|
| 27 | AMATROL Training Programme equips students with practical skills | | | | | |
| 28 | AMATROL Training Programme brings out the creativity in students | | | | | |
| 29 | AMATROL Training Programme provides effective feedback on student performance | | | | | |
| 30 | AMATROL Training Programme enhances student academic performance | | | | | |
| 31 | AMATROL Training Programme enhances student learning experiences | | | | | |
| 32 | AMATROL Training Programme promotes effective learning | | | | | |
| 33 | AMATROL Training Programme promotes effective assessment | | | | | |
| 34 | It develops students to follow directions, instructions and plans | | | | | |
| 35 | It provides the opportunity to achieving the objectives of pursuing the programme as far as practical works are concerned | | | | | |
| 36 | It prepares students skilfully to meet the expectations of industry | | | | | |

Please state any comments/suggestions you have on the AMATROL Training Programme:

……

……

……

**Thank you very much for participating**