UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY EDUCATION, KUMASI

AN ASSESSMENT OF COMPETENCY BASED TRAINING ON THE SKILLS

ACQUISITION OF ELECTRICAL/ELECTRONIC ENGINEERING STUDENTS IN

GHANA-CASE STUDY OF CAPE COAST TECHNICAL UNIVERSITY

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A Dissertation in the Department of **ELECTRICAL/ELECTRONIC TECHNOLOGY EDUCATION**, Faculty of **TECHNICAL EDUCATION**, submitted to the school of Graduate Studies, University of Education, Winneba, in partial fulfilment of the requirements for the award of Master of Technology (Electrical/Electronics) degree

DECEMBER, 2017

DECLARATION

STUDENT'S DECLARATION

I, ROBERT KISSI-BOATENG, declare that this dissertation, with the exception of quotations and references contained in published works which have all been identified and acknowledged, is entirely my 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 thesis was supervised in accordance with the guidelines and supervision of dissertation as laid down by the University of Education Winneba.

NAME: PROFESSOR AHMED ADDO

SIGNATURE ……………………………

DATE …………………………………………

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DEDICATION

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ABSTRACT

The main purpose of the study was to assess Competency Based Training on the skills acquisition of Electrical/Electronic Engineering Students in Ghana, using Cape Coast Technical University as a case study. The researcher used descriptive research design for the study. The study adopted the mixed approach which made used of both quantitative and qualitative approaches. The study population was made up of all Electrical/Electronic Engineering Students, Lecturers, Laboratory Technicians and industrial workers at the Cape Coast Technical University. The population for the study was 250 respondents. Data was collected from all 7 Lecturers, 3 Laboratory Technicians and 23 industrial workers using purposive sampling while random sampling technique was used to select 119 students for the study. Questionnaires and interview guides were the instruments used to gather primary data. The data collected was analysed statistically using Statistical Package for Social Sciences (SPSS) version 18. The study findings indicated that 57(50%) of the respondents revealed that Competency Based Training is somewhat effective on the skills acquisition of Electrical/Electronic Engineering Students. Moreover, 45(39.5%) of the students indicated that Laboratory Technicians/Instructors who are manning the various laboratories in the Department are somewhat competent. Furthermore, 60(52.6%) disagreed that tools and equipment are available for practical work. The challenges affecting the Technical University Education in Ghana are inadequate infrastructure, lack of workshops/laboratories, workshop/laboratory facilities, and inadequate funding. The study recommended that the Government of Ghana should provide adequate infrastructure and teaching and learning materials to equip the Electrical workshops/laboratories with educational resources that can improve Vocational and Technical Education (VET) in the Cape Coast Technical University.

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

The importance of Competency-Based Training (CBT) in nation building cannot be over-emphasized. CBT, has been recognised as constituting a vital segment of Ghana educational system and human resource development initiative for producing the requisite skilled manpower needs for Ghana's overall development (Baah-Wiredu, 2008). Indeed, Technical and Vocational Education and Training (TVET) is a major avenue for industrial development as well as for economic and social progress of any country. It is TVET that produces the critical mass of the requisite skilled as well as, technical and professional manpower needed for national development. Without the skilled technical manpower produced by Vocational and Technical Institutes (VTI), technical development would virtually grind to a standstill.

In this era of creative and flexible learning, most higher education in developing countries still adopt a passive approach to learning where students' success in examination is based on their ability to reproduce a credible portion of their notes from memory. Although the curricula and teaching methods have remained largely unchanged in developing countries over the years, employers are increasingly demanding analytical thinking, communication and entrepreneurial skills (World Development Report, 2007). Both technical and core competencies have become increasingly valuable in the rapidly changing labour market that requires employees to adapt to new development in technology and working operations (World Bank, 2008). Against this background, it is

crucial for developing nations to adopt a more innovative view of learning that emphasises active intellectual engagement, participation and discovery, rather than passive absorption and reproduction of facts. This reform requires re-design, review and implementation of new curricula and academic programmes that would transform the teaching and learning process. Effective reform or innovation in Technical Universities in developing countries also requires high-level support from educators, industry, government, prospective students and other relevant stakeholders. Such innovation must be customised to fit the nation's stage of development, political system, social structure, economic capacities, history and cultural system (OECD, 2014).

The pressure for change in teaching and learning in the Electrical/Electronic Training and Vocational and Educational Training (VET) systems has become even more necessary due to reasons such as global economics, industry restructuring and policy initiatives from the government (Curtain, 2014). In this regard, the development and application of skill standards derived from the curricula of Competency-Based Training (CBT) is one major teaching and learning approach that is believed to have a strong potential to increase skill levels, reduce unemployment rate, increase productivity and to achieve international competitiveness in employability skills acquisition (Smith & Blake, 2015).

Even though socio-political factors may account for the introduction of CBT in some countries, the demand for well-educated and innovative workforce at all occupational levels has been a major reason for CBT reforms in the VET systems of many countries. Another reason is that training activities in the most VET systems do not match with the skill needs of the industry. It is believed that countries that invest more in high-level skills tend to increase productivity; intermediate-level skills also address unemployment, while

lower levels skills reduce social inequities and vices in an economy (Keating, 2008). As a result, both governments and industry have attached importance to the VET system to provide all levels of skills as a means to reduce unemployment rate, increase productivity and achieve international competitiveness.

Countries such as the United States of America (USA), the United Kingdom (UK), Australia and The Netherlands have several decades of experience in the implementation of CBT in their VET systems. Central to the literature on CBT about these countries is the growing concern and dissatisfaction over the relevance of the content of formal educational programmes to the workplace environment. There is a commonly expressed belief that institution-based courses too often emphasize on theoretical knowledge at the expense of the ability to apply knowledge to perform required competencies in the workplace. Even though these countries have different contexts for CBT reform in terms of their socioeconomic, cultural, political and industrial settings, the major reasons that necessitated for CBT reforms were theory-based curricula, recessionary economic conditions and high rate of unemployment particularly among the youth.

In the UK for instance, it is argued that courses and programmes in the VET concentrated on gaining knowledge and theory to the neglect of performance (Boreham, 2012). In Australia, CBT was viewed not only as the foundation for reform in vocational and post-compulsory education but also the means of increasing skill levels and productivity (Keating, 2008). In the US, the vocational curriculum was usually prepared by teachers who placed more emphasis on book knowledge other than practical activities. The result was over-reliance on certification as the main criterion for hiring employees or workers (Carter, 2015). As a result, new models of delivering skills and credentials were

adopted in the education and training system to prepare students adequately for a globally competitive workforce (Levesque & Lauen, 2010).

In The Netherlands, the curricula in the vocational education was theory-based and for that matter, most of the students left school without adequate level of skill training leading to high level of structural unemployment particularly among the youth (Biemans et al, 2014). In South Africa, the Outcome Based Education (OBE), a variant of the CBT was introduced to provide skill training among the labour force in order to reduce unemployment and achieve economic development (Allais, 2013). Like the challenges mentioned already, increasing rate of graduate unemployment particularly from higher education institutions in Ghana has been a major challenge facing the government and the industry community. Therefore, this study assessed competency Based Training on the skills acquisitions of Electrical/Electronic Engineering Students in Ghana, using the Cape Coast Technical University as a case study.

1.2 Statement of the Problem

Competency Based Training (CBT) plays a critical role in national development of every country. One of the most important features of CBT is its orientation towards the world of work and the emphasis of the curriculum on the acquisition of employable skills. Another important characteristic of CBT is that it can be delivered at different levels of sophistication. This means that TVET institutions can respond to the different training needs of learners from different socio-economic and academic backgrounds, and prepare them for gainful employment and sustainable livelihoods. The youth, the poor and the vulnerable of society can therefore benefit from TVET to improve their livelihoods. The

advanced countries that Ghana borrows resources from are in that state today because their stakeholders have respect for Technical and Vocational Education and the people in that field. In spite of the contribution that Technical and Vocational Education and Training can make in developing the formal and informal economy, not much has been done to address the challenges the programme faces in order for it to be more beneficial to the formal and informal sector of economy. For example, the study conducted by Smith & Blake (2015) revealed that increasing rate of graduate unemployment particularly from Technical Universities in Ghana has been a major challenge facing the government and the industry community. This study aims to assess CBT on the skills acquisition of Electrical/Electronic Engineering Students at Cape Coast Technical University.

1.3 Purpose of the Study

The main purpose of the study is to assess Competency Based Training on the skills acquisition of Electrical/Electronic Engineering Students in Ghana, using Cape Coast Technical University as case study.

1.4 Objectives of the Study

The following objectives of the study are to;

1. Evaluate Competency Based Training on the skills acquisition of Electrical/Electronic Engineering Students in the Cape Coast Technical University.

2. Investigate the impact of well-equipped Electrical/Electronic workshops/laboratories in the teaching of applied electricity for Competency Based Training and skills acquisition

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3. Assess the use of teaching and learning materials on Competency Based Training and skills acquisition.

1.5 Research Questions

The main research questions for the study are:

1. How can Competency Based Training influence the skills acquisition of Electrical/Electronic Engineering Students in the Cape Coast Technical University?

2. What is the impact of well equipped Electrical/Electronics workshops /laboratories in the teaching of applied electricity for competency based skills acquisition?

3. How can the use of teaching and learning materials affect Competency based training and skills acquisition?

1.6 Significance of the Study

The study will provide useful information for the Ministry of Education, School Administrators, Electrical/Electronic Engineering Lecturers and students of Cape Coast Technical University and all Technical Universities in Ghana. This study will help educational stakeholders and Electrical/Electronic Lecturers to upgrade themselves through Competency Based Electrical/Electronic Training in order to boost employability skills acquisition in Electrical/Electronic Engineering. The conclusions drawn and recommendations made will provide the Ministry of Education, School Administrators, Electrical/Electronic Engineering Lecturers and other academic stakeholders to develop effective measures to equip Electrical/Electronic workshops/laboratories in the teaching

of applied electricity for Competency Based skills acquisition in Technical Universities in Ghana.

1.7 Scope of the Study/Delimitation

The main purpose of the study is to assess Competency Based Training on the skills acquisition of Electrical/Electronic Engineering Students in Ghana- Case study of Cape Coast Technical University. Therefore, the study is geographically limited in scope to Cape Coast Technical University in the Central Region of Ghana. The study is conceptually limited in scope to the impact of competency based training on employable skills acquisition of Electrical/Electronic Students in Ghana.

1.8 Organization of the Chapters

This dissertation consists of five Chapters, Chapter One deals with the background of the study, the statement of the problem, research questions and objectives of the study, significance and organization of the study. In Chapter Two the researcher reviewed related literature whiles Chapter Three deals with the research methodology used in the study. Other aspects of Chapter Three describes the research design, the population sample and sample procedures, data gathering instruments and data collection procedures of the study, methods of data analysis. Chapter Four describes the research findings and the discussion of the main findings and Chapter Five presents the summary of the findings, conclusions and recommendations and suggestions for further research.

CHAPTER TWO

LITERATURE REVIEW

This chapter reviewed comprehensive literature relating to Competency Based Training and employable skills acquisition. The chapter covered issues like definitions and conceptions of competence, theoretical approaches of Competency Based Training (CBT). Characteristics underpinning the curriculum development of Competency Based Training, teaching and learning theories of Competency Based Vocational Training. Moreover, the study on the impact of well-equipped Electrical/Electronic workshops /laboratories in the teaching of Applied Electricity for Competency Based skills acquisition. Furthermore, ecosystem theory of Teaching and Learning Materials (TLMs), classroom resources and impact on resource adoption, taxonomy model of the use of TLMs and impact on student outcomes, social cultural theory of learning, problems associated with the use of instructional materials, the impact of using teaching and learning materials on Competency Based Training and skills acquisition, types of teaching learning materials and their uses in the classroom.

The study further reviewed the challenges face by teachers when using teaching and leaking CBT implementation, development of competency / occupational standard, competency based apprenticeship training, challenges affecting the Technical University Education in Ghana, challenges in formal TVET sector in Sub-Saharan Africa, and the challenges facing the effective preparation of Electrical Students for the world of work.

2.1 Definitions and Conceptions of Competence

Competence is defined as the ability to perform particular task and duties to the standard of performance expected in the workplace (DEEWER, 2007). On his part, Kouwenhoven (2011) views competence as the capacity to accomplish the key occupational tasks that characterise a profession to satisfactory standards. In this sense, competence involves the application of knowledge, specified skills, and attitudes necessary for effective performance in the industry or enterprise. It includes performance of individual tasks, managing range of different tasks, responding to contingencies or breakdowns, carrying out workplace responsibilities including working with others (Schofield & McDonald, 2004). This definition views competence as a functional, task-oriented and industry-focused system of training where individuals apply the relevant skills and attitudes in a required workplace environment.

The general concept of competence is also viewed in the light of core competencies which involve the set of appropriate competencies needed to accomplish a key occupational task at a satisfactory or superior level (Kouwenhoven (2011). These core competencies may be domain-specific that concerns clusters of knowledge, skills and attitudes within a specific content related to the profession or generic because they are required in all content domains which can be transferred to new professional situations.

The concept of competence is perceived by other authors in a more generic sense. For instance, Gonczi (2009) views competent person as one who possesses the attributes necessary for job performance to appropriate standards. Eraut (2003, cited in Weigel, Mulder & Collins, 2007) defines competency as the ability to perform the tasks and roles to the expected standards. Weigel et al (2007) also perceive competency as the capability to

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perform and to use the knowledge, skills and attitudes that are integrated in the professional repertoire of an individual. In all these definitions, competence is seen as a set of features and assumptions that describe the attributes of a competent individual.

Another view of competence is seen as recognition of complex interaction of people, skills and technologies that drives company performance (Le Deist & Winterton, 2015). In this sense, competence is dependent on the context or organizations and that people tend to perform different competencies at different contexts and circumstances. The importance of contexts in the concept of competence is particularly important because a particular knowledge, skills and attributes of an individual may be valued differently in different organizations and contexts. This means that there is the need for flexibility in the standards of performance considering the changing labour market demands for skills needed by businesses, industry and organizations.

2.1.2 Theoretical Approaches of Competency Based Training (CBT)

On the basis of these conceptions and definitions of competence, CBT can be traced from two main perspectives; namely: the behaviourist tradition as practised in the USA, UK and Australia, and the holistic tradition in France, Germany, Netherlands and Austria (Biemans, Nieuwenhuis, Poell, Mulder & Wesselink, 2014; Le Deist & Winterton, 2015). Particularly, the behaviouristic conceptualisation of competence originated from the USA in the 1960s where the term competency (emphasis on "y" and "ies") was associated with the performance-based teacher training and labeled as competency-based education (Chappell, Gonczi, & Hager, 2015). It was based on the views of educational theorist Ralph Tyler (2012) who promoted the idea of developing behavioural objectives into the design

of curriculum and instruction which provided three related components, namely; performance, standards, and conditions, for breaking down learning objectives in curriculum design. It was thought the learning programmes should be assessed in terms of changes that occur in learner's behaviour.

Unlike the traditional sequenced programmes, learners could achieve mastery of prescribed competencies at their own pace while students' performances were evaluated by criterion referenced assessment (Chappell, et al., 2015). The behaviourist defines CBT in a narrowly-focused and occupationally-specific manner. It places too much emphasis on what the individual can do and pay little attention to the underpinning knowledge, values, attributes, meaning, intention and effect of interpersonal and ethical issues (Gonczi, 2016).

The Holistic approach rather views CBT in a broader context and integrates personal aptitudes, ethical and cultural values in the training program. The holistic perspective means that competence is viewed from the context in which it will be used, together with the personal or behavioural, cognitive and ethical components (Cheetham & Chivers, 2016). It also means that training delivery and assessment processes must be interrelated and must occur in relevant workplace or simulated contexts. It must be emphasized that the needs of a constantly changing industrial society can never be met by narrowly skills training which neglects aspects of general education. This is based on the premise that, the main goal of education is to prepare an individual for life, which involves not one occupation or role but a multiple of roles in order to function effectively in one's community. Moreover, if CBT is viewed from the behaviouristic perspective, some human and community services that require attitudinal or behavioural changes is likely to throw away some values and ethical standards underpinning certain professions.

Recent attempts to capture both generic and occupationally-specific competencies in the definition and conception of competence have led to the development of three competency models; namely the behaviourist, generic and cognitive approaches (Weigel, Mulder, & Collins, 2007). The behaviourist emphasizes on the importance of observing effective job performers in order to distinguish high and low performers. The generic approach identifies the common abilities that explain differences in performance. The cognitive approach includes all the mental resources of individuals that are used to acquire knowledge, perform tasks and achieve successful performance.

Cheetham and Chivers (2016) have further developed a holistic model of professional competency that consists of five interrelated competencies. They are:

Cognitive competence that involves knowledge (know what) underpinned by

understanding (know why).

Functional competencies (skills or know how); things an individual should be able

to do and demonstrate

Personal competency (behavioural competencies); individual characteristics that

make a person to behave effectively.

Ethical competencies possessing appropriate personal and professional values and

abilities to make sound judgments in a work related situations.

Meta-competencies; ability to cope with uncertainties, capacity to learn and

embrace change.

Evidently, the concept of competence is an on-going process of continual change and development of new ideas and models. This is the results of changes in technology, industry restructuring and labour market demands (Harris, Guthrie, Hobert, & Lundberg,

2015).

The foregoing definitions show that competence is generally viewed as combination of knowledge, skills, personal attributes and attitudes in the performance of a particular task to specific standards. However, competence is not only a journey, but also a context-dependent. In other words, competence goes beyond formal education and training and includes all life experiences and capacities which have been developed over a life's span. This implies that concepts of competency must be seen as an integrated form of training in order to derive other learning approaches such as problem-based learning, authentic learning inductive and exploratory learning in the training systems. Furthermore, any competency model needs to provide broader contexts of competency standards in the training system in order to facilitate diverse pathways and recognize the value of individuals' formal and informal learning in diverse contexts and circumstances (Mulder, Weigel, & Collins, 2016).

2.1.3 Characteristics underpinning the curriculum development of Competency-Based Training

On the basis of the foregoing views about the concepts of competence, the following characteristics are said to underpin the development of Competency-Based Training (CBT) curriculum (Kouwenhoven, 2013).

CBT is oriented to the professional practice. This means that future occupational practice of the student must be the pivot around which the curriculum should evolve. CBT is learner-centred and the learning process is central. Therefore, learning approach must involve individualized materials, flexible learning time and continuous feedback to the

learner (Guthrie, 2009; Hattie, 2009).

CBT is based on constructivist approach and that the individual must be actively involved in the acquisition of knowledge and skills.

In CBT the teacher's role is that of a 'cognitive guide' that encourages students to engage in active inquiry in the learning activities. CBT provides learning environments that promote the development of competencies. CBT includes the development of generic competencies which are integrated in the curriculum to stimulate transfer in a variety of settings.

Assessment of CBT focuses on competencies and includes both formative and summative. CBT curriculum development is based on the elaboration of profiles and identification of competencies required in the performance of a professional task. The characteristics of CBT require new teaching and learning roles of both teachers and students in the instructional processes. As teachers shift away from the traditional 'chalk to talk' to become a facilitator, an adviser or coach (Mitchell et al, 2013), learners need to be active and exploratory in the training programmes (Swailes & Roodhouse, 2014; Cremers, Eggink & Hoetink, 2015).

2.1.4 Teaching and Learning theories of Competency-Based Vocational Training

The introduction of CBT demands new roles and pedagogical skills in the teaching profession. Teachers in CBT need to change their traditional role as an information provider to become an expert, coach, assessor, educational developer, researcher and manager (Gauld &Miller, 2014). In the role as an expert, teachers must possess relevant knowledge of the subject matter, be abreast with current development in businesses,

organization and society, learn from the experiences of the students and professional practice and translate them into his or her educational practices. As a coach, the teacher must facilitate students learning by providing regular interaction with students, identify individual learning needs, initiate feedback dialogue with students and encourage them to achieve their learning goals. The teachers role as an assessor is to evaluate, diagnose and monitor students' competence levels, assess projects and ensure that assessment is carried out with industry personnel in an authentic environment. As a researcher, teachers must constantly conduct new studies to be able to apply the results into his or her educational practice in order to be abreast with the rapidly changing knowledge-based economy. Being an education developer, the teacher must design learning activities, develop resources to supplement real work activities and assessment procedures with other colleagues. As a learning manager, teachers need to cooperate with other stakeholders relevant to the learning process such as staff members, workplace trainers and parents towards the achievement of learning goals.

These new roles of teachers emphasize two main teaching theories in competence-based vocational education, namely: the cognitive apprenticeship model (Collins et al, 2009) and the acquisition and participation metaphors of learning (Sfard, 2008). The cognitive apprenticeship models specifies four dimensions necessary for designing and implementing competence-based learning environments in VET systems (Seezink & Poell, 2010). These include *content, method, sequence* and *sociology*. While the 'content' describes different types of knowledge, such as domain-specific or heuristic and learning strategies, the 'method' considers teaching strategies in CBT such as modeling, coaching, scaffolding, articulation, reflection and exploration. The 'sequence'

dimension prescribes the logical arrangement of learning materials to meet the needs of different learners under three main principles; increasing complexity, increasing diversity and global before local skills. The 'sociology' dimension also refers to the social context of the learning environment, particularly in authentic conditions ((Loyens & Gijbels, 2008).

The second framework for CBT theory of teaching is the 'acquisition and participation metaphors of learning. The acquisition metaphor of learning refers to the process of acquiring knowledge from the outside world into the learners' cognitive structure or mind. The learner's prior knowledge and experiences must be recognized, refined to be used as cognitive framework for advanced learning. The participation metaphor, also referred to as 'enculturation' regards learning within the social context where newcomers master specific skills and knowledge from the experienced ones in order to become active participants in the socio-cultural practices of a community (Seezink & Poell, 2010).

It must be stressed that these theories of learning are not mutually exclusive and that some elements of parallels can be drawn between them. For instance, the participation metaphor is closely related to sociology dimension of the cognitive model as both emphasize learning within the social contexts. In the same way, the acquisition metaphor of learning is very much related to the principles within the content dimension of the cognitive apprenticeship model because both dimensions refer to the need for teachers to recognize the prior learning of learners so that future learning can be built on it. Essentially, both theories provide useful framework to find out the extent to which the key features of CBT have been utilized in the implementation processes. More significantly, these theories emphasize the fact that CBT is based on constructivist learning principles that allow students to be actively involved in the learning process within an authentic learning

conditions (Loyens & Gijbels, 2008).

It must be emphasized that acquiring and developing competences is more than learning a set of skills (Kouwenhoven, 2009). Generally, the term CBT describes the acquisition and development of competences while 'training' as in Competency-based training (CBT) is more concerned with the mastering of specific knowledge and skills. As the dissertation focuses on knowledge and skills acquisition within training programmes, the term CBT will be used throughout this dissertation.

2.1.5 Competency-Based Training

Competency-Based Training (CBT) has been defined as an approach to training that places emphasis on what a person can actually do as a result of training (ANTA, 2013). Robbinson and Misko (2013) also perceive CBT as training which develops the skills, knowledge, and attitudes required to achieve competency standards. The main idea behind the introduction of CBT in the VET of many countries is to move away from the time-served approach to training to one based on the mastery of competency standards. Secondly, it is a shift from the supply or producer/educator-driven approach to and industry-led training system. Various literature and policy documents describe the characteristics of CBT as: (a) based on competency standards (b) modular format (c) outcome and not input or process focused (d) industry involved/led (e) flexibly delivered, involving self-paced approaches (f) performance-oriented (g) assessment based on criterion-referenced rather than norm referenced and allowing for recognition of prior learning (Smith & Keating, 2007; Guthrie, 2009).

Although raising technical skills of workforce is important, it is not adequate in the

context of rapid pace of technological change and high labour mobility. In other words, mastery of a job-specific task does not ensure a competent employee. Individuals require the capacity to be flexible, take initiative and exhibit adaptability to different settings by means of employability skills (Neilson 2007). Studies show that industries are in constant search of employees who are capable of combining these technical skills with employability skills in innovative and productive ways for effective participation in the emerging patterns of work and organization (Brown *et al,* 2008).

2.2 The impact of well equiped electrical workshops /laboratories in the teaching of applied electricity for Competency Based skills acquisition

Teaching and learning materials or Classroom resources can be framed in a number of ways, including taxonomies (Grubb, 2008) and complex eco-systems (Zhao & Frank, 2013). The conceptual framing of classroom resources has impact on how studies are conducted and what phenomenon rise to the notice of researchers. In the current project, possible resources included students, teachers, physical artifacts, and the relationships between them; however, they were not described as resources until they were enacted as resources. The critical element of this conceptualization of resource enactment is that resources can be any physical artifact, person, or relationships as long as they are used as resources (p. 810).

Practically speaking, this model of resources had impacts on what was recorded in the data gathering and analysis processes. Specifically, phenomenon noted in analysis were instances in which students and teachers arranged, modified, attended to, interpreted, or assigned value to an artifact, actor, or relationship. In short, TLMs/

resources were conceptualized as requiring enactment to truly be a TLMs/ resource, and the current project focused on those enactments. Furthermore, this model of resource enactment is similar in many ways to the model of classroom instruction put forward by Cohen, Raudenbush, and Ball (2013). In both models teachers and students are potential resources. Also, in both models, the classroom is conceptualized as a system of interactions and relationships.

Conceptual Model of the Study
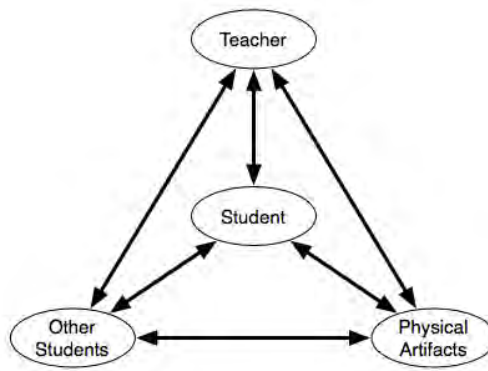
Figure 2.1: Enacted Classroom Resources Model
Source: Cohen, Raudenbush, & Ball (2013)

2.2.1 Ecosystem theory of Teaching and learning materials (TLMs), classroom resources and impact on resource adoption

Another way to conceptualize the complex relationships between teachers, students, and TLMs or resources is as an ecosystem. Zhao and Frank (2013) presented an ecosystem model to explain factors influencing technology adoption and use in classrooms. All actors in the ecosystem interact with one another and those interactions are vital to any actors "survival" in the environment. However, in order for students to interact with meaningful content, they rely on their teacher to make the content

accessible. Also, in order for any resource (technological or otherwise) to "survive" in the classroom climate, the teacher has to recognize its value and make it available for student use. With this metaphor, the teacher is the keystone species, computer uses are a "living" species, and the introduction of new resources, such as external educational innovations, can be seen as the "invasions of exotic species" (p. 811).

Zhao and Frank (2013) argue that classroom ecosystems, like biological ecosystems, exist in a state of homeostasis – where the environment is in balance and each species has their role, or niche, in the hierarchy. Therefore, invading species, such as new educational technologies or educational interventions, are unlikely to survive or last unless they are compatible with the established teaching and learning environment (p. 813). Zhao & Frank (2013) tested the usefulness of an ecosystem model of classrooms for the purpose of understanding educational technology adoption by conducting a study of technology use in 19 different elementary schools in four school districts in mid-western United States.

They gathered survey data from all school staff, interviews with administrators and technology staff, and interviews and observations from four of the participating schools - one from each participating district. Once the data was collected, the researchers categorized possible influences of technology use into six categories: the ecosystem, the teachers niche in the ecosystem, teacher ecosystem interaction, teacher-computer predisposition for compatibility, and opportunities for mutual adaptation (Zhao & Frank, 2013). They found that technologies found within classrooms, as opposed to computer labs or other locations in the school, were used more often. Zhao & Frank suggest this is because it costs the teacher considerably more energy to reserve and make use of

technology outside their own classrooms than technologies within their classrooms. Also, teachers were the most frequent users of technology, while students were the least frequent users. Teachers often used technology for communicating with colleagues, parents, and administrators. Zhao & Frank argue that the communicative technologies were compatible with the current teaching environment, since they did not require teachers to change or alter their existing teaching practice. Furthermore, the communicative technologies were filling a "niche" in the environment, supporting teacher communication, which allowed those technologies to survive and prosper in the classroom ecosystem. In comparison, student use of technologies both required a reconfiguration of teacher practices and cost considerable energy on the part of the teacher. As such, those technologies were less likely to be used.

Zhao and Frank (2013) also found that teacher-niche in the school ecosystem, as well as their relationship to other "species" in the ecosystem influenced their use of technology. Teachers who perceived pressure from colleagues were more likely to use computers only for their own purposes and were especially resistant to using technology that would require a reconfiguration of their teaching practices. While teachers who received help from colleagues, and had opportunities to experiment with software, were more likely to use computers with their students than for their own purposes. Remarkably, the perceived relative advantage of student use of technology had no statistically significant effects on what technologies were used in classrooms.

This illustrates that teacher rationale for using technology depends most directly on their own uses and needs, supporting their classification as keystone species in the environment. Zhao and Frank conclude that innovations cannot be implemented without a

regard to the internal social structures of schools, especially teacher-level factors, and expect to survive in the classroom context. An "evolutionary rather than revolutionary" approach to change in school computer use is called for (p. 833).

2.2.2 Taxonomy model of the Use of TLMs and impact on student outcomes

In one such study by Grubb (2008), he defined four categories of classroom resources and evaluated how the presence of these resources impacted factors such as student achievement and continuation of education after high school. Table 2.1 lists and summarizes the four categories of resources in Grubbs taxonomy: simple, compound, complex, and abstract. Traditionally funding structures for education have focused on the increase of simple resources, resources that can be directly bought, in hopes that the increase of these resources would increase student gains. Grubbs study sought to better understand and define the effects of simple resources on a variety of student outcomes, as well as the relationships between varying resources, school level factors, and their impact on students.

Table 2.1: Summary of Grubb (2008) taxonomy of school resources (TLMs)

Type of classroom resource Description

Simple	Resources that are physical objects (eg. textbooks) or classroom factors (eg. teacher experience and expertise) that can be directly bought, adjusted, and measured
Compound	Two or more resources that are jointly necessary for success (eg. class size reduction *and* adequate teacher preparation)
Complex	Resources that are not easily bought, measured, or adjusted (eg. instructional approaches and teaching philosophies)
Abstract	Resources that are difficult to discern and measure, and often embedded in a web of relationships and practices within a given school (eg. collegial decision-making practices, internal teacher accountability, and distributed leadership roles)

Grubb found that "simple" resources, such as textbooks, technology, increased teacher salary, teacher training, or lower pupil to teacher ratios may be necessary in some instances but not sufficient in and of themselves to influence student outcomes (Grubb, 2008; p. 107). For example, if a school decides to reduce class sizes, yet the teachers continue using the same strategies and practices that they would in a larger class then outcomes were not likely to change. They need the "compound" resource of reduced class size and modified instructional strategies. Indeed, many of the simple resources that are often stressed and discussed in education research and politics, such as pupil-teacher ratios, technology, and teacher education levels are not among the most powerful factors influencing student achievement.

While many of the simple resources were necessary for student achievement, they were virtually never sufficient. On the other hand, there were several "complex" and

"abstract" resources that had significant impacts on student outcomes. When teachers felt in control of their classrooms in terms of subject material and instruction, identified as an abstract resource, students had higher test scores. Also, school climate, an abstract resource reported on by the students, was correlated positively with student test scores (p.125). For example, innovative math teaching was a particularly powerful complex resource, which affected both student achievement scores and their decision to pursue a 2 or 4-year college qualification (p. 124). Many of the influential complex and abstract resources, such as student perception of school climate and teacher perception that their department encourages innovative teaching, were not influenced by monetary resources available but were rather socially constructed within the schools themselves. In past research of student achievement in the United States (Caldas & Bankston, 2007), it has been found that family Socio-Economic Status is one of the strongest predictors of student success.

Nonetheless, Grubb (2008) found that the explanatory power of family background proves to be smaller than school resources when complex and abstract resources were taken into account, and therefore, the theory that school effects are overwhelmed by family influences is incorrect (Grubb, 2008; p. 134). For educators and researchers in search of school reform, this is a hopeful finding. It suggests that efforts to improve school quality based on the increase of school constructed complex and abstract resources could be beneficial. However such efforts require a deeper understanding of school dynamics and the way resources are employed and even created in the school and classroom contexts.

2.2.3 Social Cultural Theory of Learning

The social cultural theory of learning was postulated by Vygotsky (1978). He postulated that knowledge is socially constructed as individuals interact with the "More Knowledgeable Other" and the "More Knowledgeable Other'' could be anyone in the teaching/ learning environment or cultural artifacts such as, TLMs in general. Socio-cultural theories view learning as the product of interactions between the learner and the environment. According to Vygotsky, human action is mediated by tools. These tools are used as aids in solving problems that cannot be solved in the same way in their absence. Atwell, 2010 (cited in Atwell and Hughes, 2010) reiterated that these tools should be part of a system that allows learners to link learning to performance in practice. Learning takes place when students actively interact together with concepts while they construct new knowledge.

Vygotsky (1978 as cited in Nanjappa and Grant, 2013) believed that children are active in their acquisitions of knowledge. However, by focusing on the learner, the availability of teaching and learning materials and their use can support new understanding and capabilities, through offering a cognitive tool to support cognitive and metacognitive process. John Dewey (1916 in Koc, 2015) espoused that if we teach today as we taught yesterday, we rob our children of tomorrow. Therefore, the availability and effective use of teaching and learning materials in the Cape Coast University will provide the opportunity for students to become active recipients in their learning of Electrical/Electronic Engineering.

This study is also informed by Constructivist learning theories as proposed by Bruner and others, developed out of Piagets theories of cognitive development. Their

basic assumption is that the learner is active in the learning process; that learning is the result of interaction with a problem context where the learners construct their own knowledge. The key concepts, as described by Glasersfeld (2012) are that:

- Knowledge concerns a students "conceptual operations" (p 33)

- Each individual must construct knowledge

- Teaching is a social activity, but learning is "a private activity" (p 33)

Knowledge is not transferred passively, but is personally constructed. Glasersfeld (2012) comments that learning is "on the basis of failures and successes of its own actions" (p 35); learners must first learn and understand before they can share their constructs with others. However, this can be done when the right TLMs are available and are effectively utilized by both teachers and students during lesson delivery. Glasersfeld holds an extreme view on constructivism, but his definitions have been selected as they show clearly the key concepts of these theories.

The relevance of this constructivist theory to the study is that, as learning is an active process, the learning context has an important role in the learning process. The context should be designed to help develop critical thinking skills in the learner by using the types of tasks performed in the professional field of practice. Problem solving activities are felt to meet this requirement, as Jonassen (2010 p 63) commented: "problem solving is generally regarded as the most important cognitive activity in everyday and professional contexts". The best problems are authentic ones, that is are ill-structured problems, as is found in real life (Jonassen, 2010). Cognitive tools are also provided in this environment to aid the learning for example by helping to decrease the cognitive load

or help with visualization. These tools can include computers, concept maps or calculators, for example.

2.2.4 Problems Associated with the Use of Instructional Materials

Since educational communication and technology is a fairly new area of importance in education, it is a lightly technical field, and to understand how it can affect the instructional delivery, one first has to understand the operational functionality of the resource kits. Teachers' knowledge have a great impact on the effective application of teaching aids or instructional materials, this is because the teacher have to understand the sequential presentation of the instructional gadgets so as to suit the interests of the learners and its appropriateness with the instructional tasks. Part of the application of teaching aids or instructional materials process is the target population for whom the materials are to be used and the setting or vicinity where the learning should take place. This also serves as one of the challenges of teachers when it comes to the use of TLMs. Time, is also a serious problem or factor that delay the effective use of instructional materials and effective instructional delivery in the class, because in most cases the time that is allotted for a subject on the timetable might not be enough for the teachers to present his contents alongside with effective use of the materials which will affect the wholesome delivery of the content.

Lack of funds is also a handicap why most educational institutions are unable to acquire relevant teaching equipment and materials. In line with this, students and teachers will lack on the opportunity to learn and use new techniques in the field. There are sophisticated teaching aids or instructional materials that can make learning easier and

faster such as computer-aided program but lack of funds has effects on its importation and use in schools. Materials available for the effective instructional delivery are poorly manhandled by both the teachers and some school authority. Schools are affected by non-availability of resource room for the proper keeping of both the locally manufactured and the commercially purchased teaching aids thereby limiting its use as at the time needed. Another pressed issue about teaching aids or instructional materials for use is that, the materials are grossly lacking in the schools. There was scarcity of both printed and audio-visual materials. In most of the instructional institutions neither printed nor audio-visual materials are available in sufficient quantity or quality.

2.3 The impact of using Teaching and Learning Materials on Competency Based Training and skills acquisition

In a study conducted by Klans (2010), teaching learning resource is a generic term used to describe the resources teachers use to deliver instructions. Broadly, teaching learning resources refers to a spectrum of educational materials that teachers use in the classroom to support specific learning objectives as set out in the lesson plans. According to Klans (2010), posited that teaching learning resources are tools that classroom teachers use to help their students learn quickly and thoroughly. A teaching aid can be as simple as a chalkboard or as complex as a computer program. They are the tools used to convey information in the classroom. Tamakloe, Amedahe and Atta (2015) also defined teaching learning resources as a material which the teacher uses to facilitate the learning, understanding and acquisition of knowledge, concept, principles or skills by his students. In short, teaching learning resources in education are the use of equipment and materials

that are relevant to motivate, inform, instruct and present the subject matter to the learner as well as making learning easier than it would have been without using it.

Most people think that, teaching learning resources refer to only materials which the teacher prepares and uses in the classroom to facilitate learning and enhance students academic performance. Mialaret (2016) also said that teaching learning resources help the teacher but does not replace him in teaching and learning processes. This also contributes to the fact that teaching learning resources will complement the efforts of the teacher to bring understanding to the students. In short, teaching learning resources are aids which help to provide sharp experiences in seeing, hearing, touching, manipulating and demonstration.

2.3.1 Types of Teaching Learning Materials and their Uses in the classroom

According to Nacino-Brown, Oke and Brown (2012), the process of teaching-learning depends upon the different types of equipment available in the classroom. There are many aids available these days. As we all know, todays' age is the age of science and technology, the teaching learning program has also been affected by it. The process of teaching-learning depends upon the different types of equipment available in the classroom. Teachers can use various teaching aids besides textbooks to arouse students, interview and demonstrate how things work. This study classified teaching resources into four. They include; visual, audio, audio visual and human beings (resource personnel). Visual resources are the aids which use the sense of vision. A visual aid is any object or picture that relates to the subject being taught. It is something you bring to

support whatever project or report you are discussing. It gives the listener something concrete to look at to enable a better understanding of what you are teaching.

Nacino-Brown, Oke and Brown (2012) disclosed that, visual resources could be objects and specimen hence providing direct first-hand experiences which are necessary for concepts formation. Students can see, touch, smell and even taste them giving a richer and more meaning to them. From this definition, it can be said that visual aids add interest to a discussion. Examples of visual aids are whiteboards or chalkboards, charts, maps, flash cards, calendars, actual objects, models, pictures, bulletins board, overhead projector, slides, among others. Audio resources are the aids that involve the sense of hearing. They are resources to help the student hear and speak. Audio aids are the aids that influence the learners auditory sense (sense related to listening and hearing). Such resources include the record player or the gramophone, the radio (programmes), tape recorder, among others. Tape recorders are useful for slow learners because, they can listen on their own without holding the rest of the class. Audio aids help in developing a listening skill.

Audio visual aids are the aids which involve the sense of vision (eye) as well as hearing (ears). They are materials using sight or sound to present information or subject matter in the classroom (Tamakloe *et al.,* 2015). According to Tamakloe *et al.,* (2015) audio visual aid or resources are aids that cater for both audio and visual perceptions. When the teacher uses an exclusively audio aid and supplements it with the use of visual aids or resources, the teacher is appealing to both audio and visual perceptions. This is how audio visual resources were initially combined and hence the hyphenated form of "audio-visual". Examples include slight projectors, TV, film-strips or a transparency with

the running of commentaries or the use of explanations and descriptions simultaneously by the teacher.

2.3.2 The challenges face by teachers when using teaching and learning materials in lesson delivery

Several school environmental factors have generally been identified as influencing the use of teaching and learning materials. These include availability of instructional materials, school location and quality of the physical facilities, class size and pupil-teacher ratios, teacher qualification and experience, and supervision. Instructional materials provide information, organize the scope and sequence of the information presented, and provide opportunities for pupils to use what they have learned (Lockheed & Verspoor, 2011). Students usually perform better when they have books or study aids to foster their learning. These study aids or material resources could be textbooks, teachers" guides, wall pictures, maps, atlases and other learning aids. The availability and use of teaching and learning materials affect the effectiveness of a teachers lessons. In addition, the school location and quality of the physical building influence the performance and achievement levels of pupils.

Harbison and Hanushek (2012) stated that the quality of the physical facilities is positively related to student performance. This assertion corroborates that of Danesty (2004, cited in Yinusa & Basil, 2008) who stressed that good sitting arrangement and good buildings produce high academic achievements and performance, while dilapidated buildings that lack mental stimulating facilities coupled with low or no sitting arrangements is destructive. According to Asikhia (2010) where the school is located

determines to a very large extent the patronage such a school will enjoy. Similarly, the entire unattractive physical structure of the school building could de-motivate learners to achieve academically.

This is what Isangedighi (2008) refers to as learners environment mismatch. According to him, this promotes poor academic performance. Engin-Demir (2009) argue that attending a school with a better physical environment is associated with increased math scores. Adepoju (2001) found that students in urban schools manifest more brilliant performance than their rural counterparts. Also, Ogunleye (2012) reported a significant difference in the achievement of students in urban peri-urban areas. Class sizes have also been identified as determinants of academic performance. Studies have indicated that schools with smaller class sizes perform better academically than schools with larger class sizes. Fabunmi, Brai-Abu and Adeniji (2007), for instance, indicated that three class factors (class size, student classroom space and class utilization rate), when taken together, determined significantly students' academic performance in Oyo state, Nigeria. Similarly, Salfi and Saeed (2007) found a significant correlation between school size and students" achievement in Pakistan. They revealed that small schools performed better than medium and large schools. In 2001, Tremblay, Ross and Berthelot found class size to be inversely related to achievement, especially for children in early grades. Kraft (2014) in his study of the ideal class size and its effects on teaching and learning in Ghana concluded that class sizes above 40 have negative effects on students" achievement.

Adeyela (2010) found that large class size is unconducive for serious academic work. Furthermore, schools with effective supervision of teaching and learning activities have high performance rates. Etsey, Amedahe and Edjah (2014) in a study of 60 schools

from peri-urban (29 schools) and rural (31 schools) areas in Ghana found that academic performance was better in private schools than public schools because of more effective supervision of work. According to Etsey (2015) if circuit supervisors are more regular in schools, this would put the teachers on the alert to be more regular and early in school. This would forestall teacher absenteeism and improve teaching in the schools. If teachers are present always following regular visits of circuit supervisors, students would be challenged to change their attitudes toward school

2.3.3 Philosophy and experiences in the implementation of Competency Based Training

The implementation of CBT has been controversial as many authors and researchers have different views about the impact of this learning innovation. Their assessment is based on the extent to which CBT is meeting the requirements of the various stakeholders, namely: industry, employers, training institutions and workers. CBT implementation is said to have brought closer collaboration between industry and training institutions. In the context of teaching and learning, this partnership is said to have increased strong linkage between theory and skills, industry-focused curricula, student-centred, active and exploratory form of learning among trainees (Swailes & Roodhouse, 2014, Cremers et al., 2015).

At the enterprise level, CBT has resulted to increased skills for achieving business goals such as improved productivity, efficiency, effectiveness and production of quality product (Callan & Ashworth, 2014). Employees or workers are able to adapt to changing organizational structures and business practices. As noted by Mulcahy and James (2010),

'the bottom line' for enterprises is relevant training where relevance means 'doing the job' to a pre-set standards. In addition, CBT also functions as a mechanism for workforce supervision and appraisal system. In Britain for instance, the use of standards in the NVQ's was found to have helped not only to raise skills levels, but also as procedures for recruitment, selections and performance review (Swailes & Roodhouse, 2014).

However, CBT implementation in many countries have attracted a lot of criticisms from researchers and practitioners to the extent that some critics have categorized them into philosophical, technical defects, pedagogical, centralization and control as well as lack of teacher capability (Smith & Keatings, 2007). Conceptually, CBT is criticized as too behaviouristic since it ignores the connections between tasks, the contexts and attributes that underlie the performance and the effect of interpersonal and ethical aspects (Gonczi, 2016). As CBT is about what a person can do, training delivery is often narrowly focused on the expected outcomes to the neglect of the underpinning knowledge and values. Another challenge facing practitioners, authors and researchers of CBT is the confusion surrounding the uses of the terms competence, competency, competences, competencies, and competency models or assessment. Lack of common usage of these terms and poor conceptual clarity have resulted into different kinds of models, principles and characteristics, curriculum development and assessment practices in many VET systems (Merriboer, Klink & Hendricks, 2012).

Assessment practices remain one of the contested issues in the implementation of CBT. Teachers argue that assessing students' with industry personnel means a loss of professional autonomy because most the industry staff do not have technical capacity to make judgment on students' performances (Biemans *et al.,* 2014). Other setbacks in

assessment practices include use of both criterion and norm-referencing, labour intensive, time-consuming and financial constraints. Non-graded form of assessment which is purely based on demonstration of competence is also criticized as a means of promoting mediocrity and discourages excellence or expertise among students (William & Bateman, 2013). Critics argue that grading provides comprehensive information and pathways for employment, selection process for further study and award purposes rather than just 'competent' or 'not yet competent'. However, there is an increasing support for the use of portfolios in many VET systems to provide sufficient documentary evidence on the students performance profile such as certificates, references from past employers, testimonials and work samples. This process is said to help not only in recognizing prior learning but also ensure that evidences of competence are gathered and properly documented from a wide range of sources (Guthrie, 2009).

2.4 Conceptual model

Competency-based training is believed to have the potential of equipping trainees with the needed skills and competencies to function effectively in the labour market (Arguelles & Gonczi, 2010). Evaluating the contribution of CBT in a number of industries and enterprises in Australia, employers reported that learning can be achieved on-the-job but further suggested the need for high quality instruction that goes beyond the specified competencies to include outcomes related to innovation and future operations at the workplace (Mulcahy & James, 2010). This makes it imperative for teachers to recognize the background characteristics of the learner (previous knowledge, skills and experiences, social context, gender, etc) as cognitive framework in their training delivery in order to

pursue future learning objectives in a variety of contexts. As evaluation is part of the implementation of every innovation (Michell et al., 2013), this study evaluates the teaching and learning processes of CBT in Ghanaian polytechnics in order to use the feedback from the implementation experiences to improve upon the innovation. To this end, a conceptual model in Figure 2.3 has been composed to find out the potential effects of some key variables on the achievement of competence. The policy context represents the governments educational policy and accreditation requirements that form the national training framework for all stakeholders in the implementation process. As the end-user of education and training, industry need to collaborate with training institutions to develop industry-focused curriculum, training delivery and performance criteria, quality assurance and apprenticeship programmes. Training institutions also provide environment for teaching and learning, equipment and learning materials in the study programmes to achieve the required competencies necessary to perform professional Tasks.

INDUSTRY

↓

POLICY CONTEXT

↓

TEACHING AND LEARNING MODULES FOR COMPETENCY-BASED TRAINING

STUDENTS' CHARACTERISTICS - PRE-EDUCATION - GENDER

↓

COMPETENCE AND SKILLS AQCUISITION
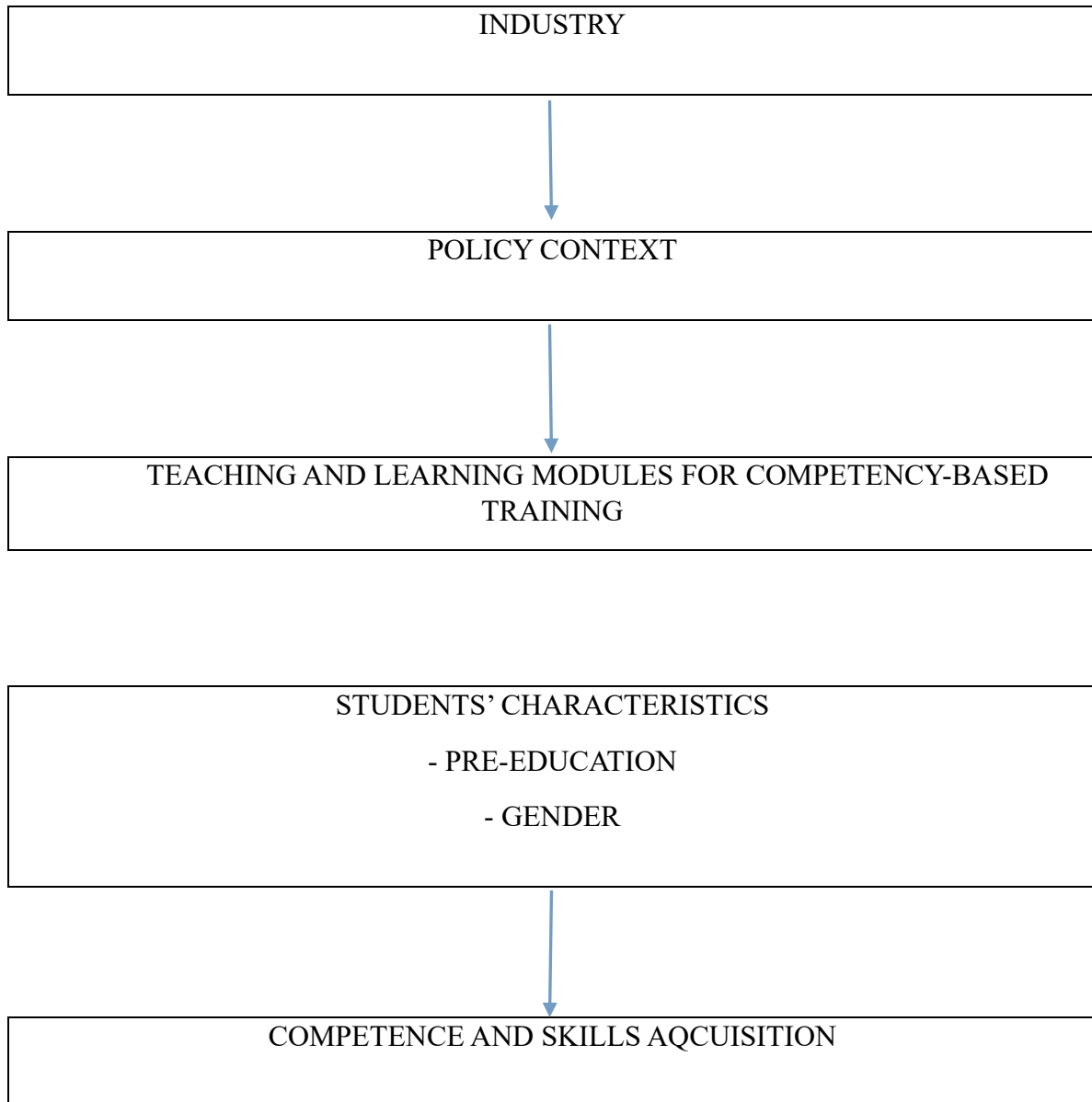
Figure 2.2 Conceptual model for CBT implementation in Ghanaian Technical Universities

In Figure 2.3 the policy context, represented by the government educational policy, funding, accreditation and quality assurance procedures, assume direct effect on both industry and teaching and learning modules used in the training institution. Industry participation in CBT refers to the active collaboration between industry and training institutions towards the development of competency standards, internship programmes and

3

quality assurance. Both industry and training institutions have reciprocal effects because the two features need to work together in the training activities. Teaching and learning modules refer to the breaking down of the curricula of the study programmes into independent units called modules with the aim of ensuring mastery of each task before progressing to a more advanced level. Each module represents a certifiable part of a job and therefore can be studied separately to acquire the specific competencies needed for a job. Incorporated in the teaching and learning modules is recognition of prior learning as a tool to recognize and accredit previous and existing learning experiences, encourage self-assessment and build learner confidence towards the achievement of the desired goal.

Effective collaboration between industry and training institution through the teaching and learning modules is assumed to have a direct effect on the achievement of competence. We also expect students' previous education and gender under background characteristics to exert a direct effect on competence or assume an interaction effects with industry and teaching and learning modules towards acquisition of competence. Achievement of competence is indicated by the utilisation of CBT features towards acquisition of skills and attributes required for the performance of professional tasks.

2.5 Competency Based Training in international perspective

In recent times, factors such as the rapid pace of technological change, the development of a knowledge-based economy and high labour mobility have influenced the need for expansion in post-secondary education and training and the development of life-long learning. New emerging markets require graduates who are able to operate in complex environments characterized by ill-defined problems, contradictory information,

dynamic and highly integrated processes (Westera, 2011). This implies that education and training systems need to focus on producing workers who are autonomous and can engage in discretionary learning to support changes in the workplaces (Wheelahan and Moodie, 2011). More specifically, Vocational Education and Training (VET) systems need to emphasize on developing competencies and capabilities rather than qualification. Developing the capabilities is believed to strengthen the link between VET and the labour market and therefore assist students to acquire employable skills (Biemans *et al.,* 2014). One major teaching and learning approach in the VET systems that is believed to have the capacity to reduce the gap between training and the labour market and achieve employability is competency-based training (CBT). The major reason for CBT reforms stems from the importance both governments and industry attach to the development of competences required in the labour market so as to reduce the unemployment rate, increase productivity and to achieve international competitiveness (Arguelles and Gonczi, 2010).

Moreover, the notion of CBT has become more popular among policy-makers because it is said to fit very well within the policy discourses of employability and lifelong learning. As a result, various competency programmes have been developed by national and international bodies in the VET systems across the globe to ensure that students acquire competencies deemed necessary to be employable. These include the European Qualification Framework (EQF), European Credit System for VET (ECVET) and Programme for International Student Assessment (PISA) by OECD member countries to assist students to acquire key competencies considered essential for effective participation in the labour market (Mulder et al, 2016). Similarly, the International Labour Organisation (ILO) and the UNESCO International Centre for Technical and Vocational Education and

Training (UNEVOC) have developed various programmes using the competence-based approaches to support the training of professionals in the Latin America, Africa and Asia (Wesselink et al, 2010).

Several studies on the effect on CBT implementation have been focused on the perspectives of staff development (Lowrie, Smith & Hill, 2009), an enterprise perspectives (Mulcahy & James, 2000), instructors' perspectives (Lowrie, 2009) and policy makers and training providers (Smith, 2010). In some of these studies, the effects of CBT on the development of employability potentials of students have been generally focused on competent performance that involves the achievement of knowledge, skills and attitudes without considering new ways of thinking about employability. It is argued that employability must be judged from the point of view of whether the training processes effectively equip students for lifetime learning and develop the self to be able to solve problems in life and employment (Knight & Yorke, 2013). The training process of CBT is perceived to equip students with competencies needed in their future professions and be able adapt to future developments in their work (Jenewein et al., 2014).

The research therefore examines two features of CBT which are linked with the achievement of employability namely; industry participation and recognition of prior learning. Industry participation in CBT is crucial to ensure that training programmes match with the needs of industry so as to reduce skill shortages and unemployment and to improve productivity. Recognition of Prior Learning (RPL) is a form of assessment that provides opportunity for students especially from disadvantaged backgrounds to participate in the VET system to acquire employable skills. RPL is said to promote lifelong learning, a critical strategy for enhancing skill development and addressing skill shortages,

and a mechanism for promoting equity and social inclusion (Smith and Clayton, 2009).

RPL assessment is linked with industry because it must be conducted in the work environment or in simulated conditions and learners' performances must be measured against the industry competency standards. The study examines whether the implementation of these features goes beyond the achievement of knowledge, skills and attitudes to promote efficacy beliefs and lifelong learning. In this regard, this study compares the implementation of these CBT features in the United Kingdom (UK) and Australia with Ghana with the purpose of drawing some useful lessons for Ghana and other countries with emerging VET institutions.

2.5.1 Contextual factors for CBT reforms in Australia, UK and Ghana

Although Australia, UK and Ghana differ in their socio-economic structure and geographical location, these countries were selected because of the similarities in method of implementation and their behaviouristic stance adopted towards CBT (Mulcahy & James, 2010, Biemans et al., 2014). In all these countries, the implementation of CBT forms a crucial part of the national reform agenda, which were triggered by government reports such as the Manpower Services Commission (MSC, 2011) in the UK, Fynn, Carmichael and Meyer reports of 2013 in Australia and COTVET (2016) in Ghana. Besides, there is a central government that is actively involved in developing and implementing CBT. In each case, government intervention engaged industry and business partners, organised labour and trade unions in the development of apprenticeship systems, qualification frameworks and funding mechanisms. In all cases, the reforms emphasised training system and transformation of the Further Education sector with particular focus on

the development of intermediate or higher level vocational qualifications. Finally, both UK and Australia have great wealth of experiences and literature on CBT implementation because of their pioneering role in developing competency-based approach in VET (Winterton, *et al.,* 2015).

The main reasons for the reform in the countries under review can be traced to government sources, economic conditions, educational sources and trade union movement. Political concerns about poor economic performance, rising unemployment as well as growing skill gaps particularly among the young people in the VET systems resulted in several national investigations and reports from the government in the early 1980s; significant among them in Australia were the Finn, Carmichael and Mayer Reports (Bowden and Masters, 2013) and the Manpower Services Commissions consultation document, a New Training Initiative (MSC, 2011) in the UK. Both reports emphasised the development of occupational competencies to achieve flexible and skilled workforce that could participate effectively in the emerging forms of work and global economic changes (Swalies & Roodhouse, 2014). The recessionary condition in UK in the 1980s (Matlay, 2009) and the technological revolution in Australia in the mid 1980s (Cornford, 2011) are economic contexts for the CBT reforms. In the UK, many young people were dropping out of education and training without sufficient vocational qualification to enter the labour market. The percentage of the UK's workforce who had no post-compulsory secondary qualification slightly decreased from 64.4% in 1976 to 62.2 % in 1987. Similarly, percentage of the workforce with intermediate vocational qualification within the same period decreased from 30% in 1976 to 26.3% in 1987 (Foot and Megginson, 2016).

As a result, the National Council for Vocational Qualifications (NCVQ) was

established to develop competences through VET and to recognise all vocational qualifications to assist greater labour mobility (Boreham, 2012). In Australia, the Structural Efficiency Principle (SEP) initiated by the Trade Union Movement particularly emphasised on skill training, careers, job classification, pay rates and equity to achieve increased productivity. These and many others set in motions a process known as the National Training Reform Agenda in Australia with CBT as its focal point.

On the educational front, the UK had a rigid system of education and training, a theory-based curriculum and certification was based on the outcome of a single examination. The existing programme for the youth had no certification system for trainees, leaving employers sceptical about the potentials of employees about the depth, range and quality of their training. Similarly, the technological revolution in Australia in the mid 1980's resulted in eliminating a large number of the repetitions and laborious jobs which were available in many industries especially for the lower-skilled and school drop-outs (Keating, 2008). New jobs created with the new technology required higher and broader levels of education and skill formation Like the UK, Ghanas VET system was theory-based and relied mainly on paper and pencil examinations for certification and employment (COTVET, 2016).

A report by the Technical Committee on Polytechnic Education (2011) also showed that the Examining Body for the Polytechnic Education in Ghana lacked the appropriate schemes for the assessment of skills, competencies, aptitudes and practical training in HND examinations. The socio-economic factors relate to difficulty in getting job placement for the polytechnic graduates in the labour market as a result of inadequate employable skills. In a study of the labour market performance of tertiary graduates

including the polytechnics, employers revealed that most of the graduates lacked basic skills to complete simple routine assignment (Boateng & Sarpong, 2012).

A tracer study on the performance of polytechnic graduates in the Ghanaian labour market by Boahin, Kamphorst and Hofman (2012) revealed that almost half of the graduates (43.8%) undertook professional training to either improve their job skills and knowledge or learn new skills to overcome deficiencies in their skill training. Moreover, there was a perceived weak linkage between training institution and industry leading to inefficient schemes of industrial attachment and apprenticeship training (JICA, 2008; Boahin, Kamphorst and Hofman, 2012). Given these realities, CBT was introduced to improve the quality and relevance of Technical and Vocational Education and Training (TVET) by equipping graduates with the required workplace and professional skills, promote a stronger working relationship with industry, reduce graduate unemployment and to achieve international competitiveness (COTVET, 2016). In Ghana, most of the institutions in the TVET systems and higher education continue to change their educational concepts by designing and redesigning teaching and learning processes towards competency-based education in Electrical/Electronics training.

2.5.2 Competency Based Training: the case of Ghana

In Ghana, CBT was introduced in the Technical and Vocational Education and Training (TVET) system to equip graduates with the required workplace and professional skills so as to reduce graduate unemployment. A report from the study undertaken on the TVET in Ghana by the Japanese International Cooperation Agency (JICA) revealed that the Curricula of Higher National Diploma (HND) were more theory-oriented than the craft

and technician courses, with theory-based form of assessment (JICA, 2011, p.49). In a labour market study on the performance of tertiary graduates in Ghana, Boateng and Sarpong (2001) observed that some employers took prospective employees through longer orientation and probation schemes after which the best performing candidates were selected.

Inadequate practical training in the polytechnics has caused an emerging trend in the study programmes where a greater number of students pursue Business-related programmes to the neglect of the Engineering and Applied Sciences and Technology. Out of the 28 elective programmes offered in the polytechnics, only four (4) are in the Business, 13 are in the Applied Arts, Science and Technology whiles 11 fall under the Engineering programmes.

Moreover, between 2001 and 2006, over a half of the graduates from the polytechnics completed from the Business programme. Only 21% - 35% are from Engineering and less than 20% from the Applied Arts, Science and Technology. The CBT in Ghanaian polytechnics covers five disciplines: Agricultural Engineering, Fashion Design, Building Technology, Civil Engineering and Automobile Engineering. Its implementation therefore, requires the interplay of stakeholders and other crucial factors that may directly or indirectly affect the training programmes. These include accreditation procedures, effective monitoring and evaluation, collaboration between industry and educational institutions, lesson delivery and assessment practices.

Policy, in terms of the governments education policy, funding, accreditation and quality assurance procedures exert indirect effects on the implementation of CBT programmes. The linkage between industry and educational institutions (polytechnics)

assumes a direct effect on teaching and learning modules, assessment practices and performance grading. These factors have direct effect on CBT implementation. The dependent variable is the effectiveness of CBT implementation which is indicated by the number of CBT features utilised in the training programmes. The independent variables are the linkage between industry and institutions, teaching and learning modules, assessment practices and performance grading.

2.6 Competency Based Training and the Concept of Employability Skills Acquisition

Employability skills have different meanings as different terms are used by different countries to describe it, although with considerable overlap. In Australia and the UK, employability skills are defined as competencies, personal attributes and values that should be acquired, not only to gain employment but also to progress within an enterprise to achieve both individual's potential and the enterprises strategic goals (Neilson 2007). In USA, employability skills describe foundational skills on which a person builds job specific skills. Gibbs (2000) argues that the notion of employability goes beyond the possession of technical skills to feature less factual, value-driven uses of practical judgment in the workplace. Thus, employability refers to both external skills and the character and attitudes of an individual. In contrast, Hughes and Stoner (2011) prefer the term 'deployment skills' deployed in employment situations as a form of self-presentation, selfconfidence and basic work habits.

Employability skills apply to all kinds of work and work organization and not specific to a particular occupation or industry. Therefore, in CBT, employability skills form integral part of the design and structure of study programmes, assessments and staff development

(Guthrie 2009). These competencies equip individuals to function effectively in a wide range of social settings, workplaces, further education and adult life (Guthrie, 2009, Kouwenhoven, 2011). Although there are variations of employability skills across VET systems, several key skill groupings appear common to many institutions and these include basic skills such as literacy, numeracy and ICT skills, interpersonal skills such as communication, teamwork, and personal attributes such as, creativity, problem-solving, capacity to learn and adapt to changes in the workplace or organization (Gibb, 2004). These key competences are embedded within competency standards and that assessment guidelines must provide broader performance criteria so that assessors can make valid inference from the learners' performances.

The major stimulus for increasing interest in employability skills is in response to high labour mobility and the fact that current jobs require flexibility, initiative and ability to undertake many different tasks. In a knowledge and information-based economy posed by globalisation, most jobs are becoming more service-oriented, making information and social skills increasingly important. Thus, jobs in business, finance, insurance and retail sectors require interpersonal skills, customer handling skills, communication and general IT user skills to respond to client needs. Similarly, manufacturing and craft workers often work with more complex processes and therefore require greater thinking, reasoning, problem-solving skills and team work to operate machinery or deal with faults. Therefore, prospective employees need to acquire a broader range of skills, professional competencies and attitudes to continually adapt and transfer skills and knowledge in different contexts. Thus, industries recruit and retain employees who are capable of combining technical skills with professional competencies in innovative and productive ways for effective

participation in the emerging patterns of work and organization (Mitchell et al, 2006). A study by Australian Industry Group revealed that over 90% of the firms were looking for people who are flexible and adaptive, willing to learn on the job, team workers, technically competent and committed to excellence (Allen Consulting Group, 2006).

Studies demonstrate that people with proactive skills, for example, engage in more self-directed learning (Jossberger et al., 2010). An on-going debate in the literature is whether or not employability skills are taught within academic disciplines or promoted in industries. Some authors are of the view that employability skills are best promoted in industries, agencies or extra-curricular activities in work contexts (Green et al., 2009). Crebert et al., (2014) find that industry-based learning, internships, structured work experiences and employer involvement in course design and delivery improve the generic skills of students in different disciplines. Other authors however, argue that employability skills can best be acquired in specific disciplines, particularly those that involve more student-centred learning (Barrie 2015). These skills are fostered through a more student-focused approach to teaching, such as enquiry-based, problem-based, reflective learning and authentic work experiences that provide more opportunities for students to explore their own creative ideas (Trigwell, 2012). Despite these debates, studies show that teachers do not integrate these competencies into their learning and assessment strategies (Barrie 2015). In Ghana, feedback from employers' surveys indicates that polytechnic graduates offer weak employability skills, particularly in terms of problem solving, organizational skills, ICT, communication and teamwork (Boahin et al., 2012).

The concept of competence has its roots from the organisational learning and development where competence was used to describe human behaviours that were

necessary to attain high job performance (Sandberg, 2010). However, different organisations and countries have different meanings to the concept of competence based on their institutional structures and labour processes. In the UK and Australia, the term is used to indicate the range of standards for occupational performance or profession. As such, the notion of competence in both systems reflects the expectation of employers and analysis of job functions in the workplace (Smith, 2010). In the UK's VET system in particular, competence denotes narrower skills, not underpinned by substantial knowledge and usually defined by outputs (Wesselink et al., 2010). For this reason, the National Vocational Qualifications (NVQs) are outcome-based and relate to the behaviouristic approach to competence (Wesselink et al., 2010).

In the United States of America (USA), competency is defined as the underlying characteristics that enable an individual to achieve exceptional performance (McGuire and Garavan, 2011). This implies that competence approach in the USA emphasises much more on potential and cognitive perspectives of learning rather than demonstrated proficiency. The European perspectives on competence tend to be holistic that includes underlying characteristics and attitudes of an individual to perform specific tasks and roles to expected standards in a given context (Mulder et al., 2016). In this sense, competence is defined in the context of functional, personal or behavioural, cognitive and ethical components (Biemans et al., 2014).

In Ghana, competence is conceptualised as the capacity of an individual to perform professional tasks to a specified standard (COTVET, 2016). In the light of these diverse viewpoints, Hofmann (2009) identifies three constituents in the term competency, namely; observable performance; which focuses on the ability to complete a task, standards; which

relates to the quality of observable performance, and underlying attributes; that includes the required underpinning knowledge, skills and attributes that can be adapted to workplace changes and social requirement. It can be deduced from the forgoing that CBT is a delivery of training that develops the skills, knowledge, attitudes and values required to perform professional tasks after the learner has completed a training programme or module. It also implies that CBT has the potential to influence the ways in which employment-related skills are developed and assessed in the training programme.

As an evolving concept, recent developments into the concept of competence and for that matter CBT tend to integrate many issues in contemporary education. Some of these include self-managed learning, the integration of theory and practice through industry and VET linkages, recognition of prior learning (RPL), authentic assessment and social constructivism (Mulder et al, 2016). The integration of these innovations in CBT aim at increasing access, encouraging self-beliefs, problem-solving strategies, capacity for self-regulation and lifetime learning among students. This study however, examines RPL implementation and involvement of industry in the context of CBT towards the achievement of employability. The concept of employability can be defined from the perspectives of the society, employer or company and individuals (Mason et al, 2016). In the views of Reid and Fitzgerald (2011) employability is about being capable and able, and learning how to learn to be able to meet future challenges in a work situation. Bagshaw (2007) offers a dynamic view of employability which is not linked to possession of skills and competencies to survive in a work situation, but requires flexibility and adaptability to be able to seek alternative employment in a changing world.

In this sense, individuals who are employable must be capable of setting goals and

priorities, be proactive in management of change, possess necessary skills for self-advocacy and networking to cope with changing circumstances, be active in the maintenance of continuous learning and capable of working within changing teams (Bagshaw, 2007). Hervey's (2011) views on employability shift the focus from individual student to get employment to an institutional achievement. Yorke (2007) perceives employability as multifaceted characteristics of an individual to gain employment and be successful in the chosen occupations. The understanding of employability is further linked with 'job mastery' and its relationship with the qualities of the study programme, on-the job training and working environment (Aamodt & Havnes, 2008). It is evident that, employability is an extremely complex and vague concept that is difficult to articulate and define. However, by synthesizing the available literature, employability is seen as a combination of factors that enable people to increase their chances of getting a job, staying in and progressing further in the workplace. However, research on current employability often focuses on predictors or characteristics such as dispositional (e.g. self-efficacy), ascriptive (e.g. age) and experience (educational background) (Van den Heijden, 2015).

Linking employability with the training curriculum, Knight and Yorke (2013) present the USEM model as four broad and interrelated components that influence employability. They are (a) Understanding of disciplinary subject-matter, (b) Skilful practice in context (academic, employment and life in general), (c) Efficacy beliefs that denotes the degree to which learners believe that they are able to demonstrate behaviour that will result in achieving their goals and (d) Meta-cognition that also reflects the notion of self-awareness, learning how to learn and capacity for self-regulation. This framework suggests that the notion of employability is not limited to the development of flexible skills but also

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self-awareness, understanding and personal attributes for lifetime learning. These qualities are very important because in the context of rapid global economies, professionals need graduates who can grow and keep pace with changes in operations and demands in the contemporary work places. In this respect, the main focus of this study is to explore how employability is achieved in the CBT programmes by focusing on competence, students' efficacy and lifelong learning.

2.6.1 Industry involvement in CBT implementation

One of the crucial aspects of CBT is to match training to the needs of industry. This implies that the competencies acquired in the training programme must correspond to the demands of the jobs, occupations and working conditions. Furthermore, the underpinning ethics, values, and moral standards should match with the profession. This section discusses the involvement of industry in CBT implementation in the development of competency standards and apprenticeship training.

2.6.2 Development of competency / occupational standard

One of the major roles of industry in CBT implementation among the countries under review was the development of occupational profiles, required competencies in each occupation, and criteria for performance standards. These standards formed the starting point that was translated into curriculum, delivery and assessment of the CBT system (Ducker, 2013). VET institutions geared their courses and training programmes to assisting individuals to achieve the standards. Industry-led agencies such as the Industry Skills Councils (ISC) in Australia, and Sector Skills Councils (SSC) in the UK formed networks with various Industry Training Advisory Boards (ITABS) to identify critical work

functions, key activities, performance standards, skills and knowledge required to successfully perform a given occupation or field (Dept of Education and Labour, 2003). In UK, the National Training Organisations (NTOs) develop occupational standards and accredit skills required in the workplace. Competences are developed from analysis of job roles with little or no underpinning knowledge, which in turn are grouped into competence to make particular NVQs. These standards are developed into modules by award bodies within the framework of the qualification authority (Keating et al, 2012). This is similar to Australian system, where standards are developed by the National Training Board (NTB) and then used to develop modules accredited by State Training Recognition Authorities. For instance, between 1992 and 2004, there were 23 national ITABS and 136 associated state or territory bodies that worked with employers to develop competency standards and provide information to the government on industry trends and future skill needs and training requirements (Sung *et al.,* 2016).

Industry also provides quality assurance in the form of accrediting programmes, monitoring and evaluation against the national standards. . The Australian Quality Training Framework (AQTF) ensures delivery of accredited training and qualifications, quality standards relating to record keeping, qualification of teachers and trainers, use of marketing mechanisms, teaching and assessment processes, recognition of prior learning and mutual recognition of qualifications (Misko, 2016). In the UK, large teams of external verifiers approve centres for training and assessment of NVQ's and carry out inspection or verification visits to these centres at least once a year (Purcell, 2011).

Quality assurance in Ghana is undertaken by the National council for Tertiary Education (NCTE), National Accreditation Board (NAB), National Board for Professional

and Technician Examinations (NABPTEX) and COTVET. These supervisory bodies accredit curriculum and programmes, monitor and evaluate assessment practices and advise government on general policy direction for TVET and higher education. Industry Training Advisory Committees (ITACs) are being established to establish links with industry, offer periodic review of the curricula, identify critical work functions, performance standards and required competencies for successful performance in a given occupation (COTVET, 2016). However a baseline survey on CBT implementation on TVET showed weak linkage between theory and practice, which was attributed to non-involvement of industry in the TVET study programmes (JICA, 2008).

2.6.3 Competency Based Apprenticeship training

Apprenticeship training provides work-based training in a broad range of sectors to individuals to learn new skills and gain recognised qualification to achieve employability. It is a mixture of work-based training and education which includes occupationally-specific qualifications, generic or key skills and underpinning knowledge. Apprenticeship is organised for different age groups of trainees for different levels of qualification. In Australia, contracts for shorter duration usually less than two years are referred to traineeship whiles apprenticeships are used for longer durations (Cuddy & Leney, 2015, Misko, 2016). This arrangement does not only help students in the VET systems but also secondary school students to undertake part-time school-based apprenticeships and traineeship programmes while completing their education (Robbinson & Misko, 2013). In 2005, about 389,000 trainees, accounting for a quarter of the VET enrolment in Australia were found in apprenticeship or traineeship (NCVER, 2007).

In the UK, the Modern Apprenticeship offers training leading to NVQ level 3 or higher while the New Deal offers the young people who have been unemployed for six months or more the opportunity to train for NVQ or other approved vocational qualifications. Furthermore, 14-16 years old undertake young apprenticeship, 16-25 for pre-apprenticeship and over 25 years old enrolled in apprenticeship although the completion rate was low. Out of 270,000 young apprentices of the 14-19 year group who engaged in apprenticeship training, only 40% of them completed (Sung *et al.,* 2016).

Apprenticeship training in the UK has constituent elements including underpinning knowledge (Technical certificate), functional skills (key skills) and NVQs (work-based assessment). Although useful and appear to be holistic, the system is criticised for lack of integration. Moreover apprenticeship in the NVQ basically focuses on level 2 qualifications which require low theoretical content for routine and low-skilled jobs rather than providing comprehensive and broadly-based VET to young people (Nuffield Review, 2008). Some apprenticeship in the UK is further criticised because acquisition of NVQs are also linked with funds and not about ensuring social and occupational mobility. In Ghana however, the large number of medium and small scale industries characterised with inadequate technical and infrastructural facilities limits formal apprenticeship training to students on internship while informal apprenticeship is provided by master craftsmen in various trades.

Practical internship programmes form a crucial segment of CBT in the VET system to ensure industry-relevant training. It is the period where students have the opportunity to spend about six months in a workplace or related institutions, industry or organisation to learn on the job. Both training institutions and industry collaborate to ensure students'

placement, supervision and assessment. However, internship programmes in the training institutions are not well-structured, leading to poor supervision and mentorship, while students' placements do not often relate to their study programmes (Boahin & Hofman, 2012).

2.7 Challenges affecting the Technical University Education in Ghana

In Ghana, one of the major challenges confronting the tertiary education system is the relevance of training programmes to the changing needs of students, industry and society. In a study of the labour market about the performance of tertiary graduates in Ghana, Boateng and Ofori-Sarpong (2012) observed from the employers that most of the graduates lacked basic skills to complete simple routine assignment. As a result, some employers take prospective employees through longer orientation and probation schemes after which the best performing candidates are selected. Like other professional institutions, the Polytechnic education in Ghana was established to provide career-focused education, skill training and opportunities for conducting practical research in collaboration with business and industry.

However, a report by the Japanese International Cooperation Agency (JICA, 2011) on the Technical and Vocational Education and Training (TVET) in Ghana revealed that "the curricula of the HND in the Polytechnics are more theory-oriented with theory-based form of assessment" (p. 49). A further report by the Technical Committee on Polytechnic Education ((Technical Report Series, 2001) also showed that NABPTEX, which is the main the Examining Body for the Polytechnic Education in Ghana, lacked the appropriate schemes for the assessment of skills, competencies, aptitudes and practical training in

HND examinations. This means that the HND awards by NABPTEX are based on theory. A tracer study on the performance of polytechnic graduates in the Ghanaian labour market by Boahin, Kamphorst and Hofman (2010) revealed skills deficiencies in some specific study programmes. For instance, in the Agricultural sector, inadequate skills in numeracy accounted for (43%), IT-professional skills (42%) and general IT-user skills were 40%. These inadequacies have resulted into migration of graduates, increasing rate of unemployment and graduates undertaking further training after completing their study programmes. Almost half of the graduates (43.8%) undertake professional training to either improve their job skills and knowledge or learn new skills to overcome deficiencies in their skill training. Among other reasons, changes in global economy and the desire of firms and industry to reduce cost of production and increase their profit margins have led to continuous refinement of their production processes, internal systems and marketing strategies which do not align with the training system of the polytechnics. As a result, there is continuous demand for skilled workers due to what is commonly referred by economists as 'technological bias' which states that at the same time that new technologies eliminate some jobs through automation, they create new higher skilled employment and up-skill existing jobs (Brown et al., 2008).

The existence of supply-demand gaps does not only results into graduate unemployment but also affects the efficient use of public investment and resources in the polytechnic education. Given these realities, innovation in the training system in the polytechnics is needed to bring out new teaching methods that will lead to better outcomes and performance of learners. Such outcomes include relevant knowledge, skills and competencies that are marketable either for the organization and their staffing demands, or

for individuals to secure greater employability in the wider world of work.

It is in the light of these challenges that the Council for Technical and Vocational Education and Training (COTVET) was established in 2006 among other things to ensure the introduction of an industry-driven CBT in the TVET systems in Ghana. Across the country, the Ministry of Education (MOE) in collaboration with donor agencies such as the Canadian Development Agency (CIDA), JICA and The Netherlands Organisation for International Cooperation in Higher Education (NUFFIC) have introduced CBT to improve the quality of vocational education. The introduction of CBT in Ghanaian Polytechnics under the NUFFIC project focuses on the revision of curricula in five disciplines: Agricultural Engineering, Fashion Design Building Technology, Electrical/Electronics Engineering and Automobile Engineering.

2.7.1 Challenges in formal TVET sector in Sub-Saharan Africa

Lauglo and Lillis (2008) posited that one dilemma which has preoccupied many countries for a long time is whether to concentrate investment in general or vocational education. But, in human capital terms, general education creates ‚general human capital‘ and TVET leads to specific human capital.‘ The former has the advantage of flexibility and, therefore, the possibility of moving from one job to another, while the latter does not. In this regard, many people consider general education as a suitable type of education that is capable of responding to economic and labour force changes in society. On the other hand, technical and vocational education has the advantage of imparting specific job-relevant skills which make the worker more readily suitable for a given job and more productive. Hence, both are important. It is in this light that most educational systems in

Africa try to combine both general and vocational streams of education in varying proportions to suit their educational goals and aspirations.

Conversely, Carnoy (2013) noted that, despite the advantages of imparting job-related skills and the high level of unemployment amongst those with general education, the recognition and preference for general education by the youth in the Sub-Saharan Africa is high. The reason for this is that personnel in administrative and leadership roles are generally chosen from people with a general education background. Therefore, talking about the importance of TVET, without any deliberate action to follow up the rhetoric, will not change its poor image and low status.

CHAPTER THREE

METHODOLOGY

Carrying out any desirable activity requires that an individual follows certain procedures or methods in order to achieve favorable results. This chapter intends to examine the methods used for the study, giving a vivid description of how the research will be carried out. This chapter will cover the research methods that will be adopted by the researcher in arriving at the findings. It describes the research design, research approach, the population, sampling and sample procedures, data gathering instruments, data collection measures, data analysis and ethical consideration are also dealt with in this chapter.

3.1 Research Design

The purpose of research design is to provide a framework for the collection and analysis of data. A choice of research design reflects decisions about the priority given to set of dimensions of the research process. The researcher used descriptive research design for the study. This refers to a research which specifies the nature of a given phenomena. It determines and reports the way things are done. Descriptive research thus involves collecting data in order to test hypotheses or answer research questions concerning the current status of the subject of the study (Bryman, 2004).

3.2 Research Approach

There are basically two research philosophies within which social research are located: interpretivist and positivist paradigms. While the interpretivist paradigm is

grounded in the qualitative approach to research, the positivist paradigm is placed within the quantitative approach to research. In this study, the researcher used the qualitative approach. This type of research approach was used because it enabled the researcher to make fair judgment about the effectiveness, relevance or desirability of the study.

According to the research conducted by Ritchie and Lewis (2003), the qualitative research, is a term used as an overarching category, covering a wide range of approaches and methods found within different research disciplines. On their part, Strauss and Corbin, (1998) believe the concept is any type of research that produces findings not arrived at by statistical procedures or other means of quantification. The central theme of qualitative research is the way in which the phenomenon under study clearly understands and interprets social reality (Bryman, 2004). One of the central motif of qualitative research is the manner in which the entity or phenomenon being studied understand and interpret their social reality (Bryman, 2004). Research designs can be classified into three main types. These are qualitative research method, quantitative research method and the mixed method which is the combination of qualitative and quantitative research methods. This research required the use of the mixed method.

The mixed method is best and more preferred method of research and has an array of strengths that appeal to many researchers. To begin with, the combined strengths of both quantitative and qualitative research can be found when using this method of research. Further, terms, pictures and narratives can be used to add connotation to numbers. In addition, while using mixed methods of research, researchers have the advantage of using numbers to add precision to words, pictures, and narratives. Another advantage of

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applying the mixed method in research is that researchers can generate and actually test a grounded theory (Bryman, 2004).

Applying the mixed method of research allows the researcher to tackle a broader and a more complete range of research questions owing to the fact that the researcher is not confined within the tenets of a particular method of research. In addition, researchers have the ability to use the strength of one method of research to counter or overcome the weaknesses in another method. In other words it incorporates the concept of complementarity (Bryman, 2004).

3.3 Population

The population was made up of all Electrical/Electronic Engineering Students, Laboratory Technicians, Lecturers and Industrial workers at the Cape Coast Technical University. The total population for the study were 7 Lecturers 3 Laboratory Technicians, 23 industrial workers and 217 Students totaling 250 in all.

3.4 Sampling Technique and Sample size

Purposive and random sampling techniques were used for selecting participants for the study. The Lecturers, Laboratory Technicians and Industrial workers were purposively selected while random sampling was used to select the students for the study. According to Creswell (2012), in purposive sampling, researchers intentionally select individuals and sites to learn or understand a phenomenon. In this way, the researcher builds up a sample that is satisfactory to specific needs. Seven Lecturers, three Laboratory

Technicians and twenty three Industrial workers were purposively sampled for the study. However, the random sampling technique which provided participants who were readily available to be selected was used to select the students. A total of 152 respondents were selected.

The total estimated sample size for the study according to Krejcie and Morgan (1970), if the population is 250, the sample size should be 152 participants (comprising 119 Students, 7 Lecturers, 3 Laboratory Technicians and 23 Industrial workers). The researcher based on this determinant to achieve the sample size for the study. The sample size was 152.

3.5 Research instrument used

Data was collected using a structured questionnaire and an interview guide. Closed and open ended questionnaire items were designed to collect primary data; this is because it has proven to be consistent and popular method of data collection (Creswell, 2012). This questionnaire and interview guide were designed for the Lecturers, Lab. Technicians and Students of Cape Coast Technical University. The questionnaire assisted the researcher to assess the Competency-Based Training on the skills acquisition of Electrical/Electronic Engineering Students in Ghana.

3.5.1 Interview Guide

The researcher used structured interview guide for the data collection during the study. A special interview guide consisting of four items was prepared. The interview centered on how Competency-Based Training can influence the skills acquisition of

Electrical/Electronic Engineering Students. Also, the interview guide solicited for views on remedial measures which can be put in place by the Ghana Education Service to make effective use of Competency-Based Training and skills acquisition.

3.5.2 Observation

The researcher observed how the Electrical/Electronic Engineering Students and their Lecturers and Technicians interacted in the Electrical workshops. Moreover, students were allowed to independently practice what they have learnt from their Electrical/Electronic Engineering lecturers. The illustrations of Figures 4.2, 4.3, 4.4, 4.5 shows the observations conducted at the Electrical/Electronic Engineering laboratory at the Cape Coast Technical University.

3.6 Pilot Study

The questionnaire was given to 15 respondents (10 students and 5 industrial workers) to answer to correct errors which could take the form of repetition of questions and typographical mistakes and the avoidance of repetition of questions. The pilot study revealed that the questionnaire were correct and adequate for mass distribution.

3.7 Data Collection Procedure

Before the data collection, the researcher sought permission from the authorities in charge of Electrical/Electronic Engineering Department at the Cape Coast Technical University to conduct the study in that setting. After permission was granted to conduct the study, the researcher sent a letter to each of the participants to seek their consent to take part

in the study and to inform them of the impending questionnaire and interview guide. A written questionnaire was delivered to all the selected students in the Electrical/Electronic Engineering Department. An interview guide was also used to solicit data from some selected Lecturers and Lab. Technicians in the Electrical/Electronic Engineering Department. Primary data was collected through a field survey from Lecturers, Lab. Technicians and Students of the Cape Coast Technical University.

Data was collected through the use of a questionnaire hand-delivered to participants in their Lecture halls and Electrical/Electronic Engineering laboratory. Questionnaires were filled out by participants and the researcher had to go for the questionnaires on the same day of distribution. Also, an interview was granted to those Lecturers and Lab. Technicians who ticked on the questionnaire that they would like to be interviewed using the interview guide prepared by the researcher to gather data, at this point, the researcher used face-to-face interview.

3.8 Data analysis

The data collected were analysed statistically using Statistical Package for Social Sciences (SPSS) version 18. The main statistical technique used was frequencies, percentages, tables and charts to explain certain findings. This was used to discuss the collected data.

3.9 Ethical Considerations

Ethical considerations in the study such as confidentiality, anonymity, access, betrayal, informed content was critically addressed. During the study, high ethical

standards was maintained to ensure that no harm is caused to any of the participants. Steps were taken to keep information provided confidentially and anonymous, seeking the participants consent were addressed.

CHAPTER FOUR

PRESENTATION OF FINDINGS

The main purpose of the study was to assess Competency-Based Training on the skills acquisition of Electrical/Electronic Engineering Students in Ghana, using Cape Coast Technical University as a case study. The researcher administered 119 questionnaires on Electrical/Electronic Engineering Students. Out of the 119 questionnaires sent out for primary data, 114 questionnaires were properly answered and received, while five questionnaires were not received. Therefore, the analyses of the students questionnaires were based on 95.8% response rate as shown in Figure 4.1.
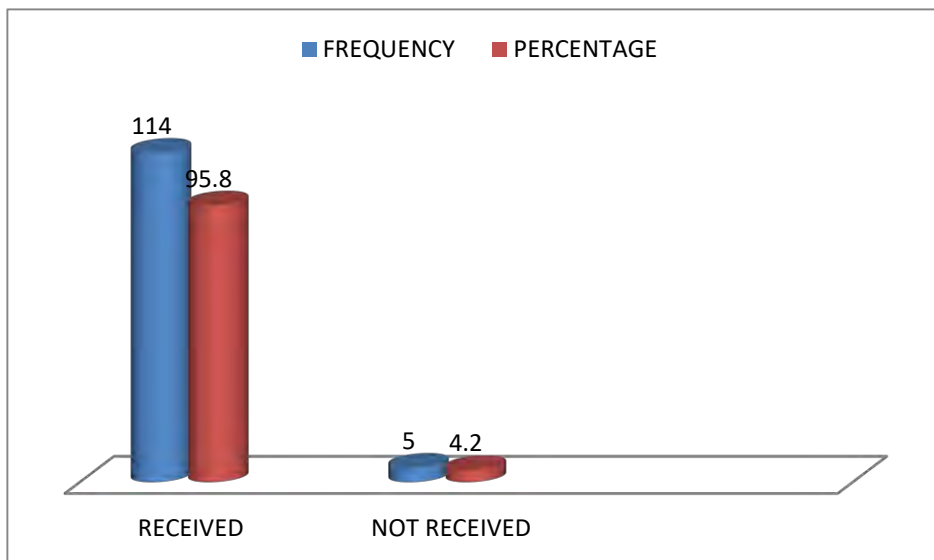
Figure 4.1: Response rate
Source: Field survey, 2017

4.1 Analysis of the Electrical/Electronic Students questionnaires

Table 4.1 indicates the demographic characteristics of the Electrical/Electronic students.

Table 4.1: Demographic information of the respondents

Gender	Frequency	Percent (%)
Male	110	96.5
Female	4	3.5
Total	114	100
Age ranges of the students		
Below 20 years	31	27.2
21-25 years	26	22.8
26-30 years	30	26.3
31-35 years	15	13.2
36-40 years	12	10.5
Total	114	100
Entry qualification to the school		
Secondary	48	42.1
Technical	57	50
Access	9	7.9
Total	114	100
Knowledge of prior skills before admission into the University		
Yes	39	34.2
No	75	65.8
Total	114	100

Source: Field survey, 2017

Table 4.1 shows that majority 100(96.6%) of the students were males while minority four students were female students. Moreover, 31(27.2%) were below 20 years, 30(26.3%) were between the age ranges 26-30 years, 26(22.8%) were between the age ranges 21-25 years, 15(13.2%) were between the age ranges 31-35 years, while 12(10.5%) were between the age ranges 36-40 years. Also, 57(50%) of the students affirmed that they were admitted into the University based on their Technical certificates like NVTI, 48(42.1%) entered the University with their Secondary school qualifications, while 9(7.9%) entered with access courses. To add more, 75(65.8%) of the students revealed that they did not learn any trade before getting admission into the University, while 39(34.2%) said that

they learnt trades like Electronics servicing, Electricals, motor and transformer rewinding, auto electrician and air – conditioning servicing.

4.2 Training methods used to facilitate competency based training

Table 4.2 identified the training methods used to facilitate competency based training.

Table 4.2: Training methods used to facilitate competency based training

Training methods used to facilitate competency based training	Agree f(%)	Neutral f(%)	Disagree f(%)	Total f(%)
Lecturing method is used to explain practical work	83 (72.8)	16 (14)	15 (13.2)	114 (100)
Laboratory works are used to explain theories	87 (76.3)	8 (7)	19 (16.7)	114 (100)
Demonstration procedures are exhibited by laboratory technicians	87 (76.3)	6 (5.3)	21 (18.4)	114 (100)
Field trips are organised by liaison unit/department for various year group students to visit industries.	35 (30.7)	24 (21.1)	55 (48.2)	114 (100)
Students are entitled for industrial attachment	85 (74.6)	8 (7)	21 (18.4)	114 (100)
On-the-job training is encouraged in the school workshops/laboratories	79 (69.3)	20 (17.5)	15 (13.2)	114 (100)
Project work facilitate practical training	82 (71.9)	17 (14.9)	15 (13.2)	114 (100)

Source: Field survey, 2017

The result in Table 4.2 indicates that 83(72.8%) agreed that lecturing method is used to explain practical work, 16(14%) were neutral, while 15(13.2%) disagreed. Moreover, 87(76.3%) agreed that laboratory works are used to explain theories, 19(16.7%) disagreed, while eight (7%) were neutral. The major stimulus for increasing interest in employability skills is in response to high labour mobility and the fact that current jobs require flexibility, initiative and ability to undertake many different tasks. In a knowledge and information-based economy posed by globalisation, most jobs are becoming more service-oriented, making information and social skills increasingly important.

The study further revealed that 87(76.3%) agreed that demonstration procedures are exhibited by laboratory technicians, 21(18.4%) disagreed, while six (5.3%) were neutral. The study results indicates that 55(48.2%) disagreed that field trips are organised by liaison unit/department for various year group students to visit industries, 35(30.7%) agreed, while 24(21.1%) were neutral. To add more, 85(74.6%) agreed that students are entitled for industrial attachment, 21(18.4%) disagreed, while eight (7%) were neutral. The study result indicated that 79(69.3%) agreed that on-the-job training is encouraged in the school workshops/laboratories, 20(17.5%) were neutral while 15(13.2%) disagreed. One of the crucial aspects of CBT is to match training to the needs of industry. This implies that the competencies acquired in the training programme must correspond to the demands of the jobs, occupations and working conditions. Furthermore, the underpinning ethics, values, and moral standards should match with the profession.

Moreover, 82(71.9%) agreed that project work facilitated practical training, 17(14.9%) were neutral, 15(13.2%) disagreed. These results agree with Okon (2013), who believed that Vocational and technical education programs are designed for people who can profit and progress by it, in order to accomplish this outcomes, an enabling environment must be provided for quality teaching and learning program. Unfortunately, the teaching and learning of subjects in vocational and technical education has been besieged by numerous problems which include poor organization and slow pace of implementation.

4.3 Supervision of students' practical work

Table 4.3 assessed the impact of the supervision of students' practical work

Table 4.3: Supervision of students' practical work

Area of supervision	Agree f(%)	Neutral f(%)	Disagree f(%)	Total (%)
Lecturers check the attendance of students at any practical lesson	25 (21.9)	23 (20.2)	66 (57.9)	114 (100)
Lecturers supervise practical training	100 (87.7)	8 (7)	6 (5.3)	114 (100)
Lecturers take part in laboratory work and demonstration	80 (70.2)	18 (15.8)	16 (14)	114 (100)
Project work is marked according to the work output of each student	85 (74.6)	20 (17.5)	9 (7.9)	114 (100)
Marking of assignment/lab. report is done on time	81 (71.1)	19 (16.7)	14 (12.3)	114 (100)
Industrial attachment is well supervised by the school	50 (43.9)	17 (14.9)	47 (41.2)	114 (100)
Feedback on students performance on practical lesson is regular	27 (23.7)	25 (21.9)	62 (54.4)	114 (100)

Source: Field survey, 2017

Table 4.3 revealed that 66(57.9%) disagreed that lecturers check the attendance of students at any practical lesson, 25(21.9%) agreed, while 23(20.2%) were neutral. Moreover, 100(87.7%) agreed that lecturers supervise practical training, eight(7%) were neutral, while six(5.3%) disagreed. The study showed that 80(70.2%) agreed that lecturers take part in laboratory work and demonstration, 18(15.8%) were neutral, while 16(14%) disagreed. The study result indicated that 85(74.6%) agreed that project work is marked according to the work output of each student, 20(17.5%) were neutral, while nine (7.9%) disagreed. Furthermore, 81(71.1%) agreed that marking of assignment/laboratory report is done on time, 19(16.7%) were neutral, while 14(12.3%) disagreed. Also, 50(43.9%) agreed that industrial attachment is well supervised by the school, 47(41.2%)

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disagreed, while 17(14.9%) were neutral. The study indicated that 62(54.4%) disagreed that feedback on students performance on practical lesson is regular, 27(23.7%) agreed, while 25(21.9%) were neutral. The study agrees with Mulder et al, (2016), who revealed that as an evolving concept, recent developments into the concept of competence and for that matter CBT tend to integrate many issues in contemporary education. Some of these include self-managed learning, the integration of theory and practice through industry and VET linkages, recognition of prior learning (RPL), authentic assessment and social constructivism. The integration of these innovations in CBT aim at increasing access, encouraging self-beliefs, problem-solving strategies, capacity for self-regulation and lifetime learning among students.

4.4 Evaluating effectiveness of Competency Based Training on the skills acquisition of Electrical/Electronic Engineering students in the Cape Coast Technical University.

Table 4.4 evaluated the effectiveness of Competency Based Training on the skills acquisition of Electrical/Electronic Engineering students in the Cape Coast Technical University.

Table 4.4: Evaluating effectiveness of Competency Based Training

ITEM	Frequency	Percent (%)
Very effective	13	11.4
Effective	19	16.7
Somewhat effective	57	50
Not at all	25	21.9
Total	114	100
The competency level of laboratory Technicians/Instructors who are manning the various laboratories in the Department		
Very competent	36	31.6
Competent	21	18.4
Somewhat competent	45	39.5
Not competent	12	10.5
Total	114	100
Rating industrial trips organise by the department		
High	61	53.5
Low	43	37.7
Not at all	10	8.8
Total	114	100

Source: Field survey, 2017

Table 4.4 revealed that 57(50%) indicated that Competency Based Training is somewhat effective on the skills acquisition of Electrical/Electronic Engineering students, 25(21.9%) said that CBT is not effective, 19(16.7%) affirmed that CBT is effective, while 13(11.4%) indicates that CBT is very effective. This result agrees with the related studies carried out by Islam and Mia (2007) in Bangladesh revealed that both formal and non-formal TVET lacked an effective linkage between training and the world of work. It further noted that because of its lack of coherent mode, practical skills training which does not produce the requisite skills for the job market. Additionally, the trainees also lacked training experience, initiative and motivation to discharge their duties effectively.

Moreover, 45(39.5%) of the students indicated that laboratory Technicians/Instructors who are manning the various laboratories in the Department are somewhat competent, 36(31.6%) said that they are very competent, 21(18.4%) said that they are competent

while minority 12(10.5%) revealed that they are not competent. The study further revealed that 61(53.5%) rated industrial trips organised by the Department as high, 43(37.7%) rated the industrial trips organised by the Department as low, while 10(8.8%) were neutral. A tracer study on the performance of polytechnic graduates in the Ghanaian labour market by Boahin, Kamphorst and Hofman (2010) revealed that almost half of the graduates (43.8%) undertook professional training to either improve their job skills and knowledge or learn new skills to overcome deficiencies in their skill training. Moreover, there was a perceived weak linkage between training institution and industry leading to inefficient schemes of industrial attachment and apprenticeship training (JICA, 2008; Boahin and Hofman, 2012). Given these realities, CBT was introduced to improve the quality and relevance of Technical and Vocational Education and Training (TVET) by equipping graduates with the required workplace and professional skills, promote a stronger working relationship with industry, reduce graduate unemployment and to achieve international competitiveness (COTVET, 2016).

4.5 Availability of training equipment and materials

Table 4.5 assessed the availability of training equipment and materials

Table 4.5: Training equipment and materials

Training equipment and materials	Agree f(%)	Neutral f(%)	Disagree f(%)	Total f(%)
Tools and equipment are available for practical work	36 (31.6)	18 (15.8)	60 (52.6)	114 (100)
Materials are given to students for practical work	49 (43)	20 (17.5)	45 (39.5)	114 (100)
Workshops are well equipped for practical training	37 (32.5)	12 (10.5)	65 (57)	114 (100)
Materials and equipment for training are adequate	44 (38.6)	10 (8.8)	60 (52.6)	114 (100)

Source: Field survey, 2017

Table 4.5 shows that 60(52.6%) disagreed that tools and equipment are available for practical work, 36(31.6%) disagreed, while 18(15.8%) were neutral. The study revealed that 49(43%) agreed that materials are given to students for practical work, 45(39.5%) disagreed, while 20(17.5%) were neutral. Furthermore, 65(57%) disagreed that workshops are well equipped for practical training, 37(32.5%) agreed, while 12(10.5%) were neutral. Moreover, 60(52.6%) disagreed that materials and equipment for training are adequate, 44(38.6%) agreed, while 10(8.8%) were neutral. These findings agrees with King and McGrath (2014), they argued that with TVET being more diverse because of the changes in the labour market, it should be able to integrate the youth into the working world. Given the prevailing economic trend, UNESCO (2014) identified the two major objectives of TVET as the urgent need to train the workforce for self-employment and the necessity to raise the productivity of the informal sector. They point out that lack of resources have led to cuts in the volume of training provided in public institutions. These cuts are a hindrance to pursuing the critical objectives of providing training and raising production. Considering the expensive nature of TVET as a form of education, it is

imperative that an expanded system with necessary and adequate facilities and equipment will lead to the effectiveness of the system.

4.6 The impact of well-equipped Electrical/Electronic Engineering workshops/laboratories in the teaching of applied electricity for Competency Based skills acquisition

Table 4.6 investigated the impact of well-equipped Electrical/Electronic Engineering workshops/laboratories in the teaching of applied electricity for Competency Based skills acquisition.

Table 4.6: The impact of well-equipped Electrical/Electronic Engineering workshops/laboratories

Students' participation in practical work when TLM is used	Frequency	Percent (%)
High	88	77.2
Low	16	14
Not at all	10	8.8
Total	114	100
Students' participation in class when the lecturer do not use TLMs		
Low	96	84.2
Not at all	18	15.8
Total	114	100
Encouraging students to use TLMs to do their personal studies		
Yes	84	73.7
No	30	26.3
Total	114	100

Source: Field survey, 2017

The study finding indicated that 88(77.2%) rated students' participation in the electrical laboratory when the lecturer uses Teaching and Learning Materials TLMs high, 16(14%) rated students' participation low, 10(8.8%) were not sure. Moreover, 96(84.2%) rated students' participation in class low when the lecturer do not use TLMs while 18(15.8%) were not sure. Also, 84(73.7%) said that lecturers encouraged students to use TLMs to do

their personal studies, while 30(26.3%) revealed that lecturers encouraged students to use TLMs to do their personal studies. This concord with Okon (2013), who indicated that Vocational education cannot function properly unless there is high quality in the standard of teaching, materials available, infrastructure, teaching methods, proper evaluation of students in the program where they are lacking, effective and efficient teaching and learning cannot be guaranteed. In Nigeria today vocational and technical education program in institutions are severely underfunded as most institution programs are run on deficit budgets. The difficult economic and political conditions made it difficult to increase fees in schools.

4.7 The impact of Teaching and Learning Materials on Competency Based Training and skills acquisition.

Table 4.7 assessed the impact of Teaching and Learning Materials on Competency Based Training and skills acquisition.

Table 4.7: The impact of Teaching and Learning Materials on Competency Based Training and skills acquisition

Statement	Agree f(%)	Neutral f(%)	Disagree f(%)	Total f(%)
The use of TLMs to facilitate competency based training can improve electrical students skills acquisition.	109 (95.6)	5 (4.4)	-	114 (100)
After successful completion of electrical studies at the University the students can work independently under low or no supervision.	70 (61.4)	11 (9.6)	33 (28.9)	114 (100)
Students usually perform better when they have books or study aids to foster their learning.	98 (86)	16 (14)	-	114 (100)
The availability and use of teaching and learning materials affect the effectiveness of a teachers lessons.	105 (92.1)	9 (7.9)	-	114 (100)
Quality of the TLMs and physical facilities are positively related to student performance.	107 (93.9)	7 (6.1)	-	114 (100)
The entire unattractive physical structure of the school building could de-motivate learners to achieve their academic goal.	100 (87.7)	4 (3.5)	10 (8.8)	114 (100)

Source: Field survey, 2017

Table 4.7 shows that 109(95.6%) agreed that the use of TLMs to facilitate competency based training can improve electrical students skills acquisition while five (4.4%) were neutral. Furthermore, 70(61.4%) agreed that after successful completion of Electrical/Electronic Engineering Studies at the University the students can work independently under low or no supervision, 33(28.9%) disagreed, while 11(9.6%) were neutral. Moreover, 98(86%) agreed that students usually perform better when they have books or study aids to foster their learning, while 16(14%) were neutral. The study revealed that 105(92.1%) agreed that the availability and use of teaching and learning materials affect the effectiveness of a teachers lessons, while nine (7.9%) were neutral. Also, 107(93.9%) agreed that quality of the TLMs and physical facilities are positively related to student performance while seven (6.1%) were neutral. The study finding revealed that 100(87.7%) agreed that the entire unattractive physical structure of the

school building could de-motivate learners to achieve their academic goal, 10(8.8%) disagreed, while four (3.5%) were neutral. The availability and use of teaching and learning materials affect the effectiveness of a teachers lessons. In addition, the school location and quality of the physical building influence the performance and achievement levels of pupils. These results agrees with Harbison and Hanushek (2012), stated that the quality of the physical facilities is positively related to student performance. This assertion corroborates that of Danesty (2004, cited in Yinusa & Basil, 2008) who stressed that good sitting arrangement and good buildings produce high academic achievements and performance, while dilapidated buildings that lack mental stimulating facilities coupled with low or no sitting arrangements is destructive. According to Asikhia (2010) where the school is located determines to a very large extent the patronage such a school will enjoy. Similarly, the entire unattractive physical structure of the school building could de-motivate learners to achieve academically.

4.8 Analysis of the industrial workers questionnaires

Table 4.8 indicated the results of the assessment of the students by the industrial based supervisor.

Table 4.8: Assessment of students by the industrial – based supervisor

Students attributes at the industries	Agree f(%)	Neutral f(%)	Disagree f(%)	Total f(%)
Level of interest for practical work is exhibited when students are on industrial attachment	21 (91.3)	2 (8.7)	-	23 (100)
Students work with less supervision	12 (52.2)	3 (13)	8 (34.8)	23 (100)
Work assigned to students are completed on schedule	10 (43.5)	2 (8.7)	11 (47.8)	23 (100)
Students exhibit a higher level of confidence after the training period	16 (69.6)	3 (13)	4 (17.4)	23 (100)
Student easily identify Engineering problems at the work place	7 (30.4)	2 (8.7)	14 (60.9)	23 (100)
Students observe safety regulations	19 (82.6)	2 (8.7)	2 (8.7)	23 (100)

Source: Field survey, 2017

The study indicates that 21 industrial workers representing 91.3% agreed that the level of interest for practical work is exhibited when students are on industrial attachment. Adding that in-service training is often required to exhibit practical competency at the industrial sector. Moreover, 12 industrial workers representing 52.2% agreed that students work with less supervision, eight industrial workers representing 34.8% disagreed, while three industrial workers representing 13% were neutral. Also, 11 industrial workers representing 47.8% agreed that work assigned to students are completed on schedule, 10 industrial workers representing 43.5% agreed, while two(8.7%) were neutral. The study showed that 16 industrial workers representing 69.6% agreed that students exhibit a higher level of confidence after the training period, four industrial workers representing 17.4% disagreed, while three industrial workers representing 13% were neutral. The study revealed that 14 industrial workers representing 60.9% disagreed that student easily

identify Engineering problems at the work place, seven industrial workers representing agreed, while two industrial workers representing were not sure. Moreover, 19 industrial workers representing 82.6% agreed that students observed safety regulations, while two industrial workers representing 8.7% disagreed and were neutral respectively. The study agrees with Boateng and Ofori-Sarpong (2012), they observed from the employers that most of the graduates lacked basic skills to complete simple routine assignment. As a result, some employers take prospective employees through longer orientation and probation schemes after which the best performing candidates are selected.

4.10 Observations at Cape Coast Technical University

The researcher observed how the Electrical/Electronics engineering students and their Lecturers interacted in the electrical workshops. Moreover, students were allowed to independently practice what they have learnt from their electrical lecturers. The illustrations of Figures 4.2, 4.3, 4.4, 4.5 shows the observations conducted at the electrical laboratory at the Cape coast Technical University.

Figure 4.2: The researcher demonstrating how to find fault and repair a faulty capacitor bank for power factor correction while the students observe.

Figure 4.3: Electrical/Electronic Engineering Students in a practical session at Cape coast Technical University while the researcher observe.

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Figure 4.4: Students testing an electric motor to verify its electrical properties after it has undergone maintenance (rewinding) while the researcher observe.

Figure 4.5: The researcher assisting students in construction of star/delta starter for corn mill motor.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

The main purpose of the study was to assess Competency Based Training on the skills acquisition of Electrical/Electronic Engineering Students in Ghana, using Cape Coast Technical University as a Case study. The researcher used descriptive research design for the study. The study adopted the mixed approach which made used of both quantitative and qualitative approaches. The study population was made up of all Electrical Engineering Students, Lecturers, Laboratory Technicians and industrial workers at the Cape Coast Technical University. The total population for the study was 250 respondents. Purposive and random sampling techniques were used to select 152 participants for the study (comprising 119 students, 7 Lecturers, 3 Laboratory Technicians and 23 Industrial workers). Questionnaires and interview guides were the instruments used to gather primary data. The data collected was analysed statistically using Statistical Package for Social Sciences (SPSS) version 18.

5.1 Summary of findings

5.1.1 Training methods used to facilitate Competency Based Training

The study results indicate that 83(72.8%) agreed that lecturing method is used to explain practical work. Moreover, 87(76.3%) agreed that laboratory works are used to explain theories. The study further revealed that 87(76.3%) agreed that demonstration procedures are exhibited by Laboratory Technicians. The study results indicate that 55(48.2%) disagreed that field trips are organised by Liaison unit/Department for various year group students to visit industries. To add more, 85(74.6%) agreed that Students are

entitled for industrial attachment. The study result indicated that 79(69.3%) agreed that on-the-job training is encouraged in the school workshops/laboratories. Moreover, 82(71.9%) agreed that project work facilitated practical training.

5.1.2 Supervision of students practical work

The study revealed that 66(57.9%) disagreed that lecturers check the attendance of students at any practical lesson. Moreover, 100(87.7%) agreed that lecturers supervise practical training. The study showed that 80(70.2%) agreed that lecturers take part in laboratory work and demonstration. The study result indicated that 85(74.6%) agreed that project work is marked according to the work output of each student. Furthermore, 81(71.1%) agreed that marking of assignment/laboratory report is done on time. Also, 50(43.9%) agreed that industrial attachment is well supervised by the school. The study indicated that 62(54.4%) disagreed that feedback on students performance on practical lesson is regular.

5.1.3 Evaluating effectiveness of Competency Based Training on the skills acquisition of Electrical/Electronic Engineering Students

The study indicated that 57(50%) indicated that Competency Based Training is somewhat effective on the skills acquisition of Electrical/Electronic Engineering students. Moreover, 45(39.5%) of the students indicated that laboratory Technicians/Instructors who are manning the various laboratories in the Department are somewhat competent, 36(31.6%) said that they are very competent. The study further revealed that 61(53.5%) rated industrial trips organised by the Department as high.

5.1.4 Availability of training equipment and materials

The study showed that 60(52.6%) disagreed that tools and equipment are available for practical work. The study revealed that 49(43%) agreed that materials are given to students for practical work. Furthermore, 65(57%) disagreed that workshops are well equipped for practical training. Moreover, 60(52.6%) disagreed that materials and equipment for training are adequate.

5.1.5 The impact of well-equipped Electrical/Electronic workshops/laboratories in the teaching of applied electricity for Competency Based skills acquisition

The study finding indicated that 88(77.2%) rated students' participation in the electrical laboratory when the lecturer uses Teaching and Learning Materials TLMs high. Moreover, 96(84.2%) rated students' participation in class low when the lecturer do not use TLMs. Also, 84(73.7%) said that lecturers encouraged students to use TLMs to do their personal studies.

5.1.6 The impact of Teaching and Learning Materials on Competency Based Training and skills acquisition.

The study result showed that 109(95.6%) agreed that the use of TLMs to facilitate competency based training can improve electrical students skills acquisition. Furthermore, 70(61.4%) agreed that after successful completion of electrical studies at the University the students can work independently under low or no supervision. Moreover, 98(86%) agreed that students usually perform better when they have books or study aids to foster their learning. The study revealed that 105(92.1%) agreed that the

availability and use of teaching and learning materials affect the effectiveness of a teachers lessons. Also, 107(93.9%) agreed that quality of the TLMs and physical facilities are positively related to student performance. The study finding revealed that 100(87.7%) agreed that the entire unattractive physical structure of the school building could de-motivate learners to achieve their academic goal.

5.2 Conclusions

The study further concluded that Competency-Based Training is somewhat effective on the skills acquisition of Electrical/Electronic Engineering Students. The training equipment and materials are not adequate to impart competency based vocational training. Furthermore, the workshops are not well equipped for practical training. This means that materials and equipment for training are not adequate. Students' participation in the electrical laboratory was high when the lecturer used Teaching and Learning Materials TLMs to facilitate learning. The use of TLMs to facilitate competency based training improved electrical students skills acquisition.

The challenges affecting the Technical University Education in Ghana are inadequate infrastructure, lack of workshops/laboratories, workshop/laboratory facilities, inadequate funding, poor perception of Vocational and Technical Education (VET) in the society, shortage of teachers and facilitators to man vocational and technical education programme in the schools, ineffective administration & supervision of teaching and learning Vocational and Technical Education (VET) in the schools.

5.3 Recommendations

The following recommendations are made to address the findings:

1. The Government of Ghana should provide adequate infrastructure and teaching and learning materials to equip the electrical workshops/laboratories with educational resources that can improve Vocational and Technical Education (VET) in the Cape Coast Technical University.

2. The Vocational and Technical industries should do well to organise periodic workshops and educational programmes to educate the youth and the entire society to reshape the poor perceptions of the society regarding Vocational and Technical careers.

3. The Management of the Cape Coast Technical University should recruit competent teachers and facilitators to man Vocational and Technical Education programme in the University.

5.4 Suggestions for Further Research

According to the recommendations of the study, the study suggested that a similar study should be conducted to assess the impact of providing adequate TLMs on Competency-Based and skills acquisition at the Cape Coast Technical University.

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APPENDIX A

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY EDUCATION

QUESTIONNAIRE FOR THE ELECTRICAL STUDENTS

The researcher is a Post Graduate student of University of Education Winneba, Kumasi Campus conducting a research to assess Competency Based Training on the skills acquisition of Electrical/Electronic Engineering students in Ghana- The Case of Cape Coast Technical University. I respectively request that you form part of this research by completing the attached questionnaire. Anonymity and non-traceability are assured. It is my fervent hope that you participate in the study. May I thank you for your valuable cooperation.

SECTION A: Socio – Demographic Characteristics

Please tick [√] in the box where appropriate

1. Gender

Male 1[   ] Female 2[   ]

2. Age

Below 20 years 1[   ] 21-25 years 2[   ]

26   years 3[   ] 31-35 years 4[   ]

36   years 5[   ] 41 years and above 6[   ]

3. Entry qualification to the school.

Secondary 1[ ] Technical 2[ ] Access 3[ ]   others, specify 4[ ] …........

4. Did you learn any trade before getting admission into the University?

Yes 1[ ] No 2[ ]

5. Which of the trade did you learn before getting admission into the

University?

Electronics servicing 1[ ] Electricals 2[ ] Motor and transformer rewinding 3[ ]

Auto electrician 4[ ] Air – Conditioning Servicing 5[ ]

6[ ] others, please specify ……………………………………….

SECTION B: Training Methods

Using the scale, 5-strongly agree, 4-agree, 3-neutral, 2-disagree, and 1-strongly disagree

indicate the following training methods used in practical skill training in the school.

Training methods used to facilitate competency based training	5	4	3	2	1
6. Lecturing method is used to explain practical work					
7. Laboratory works are used to explain theories					
8. Demonstration procedures are exhibited by laboratory technicians					
9. Field trips are organised by liaison unit/department for various year group students to visit industries.					
10. Students are entitled for industrial attachment					
11. On-the-job training is encouraged in the school workshops/laboratories					

12. Project work facilitate practical training					

SECTION C: Supervision of Students

Use the scale 5-strongly agree, 4-agree, 3-neutral, 2-disagree, 1-strongly disagree

Area of supervision	5	4	3	2	1
13. Lecturers check the attendance of students at any practical lesson					
14. Lecturers supervise practical training					
15. Lecturers take part in laboratory work and demonstration					
16. Project work is marked according to the work output of each student					
17. Marking of assignment/lab. report is done on time					
18. Industrial attachment is well supervised by the school					
19. Feedback on students performance on practical lesson is regular					

SECTION D: Evaluating Effectiveness of Competency-Based Training on the Skills Acquisition of Electrical/Electronic Engineering Students in the Cape Coast Technical University.

Please tick [√] in the box where appropriate

20. How effective is Competency Based Training on the skills acquisition of Electrical/Electronic Engineering students.

Very effective 4[   ] Effective 3[   ] Somewhat effective 2[   ] Not effective 1[   ]

21. How competent are the laboratory Technicians/Instructors who are manning the various laboratories in the Department?

Very competent 4[   ] Competent 3[   ] Somewhat competent 2[   ] Not competent 1[   ]

22. To what extent do you evaluate industrial Trips organise by the Department?

High 3[   ] Low 2[   ] Not at all 1[   ]

SECTION E: Training Equipment and Materials

Use the scale 5-strongly agree, 4-agree, 3-neutral, 2-disagree, 1-strongly disagree

Training equipment and materials	5	4	3	2	1
23. Tools and equipment are available for practical work					
24. Materials are given to students for practical work					
25. Workshops are well equipped for practical training					
26. Materials and equipment for training are adequate					

SECTION F: The Impact of Well-Equipped Electrical Workshops/Laboratories in the Teaching of Applied Electricity for Competency Based Skills Acquisition

Please tick [√] in the box where appropriate

27. How do you rate students' participation in the electrical laboratory when the lecturer uses Teaching and Learning Materials TLMs?

High 3[   ] Low 2[   ] Not at all 1[   ]

28. How do you rate students' participation in class when the lecturer do not use TLMs?

High 3[   ] Low 2[   ] Not at all 1[   ]

29. Do you encourage students to use TLMs to do their personal studies?

Yes 1[   ] No 2[   ]

SECTION G: The Impact of Teaching and Learning Materials on Competency Based Training and Skills Acquisition.

Please tick [√] in the box where appropriate

To what extent do you agree that the use of teaching and learning materials in competency based training influences skills acquisition? Please rate using the scale:

5-strongly agree, 4-agree, 3-neutral, 2-disagree, 1-strongly disagree

Statement	5	4	3	2	1
30. The use of TLMs to facilitate competency based training can improve electrical students skills acquisition.					
31. After successful completion of electrical studies at the University the students can work independently under low or no supervision.					
32. Students usually perform better when they have books or study aids to foster their learning.					
33. The availability and use of teaching and learning materials affect the effectiveness of a teachers lessons.					
34. Quality of the TLMs and physical facilities are positively related to student performance.					
35. The entire unattractive physical structure of the school building could de-motivate learners to achieve their academic goal.					

APPENDIX B

INTERVIEW GUIDE FOR THE ELECTRICAL/ELECTRONIC LECTURERS

AND LABORATORY TECHNICIANS

Please, indicate your rank……………………………………………………………

What type(s) of CBT programme(s) is/are available in your institution and how do you run it/them?

….…………………………………………………………………………………………

….…………………………………………………………………………………………

Who are the personnel involved in the CBT training for HND/B.Tech students?

….…………………………………………………………………………………………

………………….…………………………………………………………………………

How can competency Based Training influence the skills acquisition of Electrical/Electronic Engineering students in Cape Coast Technical University?

….…………………………………………………………………………………………

………………….…………………………………………………………………………

How are the students assessed under CBT programme?

….…………………………………………………………………………………………

………………….…………………………………………………………………………

1

What collaboration/partnership do you have with industry?

……………………………………………………………………………………………………

…………………………………………………………………………………………………….

What roles do the following groups play in CBT programme?

Students

……………………………………………………………………………………………………

Lecturers/Lab. Instructors/ Technicians

……………………………………………………………………………………………………

……………………………………………………………………………………………………

Industry

……………………………………………………………………………………………………

What are the types of employment students get after training?

……………………………………………………………………………………………………

Are the products accepted by industry?

……………………………………………………………………………………………………

Is there a tracer study of products in employment?

……………………………………………………………………………………………………

If yes, what are the outcomes?

……………………………………………………………………………………………………

If no, why not?

…………………………………………………………………………………………………

What is the impact of well-equipped electrical workshops/laboratories in the teaching of Electrical and Electronic Engineering discipline for competency based skills acquisition?

…………………………………………………………………………………………………

…………..………………………………………………………………………………………

…………..…………………………………………………………………………………………

How can the use of Teaching and Learning Materials affect Competency Based Training

and skills acquisition?

…………………………………………………………………………………………………

…………..…………………………………………………………………………………………

…………..…………………………………………………………………………………………

What are the challenges affecting the smooth running of CBT programme in the

Electrical/Electronic Engineering Department and the mechanism being put in place to

overcome such challenges?

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

APPENDIX C

UNIVERSITY OF EDUCATION, WINNEBA-KUMASI CAMPUS

QUESTIONNAIRE FOR INDUSTRIAL BASED SUPERVISORS/WORKERS

The researcher is a Post graduate student of University of Education Winneba, Kumasi Campus conducting a research to assess Competency Based Training on the skills acquisition of Electrical/Electronic Engineering students in Ghana- Case of Cape Coast Technical University. I respectively request that you form part of this research by completing the attached questionnaire. Anonymity and non-traceability are assured. It is my fervent hope that you participate in the study. May I thank you for your valuable cooperation.

SECTION A: Socio - Demographic Characteristics of the Industrial – Based Supervisors/Workers

Please tick [√] in the box where appropriate

1. Gender

Male 1[   ] Female 2[   ]

2. Age

21-25 years 1[   ] 26-35 years 2[   ] 36-45 years 3[   ]

46-55 years 4[   ] 56 years and above 5[   ]

3. How many years have you worked at the industry?

Below 1 year 1[   ] 1-10 years 2[   ] 11-20 years 3[   ]

21-30 years 4[   ] 31-40 years 5[   ] 40 years and above 6[   ]

4. Name of Organization/Company...

5. Status of Industrial-based Supervisor/Trainer

Technician 1[   ] Supervisor 2[   ] Engineer 3[   ]

6. Do you have the technique to train unskilled person?

Yes 1[   ] No 2[   ]

SECTION B: Assessment of Students by the Industrial – Based Supervisor

Use the scale 5-strongly agree, 4-agree, 3-neutral, 2-disagree, 1-strongly disagree

Students attributes at the industries	5	4	3	2	1
7. Students go to work regularly					
8. Level of interest for practical work is exhibited when students are on industrial attachment					
9. Students work with less supervision					
10. Work assigned to students are completed on schedule					
11. Students exhibit a higher level of confidence after the training period					
12. Student easily identify Engineering problems at the work place					
13. Students observe safety regulations					
14. Students acquire adequate practical experience before leaving your place.					

SECTION B: Attachment Students Particular Domain of Assessment

Below is a five-point rating scale indicating the level or score of Attachment

 student in a particular domain of assessment. Please generally score the performance of

the students in every domain (15-30) by drawing a circle around the scale and thus tick [√]

its respective statements below. The interpretation of the rating scale is:

[5 – Excellent] [4 – Very Good] [3 – Good] [2 – Satisfactory] [1 – Poor]

Affective / Behavioural domain	5	4	3	2	1
15. Students enthusiasm to acquire practical skills					
16. Students attendance to work					
17. Students work with less supervision					
18. Students punctuality to work					
19. Students willingness to work in a team					
20. Students willingness to accept suggestions and corrections					
21. Students ability to adapt easily to work environment					
22. Students relationship with colleagues					

1

Cognitive domain	5	4	3	2	1
23. Students ability to take initiative and solve problems					
24. Students comprehension of basic work schedule/duties					
25. Students application of theoretical concept to work activities					
26. Students familiarity with organization score operation					
27. Students general interest in the task allocated him/her					
28. Students general conduct and approach to safety at work					
30. Students overall performance on the job					