THE RELEVANCE OF TELECOMMUNICATIONS AND ELECTRICAL ENGINEERING PROGRAMMES TO THE NEEDS OF ADULT LEARNERS IN GHANA

BY

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DECLARATION

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ABSTRACT

The growth in the Telecommunications and energy sectors in Ghana requires a highly trained workforce to meet the increasing knowledge and skills demands of the industry. The training of the workforce calls for adequate arrangements by higher education institutions (HEIs) to satisfy both the needs of industry and those employed in these sectors. A significant number of these employees are adult learners enrolled for Telecommunications and Electrical Engineering programmes at HEIs. These programmes are not necessarily designed to address the specific needs of adult learners, thereby leading to dissatisfaction among adult learners.

This study, investigating the relevance of Telecommunications and Electrical Engineering programmes to the needs of adult learners, was framed along an interpretive paradigm, relative ontology, transactional epistemology and constructivist theory of learning. Building on the work of Buchanan and Smith (1998), the study uses an integrated framework to interrogate the key considerations necessary for developing adult learning programmes for students pursuing Telecommunications and Electrical Engineering in three diverse universities in Ghana.

The study adopted an embedded multiple case study design that was adapted from Gable's model. Probability and non-probability methods of sampling were used to gather relevant information from respondents and discussants. The sample included 200 student respondents, while focus groups discussions were conducted with 11 groups of adult learners from the three purposively selected institutions. The views of heads of the Telecommunications and Electrical Engineering departments, industry representatives, the Deputy Executive Secretary of the National Accreditation Board and the Deputy Secretary General of the Trade Union Congress provided additional evidence for the empirical study. Statistical software, *Statistica*, was used in analysing the quantitative data, while the hermeneutic process of developing patterns, codes and themes were used to analyse the interviews conducted.

The study revealed that in developing relevant curricula for adult learners in the field of Telecommunications and Electrical Engineering, the constructivist theory required amplification by other theories such as experiential and transformative learning. Secondly, the three cases investigated in this study did not provide separate curricula for adult learners who enrolled in the programmes with varied experience and skills expectations. The study also found that while adult learners were not involved in the planning of their programmes, relevant learning resources such as text books, e-books, course materials, laboratory guides, field work guides and industrial attachment manual for their programmes were either not provided or were not in good condition. The possible implications for the study are that different learning theories are required to design appropriate curricula for adult learners in the engineering field, HEIs and industry should collaborate to develop the knowledge and skills of adult learners and adult learners should be actively involved in the planning of their programmes together with their facilitators and programme developers.

OPSOMMING

Die groei in die telekommunikasie- en energiesektore in Ghana benodig `n hoogs opgeleide werksmag om aan die groeiende vraag na kennis en vaardighede in die industrie te beantwoord. Die opleiding van die werksmag vereis geskikte reëlings deur hoër onderwysinstellings (HOIs) om die behoeftes van sowel die industrie as dié wat in hierdie sektore werksaam is, te bevredig. ‘n Aansienlike aantal van hierdie werknemers is volwasse leerders wat vir telekommunikasie en elektriese/elektroniese ingenieursprogramme by HOIs ingeskryf is. Hierdie programme is nie noodwendig ontwerp om die spesifieke behoeftes van volwasse leerders aan te spreek nie, wat dus lei tot ontevredenheid onder volwasse leerders.

Hierdie studie wat die relevansie van telekommunikasie en elektriese/elektroniese ingenieursprogramme met betrekking tot die behoeftes van volwasse leerders ondersoek, het ‘n interpretiewe paradigma, relativistiese ontologie, transaksionele epistemologie en konstruktiwistiese leerteorie as raamwerk. Gegrond op die werk van Buchanan en Smith (1998), gebruik die studie ‘n geïntegreerde raamwerk om die kernoorwegings wat nodig is vir die ontwikkeling van volwasse leerprogramme vir studente in telekommunikasie en elektriese/elektroniese ingenieurswes aan drie diverse universiteit in Ghana te ondersoek.

Die studie is ontwerp as‘n gevallestudie, en maak gebruik van Gable se ingebedde meervoudige gevallestudie-ontwerp. Metodes van waarskynlikheids- en nie-waarskynlikheids steekproeftrekking is gebruik om relevante inligting van respondente en deelnemers te versamel. ‘n Steekproef van 200 studente het vraelyste voltooi, terwyl fokusgroepbesprekings gevoer is met 11 groepe volwasse leerders van die drie instellings. Die menings van departementshoofde van die telekommunikasie en elektriese/elektroniese ingenieurswese departmente, verteenwoordigers van die industrie, die Adjunk Uitvoerende Sekretaris van die Nasionale Akkrediteringsraad en die Adjunk Sekretaris-generaal van die Vakbondkongres het bykomende gegewens tot die empiriese studie bygedra. Statistiese sagteware, Statistica, is gebruik om die kwantitatiewe data te analiseer, terwyl die hermeneutiese proses vir die ontwikkeling van kodes, patrone, en temas gebruik is om die onderhoude wat gevoer is, te analiseer.

Die studie toon aan dat wanneer toepaslike kurrikula vir volwasse leerders in die veld van telekommunikasie en elektriese/elektroniese ingenieurswese ontwikkel word, die konstruktivistiese teorie aangevul moet word met ander teorieë soos eksperiënsiële en transformatiewe leer. Tweedens is bevind dat die drie gevalle wat in hierdie studie ondersoek is, nie afsonderlike kurrikula vir volwasse leerders wat met ‘n verskeidenheid van ervaring and vaardigheidsverwagtingsin die programme ingeskryf het, voorsien het nie. Die studie het ook bevind dat volwasse leerders nie betrokke was by die beplanning van hulle programme nie, toepaslike hulpbronne vir leer soos laboratoria, internet konnektiwiteit en biblioteekbronne vir hulle programme of ontbreek het of in ‘n swak toestand was. Die moontlike implikasies vir die studie is dat verskillende leerteorieë nodig is om toepaslike kurrikula vir volwasse leerders in die ingenieurswese te ontwerp, HOIs en die industrie moet saamwerk om die kennis en vaardighede van volwasse leerders te

ontwikkel, en volwasse leerders saam met hulle leerfasiliteerders en programontwikkelaars, aktief betrokke moet wees in die beplanning van hulle programme.

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DEDICATION

I dedicate this work to my father Mr. Kwadwo Owusu-Agyeman who solely funded my PhD education. Dad, I know the sacrifice you made to get me this far and I would forever be grateful.

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LIST OF ACRONYMS

AAS	African Academy of Sciences
AAU	Association of African Universities
ADEA	Association for the Development of Education in Africa
ADPE	Accelerated Development Plan for Education
AHES	African Higher Education Summit
CEO	Chief Executive Officer
COL	Commonwealth of Learning
GEC	Ghana Energy Commission
GET	Ghana Educational Trust
GDP	Gross Domestic Product
GSS	Ghana Statistical Services
GTUC	Ghana Technology University College
HE	Higher Education
HEIs	Higher Education Institutions
HHMP	Head of Human Manpower Planning
HOD	Head of Department
HRM	Human Resource Manager
HCRS	Head of Corporate Social Responsibility
HN	Head of Networking
ICT	Information Communication Technology
IMF	International Monetary Fund
KNUST	Kwame Nkrumah University of Science and Technology
MDG	Millennium Development Goal
MNO	Mobile Network Operators
MOE	Ministry of Education
MOOC	Massive Open Online Courses
NCTE	National Council for Tertiary Education
NTVETQF	National Technical and Vocational Education and Training Qualifications Framework
OTD	Ordinary Technician Diploma
RMU	Regional Maritime University
TEP	Tertiary Education Project
TUC	Trades Union Congress
UNESCO	United Nations Educational, Scientific and Cultural Organisation
URC	Universities Rationalization Committee

STRUCTURE OF THE RESEARCH

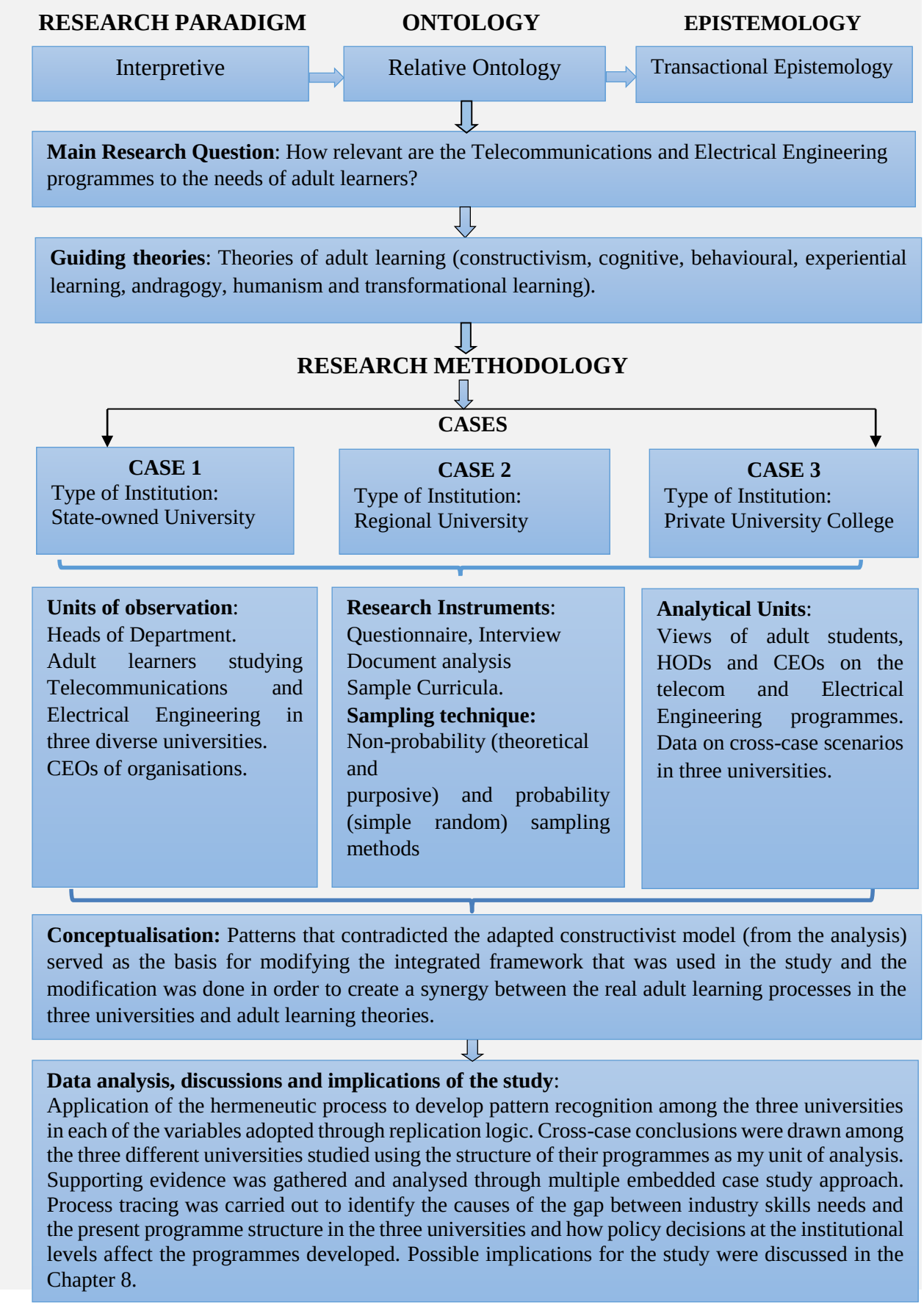

Figure 1.1: Structure of the research

CHAPTER ONE

ORIENTATION TO THE STUDY

1.1 INTRODUCTION

This chapter provides an introduction to the study by discussing the standard processes that were used in arriving at the research objectives, problem statement, research questions, research design, validation of the study, definition of key concepts and the ethical considerations necessary in carrying out the research work. The next paragraph provides an overview to the study and focuses on the current pattern of teaching and learning in Higher Education Institutions in Ghana with respect to the following: the requirements of HEIs, the need for specialists trained to develop the energy and Telecommunications needs of Ghana and the specific needs of adult learners, particularly those in Telecommunications and Electrical Engineering programmes.

The economic transformation of many countries has necessitated the training of more skilled workers with higher education qualifications to provide the needed technical skills and knowledge which are identified as essential for growth and development. Unlike the industrial economy of the early 20th century that generated remunerated employment for persons without specific skills, the modern economy can be described as an Information Communication Technology (ICT) and service economy that requires a workforce with higher levels of academic and technical knowledge and problem-solving abilities (ETA, 2007). The need to train workers in the ICT and energy sectors of the Ghanaian economy is considered important because modern technology and designs require that engineers be abreast with knowledge, skills, equipment and attitude needed to solve challenges in those industries.

The present expansion in the Telecommunications and energy sectors in Ghana has led to the creation of several job opportunities for skilled workers. In the energy sector, the opening of the Bui hydro-electric dam, the Asogli power plant and the mini power badges have not only increased the number of workers needed to maintain these facilities, but has also added to the number of sources of power supply in the country. The growth in the energy sector directly affects the performance of other sectors of the economy; this is seen in the integrated energy system which supports sectors such as commercial and services, agriculture and fisheries, transport and industries and private residential sectors of the economy (GEC, 2013). According to the Ghana Energy Commission's 2013 outlook report, while total oil products supplied to the economy increased from 2.3 million tons in 2011 to 2.4 million tons in 2012, crude oil

production from the Jubilee field also increased from an annual average of about 73000 barrels per day in 2011 to 100000 barrels per day during the last quarter of 2012 (GEC, 2013). What this means is that there would be continuous demands for skilled personnel to support the growth of the energy sector of the economy. The continuous demand for skilled personnel calls for the development of relevant programmes in universities to meet the knowledge needs of workers who require in-depth knowledge and skills to meet job needs (Moore, 2011).

Similarly, the Telecommunications industry continues to expand with the extension of mobile communication networks to both rural and urban areas and the provision of internet services all over the country. Additionally, the introduction of mobile money services and other digital financial services has enabled Telecommunications firms in the country to expand their operations to meet the increasing demands of consumers. Other developments presently taking place in Ghana in the Telecommunications sector include increased bandwidth supply, infrastructure development (including laying marine cables and the extension of telephone cables to newly approved districts), promotion of digital financial services and payment systems and an increase in the number of mobile network operators (MNOs). These developments come with increases in human capital needed for the growth of the sector especially in this era of modern technology. While most of the skilled workers who do not have post-secondary qualifications continue to seek advanced knowledge in universities in Ghana, it has become necessary to investigate the relevance of the programmes offered by the universities to adult learners.

The need for specialists trained for science and for technical professions is increasingly shaping the nature of the higher education curriculum in most developing economies (UNESCO, 2009) including Ghana. Important prerequisites for developing effective career-focused curricula in the field of Engineering are; the integration of elements of work knowledge, reflection on the teaching and assessment methods, the subject knowledge used (Moore, 2011; Garraway, 2011; Joseph, 2011), social awareness, technical expertise and a bias for innovation (Crawley, Malmqvist, Östlund, Brodeur & Edström, 2014:1). The espousal of career-focused curricula has increased with a call by international organisations on policy makers and key stakeholders to provide new systems for academic support and innovative approaches to pedagogy in higher education institutions (UNESCO, 2009; Crawley et al., 2014) and this also include industry workers who require further knowledge in their fields of work.

There is the need to develop programmes that will suit the needs of adult learners and also provide a conducive learning environment that will help these adult learners acquire the appropriate knowledge and skills through self-directed learning and peer-coaching. Higher Education Institutions could best provide

the needed transformation of adult learners from semi-skilled to highly skilled persons who will be able to demonstrate the needed knowledge, skills and attitude required by employers. This view is amplified by Litzinger, Lattuca, Hadgraft and Newstetter (2011) who suggest that engineering education should be identified as a learning process that supports the knowledge and skills of development through a process of acquiring conceptual knowledge of the engineering field, technical and professional proficiency and ability to undertake engineering projects. Additionally, for any educational institution to achieve its goals, it must be dynamic, respond to new knowledge, understand the needs of the various disciplines it offers and stay abreast of new employment market needs (Davis, Little & Stewart, 2011). It will not suffice to say that the methods of teaching adult learners and regular students who pass out of secondary schools, especially in the Telecommunications and Electrical Engineering programmes, are the same.

With the continuing spread of knowledge and the gradual shift of old fixed patterns of employment to new ones, learners are increasingly demanding a type of education that allows them to update their knowledge throughout their working lives at the undergraduate and graduate levels (UNESCO, 2005). Special arrangements have been developed for these students but the core activity of the university, teaching to full-time young undergraduates, often goes on much as before (Daniel, 1996). Key among the factors that have precipitated the emerging trends in adult learning is the changing nature of education and associated forms of knowledge that could be found in new technology and open source materials and the mix between countries, governments and stakeholders, which are aimed at achieving value for money (Slowey & Schuetze, 2012; Romiszowski, 2016).

This study thus focuses on the relevance of Telecommunications and Electrical Engineering programmes to adult learners in three diverse universities in Ghana. In addition, the study also identifies the extent to which adult learners in the three universities advance their knowledge, skills and attitudes through the Telecommunications and Electrical Engineering programmes that have been designed for them in particular. Lastly, the study also identifies the roles of adult learners, universities and employers in the design of programmes for adult learners. The first chapter provides brief information on the background to the study and an overview of the educational system in Ghana. The research goals and objectives, research questions, statement of problem, research design and methodology have also been discussed in this chapter. The next paragraph discusses a brief overview of the educational system in Ghana and how higher education in particular has advanced the training of human capital needed for the development of the country.

1.2 MOTIVATION FOR THE STUDY

1.2.1 Background on the Ghanaian geographical, economic and education context

Ghana is an African country on the western part of Africa with a land size of 227,540 km² (The World Bank, 2013) and shares her borders with neighbouring Burkina Faso to the north, La Côte d'Ivoire to the west, and Togo to the east. To the south of the country are the Gulf of Guinea and the Atlantic Ocean. The country attained independence from Great Britain in 1957 and became a republic in 1960.

Ghana's present population is 25.9 million with a Gross Domestic Product (GDP) of 40.71 billion dollars. According to the International Monetary Fund report for 2013, mining and agriculture accounts for much of Ghana's exports while the construction and services sectors provide more than half of the country's output, with most jobs concentrated in the informal sector (IMF, 2013). The economy of Ghana presently relies mainly on agriculture and natural resources with concentration of exports in three commodities namely gold, cocoa, and oil (IMF, 2013). The IMF report considers Ghana a lower middle-income country with less than 30 percent of the population being classified as poor. With a current growth of 7.9% in the Gross Domestic Product, a stable democracy and private sector investment and growth, Ghana is considered as one of the countries in the sub-Saharan region with considerable potential to improve her economic performance over the next five years (IMF, 2013).

The economy of every country (including Ghana) depends on the strength of its workforce and the knowledge acquired by the workforce is often derived from the educational institutions and the policies put in place to develop the skills and knowledge of the workforce. According to the Ghana Statistical Service (2010), enrolment rates at the tertiary level are very low and cannot support the development agenda of the country for it to become a middle-income country. Similarly, "Improvements in educational outcomes have been widely recognised as essential to enhancing growth in both developed and developing countries" (Holland, Liadze, Rienzo & Wilkinson, 2013:12). Sianesi and Van Reenen (2003 cited in Holland, et al, 2013:12) show that strong empirical evidence exists of a link between human capital and productivity in other words that education enhances productivity.

In Ghana, research conducted in the early 1970s (Foster, 1971; Graham, 1971; Taylor 1974) showed that factors that inhibited the development of education included the low literacy levels of most parents, gender inequality in the use of family income to support education (most family support were for boys' education), lack of funds from government and local authorities to support education and geographical imbalances (discrepancies between urban and rural communities). Today, the situation has not changed

much as these factors continue to hamper the achievement of the developmental goals of the nation with reference to education for all citizens.

While there seems to be improvement at the basic and post-basic levels of education in Ghana today, the same cannot be said for the secondary and the tertiary levels of education where the rates of enrolment continue to decline (GSS, 2015). The Ghana Statistical Service Report for the 2010 Population and Housing Census showed that 56.3% of the population (6 years and older) had received basic education with the break-down as follows: primary school - 26.6%, junior secondary school - 20.6% and senior higher school - 9.1%. Only 7.5% of the population had obtained higher education qualifications beyond the secondary school level while less than 0.5% of the population had post-graduate education (GSS, 2015). The statistics from the GSS reveals that there must be vast numbers of adults with an incomplete educational career who are in need of education and training opportunities in HEIs.

Although the emphasis on developing the literacy and numeracy of children and adolescents at the basic and secondary levels is commendable, the basic question that arises is, of what good is an incomplete educational career to an individual? While the Ghana Statistical Service report for 2013 (GSS, 2015) revealed that only 9.1% (showing an increase of 1.6% from the figure of 7.5% in 2010) of the total working population in Ghana had completed tertiary education, another main concern is the development of access routes that will give adult learners all over the country the opportunity to obtain relevant qualifications needed for their jobs. As many people continue to defer their education at the tertiary level either by choice or through uncontrollable circumstances, there is the need for policy decisions to be made at the national level to support such adults. It is in line with the call by various interest groups to provide sustainable alternatives to the educational bottlenecks of Ghana at the tertiary level (Owusu-Agyeman & Van Oostenkamp, 2009) that this study sought to identify the needs of adults in the Telecommunications and energy sectors who strive to acquire knowledge that is essential for the development of Ghana.

Since 1944, several schemes and programmes have been designed to cater for the growing human capital needs of the economy. Prior to the establishment of the University of Ghana (which was formerly called the University College of Gold Coast), teacher and agricultural training institutes had been established in some parts of the country to provide post-secondary certificate qualifications. During the same period, arrangements were made to either send some secondary school leavers to Britain for their tertiary enrolment or send them to Achimota School to enrol in an intermediate degree or special courses which were then offered with corresponding institutions in Britain (Foster, 1971). During this period (between

1944 and 1960), several attempts were made to provide special literacy classes for workers in the country. To this end workers' colleges were set up in all the regions to provide literacy and pre-tertiary classes to workers.

Although informal training of adult learners commenced before the Gold Coast era, formal adult learning centres established to award certificates started at the University of Ghana in 1948 (Tagoe, 2012). Today some institutions have special programmes to upgrade the skills and knowledge of adult learners especially by developing programmes that are intended to make the adult learner combine work and study effectively. In spite of all these arrangements, it has become imperative to move beyond meeting the certificate needs of adult learners to providing them with the requisite skills and knowledge (Altbach, Reisberg & Rumbley, 2009) which augment their years of work experience.

One of the reasons for the weak programme structure of adult learning programmes found in many countries, including Ghana, is that students who are supposed to benefit from curricula are not considered in their development (Maruatona, 2012). In order to mitigate the effect of such pedagogical and curriculum challenges, in Ghana adult and continuing education have become part of a sustained effort by government to encourage learning (NCTE, 1998), yet not much has been achieved in this regard.

Key to all this analysis is the basic question: what type of knowledge and skills are provided to adult learners studying Telecommunications and Electrical Engineering programmes in Ghanaian universities? Very little research has been conducted on the relevance of the programmes designed for secondary school leavers that are also used for adult learners. Although the various theories of adult learning will be discussed in Chapter three, the unveiled dilemma (as the researcher will term it) is that the knowledge and skills of many adults who complete their programmes of study in Telecommunications or Electrical Engineering in the various universities do not meet the expectations of their employers. What this means is that they only enrol in universities to obtain certificates that will help secure jobs. Such certificates are termed "gyekodidi certificate" literally translated as "have this certificate for your daily bread".

While policy makers, regulators and HEIs continue to seek alternatives to develop the knowledge and skills of individuals through education, it is important to explain what education is in relation to training and in the context of this study. Education could be seen as a "transmission of what is worthwhile to actors or individuals who are committed to it" (often subject to the views of stakeholders); as a process that "involves knowledge, understanding and the development of cognitive perspective which are not inert" and one that "rules out some rigid procedures of transmission based on reasons that they do not

allow wittiness and voluntariness on the part of learners" (Peters, 1966 cited in Tight, 2004:16). Similarly other authors have provided different meanings to education as compared to training such as; a learning process that supports the development of knowledge and comprehension of learners regarding the scope of the learning outcomes (Dearden, 1984 cited in Tight, 2004;18); a process that seeks to preserve and provide for change in values, beliefs, customs, rites and the knowledge that meets the needs of society (Bass, 1997); a learning process that looks beyond the job-setting and provides avenues for learners to critically examine issues beyond the terms of reference and seek to provide solutions that are universally accepted (McKenzie, 1995 cited in Tight, 2004:18).

Training on the other hand is defined as a systematic process that is designed to improve the competency level or the operative efficiency of an individual on the job (Dearden, 1984 cited in Tight 2004). Additionally, Blundell, Dearden, Meghir & Sianesi (1999) argue that individuals who obtain formal education qualification are more likely to participate in training programmes in order to develop their knowledge and skills in a specific discipline. The definition of training as distinct from education is that while training focuses on developing the competency or operative efficiency of individuals in a specific discipline designed for job purposes, education provides a comprehensive learning process that develops the knowledge, skills and attitude of individuals for both work and for the benefit of society.

In the context of this study, education is defined as the formal arrangement made by HEIs in collaboration with industry and state regulatory agencies to provide the requisite knowledge, skills and attitudes to students that will benefit industry and society. The purpose of education which is the development of skills, knowledge and attitudes of the adult learners in such circumstances (as conceptualised in this study) often becomes peripheral due to the weak programme structure of these programmes designed for adult learners. It has increasingly become imperative, if not obligatory, for education providers to adopt strategies that will enable adult learners to gain the best out of the curriculum designed for them.

The underlying factor supporting formal learning is that it is usually undertaken within a formal setting that could be described as an institution that is resourced and accredited to train students to acquire knowledge, skills and attitudes, which are relevant for the workplace and the society (Shapiro, 2005). Frith, de Jong, and Vansteenhuyse (2012) have shown that adult learners are more open to engage in a formal education program rather than pursuing non-formal education, because the former involves a life-course altering decision which requires a momentary reorganisation of the adult student's time structure and a potential change in the student's portfolio, professional prospects and self-awareness. It is crucial,

therefore, when conducting research into formal adult education to link participation to individuals' career development and personal developmental issues (Frith et al., 2012).

In conceptualising the emerging trends in the development of skilled person power amongst adult learners, Holton, Swanson and Naquin (2001) and Fasokun, Katahoire and Oduaran (2005) suggest that the understanding of learning theories is important in any improvement intervention which involves learning and training. The researcher will therefore provide an overview of the specific theories that are relevant for this study and their orientation to the concept of adult learning, especially within formal settings as depicted in the cases selected.

1.2.2 Adult learning theories

In order to develop a conceptual framework for this study, it is important to identify the various theories that influence learning and teaching at HEIs and connect them to the patterns of learning of adults. In the next paragraph, the relevant learning theories and how they either support or reject the views of theorists who posit that providing separate learning pathways for adults who enrol in HEIs is essential for their skills and knowledge development is briefly discussed.

Hillier (2002) suggests that learning can be categorised into four main groups namely physiological (neurological and chemical), psychological (behavioural, cognitive, humanist, developmental and psychoanalytical), sociological (radical, transformative, liberal, human/social capital and group dynamics) and multi-disciplinary (deep and surface, experiential and andragogy). Although other categories have been suggested by other authors, Hillier's typology provides a useful point of departure. Seeing that this study focuses on the organisational setting of adult learners, the discussion will concentrate on the most prominent psychological, sociological and multi-disciplinary theories.

Behaviourism as a psychological theory was originally developed by Watson (1913) when he studied the behavioural consequences of stimuli (Merriam & Brocket, 1997). Behaviourism relies basically on the conditioning of individuals to develop their knowledge and skills through a systematic introduction of stimuli by another person (Merriam et al., 1997). However, in the training process, the individual has very little control over his/her actions and therefore cannot define his/her own boundaries of operation in the whole exercise. The development of the skills and knowledge of the adult learner requires further considerations that too are not provided by the behavioural theory. By this the researcher refers to the application of work experiences which are unique in the different fields from which the learners come.

This justifies the need to integrate aspects of the various learning theories that support adult learning, especially those adults studying in the Telecommunications and Electrical Engineering fields.

A second psychological theory, the cognitive approach refers to how individuals gain knowledge about their environment and the world through different stages which also need different approaches (Keegan, 2009). Cognitive theory identifies the learner as the main concern and sees the individual as one that is born with intelligence and is able to use his/her mind appropriately. Cognitive approaches often tend to be structural because they assume that there are stages in the development of the individual mind: from a low point to a highpoint and then a decline stage. Although the cognitive theory is closely related to the constructivist theory, it falls short of identifying the means by which the learner constructs meaning from his/her environment. While the adult learner is able to draw on previous experiences to create his/her own meaning and ideas to form new knowledge, a child must be systematically taught through demonstrations and nowadays through simulation to enable him/her to make meaning out of the world. What makes adult learning different from the learning of children is the introduction of key experiences in the learning process.

Transformative learning, which was also developed to explain how individuals could blend their own experiences with new knowledge, has its roots in sociology and was first developed by Kuhn in the early 1960s. The theory was later explicated by writers such as Freire (1970), Habermas (1971), Mezirow (1991) and Kitchenham (2008). Transformative learning identifies prior experiences as the foundation for innate expectations, which the learner constructs meanings to and relates to his/her environment (Mezirow, 1991; Taylor & Cranton, 2013). Although transformative learning identifies the need for the experiences of adult learners to be recognised in the learning process, it does not identify the need for adult learners to create their own knowledge from what they are introduced to in a programme. Rather, the adult learner is required to learn and reformulate what already exits. The gap created by theorists who support transformative learning leads the researcher to briefly discuss the theory of andragogy, which he considers as fundamental to the study of adult learning in general and also to this study in particular.

Originally coined by a famous German teacher called Alexander Kapp in 1833 (Davenport & Davenport, 1985), andragogy was further developed by Malcolm Knowles(in the late 1960s) who suggested that the processes involved in learning by children could not be same for adult learners (Hillier, 2002:91). Andragogy proposes that adult learners should be given a free role to direct, control and negotiate their own learning processes and develop pathways for their careers (Brocket & Hiemstra, 1991; Merriam et al., 1997; Hillier, 2002). Knowles (1978) developed five basic assumptions underlying andragogy that

will be discussed in detail in the following chapter. The goal of andragogy is to provide adults with the resources they need to develop their own knowledge that will be useful in their working environment. The link between the formal learning environment and workplace of the adults is essential to the overall development of their knowledge, skills and attitudes. This study identifies constructivism as very important in the development of the knowledge, skills and attitudes of adult learners because it allows adult to adapt to the learning environment while also developing their own ideas that are relevant for work and society.

The constructivist approach – which serves as this study's point of departure among the different theories and was briefly discussed above – seeks to identify the experiences of adult learners as important to the learning processes. The constructivist approach seeks to enhance the knowledge, skills and professional attitude of adult learners by providing the necessary pathway that support individualised and affective domains of learning among adult learners. Adopting the constructivist approach as the theoretical framework for this study implies a consideration of the level of application of the teaching and learning processes of adults pursuing Telecommunications and Electrical Engineering programmes in Ghana. Emphasis was placed on drawing a continuum of extremes from which the researcher could provide evidence for concluding that the level of support provided to adult learners and the relevance of their programmes to their job needs greatly depend on the type of institution and the policies put in place. In conceptualising the constructivist approach to adult learning especially among those in the field of engineering, the various processes, namely self-directed learning, creativity and innovation are vital to obtaining relevant knowledge, skills and attitude and these formed the basis of this study. The constructivist approach also provides the basis for developing learning objectives, processes and outcomes by identifying the adult learner typology in a given context.

Overall, theories of learning are necessary in the development of curriculum for universities because they provide teachers, students and other stakeholders with the framework of teaching and learning. The relationship between the various stakeholders in the delivery of curriculum content could be described as whole network relations (Fenwick & Edwards, 2013), which include knowledge, identities, rules, routines, behaviours, new technologies, regulatory regimes and learning. Loureiro and Caria (2013) show that constructing and reconstructing knowledge among adult learners are driven by experimentation, mutual help, reflection, and negotiation of meaning by individuals. That is not to say that the humanist and constructivist approaches provide the only basis to develop the knowledge, skills and attitude of adult learners. The learning theories have been extensively discussed in Chapter three of this study.

Several adult learner typologies (West, Hore & Kennard, 1986; Kasworm, 1993; Teichler, 2005) have been developed to provide an explanation for the term adult learner. This study adopted the typology provided by Guyot (1996) because it suits the Ghanaian context and uses factors such as age, scholastic career and previous enrolments in the university, which are necessary when investigating the extent to which HEI programmes serve the needs of adult learners using the constructivist lenses. In order to assess the relevance of HE programmes for adult learners in Ghana, the researcher selected the constructivist perspective because it supports the need for individualised and affective domains of learning among adult learners; this leads to the discussion of the statement of the problem in the next paragraph.

1.3 STATEMENT OF THE PROBLEM

In an era of globalisation and the knowledge economy, the expectations of stakeholders in HE are that all students, including adult learners, will receive relevant knowledge, skills and attitudes for the workplace and society. While most programmes of HEIs are designed for school-leavers, it is important for education providers to consider the peculiar needs of adult learners who are often workers in industries and other organisations. Additionally, modern HE has evolved to include emerging trends such as 'earn and learn' market and blended learning which support workers and adult learners who may not always be in the classroom to study due to their busy schedules. The quest by adult learners to achieve HE qualifications has also increased the call on universities to develop programmes that serve the specific needs of adult learners.

Adult learners in Ghana usually consist of deferrers, second chancers and returners who require higher education that is designed to develop their knowledge, skills and attitudes as well prepare them for challenging tasks at their work places and in society. Similarly, while other tertiary institutions (often termed as institutions of further education) continue to provide technical and vocational skills to students, universities are expected to provide opportunities for both adult learners from these institutions as well as high schools returners to obtain advanced knowledge and skills required by modern technology-driven industry and society. Statistics from the NCTE show that there were about 8,200 of such adult learners in five public universities in Ghana during the 2007/2008 academic year.

Adult learners in the engineering sector in Ghana often progress through technical institutes and polytechnics where they receive knowledge and practical training that is relevant for industries. When such adult learners with years of working experience are admitted into universities to develop their signature pedagogies (knowledge, skills and attitudes) which cannot be obtained through other training programmes such as in-service training, workshops and work-based training, they are often compelled to

combine their work schedule and a rigorous academic routine. They are also taught the curriculum of regular students (school-leavers) who do not have work experience. The provision of relevant teaching and learning support to adult learners is in part influenced by the structure, policy directions and traditions of HEIs in Ghana. While some institutions are able to quickly vary their teaching and learning strategies to meet emerging market trends and global developments, others require time and detailed processes to adopt new methods and trends while others are not able to adjust at all to provide the needed support to adult learners. This means that the governance structure of HEIs to some extent influence decisions made on the programmes of adult learners which may either increase or reduce access to higher education. Therefore, while other tertiary institutions concentrate on developing the competences of learners for the world of work, universities must focus on developing the knowledge, skills and attitudes of learners to transform the world of work (Teferra & Altbach, 2004) through critical thinking, advanced technology application and leadership skills.

Although many adults continue to seek higher education to improve their knowledge and also progress in their chosen careers, not much research has been undertaken to identify the relevant knowledge, skills and attitudes needed to meet their goals and aspirations. Additionally, it is important to distinguish between knowledge and skills acquired through years of work and training and the knowledge and skills acquired through formal learning in HEIs. To put an adult learner and a secondary school leaver in the same class to be taught using the same approach may not benefit the adult learner and employers will not gain from the improved services of these adult learners. More so, adult learners have specific learning needs which can be best provided through an open and flexible approach (yet formally structured) which will satisfy all interest groups. By interest groups, the researcher refers to HEIs, regulatory agencies, employers and the adult learners themselves.

In order to develop a succinct argument to support the statement of problem, the research goals and objectives have been discussed in the next paragraph.

1.4 RESEARCH GOAL AND OBJECTIVES

In the wake of increasing demands by employers, regulatory bodies and other interest groups for the programmes of HEIs to reflect growing global trends, this study explores the relevance of these programmes to the job needs of adult learners. Additionally, the study identifies the knowledge, skills and attitudes adult learners pursuing Telecommunications and Electrical Engineering programmes in universities require to meet the needs of industry and employers. Since most of the firms in the energy and Telecommunications sectors rely on existing staff to develop their organisations, it has become

necessary to investigate the nature of knowledge, skills and attitudes these engineers acquire during their study at the institutions of higher learning. Beyond inquiring about the relevance of the programmes of HEIs to the needs of adult learners, the study also attempts to provide alternatives to developing more relevant programmes in Telecommunications and Electrical Engineering for adult learners through the application of learning theories. The study had the following specific objectives;

i. To identify the type of knowledge, skills and attitudes required by adult learners in the Telecommunications and Electrical Engineering fields.
ii. To assess the structure of Telecommunications and Electrical Engineering programmes in three diverse universities in Ghana using a case study approach.
iii. To ascertain how Telecommunications and Electrical Engineering programmes could be developed to suit adult learners through collaboration between HEIs and Industry.
iv. To identify how adult learning theories could serve as the basis for developing a more relevant programme for adult learners in the Telecommunications and Electrical Engineering fields.

In order to provide an empirical basis for the study, the researcher developed the following research questions for the study:

Main research question

How relevant are Telecommunications and Electrical Engineering programmes at universities in Ghana to the needs of adult learners?

Sub-questions

i. What type of knowledge, skills and attitudes are required by adult learners in the Telecommunications and Electrical Engineering fields?
ii. How are Telecommunications and Electrical Engineering programmes in the three universities presently structured?
iii. How can adult learning theories serve as the basis for any intervention that is aimed at providing adult learners with the relevant knowledge and skills?
iv. How can industry and HEIs collaborate to provide adult learners with requisite practical knowledge and skills that are relevant for their jobs?

1.5 RESEARCH PARADIGM, METHODOLOGY AND DESIGN

1.5.1 Research paradigm

This study was aligned to the interpretive research paradigm mainly because it provided the basis for understanding the context within which adult learners are expected to acquire knowledge needed for their job setting through self-directed learning, creativity and innovation. Reed (2008) posits that, from the realist viewpoint, social science theories provide conceptual direction to the basic social relations that shape the course of history and the limits of social action.

The essential premise of the interpretive paradigm is that the learner is able to make sense of the set of information and constructs that he or she gathers from respondents and documents. The Interpretive research paradigm suggests that it is necessary to provide students with the environment, support and conditions that will make them create meanings of their social life. The continuous construction and amending of structures of a person's knowledge could be termed as schemata (Fry, Ketteridge & Marshall, 2009) and these could continually change through processes such as new experience, understanding and information. While the social structures form the basis of reproduction, the ideas that support these structures create knowledge patterns which are also referred to as schemata (Fry et al., 2009). The schemata defines the way individuals make meaning out of what they observe, experience and practice daily and in the context of this study, the various modes which adult learners studying Telecommunications and Electrical Engineering are able to develop their own meaning out of their experience and what they learn in class were explored.

The need to identify the parameters of learning within the interpretive paradigm has been espoused by authors such as Goles and Hirschheim (1999) who indicate that designing programmes for instruction requires that facilitation is provided by the instructor through learning enhancing rather than controlling, thereby reducing reliance on learning outcomes. The constructivist mode of engagement in any research activity is through a qualitative process which seeks to identify events of interest with relatively large numbers of observations through process tracing, congruence testing and counterfactual analysis. The importance of qualitative research to the constructivist mode of investigating patterns and causal relationships leads the researcher to discuss the research design and methodology in the next paragraph.

1.5.2 Research design and methodology

The researcher chose the explorative design because the underlying philosophies and structure of Telecommunications and Electrical Engineering programmes in three different universities and their

relevance to the needs of adult learners were investigated. Using the embedded multiple case study framework developed by Gable (1994), the methodology focused on adopting more than one unit of analysis in the study. Additionally, the embedded multiple case study approach allowed the researcher to use both qualitative and quantitative data collection and analysis procedures to investigate the relevance of Telecommunications and Electrical Engineering programmes to adult learners in three diverse universities in Ghana. The approach used to gather and analyse data from respondents and discussants were replicated in the three diverse cases.

Bassey (1999) and Yin (2009) identify educational case study as an empirical enquiry, which is conducted within a localised boundary. Secondly, the embedded multiple case design was used because the significant features of all three universities in the study which focused on the relevance of the Telecommunications and Electrical Engineering programmes for adult learners were investigated. Herriott and Firestone (1983 cited in Yin, 2009), argues that embedded multiple case designs provide evidence that are more compelling, robust and give a basis for better generalisation across similar studies although they require extensive resources and time.

Case studies of three diverse universities in Ghana were done and the unit of analysis in each case was the Telecommunications and Electrical Engineering programmes in the universities. The units of observation in the study consisted of adult learners, HODs, sample curricula and four Telecommunications and Electrical Engineering firms in Ghana.

A structured questionnaire was administered and focus group discussions were conducted for adult learners pursuing Telecommunications and Electrical Engineering programmes at Kwame Nkrumah University of Science and Technology (KNUST), Ghana Technology University College (GTUC) and Regional Maritime University (RMU). Structured interview questions were designed for Heads of Departments of selected Higher Education Institutions and Chief Executive Officers of business organisations in the Telecommunications and energy sectors in Ghana. The business organisations used for this study were purposively selected based on their activities as either Telecommunications services providers or as energy power distributors. The sampling structure and the population under study are explained in detail in the next paragraph.

1.5.3 Population and sample

Ghana has a total number of sixty (60) universities and university colleges with the break down as follows; nine (9) state-owned universities, one (1) regional university, and fifty private universities and

university colleges. Out of these institutions, only 20% offer degree programmes in Telecommunications Electrical Engineering. The researcher considered the size of the institution, number of students, type of programmes offered, mode of delivery and the type of institution (regional, public and private) in selecting the universities.

This study adopted the embedded multiple case study design which is able to combine replication logic and sampling logic in a study. Additionally, the replication logic applied in this study emerged from theories (Chapter three provides detailed information on the theories used in the study) that formed the basis of the study. Yin (2003) provides two logics underlying the use of embedded multiple cases; first is that, they predict similar results and secondly, that they predict contrasting results but for predictable reasons. While the replication logic provided the researcher with the basis to identify unique philosophies and structures of Telecommunications and Electrical Engineering programmes in the three universities, the sampling logic provided the basis for selecting adult learners to respond to questionnaires. The research methodology, the population and sample connect with the data collection method and in the next paragraph, data collection processes used in this study has been thoroughly discussed.

1.5.4 Data collection

An important element in the case study design is the use of multiple data collection methods. In this study, document analysis, survey, observations and interviews were used as data collection methods. Yin (2009) states that the goal of reliability is to demonstrate that the operations of a study can be repeated with the same results at any given time. In addition to using valid and reliable data sets the researcher obtained triangulation by using different data collection methods namely interviews, observations, focus group discussions, questionnaire and document analysis. Bush (2005) posits that triangulation provides the researcher with the option of comparing many sources of evidence in order to establish the accuracy of findings and enhance confidence in the research findings. In a case study design, the accuracy of findings depends on five key interrelated components, which are; study questions, propositions, units of analysis, the logic linking the data and propositions and criteria for interpreting the findings (Yin, 2009). The five interrelated components have been discussed in Chapter five of this study.

For the purpose of this study, adult learners' demographic information, core knowledge in engineering, relevance of the programme to their needs, programme planning and motivation for self-directed learning, teaching and learning methods, the connection between the courses offered by the universities and their relevance to work of adult learners and employability skills development were gathered. In order to compare the data collected from the three cases, a thorough analysis of the data were done.

1.5.7 Data analysis

The data analysis in this study was done by combining qualitative and quantitative analysis using the embedded multiple case method approach (Gable, 1994). Cross-case conclusions among the three diverse universities used in the study were conducted by using pattern recognition among the different variables namely: core knowledge in engineering; relevance of the programme to the needs of adult learners; programme planning and motivation for self-directed learning; teaching and learning methods; the connection between the courses offered by education providers and their relevance to work of adult learners and employability skills development.

Patterns that contradicted constructivism served as the basis for modifying the model that was used and the modification was done in order to create a synergy between the real adult learning processes in the three HEIs and theories that have been discussed in Chapter three of this study.

From the analysis drawn in Chapter six, the study provided alternatives to the present patterns of teaching and learning among adult learners in the Telecommunications and Electrical Engineering programmes in Ghana. The conclusions drawn have considerable implications for the development of educational and economic policy necessary for making the curriculum of adult learners relevant to their knowledge and skills needs. A cross-case synthesis has been drawn and discussed in Chapter seven of this study. In order to provide a plausible interpretation of the research analysis and to test for its trustworthiness, the researcher provided an audit trail of the data collected, the analysis and the interpretation which were submitted to his supervisor as part of the requirement for this study.

The research paradigm and methodology are often validated on the assumption that the instruments used in any study actually test what they were intended to test. The validation strategy adopted for this study has been discussed in the next paragraph.

1.6 VALIDATING THE STUDY

According to Yin (2003:46), “case study inquiry copes with the technically distinctive situation in which there will be many more variables of interest than data points as one relies on multiple sources of evidence, with the data needing to converge in triangulation”. The triangulation supports the prior development of theoretical propositions that guide the researcher in data collection and analysis. Therefore, case study can be seen as a comprehensive research strategy (Stoecker, 1991 cited in Yin,

2003) which enabled me to study different evidences and patterns of teaching and learning among adult learners from the three different universities.

At the data collection stage, construct validity was strengthened through the use of multiple sources of evidence consisting of focus group discussions, interviews and document analysis that sought to test the patterns that emerged in the study. In applying these processes, the researcher sought to establish a chain of evidence within the programmes of the various HEIs drawn in the study. At the data collection stage, reliability was important to ascertain whether the instruments and processes, if replicated across the three universities, would provide the same set of results.

1.7 DEFINITION OF KEY CONCEPTS

Some key concepts used in this study are explained below:

1.7.1 Adult learner

Adult learners are considered as individuals who continue their education after a period of interruption. In the context of this study adult learners were categorised as deferrers, second chancers and returners (Davis, 1995; Bourgeois et.al, 1999; Teichler & Hanft, 2009) who are above 25 years and who decide to enrol on a programme in an HEI after interrupting their education for a period. Similarly, Guyot (1996) provides three main classification of adult learners: students with continuous careers but not university degrees; students with no break in their scholastic careers who already have a University degree and students with breaks in their scholastic careers who may already have a certificate or diploma - all these categories applied to this research.

1.7.2 Adult learning

Adult learning has been widely accepted as a process (Ormrod, 1995; Illeris, 2003; Hillier, 2002) which explains how adult learners acquire knowledge, skills and attitude through a generally accepted set of ideas.

1.7.3 Curriculum

Barrow (1984, cited in Carl (2012:32) observes that the concept of curriculum could be described as a programme of activities involving learners and teachers that are designed to enable learners attain the intended academic objectives.

1.7.4 Electrical Engineering

Electrical Engineering is a discipline that focuses on the research, generation, distribution and maintenance of power and power equipment for commercial and private purposes.

1.7.5 Telecommunications Engineering

Telecommunications Engineering, a branch of Information Communication Technology (ICT), is a discipline that involves the research, design, development and maintenance of voice and data communication systems, which include satellite, optical fibre, mobile communication and networks and wave propagation.

1.7.6 Replication logic

Replication logic refers to the concept of using a research technique in another setting within a particular study frame (Yin, 2003). The study used the replication logic in the three different cases considered.

1.7.7 Constructive alignment

Constructive alignment refers to the set of arrangements that is carried out by education providers to relate the teaching methods, assessment systems and learning outcomes with institutional climate, policies and practices (Biggs, 1999; Fry et al., 2009; Boev, Gruenwald & Heitmann, 2013).

1.7.8 Relevance

Relevance as used in the title of this study refers to the significance of Telecommunications and Electrical Engineering programmes to adult learners who require specific knowledge and technical skills that are applicable in their work environment. Additionally, relevance in the study also refers to the applicability of the programmes developed by HEIs to employers who expect their employees to apply the knowledge and skills they acquire from the HEIs. Professional bodies also expect adult learners to be able to demonstrate the knowledge and skills they acquire from HEIs in the industry where they work as well as share ideas with their colleagues in the profession.

1.7.9 Ghanaian values

Ghanaian values refer to the standards of behaviour and practices that govern the way individuals live in their communities. Ghanaian values include common sense of community and preservation of culture (Boateng, 1983), respect for the right of others, humility and commitment to the goals of society (Dei, 2004). Values as used in the context of this study describes the incorporation of acceptable rules of

behaviours such as respect, common sense of community and preservation of Ghanaian culture in the teaching and learning processes in HEIs.

1.8 ETHICAL CONSIDERATIONS

The ethical guidelines set by the Research Ethics Committee of Stellenbosch University for research students and those set by the institutions where data was collected guided the conduct of this study. In line with the rules of the Research Ethics Committee, the researcher obtained institutional permission and ethical clearance to enable him to conduct the research in the HEIs and business organisations concerned.

Secondly, in following the institutional ethical conditions on research in the humanities and social sciences, the researcher ensured that all respondents and participants in the study were contacted and that they consented to participating in the research. The researcher also obtained permission from the University authorities before conducting the focus group discussions. All respondents and participants were provided with an informed consent form to sign. Also in line with the ethical considerations, the will of prospective participants who refused to be interviewed or respond to the questionnaire were respected.

The researcher also observed the general rules guiding research, which indicates that researchers need to be open and honest regarding their work. In distributing the data collection instruments, respondents and participants were informed that all the information they provided would be kept confidential and in addition, their names and addresses would not be entered in the research database. The researcher also ensured that information used for the study was obtained from different sources such as books, journals and internet publications were properly referenced.

The data and findings of this study are open to all interested individuals and organisations who intend to use the information for other purposes or make reference to any portion therein. Similarly, all data and portions of the research should be correctly referenced as the copyright law stipulates.

All information and data that were used for this study have been saved on an electronic device and safely stored and no personal information of any of the respondents would be used for any research activity. The researcher also stated in the consent letter that the information that was provided by the respondents and participants would be safely and confidentially kept.

Finally, in adhering to the ethical standards of research, the researcher maintained a professional relationship with all respondents and participants in the study. The researcher ensured that no financial benefits or any other form of gains from the research that was undertaken accrued (additional information on ethical consideration has been provided in Chapter five).

1.9 SCOPE AND LIMITATIONS OF THE STUDY

The patterns of the Telecommunications and Electrical Engineering programmes in three diverse universities in Ghana were explored. In doing this, the researcher sought to identify the patterns that exist among HEIs in Ghana in relation to programme content and structure. Additionally, the study was limited to only three universities in Ghana and within the three universities due to resource and time constraints. Hence, the result of this study cannot form the basis of any generalisation across different disciplines in other universities.

1.10 OUTLINE OF THE STUDY

This study has been arranged in eight main chapters. Details of the chapters are discussed in the following paragraphs:

Chapter one provides an introduction to the study by discussing the standard processes that were used in designing the research objectives, problem statement, research questions, research design, validation of the study limitation and scope of the study and the ethical considerations necessary in carrying out the research work.

Chapter two provides a historical overview of education in Ghana with the various strategies used in promoting formal education from the primary level to the tertiary level. It also discusses the development of education between 1500 and 2000 with emphasis on the development plans of various governments during the period. The chapter also provides information on higher education with emphasis on adult learning in Ghana and how it affects the acquisition of knowledge, skills and experience of adult learners.

Chapter three discusses the theoretical underpinnings of lifelong learning and adult learning in HEIs and explains how adult learning theories serve as the basis for intervention that provides adult learners studying Telecommunications and Electrical Engineering programmes in three diverse universities in Ghana with alternative learning forms. Major aspects of adult education such as motivation for adult learning, characteristics of the adult learner, barriers to adult learning, philosophies of adult learning and adult learning theories in the field of engineering have been discussed in the chapter.

Chapter four describes the structured pattern of teaching and learning among adult learners in higher education. The chapter which can also be considered as the various processes for designing adult learning programmes in universities and also highlights the relevance of using appropriate techniques in providing adult learners with the right skills, knowledge and attitude. Key topics discussed in this chapter are; flexible curriculum for adult learners, elements in the design of HEI curricula for adult learners, identifying the core elements of a course, planning of course, session planning, the role of technology in adult learning environment, the role of the facilitator in adult learning, negotiating teaching and learning with adult learners.

Chapter five describes the research methodology used in the study. The chapter discusses the research paradigm, the research design, data collection techniques, data analysis techniques, validity and reliability of the data sets and the ethical consideration in conducting the research. Areas of interest in the study namely; the curricula of the Telecommunications and Electrical Engineering programmes, students' perception of the relevance of the existing programmes to their career needs, the views of the Heads of Departments on the considerations made in designing the curricula of the engineering programmes and the expectations of employers on the existing programmes in the universities were considered in the data collection techniques.

Chapter six contains the results and discussion of the data sets. The chapter also presents analyses of the data collected from the three cases studied, CEOs of some selected organisations in Ghana, the National Accreditation Board, the National Council for Tertiary Education and sample curricula of Telecommunications and Electrical Engineering programmes in the cases studies.

Chapter seven provides information on the cross-case synthesis and assesses the similarities and differences between the three diverse cases used in this study with respect to programme structure and relevance to adult learners. The chapter also discusses how the different universities used in the study structure their Telecommunications and Electrical Engineering programmes to meet the needs of adult learners in Ghana. The concluding part of the chapter discusses the benefits of collaborations between HEIs and industries Ghana.

Chapter eight discusses the possible implications of the study with reference to policies, practices and research. Additionally, the chapter provides information on how the integrated constructivist approach could be used to assess the relevance of Telecommunications and Electrical Engineering programmes to

the needs of adult learners. The concluding part of Chapter eight focuses on the limitations of the study and areas of further research.

1.11 CONCLUSION

The first chapter was designed to introduce the study as well as provide relevant background information about the study. It also gave details about the objectives and hypothesis of the study, the research design and ethical consideration of the study. Key to the basic structure of the study was the interpretive research paradigm, which was explained in detail as the basis for adopting relative ontology, a transactional epistemology and explorative research design. The chapter finally served as the building block for the remaining chapters of the study. The second chapter of this study provides a historical overview of education in Ghana with the various strategies used in promoting formal education from the primary level to the higher education level.

CHAPTER TWO

THE HISTORY OF EDUCATION IN GHANA

2.1 INTRODUCTION

This chapter seeks to trace the history of education in Ghana from the 16th century to the 21st century and assesses the impact of higher education on the development of the knowledge, skills and attitudes of learners with adult learners as the point of departure. Adult learners in the field of Telecommunications and Electrical Engineering often enter Higher Education Institutions (HEIs) with years of experience and technical knowledge which they obtain from either technical institutions which focuses on vocational education or polytechnics. The shortfall in the number of workforce needed to occupy positions in the energy and Telecommunications sector of Ghana could be explained by interrogating the educational system and the development of appropriate interventions to increase enrolment at the basic, secondary and higher education sectors of the country. This chapter argues that the shortage in skilled workforce in the energy and Telecommunications sector of Ghana could be traced to the development of education between 1500 and 2000 (spanning approximately 500 years). Additionally, the emergence of engineering programmes in the early 1950s at the Kwame Nkrumah University of Science and Technology (KNUST) and later at other institutions including the Ghana Technology University College (GTUC) and the Regional Maritime Academy (RMU) provided the country with trained personnel in the engineering field. The concluding part of this chapter argues that improving access and enrolment rates at all levels of education in Ghana are relevant for meeting the skills and knowledge needs of industries especially in the energy and Telecommunications sector. Additionally, this chapter provides that the relevance of developing curriculum for adult learners in the Telecommunications and Electrical Engineering fields does not only lie on the efforts of government but others such as regulatory agencies, HEIs and employers.

Ghana[1]- which was formally called Gold Coast – gained independence from Britain in 1957 and in 1960 Ghana became a republic. The first white settlers in Ghana were the Portuguese who arrived on the shores of Ghana in 1471 (Gocking, 2005). Later, other settlers such as the Dutch, Danes, Swedes and English also arrived with the purpose of trading with the indigenes. Although provision of education to the local indigenes was not the primary aim of the European settlers, they considered it as necessary to enhance

[1]The name Ghana (which was formally called Gold Coast) was taken from the ancient empire which existed from the fifth to the thirteenth century (Gocking, 2005).

trade and communication along the coast and inland. This chapter argues that the historical development of education in Ghana which started from the three main territories; Coastal/Southern, Northern and Ashanti provides better understanding of participation rates among learners from the primary level to the University.

2.2 EARLY EDUCATION IN GHANA

This section discusses the development of education in Ghana between 1600 and 1970, with particular reference to the role of European missionaries, the British government and local communities in the provision of basic and secondary education. The section concludes with a discussion of the emergence of engineering programmes at the Kwame Nkrumah University of Science and Technology and its impact on adult learning in the field of Telecommunications and Electrical Engineering.

2.2.1 The emergence of formal education in Ghana - 17th to the 19th century

Ghana has gone through several decades of transformation of her educational system which can be described as a legacy of the erstwhile British colonial educational system. The present structure of education can be traced back to the early years of the century when education was brought to the then Gold Coast.

The history of education in Ghana dates back to the sixteenth century when the Portuguese who settled in Elmina[2] established a learning centre for slaves who were taught to read, write and pray (Foster, 1971:43). This marked the beginning of literacy in the Gold Coast. Later, in 1644, the Dutch also established a school in Elmina where the local populace were taught to read and write; this school existed for about two hundred years. In 1722, the Danes established another school in the Christianborg Castle which is located in Accra to add to the number of existing schools (Foster, 1971; Graham, 1971). Most of these schools, including one that was later set up in the British fort by Thomas Thompson, were run by missionaries (Graham, 1971). According to Foster (1971), Thompson, who arrived in the country from Britain in 1754, was the first British to send three Gold Coast citizens to Britain in 1754. Of the three, only Philip Quaque survived; he was later ordained as a priest after which he returned to the Gold Coast in 1756.

Remarkable expansion in the educational sector was recorded in the first half of the 19th century, mainly carried out by missionaries from the Wesleyan Methodist Missionary Society and the Basel Society

[2]Elmina was the first European settlement in Ghana (formally, Gold Coast). It is located in the Central Region of Ghana.

(Foster 1971:48), whereas some trading organisations also contributed to the early growth and development of schools in the Gold Coast.

The development of career-focused curricula can be traced to the early part of the 19th century with a select Committee set up by the British government to investigate whether and how the various schools incorporated trades such as agriculture, carpentry and blacksmithing into their programmes (Graham, 1971; McWilliams & Kwamena-Poh, 1975). The lack of career-focused training in the curricula of most schools in the former British colonies can be linked to the early stages of colonial rule when the focus was mainly on teaching reading, writing, arithmetic, geography and religion (Foster, 1971). The decision by the British to develop the school system to include vocational curricula was in contrast to the goals of the early European settlers who taught the indigenes to read and write so that they could work in the administration of the colonies and also convert them to Christianity (Gocking, 2005). An overview of the development of education in Ghana from 1800 to 2000 is provided in the next section and it seeks explain the impact of formal education to the social and economic well-being of the citizenry.

2.2.2 Expansion of educational provision - 1800 to 1920

Between 1800 and 1920, the European missionaries continued to establish schools in addition to those built in 1644 by the Portuguese, 1727 by the Danes and 1751 by the British, purposely to provide education foundation to the children and also prepare them for the world of work. In order to achieve the goal of increasing access to children of school going age, from 1850 to 1920, many educational institutions were set up. They were mainly at the basic level[3] together with a few training colleges (George, 1974:29). During the same period, there was rapid expansion of educational facilities in the southern part of Ghana which was the result of both government interventions and missionary projects. Yet, majority of the local population could not read nor write. These large number of illiterates mainly relied on subsistence farming, fishing and haunting to survive. Very few people at that time were trained as masons, carpenters and blacksmiths, even if there was a need for the services of these artisans.

Missionary groups such as the Basel Society, which set up initially at Christiansborg in 1828, the Wesleyan Methodist Missionary Society which was set up at Cape Coast in 1835 and the Bremen Mission Society which started in the Volta Region in 1847, played key roles in the expansion of education (Graham, 1971; McWilliam & Kwamena-Poh, 1975). The missionary societies to a large extent had the consent of the local chiefs and the governors in establishing their schools. The government left the

[3]Basic education refers to enrolment of pupils from primary 1 to level 3 of the Junior High School, covering the age group 4 to 14 years (UNESCO, 2015a).

missionaries to expand their institutions to all parts of the country; this was mainly due to the government's decision as a means to allow the missionaries to support the development of education in the country. In areas where the missionaries could not set up schools, the government, with the support of local chiefs, provided the communities with mostly basic schools (George, 1974).

Available statistics show that in 1856 the Wesleyan schools in the West Coast of Ghana and the Southern Region of Nigeria namely, Badagry and Abeokuta had a total population of 1200 pupils (Foster, 1971). The development and expansion of schools in the Gold Coast continued until 1882 when the missionary societies could no longer fully support their schools, and the government had to step in to provide the necessary support. This was followed by the education ordinances of 1882 and 1887, which were basically a replication of the English Education Act of 1870, and intended to be used in designing policies for local schools (Graham, 1971). The act sought to provide education for all citizenry of the then Gold Coast to enable them acquire knowledge and skills, which were required in the manufacturing as well as services sector.

According to George (1974) the total number of government and government-assisted institutions in 1881 were 139 with most of them located in the southern part of the country while the total number of pupils enrolled in the various institutions amounted to 5000; this figure grew to 12000 in the beginning of the 20th century. Although the period between 1850 and 1920 saw a rapid growth in education mainly at the basic level in the southern part of the Gold Coast, the Northern part and the Ashanti territory still had only a few basic schools and low enrolment rates even though the local people continued to strive for education.

Within the same period, very few post-basic and technical institutions were established to train the pupils who passed out of the basic schools, and this led to a stunted growth in the rate of post-basic enrolment. While the number of middle school leavers increased in this period, the number of those who qualified to enter either technical institutes or teacher training colleges was very low and this led to a significant drop rate in enrolment at the post-basic level (McWilliam & Kwamena-Poh, 1975).

2.2.3 Development of post-basic and higher education - 1920 to 1959

The period between 1920 and 1959 was characterised by continuous development in the area of post-basic and higher education in the then Gold Coast. The involvement of the missionaries in the development of education during this period was also very intense with improved government support in the form of policies that encouraged the missionaries to set up more schools based on their own strategic

directions and goals. Although the missionaries were involved in the establishment of schools all over the country, the disparity between the number of schools in the Northern part of the country and those in the Southern part was a major concern for the government. Additionally, in response to the concerns of the citizens in the Northern part of the country about the lack of schools, many institutions were established by the government in the Northern territory of the then Gold Coast. This was to ensure that education was provided to the Northern citizens who did not benefit much from the missionary activities which were predominantly located in the southern part of Ghana. According to George (1974:31) majority of the basic schools which were set up in the Northern region were started by local communities with no approval certificates of the educational units of the then Gold Coast government.

In 1951, the Gold Coast government launched a five-year educational expansion programme that sought to increase the number of primary, middle, secondary and technical schools in the country, in addition to training more teachers to teach in these schools. The programme was known as the Accelerated Development Plan for Education (ADPE) of 1951 and it was designed to provide funding for the expansion of educational institutions, including HEIs, across the country, especially in the Northern and Ashanti Territories (George, 1974).

Activities under the ADPE included providing universal free primary education for every child of school age, the construction of more primary, middle, secondary and technical schools, increasing enrolment rates in all levels of education and absorbing all institutions that were run by individuals, communities and missionaries into the public educational system (although the plan stated in principle that the financial responsibility was to be shared). In addition to increasing the number of teacher training colleges, the ADPE also introduced a two-year teachers' certificate B course for middle school leavers who opted to be trained as teachers, while the certificate A courses were transformed into a four-year programme (George, 1974). The rationale for introducing the certificate B programme in the teacher training colleges was to produce more teachers for the increased number of primary schools throughout the country.

The ADPE brought about significant changes in the enrolment rates of primary school pupils. According to George (1974), in 1952 the number of pupils enrolled in primary schools in the country was 335000 compared to 154000 in 1951. In addition to the increase in enrolments in primary schools, the ADPE also ensured that all primary schools that were not receiving government funding were added to the mainstream public system and provided with the necessary assistance. Although the ADPE was successful in increasing enrolment rates among primary school pupils across the country, not many secondary schools, especially in the Northern and Ashanti provinces, were established between 1951 and

1959. Because the small number of secondary schools could not absorb the increasing number of middle school leavers, most of these students were compelled to enrol in either teacher training colleges or learn a trade. Between 1951 and 1957 the number of teacher training colleges grew, while enrolment rates of teacher trainees also increased significantly (George, 1974:48).

During this period of rapid infrastructural and human resource development in the Gold Coast, the Kumasi College of Technology (now Kwame Nkrumah University of Science and Technology) was opened in 1952.

Between 1900 and 1950, several commissions and education review boards were set up to consider ways of expanding schools across the country to create a better geographical balance in educational provision, and restructuring the curricula to make them relevant to the needs of the business sector and the economy (Graham, 1971). The commissions included the Phelps-Stokes Commission in 1923, the Education Ordinance in 1925 (meant to also strengthen teacher education), the Education Review Committee of1930, and the 1937 Committee which included Sir Arku Korsah[4] (Graham, 1971).The Jesse Jones Commission of 1922 proposed that the curriculum in the then Gold Coast and other African countries should be designed to meet the values and needs of the citizens, which included training in trades and agriculture (Taylor, 1974). The Power Committee (1937 – 1941) recommended the introduction of vocational skills training in the curriculum of schools to include fishery, agriculture, craft and domestic science (Taylor, 1974). Between 1966 and 1967, the Kwapong Committee made several recommendations, including the introduction of Ghanaian languages, English, Mathematics, History, Civic Education, Geography, House Craft and Religious and Physical Education in the curriculum of schools (Taylor, 1974). According to Taylor (1974) reports of the various committees set up between 1900 and 1970 had two basic underlying suppositions; firstly, any educational system in Ghana should reflect the Ghanaian values and meet the needs of the individual and the broader society, and secondly, that education should help the individual develop Christian values.

The period between 1959 and 1980 saw a remarkable expansion of education in Ghana, especially at the post-secondary level. Yet, the number of students who could not enter higher education institutions because of limited space and difficulty in obtaining the requisite passes was identified as a major

[4] Sir Arku Korsah was one of the first two Ghanaians to be appointed in 1942 to the legislative council by the then governor of the Gold Coast, Sir Alan Burns. He later became the first black chief justice of the then Gold Coast in 1956

hindrance to the training of skilled personnel needed for the industrial development of the then Gold Coast. A brief overview of this period is discussed in the next paragraph.

2.2.4 Education development plans - 1959 to 1980

2.2.4.1 The five year capital development plan of 1959 to 1964

In 1959 the government launched a five-year capital development plan (also known as the second development plan, following on the ADPE of 1951) which was aimed at expanding infrastructure for primary, middle and secondary schools, while also supporting the development of higher education in the country. This arrangement was meant to reduce the number of students who could not continue their education after completing secondary schools and also ensure that majority of the population obtained higher education qualifications to help in the development of the country.

The strategic direction of the government at the time was to ensure that the number of pupils and students who passed out of the basic and secondary schools increased while they also sought to provide further and higher education for the secondary school leavers. At the primary and middle school levels of education, the capital development plan was designed to provide free, compulsory education to all pupils in all parts of the then Gold Coast. The government allocated 510 000 pounds for the construction of more primary and middle schools in the Northern region to provide pupils in that region with access to basic education. The capital development plan also had as part of its objectives, the setting up of secondary schools across the country to absorb at least 10% of the total number of primary school leavers (in each of the regions), increasing the enrolment of secondary school students in government funded schools from 2200 to 6000 by 1964, the construction of 34 new secondary schools across the country through the Ghana Educational Trust (with major funding from the Cocoa Marketing Board which provided 2.5 million pounds for this purpose), and the expansion of 18 existing secondary schools to increase the intake of students. Although the five-year capital development plan was intended to develop all levels of education in the country, the construction of the 34 secondary schools used almost half of the total budget for the plan (George, 1974).

As far as technical and teacher training are concerned, the capital development plan had the following objectives: to expand and reorganise technical institutions in the country, to set up one teacher training college for the training of technical teachers, the introduction of advanced certificate courses in all technical institutions across the country and the construction of four new teacher training colleges in the Northern region to train more teachers for the increasing number of pupils in primary schools in the Northern region.

The development of higher education in the country was among the priorities of the then government, and in order to achieve this goal, an amount of 3.6 million pounds was budgeted for the expansion of two university colleges in Accra and Kumasi to provide diploma and degree programmes. These developments were also aimed at transforming the nature of higher education which was hitherto considered a direct replication of the British system of higher education and had very little relevance to local conditions and needs. According to McCain (1980:91):

> During the colonial period, university education in the Gold Coast was regarded as ancillary to the goals and purposes of the British. The curriculum reflected this bias, and there was little concern for instruction appropriate to the developmental needs of the Gold Coast. University education generally assured the recipient a government job, high status, and a secure income. To a certain extent this is still true today, although there are limits to the numbers of graduates which the regime can now absorb into the ranks of the bureaucracy.

Additionally, the aim of the government was to develop the structures within the universities in Ghana to award local diplomas and degrees rather than relying on external institutions, such as the University of London, which were still awarding qualifications. The expansion of the universities was also meant to train the larger numbers of secondary school leavers -including workers who had completed training at technical institutions -so that they could provide the local industries and government agencies with the skilled labour required. Although the capital development plan was introduced to improve educational development in the Gold Coast, it was suspended in 1962 and replaced with the seven-year capital development plan.

2.2.4.2 The seven-year capital development plan of 1963 to 1970

The seven-year national reconstruction and development plan was an integrated approach to the overall development of Ghana that aimed at interlinking all facets of the economy to provide a harmonised developmental framework. The goal of integrating the seven-year educational development plan into the national reconstruction and development plan was to make education relevant to development needs of the country with a focus on the teaching of skills and knowledge that were pertinent for the transformation of Ghana into a country with an advanced economy (George, 1974; McWilliam & Kwamena-Poh, 1975).

The development plan had, as part of its objectives, the reduction of the number of years pupils had to spend in basic schools from eight to six years, and the introduction of a two-year continuing education programme through which students could acquire basic working skills, especially in industries that fit the development agenda of the country. The decision by the government to equip middle schools to provide skills training to students was considered a necessity in developing the knowledge, skills and attitudes of students who were needed to work in both public and private sectors of the economy of the then Gold Coast (Graham, 1971; George, 1974).

The seven-year development plan also called for the expansion of teacher training colleges for the purpose of training more teachers, increasing enrolments from 5000 to 20000, while the estimated number of teachers to be produced during this period was to reach 31000 by the end of 1970. The seven-year development plan also had as part of its goals educating 1000000 pupils across the country between 1963 and 1970 (George, 1974).

In order to train more students to be absorbed into the industrial and services sectors of the economy, the seven-year development plan aimed at increasing secondary enrolment rates from 10000 in 1964 (this was based on the five-year development plan of 1959) to 22000 by 1970. The government also envisaged the establishment of a new university and the expansion of the existing universities to meet the increasing secondary school and teacher training college turn out (George, 1974; McWilliams & Kwamena-Poh, 1975).

The seven-year development plan yielded the needed results, and enrolments at the secondary and tertiary level of education increased even more than expected. The increased enrolment at the secondary school level was mainly the result of the additional secondary schools which were built in the country. According to George (1974), the number of secondary schools in the country increased from 39 in 1959 to 105 in 1966, while secondary school enrolments increased from 11000 to 42000. The enrolments at the three universities namely the University College of Ghana, the Kwame Nkrumah University of Science and Technology and the University College of Cape Coast increased from 1184 in 1961 to 4267 in 1966.

By 1965, education at the basic level in Ghana was free and parents were encouraged to send their children to public schools. The challenges that the country faced in its development process in the area of education were: dependence on expatriate teachers at secondary schools, teacher training colleges and universities; more than 65% of teachers at basic schools were not trained; low rate of progression from middle schools to secondary schools; and low participation rates in universities, mainly because the

secondary schools did not turn out the number of students who were needed to enrol in the universities. Although government had made provision for the training of students at the country's universities, very few students could enrol because the drop-out rate at the middle school level was very high. The effect of the low participation rates at the university level was that many workers in the industries and service sectors would be seeking higher education in future with most of them seeking admission as adult learners (George, 1974).

2.2.4.3 The two-year development plan of the NLC

The overthrow of the government and then President Kwame Nkrumah in 1966 brought the seven-year development plan to an abrupt end. The National Liberation Council which overthrew the Nkrumah government set up the two-year education development plan with the following objectives: development of infrastructure in all three universities while ensuring that the programmes offered by the universities were in fact relevant to the development agenda of the country; and the restructuring of other post-basic institutions such as technical institutes to produce students who could be admitted into the universities. Between 1966 and 1968, the expenditure on secondary schools, however, reduced by nearly 50% and there was a growing imbalance between the various levels of education in the country (George, 1974).

2.2.4.4 The one-year education development plan

The one-year development plan of 1968 was put in place as a short-term project to correct the apparent imbalances of the educational system resulting from investment in the university sector as the priority of government. The following were considered as necessary in meeting the goals of the one year development plan:

i. Expanding the infrastructure and providing more teachers for secondary and technical education in the country.
ii. Improving the quality of primary education in the country and ensuring that there were enough trained teachers to teach in the primary schools that were built to admit the increasing number of pupils who enrolled in these schools.
iii. Controlling the expansion of university education in the country and directing the growth in university education to meet the development needs of the country.

Research conducted by Moulton, Mundy, Walmond and Williams (2002) in five sub-Saharan African countries, including Ghana, showed that the changes in the educational structure in most of the countries studied were the result of the changes in government, especially from democratically elected governments to military regimes. The difficulty with most of these reforms was that very little research was conducted into the implementation of these policies and interventions.

2.3 HIGHER EDUCATION IN GHANA

Higher education in Ghana has undergone several transformations that were aimed at creating the right conditions for the training of skilled personnel needed for the development of the economy of the country. One of these measures was the Tertiary Education Project (TEP) which was designed by the government to strengthen the quality of tertiary education in the country, and had the following goals: "to reverse system deterioration, falling standards, and declining quality of education; to expand access to tertiary education; to establish a stable and sustainable basis for the financing of tertiary education and to create institutional capacities for quality monitoring and policy evaluation in the tertiary education sector" (Girdwood, 1999:20).

Although the first rationale for the setting up of the Tertiary Education Project was to serve the interests of the different categories of learners, the second rationale, which was to expand access to tertiary education, was the main driving force for introducing formal adult learning modes of education (Manuh, Gariba & Budu, 2007). This also saw the setting up of distance learning centres in many universities in Ghana. The concept grew through the 1990s and into the first part of the 21st century where three of the state-owned institutions either set up a department or an institute specifically for the advancement of distance learning programmes.

2.3.1 The Universities Rationalisation Committee (URC) of 1986-1988

What precipitated the setting up of the Universities Rationalisation Committee (URC) was the deteriorating educational system in Ghana that was considered to be unable to meet the broad policy objectives of the country. The period between the late 1970s and 1980s saw several elements of tertiary education, namely academic standards, instructional resources, lecture halls, laboratory equipment and libraries deteriorate, while lecturers also left for neighbouring Nigeria in search of better service conditions (Sawyer, 1994 cited in Girdwood, 1999). These conditions were in part the result of challenging economic conditions that affected almost all aspects of Ghanaian development, including education from the basic level to the tertiary level.

The Universities Rationalisation Committee made, among others, the following recommendations

"i. An integrated and co-ordinated tertiary education sector under the general supervision, direction and control of the Ministry of Education;

ii. Greater cost-effectiveness and institutional income generation. To that effect a system of cost-sharing for the financing of tertiary education is to be established between government, students and the private sector;
iii. Restructuring tertiary institutions such as diploma–awarding institutions to improve cost-effectiveness upgrade the quality of teaching and increase output. This involves establishing university colleges from the existing, diploma-awarding institutions;
iv. increased access for qualified people and improved gender balance;
v. production of more appropriate proportions of higher level and middle level personnel;
vi. greater relevance to and articulation with the workplace and employment opportunities; and
vii. better management in all the tertiary education institutions" (NCTE, 1998:6)

Additionally, the URC report also contained the following suggestions on the structure of schooling in Ghana which were later promulgated by the government White Paper: six years of primary school; three years of junior secondary school; three years of senior secondary school; four years of university education.

Following the report of the Universities Rationalisation Committee, the government issued a White Paper in 1991 with the following reforms:

i. academic autonomy of the institutions remains unchanged. However, all institutions of higher learning are to come under the general supervision and direction of the Ministry of Education (MOE) with regard to policy formulation and monitoring;
ii. supervision of the sector would be undertaken by the MOE and assisted by an Advisory Education Commission. (This was later, in 1993, changed to the National Council for Tertiary Education (NCTE);
iii. to improve cost-effectiveness, and to upgrade the quality of teaching and increase output, university colleges are to be established from the existing diploma awarding institutions;
v. to improve access to tertiary education, a university in the north of the country is to be established. In addition, new action-oriented degree programmes in priority areas of development like the agricultural industry will be introduced;
vi. a system of cost-sharing between government, students and the private sector will be established for the financing of tertiary education;
vii. by 1994, the curricula of tertiary institutions are to be adjusted and made compatible with those of the new secondary school system; and

viii. distance education is to be pursued as an alternative mode of delivering and increasing access to university education (White Paper on University Rationalisation, 1991:64-68).

The Tertiary Education Project (TEP) was established in 1993 to implement the recommendations of the URC. The policy framework recommended by the URC also served as reform objectives for the TEP and they consisted of the following: "reverse system deterioration, falling standards, and the declining quality of education; expand access to tertiary education; establish a stable and sustainable basis for the financing of tertiary education; create institutional capacities for quality monitoring and policy evaluation in the tertiary education sector" (Girdwood, 1999: ix).

Although the University Rationalisation Committee and the Tertiary Education Project brought to the fore important elements for the development of higher education in Ghana, little was said about providing opportunities for working adults to acquire further education in HEIs which in-service training and other forms of training could not provide. What was discussed by the various Committees was the setting up of distance education institutions which would provide more higher education opportunities. By implication distance education was seen as a way of providing more adult education opportunities. Yet, this form of education was not necessarily ideal for this purpose, and according to Girdwood (1999:53) "distance education should be encouraged only after lengthy consideration of all its advantages and disadvantages. Cost-implications (which would be high) must be anticipated". What the URC and TEP could not develop was a comprehensive policy and plan to support adult learning in Ghana.

The present arrangements for HEIs, including polytechnics, in Ghana consist of the following: they are legally independent corporate institutions established by an Act of Parliament. They have the power to sue and be sued. They also have other corporate powers such as perpetual succession, common seal and ability to acquire and own property in their own names; they have a relatively fragmented organisational structure including many semi-autonomous units; they have diffused decision-making power through a system of Boards and Committees; a substantial amount of authority and initiative are vested in individual academics, and there is a high degree of concentration of brain power within the institutions (Effah & Mensah-Bonsu, 2001cited in Owusu-Agyeman et al., 2009).

According to Owusu-Agyeman et al. (2009) curricula quality and relevance have been described as key requirements for the training of skilled manpower needed for the development of Ghana. Although the

National Technical and Vocational Education and Training Qualifications Framework (NTVETQF)[5] was launched in 2012 to address the challenges facing technical education in Ghana[6] (UNESCO, 2015b), it has not been integrated into the HE qualification structure of Ghana.

2.3.2 The development of universities in Ghana, with a particular focus on Engineering programmes

Before 1990, Ghana had three universities, namely the University of Ghana, the Kwame Nkrumah University of Science and Technology and the University of Cape Coast. The latter institution was originally established in 1962, and until 1970 known as the University College of Cape Coast. According to George (1974), the University of Ghana was established in 1948 as the University College of the Gold Coast. The Kwame Nkrumah University of Science and Technology, which was formerly known as the Kumasi College of Technology, was established in October 1951, and opened its doors in January 1952.

Originally, the Kwame Nkrumah University of Science and Technology was set up to provide university education in the areas of the arts, applied sciences, health and engineering. In 1952, the first engineering department was created to provide the needed training in engineering (George, 1974; Manuh et al., 2007). Students who originally enrolled in engineering programmes offered by the university were awarded University of London Certificates in Engineering. Most of the students who pursued these engineering courses were products of the technical institutes that were set up to provide skilled training for individuals who wished to pursue an engineering profession (Manuh et al, 2007). In 1964, the Kwame Nkrumah University of Science and Technology was tasked by the then President to focus on the training of skilled person power in the areas of engineering and technology education in Ghana.

After the University was mandated to award its own degrees and certificates, new diploma and certificate courses were introduced to provide training to middle-level personnel who were needed for various industries in Ghana. In addition to providing education at the certificate and diploma levels, the University also served as the last resort for individuals who graduated from the various polytechnics and technical institutes. George (1974) points out that the changes to the educational system, especially in the

[5] The National Technical and Vocational Education and Training Qualifications Framework (NTVETQF) was passed following the promulgation of LI 2195 under the Council for Technical and Vocational Education and Training (COTVET).

[6]The challenges facing technical and vocational training in Ghana include weak curricula that fail to address the skills needs of students, lack of validation for informal and non-formal qualifications and resource challenges (UNESCO, 2015b).

engineering field, involved the creation of pre-technical programmes that included vocational and craft courses as well as general courses in engineering.

With the reorganisation of technical institutes in 1963 to provide further education, technician and ordinary technician diploma courses were introduced to offer training in building construction, and mechanical and Electrical Engineering (George, 1974; Manuh et al, 2007). While technical institutes were set up to provide these programmes in Ghana, the polytechnics were mandated to offer advanced certificates and diploma programmes in some fields, including Electrical Engineering. Most of the syllabuses used at the pre-technical education level were those of the City and Guilds of London Institute (CGLI) in the United Kingdom and they mainly served as terminal programmes for professionals in the various fields (George,1974), including electrical and Telecommunications engineering. Students who completed the technician course and who wanted to progress to the higher diploma level were required to take further courses and meet additional requirements to be able to enrol at the institutions of higher learning.

It is important to emphasise that even when the restructuring of the technical institutes was done after 1962, not much effort was devoted to designing a pathway for students who enrolled in technical institutes to obtain higher education qualifications at the university level (Manuh et al, 2007). In effect, the technician certificate was considered sufficient to earn them a living in the post-colonial era when more industries had been set up. Students who obtained the Ordinary Technician Diploma (OTD) and who wanted to pursue diploma programmes at the Kwame Nkrumah University of Science and Technology were required to have the requisite passes and in addition to a two-year programme leading to the university's diploma award which was equivalent to the British Higher National Diploma at the time. According to George (1974), the Ordinary Technician Diploma (OTD) replaced the Overseas Ordinary National Certificate programmes between 1964 and 1965. While the polytechnics were later given the mandate to train Ordinary Technician Diploma students in Electrical Engineering and other courses, the universities were focused on providing the relevant training in higher education programmes.

The government's decision to transform the university colleges in Ghana into full-fledged universities led to a major reorganisation and expansion of the University of Ghana and the Kwame Nkrumah University of Science and Technology in 1961 (Manuh et al, 2007; George, 1974). Among the changes that took place during the period were: the restructuring of the existing faculties in both university colleges to the status befitting a university that could award its own degrees; the setting up of a new university in Cape Coast that would also see the transfer of one science and the arts department from the

Kwame Nkrumah University of Science and Technology to the new University; and the placing of the newly set up University of Cape Coast under the auspices of the University of Ghana for purposes of mentoring as well as the issuing of certificates.

The legislative instrument that provided for the restructuring of these universities was finally passed in August 1961 (George, 1974). The University of Ghana commenced with Faculties of Arts, Social Studies, Agriculture and Science whiles the Kwame Nkrumah University of Science and Technology started by transforming its existing five departments into faculties. To this end, there was a deliberate arrangement to gradually remove the external programmes that were offered by the university colleges and replace them with the new universities' certificate and degree programmes. It is important to note that most of these faculties still held on to the curriculum of the external universities and did very little to develop local content, especially in the social science programmes.

The result of the restructuring of the universities was that the combined enrolment figures for the two universities between 1961 and 1965 rose by almost 250% while the government's financial support to them also increased considerably (George 1974).

2.4 ADULT EDUCATION IN GHANA

In Ghana the concept of adult education refers to the various activities and programmes that are used to provide adults with relevant knowledge and skills. Institutional policies guide the teaching of adults in the formal mode of education in institutions across the country. Most adult learning programmes in Ghanaian universities are run by separate structures put in place to provide adult learners with relevant knowledge and skills.

2.4.1 The development of adult education in Ghana

The history of adult education could be traced to 1948 when the first adult education unit was established akin to the Oxford Delegacy of Extra-mural (Tagoe, 2012). Similarly, formal adult education in the Gold Coast was started by the Department of Extra-Mural Studies of the University College of the Gold Coast. In 1949, the adult education unit was incorporated into the University College of Gold Coast and later developed into an institute in the University of Ghana.

In July 1962, the Department was transformed into an Institute for Public Education by the then President of the country. Further to this development, the Institute for Public Education also set up workers' colleges in all the regions in the country to provide training to workers in the General Certificate of

Education in ordinary and advanced level courses as well as some vocational and professional courses. Jarvis (2004) gives insight into the work of universities that provide extra-mural adult education by stating that the university, in discharging its obligation, provides community education where they either request academic staff to teach in the community or employ part-time staff to teach adult learners in the community. Adult learning can therefore be seen as both a human right and a basic need in all societies so that individuals' learning needs can be met, their potential can be developed and they can secure a position in the society which relates to individual accomplishment.

Adult learning in Ghana has developed to include distance and continuing education which seeks to provide workers and adult learners with formal education (NCTE, 1998). The present policy on Distance Education was developed between 1991 and 1994 between the government of Ghana and the United Nations Educational, Scientific and Cultural Organisation (UNESCO) and the Commonwealth of Learning (COL). The recommendation of the team and the state-owned universities then, gave way to the implementation of distance learning programmes across the country. Prior to the adoption of the distance education Ghana in 1997, there had been several programmes notably the setting up of the workers college to provide workers across the country with tuition for General Certificate Ordinary and Advanced level examinations, Modular Teacher Training Programme (MTTP) and the training of civil servants across the country in several programmes offered by the universities.

Today, while new providers are emerging in the higher education sector of Ghana (Effah, 2003), there is the need for these institutions to offer academic courses that advance knowledge among adult learners and also combine the theoretical and practical aspects of course delivery (especially in the field of Telecommunications and Electrical Engineering). There is also the need to provide customised education and training services on contract to staff of enterprises which are often more efficient and useful than regular training, and at lower cost[7]. Although continuing education could be used as the generic term for all forms of adult learning in Ghana (as stated in the policy document of the National Council for Tertiary Education), it is important for the formulation of policies to cover emerging trends in higher education such as the developing of Massive Open Online Courses (MOOCs), blended learning and online learning. The present policy on distance education saw the setting up of regional campuses of some of the state-owned universities as well as some institutions of higher learning but what is more important at this stage is the development of new sets of policies that guide teaching and learning among adult learners.

[7]Chapter 4 discusses the relationship between industry and higher education institutions in the development of adult learning programmes in the field of electrical and Telecommunications engineering in Ghanaian Universities with a focus on three diverse institutions.

In the field of Telecommunications and Electrical Engineering, institutions such as Kwame Nkrumah University of Science and Technology (KNUST), Ghana Technology University College and the Regional Maritime University have developed structures to provide adult learners with requisite knowledge and skills needed by industries in Ghana. This study however focuses on identifying the relevance of the Telecommunications and Electrical Engineering programmes to the needs of adult learners using the three cases as evidence of the evolvement of adult learning programmes from its commencement in 1948 to its present state.

2.4.2 Access and enrolment implications for adult learning

Although this study is not directly linked to issues of access and opportunity available to adult learners in the field of electrical and Telecommunications engineering in Ghana, it is important that some key issues underlying the existing limitations in the field of adult education are discussed. At the primary level of education, government's intervention such as provision of free meals, uniforms and capitation grants have yielded the desired results with an increase in enrolment rates in the last 14 years (anecdotal information) with a corresponding decline in the rate of drop out among pupils in primary school. A brief discussion of the out-of-school rates among pupils in primary schools in Ghana will provide a better understanding of the implications of increased enrolment for secondary and higher education Ghana.

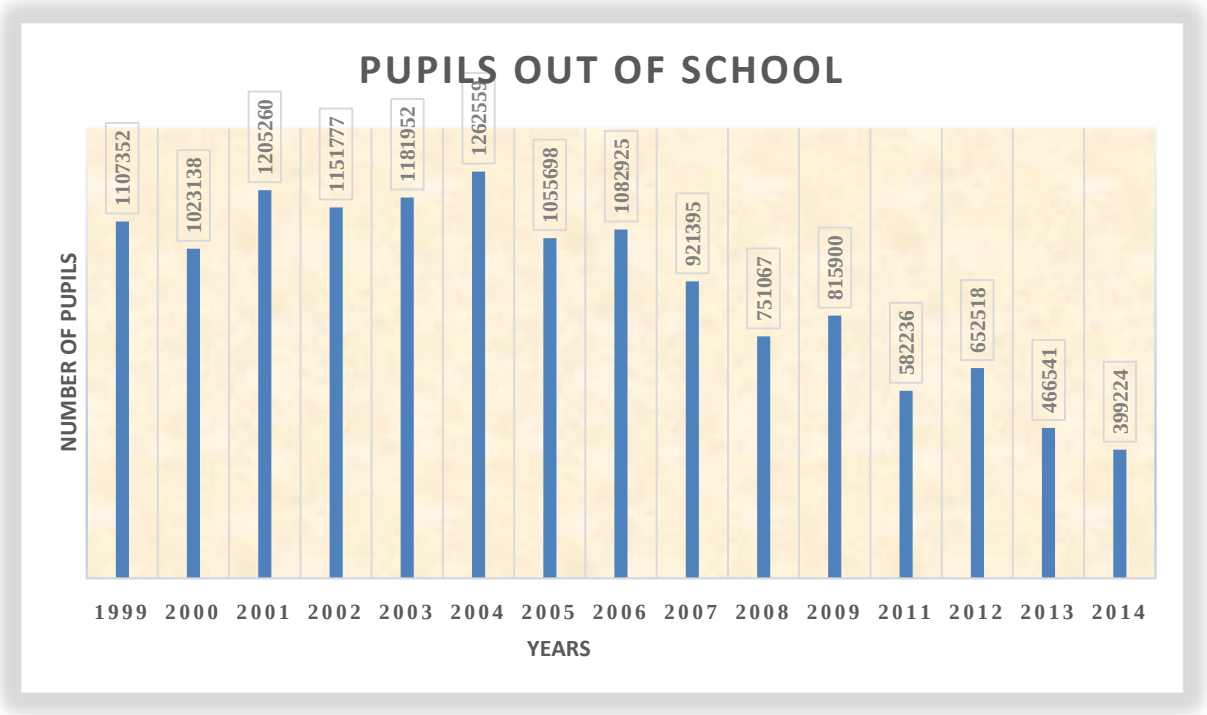

Figure 2.1: Number of out-of-school children of primary school age in Ghana, 1999-2014
Source: UNESCO, 2015a.[8]

Figure 2.1 shows the out-of-school children of primary school age in Ghana between 1999 and 2014. There has been a significant reduction in the number of pupils who are unable to access primary education at the lower level due to financial challenges or socio-cultural factors (such as those which inhibit the girl child from enrolling in school). What Figure 2.1 shows is that there has been a continuous increase in the number of pupils who sought secondary education and then higher education. Although government interventions by way of capitation grants, school feeding programmes and free uniforms and bags have been described as vital for increased number of enrolment at the primary level of education (Akyeampong, 2011), not much has been done to significantly improve the enrolment figures especially in the rural communities. The implication of the continuous fall in the number of school dropouts is that government and other agencies will have to make provision to admit more students into secondary schools and then into higher education institutions.

[8]The rate of out-of-school children is calculated as a percentage of the total number of pupils expected to be enrolled in a particular year. The period 1999 to 2014 was chosen because of the consistent growth it shows over the period. There were no rates available for 2010 as shown in Figures 2.1 and 2.2.

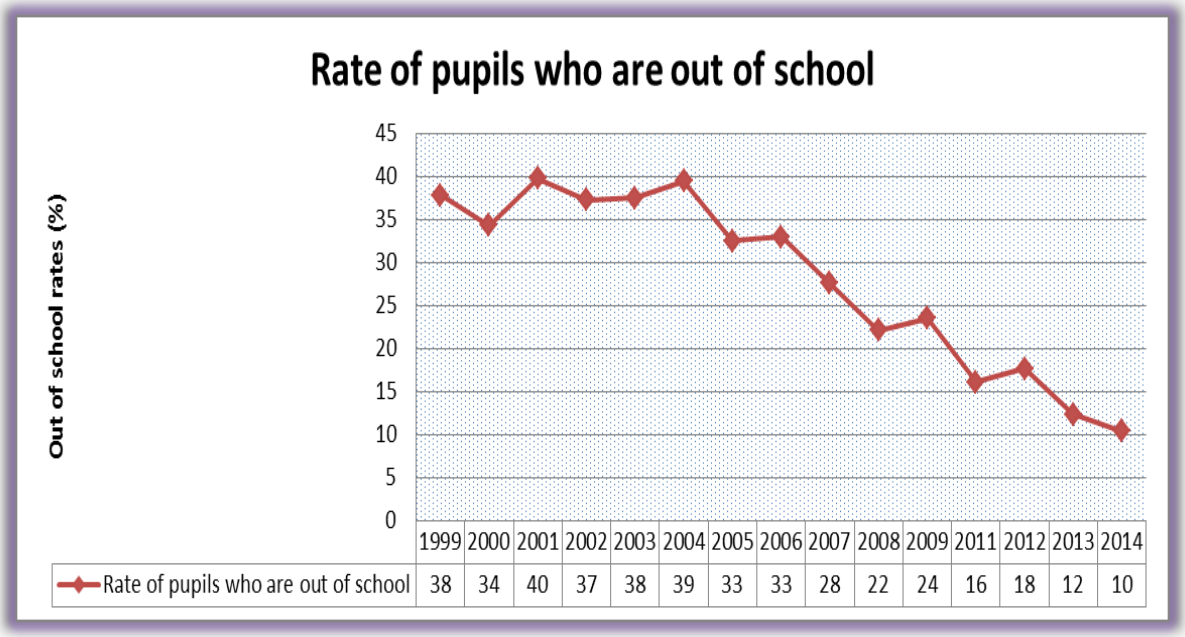

Figure 2.2: Rate of out-of-school children of primary school age, 1999-2014

Source: UNESCO, 2015a.

Figure 2.2 shows the rate of out-of-school children of primary school age in Ghana between 1999 and 2014 expressed as percentage of the total number of pupils expected to be in school in the period. The continuous fall in the rate of out-of-school children of primary school age in Ghana between 1999 and 2014 reflects a growing participation rate among pupils across the country. While the rate of drop out in 1999 was 38% of the total rate of pupils expected to be in school, in 2014, the rate of pupils who dropped out of school was 10%.This represents a significant decline in the rate of pupils who drop out of school. When comparing the rate of school dropout to those of six other countries in the West-African sub-region in 2013,only two countries had lower dropout rates than Ghana: Togo (2.5%), Benin (4.5%), while Gambia (30.3%), Burkina Faso (32.1%), Chad (20.7%) all had higher dropout rate than Ghana (10%).

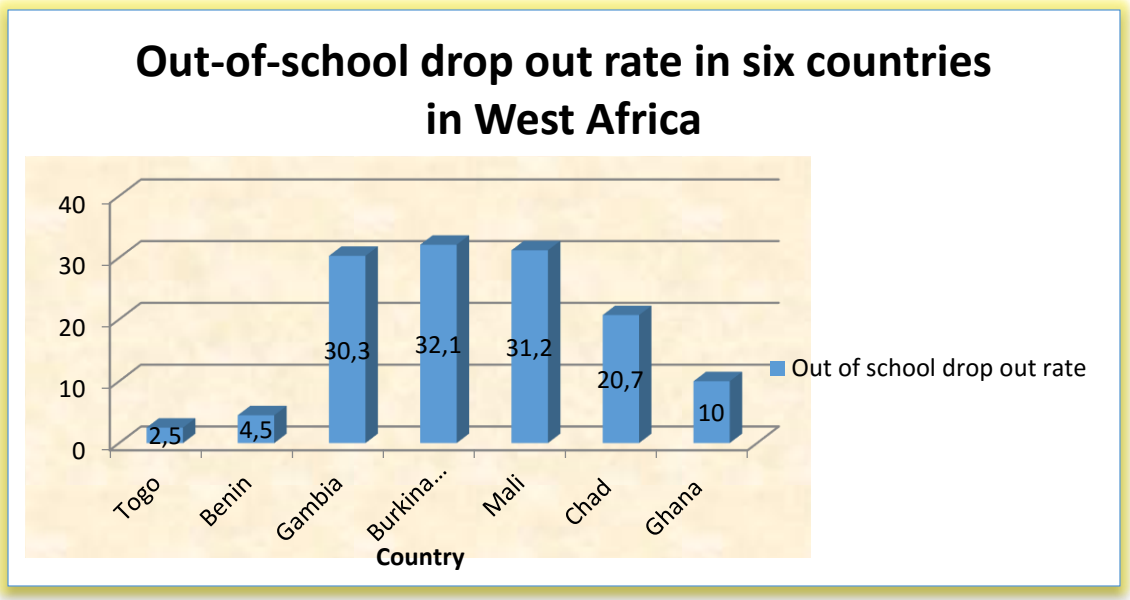

Figure 2.3: Out-of-school dropout rates among children of primary school age in six African countries, 2013.

Source: UNESCO, 2015a.

The rates show that while countries like Togo and Benin recorded very low out-of-school rates, countries like Gambia, Burkina Faso and Mali recorded very high rates. Comparing the rate of out-of-school children to those of other countries, it is clear that Ghana could do better in enrolling pupils of school-going age in primary schools[9].

Similarly enrolment rates at the secondary level of education have seen a significant increase over the last 14 years. Since 2001, the number of students enrolled at the lower level of secondary schools have increased and this most probably reflects the continuous support that international agencies like UNESCO and the government of Ghana provide. Intervention at the secondary level of education included massive infrastructural development which increased the intake of students, increased the number of teaching staff and increased government subvention to state owned secondary schools. Figure 2.4 shows the lower secondary enrolment figures from 1999 to 2014.

[9]The out-of-school dropout rate presents a better understanding of the achievement of member countries in reducing the dropout rates in the West African sub region. Countries like Nigeria and Sierra Leone were not included because there were no rates submitted for the period.

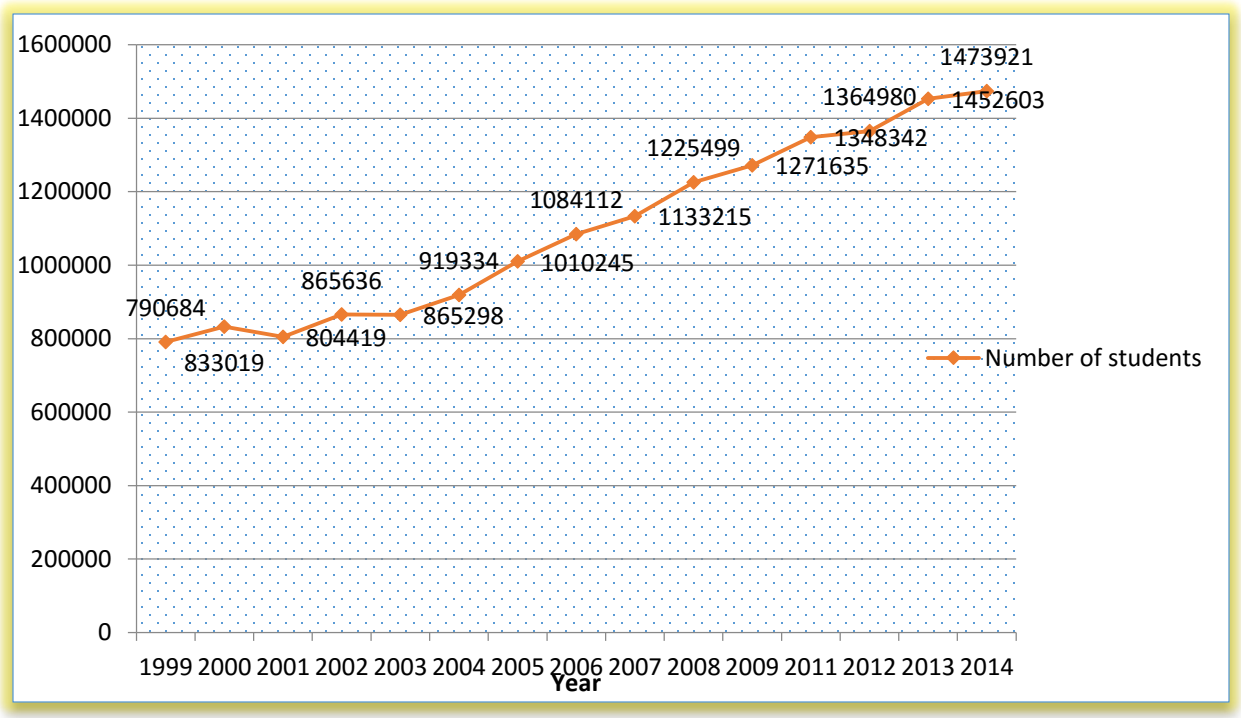

Figure 2.4: Enrolments in lower secondary general education, 1999-2014

Source: UNESCO, 2015a

Figure 2.4 shows a consistent increase in the number of students who were enrolled in the lower level of secondary education from 808419 in 2001 to 1473921 in 2014. The implication of this increase is larger numbers of secondary school leavers who will seek access to the universities, and concomitantly larger numbers of school leavers who may not gain access and may have to defer enrolment in higher education to a future date. These students may later enrol as mature students after having accumulated some work experience.

Access to higher education can be considered a very important aspect of national development because it provides the channel for secondary school leavers and adult learners to obtain the knowledge, skills and attitudes that are relevant to employers and the society (Teferra et al., 2004). Access depends upon standards of admission, standards of expected performance, individual motivation for higher education, and the cost of enrolment to the student (Perkins, 1972 cited in Owusu-Agyeman, 2006). Merriam, Caffarella and Baumgartner (2007) have shown that members of under-represented populations are often negatively affected by issues of access and opportunity; this is also true of the situation in Ghana.

In Ghana such disparities occur, for example, between urban and rural communities. Also, some cultures do not support or encourage participation of females in higher education. Cropley (1980) suggests that the disparities that occur in the provision of education between rural and urban dwellers are driven by factors such as values, beliefs, attitudes, priorities and habits that symbolise people's economic status, geographical location or the structure of education in the country. Although Cropley's explanation could be described as peripheral to the concept of access to HEIs, it presents additional elements that influence participation in HEIs. Four key considerations are necessary when examining the effect of access on participation in higher education and these are; geographical, demographic, socio-economic and cultural factors (Merriam et al, 1997).

In explaining how geographical factors affect access to HE, Merriam et al., (1997) observe that the disparity between urban and rural societies continues to shape the pattern of participation in HE. This is even more prevalent when looking at the differences in enrolment rates in HE between developed and developing economies. While many Western societies may tend to identify prevailing access issues among migrants, the homeless and families in suburban communities, developing countries such as Ghana still struggle with unequal access of urban and rural communities.

Available statistics in Ghana show that although enrolment rates at the primary level of education continue to increase remarkably, the enrolment rate in HEIs seem to be very low.

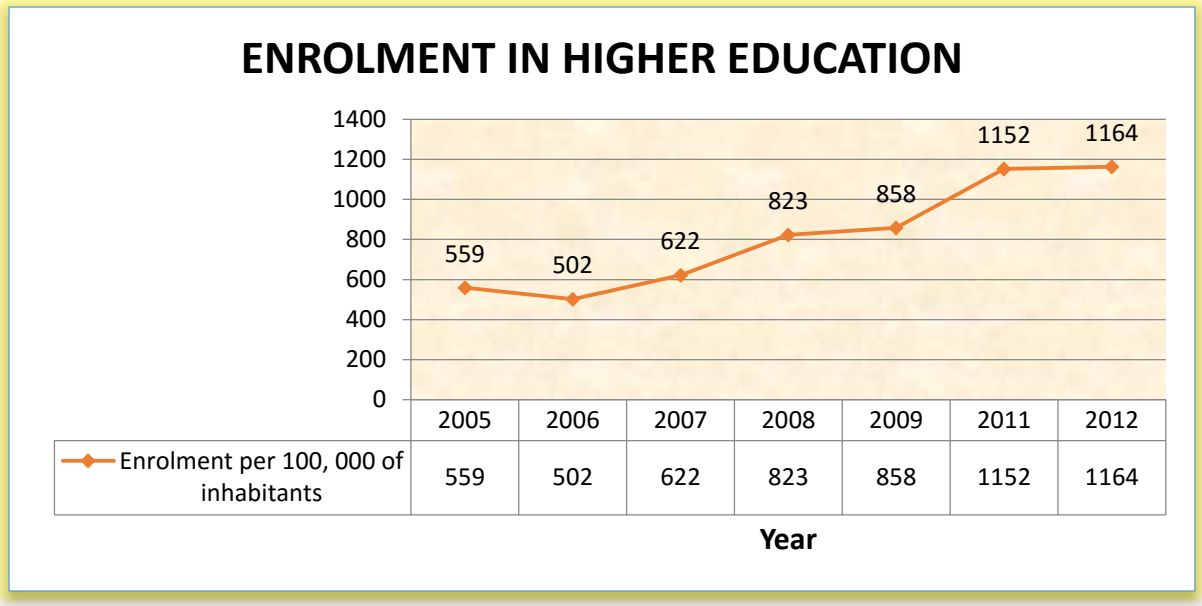

Figure 2.5: Enrolment in higher education per 100,000 inhabitants, 2005-2012

Source: UNESCO 2015.

Figure 2.5 shows the enrolment figures in HE institutions per 100 000 inhabitants from 2005 to 2012. The chart shows a continuous increase from 559 per 100 000 in 2006 to 1164 per 100 000 in 2012. Although the number of students who enrol in higher education continue to increase every year, there are still many secondary school leavers who do not gain access to HE.

Age and sex remain the most dominant constituents of demographic factors in Ghana, when considering access and participation in HE (Owusu-Agyeman, 2006; Manuh et al, 2007).While demographic factors such as age and sex could affect access and participation rates among adults across continents, factors such as life expectancy rates could also affect participation rates and disparity between developed and less developed countries (Merriam et al, 2007). Additionally, participation among male students tend to be higher than that of females at the higher levels of education and this situation continues to limit the chances of female adult learners in less developed economies. Arguably, the issue of disparity between males and females transcends enrolment rates.

Coombs (1985, cited in Merriam et al., 1997) identifies five key factors that account for the disparity in the quality of educational provision between developed and developing countries: where participation rates generally are low, the participation rates for females will also be very low. Thus, the lowest rates in female participation are likely to be found in countries where participation rates at all levels of education are low; where there are disparities, they are often greater in higher education since there is a tendency to have lower participation rates at the higher levels of education; where there is parity in HE, there will be disparity in the enrolment rates among the various post-secondary institutions that is, polytechnics, special institutions and universities; disparity in enrolment rates between the two sexes is directly related to employment rates and arrangements. Thus, jobs that are dominated by women are likely to pay less than those that are dominated by males. This is, however, not true in all cases and may relate to just some societies. The disparity in education generally reflects the cultural practices, customs, norms, beliefs and traditions of a particular group or society. Overall, demographic factors affect participation rates in HEIs across countries. Countries such as Ghana, Kenya, Uganda and the United Republic of Tanzania have taken initiatives to increase female enrolment rates (UNESCO, 2009).

Socio-economic conditions also continue to affect participation rates in emerging economies all over the world, including Ghana. High income earners who are highly educated are likely to offer their children better education at all levels and such students tend to progress better through the various levels of education than children from homes where parents do not have educational qualifications at the higher level (Coombs, 1985, cited in Merriam et al., 1997). In Ghana, children whose parents are either less

educated or receive low incomes are likely to enrol in technical and vocational schools. In presenting a broader picture of the impact of socio-economic conditions on the issue of access to HEIs, Merriam et al (1997) arguably observe that parents who are unable to send their children to HEIs are also not likely not to have obtained HE qualifications. Additionally, the provision of higher education to all post-secondary education leavers of a nation's population suggests the importance of addressing issues of social inequality[10].

Although the global percentage of enrolment in HE rose from 19% in 2000 to 26% in 2006, that for the sub-Saharan Africa region, which includes Ghana, over the same period was 5% (which is lower than the average percentage of low-income countries which was 7%). What this means is that individuals will continue to defer their enrolment in higher education institutions in the region (UNESCO, 2009). One factor that could be considered vital in ensuring that countries in the West-African sub-region increase enrolment rates in higher education is greater state involvement through political decisions and higher levels of funding.

2.4.3 The role of government in the provision of education in Ghana

Merriam et al (1997) refer to political response as government led and funded legislation and policies to address issues of disparities in participation and access to HEIs. In Ghana, government has to some extent provided legislative backing for adult learning for all citizens. Yet those responses as identified may not necessarily result in the activities that are needed to reduce the inequalities in the educational system. Contentions exist as to the level of coordination at the national level and who should be responsible for the implementation of the policies.

Government actions could either support or create setbacks to the various policies and programmes put in place by international organisations and local agencies to ensure that citizens obtain formal education. In Ghana, besides the Constitution providing the right of the citizens to lifelong education, specific government policies as provided in the Millennium Development Goals (MDG Report, 2012) also support adult learning. The outcome of these activities and the expectation of the citizens who benefit from these policies and interventions support the increasing call on government to provide adult learners with the needed support to develop their knowledge, skills and attitude.

[10] Social inequality is linked to the history, culture and economic structure of a country and often contributes to an individual's ability to obtain HE qualification (UNESCO, 2009).

Deliberations about the coordination of adult education activities at the national level usually involve issues on the type of providers of adult education in HEIs, the goals and objectives and the training received by personnel employed to teach adult learners (Knowles, 1977, cited in Merriam et al, 1997:203). Policies are usually coordinated by government although institutions have academic autonomy on how to provide this training.

Additionally, it is important for states to decentralize their structures in terms of planning, curriculum development, teacher training and financial discretion (Coombs, 1985 cited in Merriam et al 1997:205) to correct the existing disparities among citizens. Some authors (Omolewa, 2002; Gboku & Nthogo, 2007) suggest that although formal programmes of adult learning have achieved some success in improving access and raising participation rates, alternatives such as non-formal education, popular education and community development education provide learners with greater involvement in the planning and implementation of decisions on teaching and learning.

Adult learners in Ghana continue to face major challenges such as smooth access to higher education institutions, inadequate curriculum content necessary for their specific work settings and lack of knowledge that is essential for their academic careers (Owusu-Agyeman et al, 2009). The challenges contained in the Technical Report Series of the National Commission for Tertiary Education (NCTE, 1998) include the absence of clear institutional policies for adult learners, accommodation problems, staffing problems, inadequate financing and logistics and problems of infrastructure. The need for adult learners to use basic academic tools and apply Information Communication Technology in their work environment is important to the overall development of lifelong learners.

2.5 Qualifications structure of Ghana

In Ghana, pre-school for children starts at age 2 until age 5 when they commence basic school. Basic education in Ghana consist of primary and junior high schools and pupils who attend public basic schools are not required to pay school fees. The total number of years pupils spend at the basic level of education in Ghana is 9 years and then they progress to either senior high schools, senior high technical schools or technical institutes.

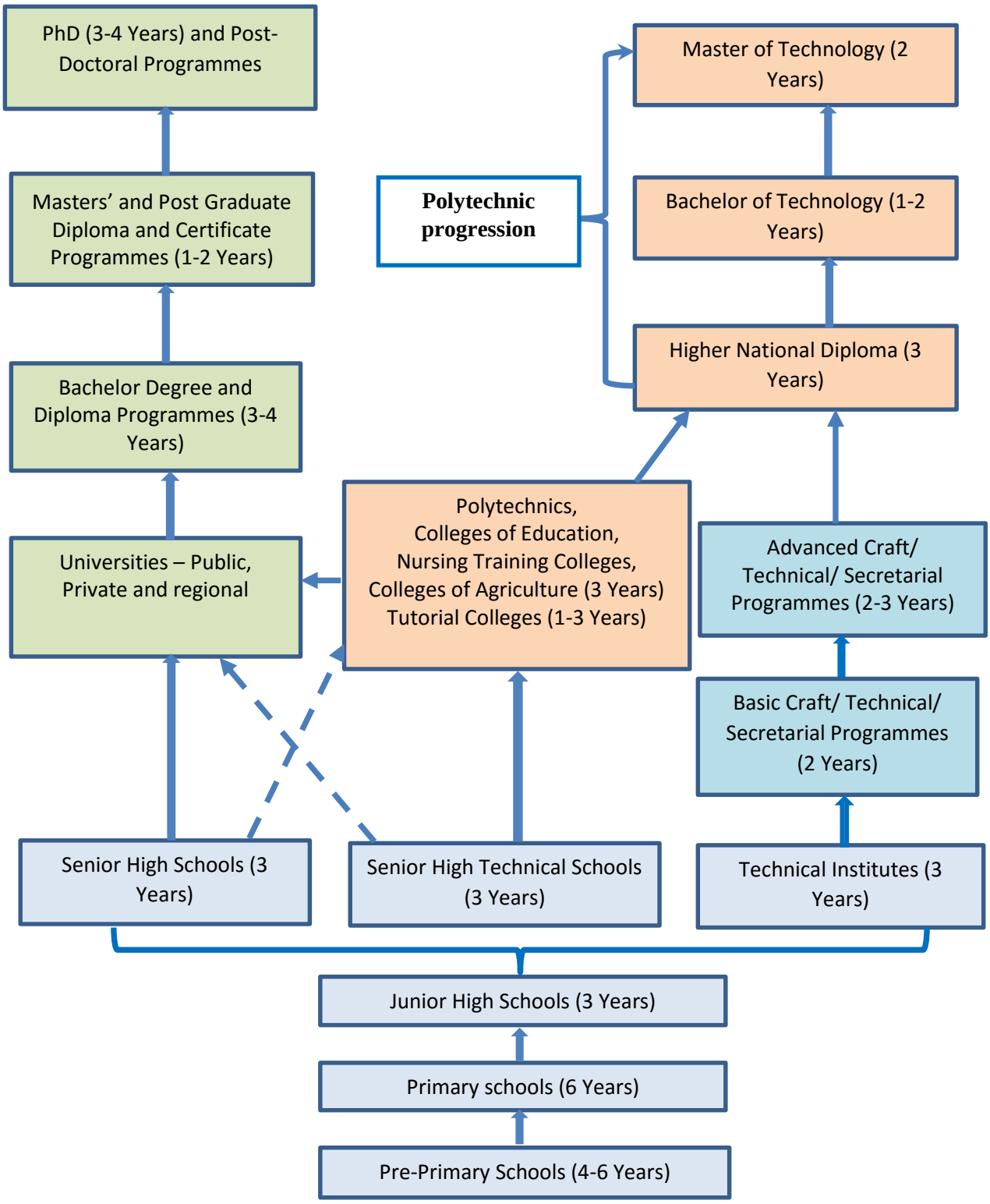

Figure 2.6: Qualifications Structure of Ghana.

Source: Adapted from Gondwe & Walenkamp (2011)

Figure 2.6 shows the qualifications structure of Ghana with the levels of progression from primary to the tertiary level of education. The number of years students spend in either senior high schools, senior high technical schools or technical institutes is three years. The difference between these three types of post-basic schools that while the senior high and senior high technical schools in Ghana focus on providing students with foundation knowledge relevant for tertiary education especially in the areas of science, business, construction, general arts and industrial arts, technical institutes provide students with knowledge and skills that are relevant for industry. Most technical institutes in Ghana provide students with skills proficiency certificates and students who pass out of these institutes are able to work in industries after their programmes. Additionally, senior high technical schools provide students with specific knowledge and skills which are further developed when they enter tertiary institutions.

Tertiary institutions in Ghana consist of universities, polytechnics, nursing training colleges, colleges of education, agricultural colleges and tutorial colleges (Gondwe & Walenkamp, 2011). The duration of most programmes offered by tertiary institutions in Ghana is 3 to 4 years and the award of degrees and diplomas often require students to demonstrate some knowledge and skills in specific areas of specialisation. Most technical institute leavers continue their education at the polytechnics while students who pass out of nursing training colleges, colleges of education, tutorial colleges and in some cases, polytechnics continue their education at the universities. The universities also have their progression levels which consist of the Bachelors, Master and Doctoral while the polytechnics focus on Higher National Diploma, Bachelor of Technology and Master of Technology.

In the context of this study, adult learners are described as either learners who did not continue with their education after high school and learnt a technical vocation through on-the-job training and short courses, or graduates from polytechnics who obtained Higher National Diplomas after three years of study, or mature applicants who were admitted to do degree programmes based on their age (25 years and above) and performance during the mature-entrance examinations and interviews organised by the universities.

2.6 CONCLUSION

This chapter focused on the historical development of education in Ghana and the various policies that have helped to shape particularly higher education in the country. The chapter also discussed the emergence of adult learning in Ghana and the policies that have been designed over the years to ensure that adult learners obtain the requisite knowledge, skills and attitudes that are relevant for the transformation of individual, community and national goals. Similarly, the emergence of engineering

programmes in the higher education sector, specifically at KNUST and later RMU and GTUC was discussed thus providing background information to further discussion of the structure of Telecommunications and Electrical Engineering programmes for adult learners in Ghana. Additionally, this chapter argued that access to higher education is relevant for providing adult learners with requisite knowledge, skills and attitude that are required by employers. Similarly, this chapter argued that the role of government, HEIs, regulatory agencies and employers are important in developing appropriate learning intervention for adults to obtain higher education qualification. The qualifications structure of Ghana (figure 2.6) has been discussed to provide detailed information on the various levels of education as well as the different types of qualifications at the tertiary level of education.

Chapter three provides information on the theories of adult learning and how they serve as the basis for interventions that support adult learners studying Telecommunication and Electrical Engineering programmes in three diverse universities in Ghana.

CHAPTER THREE

AN INTEGRATED CONSTRUCTIVIST FRAMEWORK

3.1 INTRODUCTION

The need for further training and higher education qualifications of adult learners requires educational institutions to develop programmes that will develop the relevant knowledge, skills, and attitudes of these learners more effectively. In order to do this HE programmes should take careful account of adult learning theories and what the implications of these theories for successful HE programmes are.

In this Chapter, the researcher analyses the theoretical underpinnings of adult learning and explains that adult learning theories serve as the basis for intervention that is aimed at providing adult learners in the Telecommunications and Electrical Engineering programmes in three diverse universities in Ghana. Adult learning programmes in the engineering field are in certain respects quite different from those in other disciplines (Dickens & Arlertt, 2009), because they require the application of simulation, project work, laboratory exercises, experiments, field trips and practical research work. The overview provided in this chapter takes cognisance of these contextual nuances, whilst painting a conceptual backdrop to the study from the broader literature on adult learning. Building on the work of Buchanan and Smith (1998), this chapter develops an integrated model that provides the foundation for developing a curriculum for adult learners studying Telecommunications and Electrical Engineering in three universities in Ghana.

3.2 THEORIES OF ADULT LEARNING

Theories of adult learning are important when considering the processes of developing programmes for adult learners. Although it is difficult to identify a common definition of adult learning (Merriam, et al., 2007), it has been widely accepted as a process (Ormrod, 1995; Illeris, 2000; Hillier, 2002; Preece, 2011; Preece & Hoppers, 2011) which explains how adult learners acquire knowledge, skills and attitudes through a generally accepted set of ideas.

Learning theories represent the mental frameworks that enable individuals to comprehend and explain teaching and learning practices, and the acquisition of knowledge, skills, attitudes, values and interest by adult learners (Fasokun et al., 2005:37). It is also important to note that no single theory provides answers to all the questions on effective learning by adults (Merriam et al, 2007).

In this chapter, the researcher will briefly consider seven major theories of learning that have implications for adult learners and relate these theories to the concept of adult learning, especially within the setting of HEIs. Adult learners are required to relate and organise the various concepts introduced in class into a more meaningful use (Tennant & Pogson, 1995; Barkley, 2009; Sambell, 2011) by drawing experiences from their jobs into the learning context in class. The theories included in this analysis include the behavioural theory, cognitive theory, transformative theory, humanism, andragogy, experiential learning and constructivist learning. Having considered the usefulness of each theory, the researcher's eventual focus will fall on the constructivist theory of learning, which is relevant to the development of adult learners in the Telecommunications and Electrical Engineering programmes in Ghana.

3.2.1 Behavioural theory

Behaviourism emerged as a branch of psychology that was meant to describe how the behaviour of individuals could be measured, trained and shaped through conditioning. Watson (1913:158) identified behaviourism as an aspect of natural science that was completely objective in nature. This was also referred to as the study of the behavioural consequences of stimuli.

In explaining the emergence of the behavioural theory and how it relates to learning, Merriam et al., (1997:39) posit that Skinner (1971) applied the concepts of reinforcement and operant conditioning in an educational setting, and showed that when individuals respond to their environment to obtain specific outcomes, the behaviour of those individuals is ultimately controlled for the benefit of society. Relating behaviourism to learning among adults, Jarvis (2004) argues that the theory could be viewed from two main positions: conditioning and connectionism. Conditioning has two forms: firstly, classical conditioning as proposed by Pavlov in 1927 that refers to a learning situation where the learner is provided with a reward even before learning takes place and this serves as a stimulus which enables learners to give their best. Classical conditioning among adult learners refers to the orientation provided to them on the course outline, the resources available to them, the grading system and the classification of awards after the programme. The second form of conditioning is operant conditioning referring to a learning situation where, after satisfying a behavioural condition, the learner is given a reward.

Adult learners expect feedback on their assignments, demonstrations, presentations and examinations and operant conditioning describes the orientation of adult learners to receive the outcome of their submissions. The concept of conditioning regarding adult learners is based on the proposition that knowledge acquisition emanates from individual reactions to stimuli in the environment and this is

essential for [11]planning the programme of adult learners (Fasokun et al. 2005:53). The second form of behaviourism is connectionism which suggests that individuals will consistently repeat an act until they gain mastery of that act (Thorndike, 1928 cited in Jarvis, 2004). Experience acquired by adult learners in their field of work cannot be described as connectionism because this represents knowledge and skills that are developed over time. However, the process of developing the knowledge and skills of adult learners in a formal setting and the introduction of new techniques in laboratory and field settings require repeated practice that the facilitator needs to patiently guide adult learners through. This can be seen as connectionism.

Behaviourists suggest that individuals should be guided to respond to external stimuli and events that occur within their environment and this can only be done by helping them develop the required mental machinery through learning and recollection (Watson1913:173). Although Watson advanced sound arguments to support his claim that individuals could be conditioned to react to the challenges within their environment, he fell short of advancing an argument for the more complex human behaviours such as conception, imagination, judgment and reasoning that are important for students in higher levels of academic studies, as well as adult learners.

While acknowledging the strengths of behavioural theory as important in skills development, it falls short when suggesting that adult learners are assessed solely on their observable behaviour. This may disregard the internal thought processes that are often developed through reflections (demonstrated by cognitive theory). In relating the weaknesses of the behavioural theory to its formative stages - because most of the tests were conducted on animals -its advocates ignore research into individual thought processes that occur during learning. The environment alone does not shape the knowledge and skills of adult learners; other factors such as the structure of programmes and the psyche of adult learners could influence their learning processes. While change of behaviour is a product (Jarvis 2004), learning is a process that actually happens before the change that occurs overtime. Similarly, complex behaviours among adult learners could be explained as developing through a systematic process that identifies the background of the learners, the environment in which they find themselves (in this case their work environment) and the meanings they make of the environment in which they find themselves.

The rationale for including the behavioural theory in the learning theories I have chosen to discuss is that it provides for important educational concepts such as behavioural objectives, accountability,

[11]Chapter four provides detailed information on the planning of programmes for adult learners.

instructional design models, competency-based curricula, simulation, and certain planning and evaluation models that are relevant in Telecommunications and Electrical Engineering programmes. Behaviourists support the development of skills among learners and also suggest that the desired behaviour expected of learners is measured through application of knowledge in a practical setting (Keating, 2015).

In relating behaviourism to the practical ways in which adult learners learn in the engineering field, elements such as field and laboratory work provide the adult learner with a structured process of developing understanding of the application of tools, equipment and laboratory equipment. Competency-based learning is a form of behaviourism that includes practical fieldwork and industrial attachment, which may support the development of students in HEIs. Furthermore, behaviourism could be used in adult learning environments by allowing adult learners to develop their skills and knowledge through repeated actions on a task, the introduction of rewards through certification and scores after a course and using the programme as motivation for adult learners and facilitators who are trained to use diverse stimuli to obtain good results from students after repeated processes.

Clearly some elements of a behavioural approach in the development of the skills, attitudes and comprehension of adult learners, especially in the engineering field, could be useful. The next theory I will discuss is the cognitive theory. The behavioural theory provide answers to the processes and methods required to develop the psychomotor domain of adult learners, thus providing justification for an integrated framework that incorporates the strengths of the different theories.

Whereas behaviourism in considered a theory that focuses on the stimulus of the adult learner, cognitivism considers the internalised meanings adult learners will give to the new knowledge and skills they acquire.

3.2.2 Cognitive theory

Cognitive theory describes how individuals gain knowledge about their environment and the world in which they live. Cognitive learning theories identify learners as the main concern and see individuals as persons with intelligence that are able to use their minds appropriately.

A major proponent of cognitive theory was Piaget who identified stages in the process of cognitive development akin to the biological growth and development of children. These stages included formal operational thinking, pre-operational thought, intuition, concrete operations and sensory-motor operations (Jarvis 2004).

Cognitive approaches often tend to be structural because they assume that there are stages in the development of the individual mind from a low point to a higher point and then to a decline stage. Meanings and perceptions are important considerations in cognitive theory because adult learners are seen to interpret their sensations and provide meanings to their activities. The cognitive domain as represented by Bloom's taxonomy (knowledge, understanding, application, analysis, synthesis and evaluation) explains how the knowledge of adult learners is developed to ensure that they connect the theories they learn to the work they do. Bloom's taxonomy illustrates that the cognitive theory does not identify the affective and psychomotor domains, which are essential in the learning process, and this could be considered as a limitation in the theory.

Although cognitive theory suggests that learning is meaningful when it is related to concepts that exist in an individual's mind (Ausubel, 1967, cited in Merriam et al., 2007) and supports the assimilation of new experiences, its over-reliance on the thinking abilities of individuals is a major weakness of this theoretical approach to understanding learning. Other factors such as the environment (which is considered as important by constructivist theory), the background and the experience of the adult learner also play important roles in the development of the learners' knowledge, skills and attitude.

Elements of cognitive theories that are usefully applied in the teaching and learning of adults include the structural arrangement of course contents based on the ability of learners to understand and make meaning of what is taught through a gradual process. When learners are able to adapt to the teaching and learning regime through a gradual process, they develop their own meaning based on a structured arrangement that identifies them as capable of recreating their own meaning through a well-planned pattern.

Cognitive theory is considered as important in the discussion of relevant adult learning theories because it provides the basis for understanding how adult learners develop their knowledge through reasoning, how adult learners adapt to the teaching and learning process and the essence of moral, psychological and religious development in the adult learning process. Although cognitive theory enlightens relevant features of adult learners such as their reasoning abilities, it does not consider the social arrangements that support the development of adult learners. This shortfall leads me to discuss transformative theory

3.2.3 Transformative theory

One of the most dominant theories of learning as categorised by Hillier (2002) is transformative theory. Transformative theory has been in existence for more than fifty years and has its roots in sociological

theories. The concept was originally developed by Kuhn in the early 1960s and was later expounded by other writers (Freire, 1970; Habermas, 1971, 1984; Kitchenham, 2008; Keegan, 2009; Mezirow, 2009; Taylor & Snyder, 2012; Taylor & Cranton, 2013).

Transformative learning is defined as the process by which problematic frames of reference (mindset, habit of mind and meaning perspectives) are transformed to make them more inclusive, discriminating, open, reflective and emotionally able to change (Mezirow, 2009:92). Frames of reference among adult learners in the engineering discipline could be described as the structures (social and mental arrangement) of culture (work processes) and language (technical terms) of which they construct meaning through coherent and significant modes and experiences. The frames of reference selectively shape and delimit adult learners' perceptions, cognition and feelings by exposing their intentions, beliefs, expectations and purposes. Connecting transformative learning to the constructivist theory, Mezirow (2009) argues that constructivist developmental psychologists[12]posit that knowledge and skills development involves movement through a predictable frame of reference that results in the development of the adult capacity. This does not take into account that adult learners are able to develop the transformative process of critical self-reflection and reflective judgment through discourse in the lecture room, laboratory and workplace. Although proponents of transformative theory suggest that most of the learning that takes place is developed through mind patterns that are acquired through observing and doing what others do, it does not provide alternate explanation for learning that requires the reorganisation of thoughts based on the learners' understanding of the environment.

One of the strengths of transformative theory is that it hinges on the significance of prior experience as the primary medium of developing the knowledge and skills of adult learners. Additionally, the prior knowledge and experiences of adult learners serve as the foundation for innate expectations, which include values, beliefs and ideologies that adult learners identify, construct meanings about and directly relate to the environments in which they live or work (Mezirow, 1991: Taylor & Cranton, 2013).The role of the facilitator in transformative learning is to assess the depth of students' prior knowledge to be able to provide relevant teaching and learning in the particular field of study (Ambrose, Bridges, DiPietro, Lovett, & Norman, 2010).

[12]Yilmaz (2008) provides three main branches of the constructivist approach to learning; sociological, psychological and radical constructivism. This study focuses primarily on psychological constructivist theory which identifies the factors that promote learning among individuals.

Mezirow (2009) identifies transformative learning theory as a meta-cognitive epistemology of evidential (instrumental) and dialogical (communication) reasoning. In the context of adult learners studying engineering programmes, transformative learning could be explained through the following: reflecting critically on theories and practical lessons; using empirical research methods (instrumental learning); participating freely and fully in an informed continuing discourse in class (communicative learning); taking action based on information received and transformed through personalised understanding; being critically reflective of own assumptions and those of others to seek validation of their transformative insight (Mezirow, 2009:94).

When relating adult learning to transformative learning Quinnan (1997:42) suggests that the theory "is predicated on the idea that students are seriously challenged to access their value system and world view and are subsequently changed by that experience"., Quinnan (1997) further posits that the significance of transformative theory includes: identifying individual experience, helping the learner to develop critical reflection, developing dialogue within the learning environment, making learners aware of the context and encouraging positive relationships between learners and the facilitator. These descriptors fit the adult learning proposition well because they describe experience and reflective practices as important to achieving the goals of providing adult learners with the requisite knowledge, skills and attitudes. Hill (2014:64) also suggests that, "learning can be a transformative experience that changes people, enriches their lives, and enlarges their perspectives".

The development of curricula for adult learners in the context of transformative learning involves the building of frames of reference by adult learners through communication, perception, cognition and feelings that are linked to their beliefs, expectations and purposes. In the context of adult learning in higher education, transformative learning could be seen as relevant in developing the understanding of adult learners through reflective practices, effective communication between instructors and among students, integrating cultural and moral practices in the learning process, connecting work experiences with the theories learnt in class and developing their cognitive skills through social networks (Wenger, 2009) within the academic environment.

While transformative learning could be described as important to the learning process of the adult learner, it relies quite heavily on the ability of the learner to develop new ideas by identifying previous knowledge and experiences and building on them. The challenge is that where adult learners cannot connect previous experiences to the new knowledge they are expected to acquire, learning may not take place. Arguably, transformative learning should move beyond the development of frames of reference and critical

reflection among adult learners to the integration of external stimuli that challenge learners to adapt their thinking by incorporating the views of others in a broad setting.

Although transformative learning as a theory has been identified as important in informing the development of the knowledge, skills and attitude of adult learners, it is not without shortcomings. Another theory that is discussed below is humanism which continues to gain much attention because it seeks to develop the potential of the individual through a learner-centred approach.

3.2.4 Humanism

The liberal education perspective, which is also referred to as classical humanism and perennalism, can be linked to early proponents such as Locke, Kant and Hegel who regarded this theory as one that developed the intelligence culture, knowledge and access to information of the citizenry. Although other theories have overtaken the liberal education perspective, its contribution to knowledge in society cannot be ignored. Writers such as Adler (1982), Bloom (1987) and Hirsch, Kett and Trefil (1987) provided some useful additions to the original versions. While traditional liberal education emphasised the teacher to plan, develop and provide content that were considered beneficial to students, the progressive perspective was born out of urbanisation, industrialisation and scientific methods that gave rise to a new view of education. Humanism, which is derived from the progressive perspective, is very broad and includes scientific humanism, existentialism, Marxist humanism and Christian humanism. Additionally, humanism could be traced to the ideas of Confucius, Aristotle and philosophers who were involved in the Italian Renaissance in the fifteenth century (Brocket et al., 1991:121).

In espousing the assumptions of humanism in relation to adult learning, Merriam et al., (1997:41) observe that it focuses on developing the potential of the person through a learner-centred approach. This leads to internal motivation where the learner is able to know his/her specific needs, and to make decisions about course content.

Focusing on the development of the adult learners' cognitive abilities in the context of humanism, Savicevic (2008:361) argues that the need to pay particular attention to the pattern of learning among adults has become very important, because the absence of the studying of lifelong human potentialities has negatively affected the development of individuals. The call for a separate approach to the teaching of adults does not suggest that the processes involved in the teaching of children and adolescents are irrelevant (Savicevic, 2008); rather it could be described as a layer on the continuum of lifelong learning, which provides a unique way of serving adults with the needed knowledge, skills and attitude. Thus,

> …by ignoring of a whole field of adult learning and education, and by excluding the adult population from the learning efforts, one could not gain vividity in the philosophy of lifelong learning and lifelong education (Savicevic, 2008:361)

Adult learning programmes should not only be limited to students' core subjects but more importantly, they should have vertical dimensions which provide learners with broad knowledge from different cultures, professions and social settings that are necessary for personal and global development (Savicevic, 2008:364). According to Savicevic (2008), vertical dimensions of learning among adults could be traced to the ancient Roman and Jewish civilizations where learning activities took place in the libraries, reading rooms, open squares and forums in the case of the former, while synagogues, temples and meeting homes served as adult learning centres for the latter. In conceptualising humanism in teaching and learning among adults in the engineering field, the theory suggests that adult learners should be able to develop their knowledge and skills in an environment that is open, attractive and allows students to interact with one other and with their facilitators.

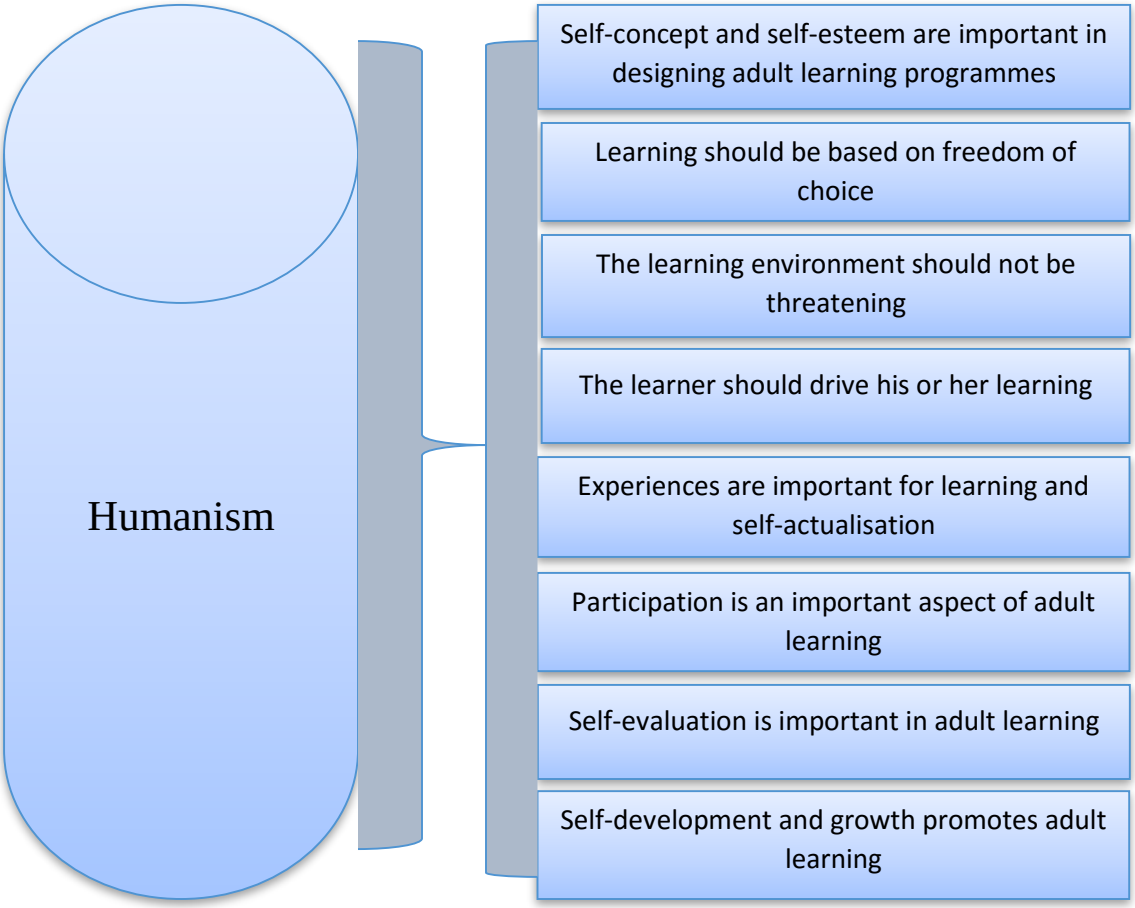

Figure 3.1: Assumptions of humanism

Source: Adapted from Fasokun et al. (2005:54-55)

Figure 3.1 shows eight basic assumptions of humanism which support adult learning in HEIs. The first assumption is that self-concept and self-esteem are important in designing adult learning programmes because they define the cognitive characteristics of the adult learner in the programme. The second assumption is that learning should be based on freedom of choice where the adult learner reserves the right to either participate in the learning process or withdraw. Tennant and Pogson (1995) showed that adult learners need relative freedom from internal and external constraints in order for them to properly reflect on their experiences and develop new knowledge and skills. It is important to note that although the adult learner has his or her freedom to learn, the rules governing learning within any learning environment should be adhered to. The third assumption is that the learning environment should not be threatening and that adult learners are expected to learn under liberal conditions where they are not coerced to study.

Another assumption of humanism is that the learner should drive his or her own learning through a conscious effort with support from the programme facilitators. If adult learners drive their own learning activities, they tend to be responsive to the demands of the programme and in addition, contribute to their own development. This assumption is directly linked to the constructivist theory that suggests that individuals make their own meaning from interaction with their environment.

The fifth assumption of humanism is that experiences are important for learning and self-actualisation, and this is because the experiences of adult learners support the learning process and learners are able to relate theory to experience.

Participation is an important aspect of adult learning because adults, like children, learn through active engagement with learning tasks and procedures that are led by programme facilitators. Participation is the sixth assumption of humanism.

The seventh assumption of humanism is that self-evaluation ensures that adult learners reflect on their involvement in the learning process and are able to identify areas where there should be improvement in meeting the learning goals. The last assumption is that self-development and growth promotes adult learning through a planned process that is followed by the adult learner with the support of the facilitator. Humanism suggests that the teacher, who is a facilitator of students' learning, shapes the personality and attitude of the adult learner through instructional methods that are non-threatening, experiential and collaborative (Merriam et al., 1997:47). This does not abrogate the fundamental principles underlying the concept of self-directed learning, which is considered as an important aspect of humanism.

Humanism could be observed in the learning of adults through the conscious effort they make to undertake further studies and achieve their goals. When they enrol in programmes in HEIs, they take responsibility for their learning and make decisions regarding their academic development such as joining a study group to share and learn, developing interpersonal relationships that are important for learning and working, submitting a well-written assignment to receive good grades and feedback from the lectures, visiting the library to read more about the topics covered in class and contributing to discussions in class. Overall, humanism describes the aspects of learning by the adult learner that enhances him- or herself as an ideal person. Although humanism can be described as very important to inform the development of the knowledge, skills and attitude of adult learners, it will not be sufficient to suggest that it contains all the essential tools necessary for teaching adult learners. Whereas humanism has particularly influenced

pedagogy, andragogy has been widely considered as a major theory that is relevant for developing adult learning programmes because it has a stronger focus on adult learning. The next section discusses the importance of andragogy as a theory that supports adult learners in HEIs.

3.2.5 Andragogy

Andragogy, as advanced by Malcolm Knowles (1978), is based on five main assumptions: that as a person matures, the self-concept moves from dependency towards self-direction; that maturity brings an accumulating reservoir of experience which becomes a predominant resource for learning; that as a person matures, readiness to learn is increasingly oriented towards self-direction; that as a person matures, his/her orientation towards learning becomes less subject centred and increasingly problem centred (Knowles, 1970, cited in Davenport et al., 1985) and as a person matures the motivation to learn becomes more internal (Knowles 1984).

While several scholars such as Elias (1979) and Merriam et al. (1997) consider the work of Malcolm Knowles as having really exposed the need for adult learners to be given unique forms of teaching to suit their peculiar situation, others also thought that the theory was not worth fitting into the scheme of education. One of the known critics of Knowles is Cyril Hole. In his book, *The Design of Education* (1972), he posits that education can be identified as one single human process that cannot be separated into different categories (Davenport et al., 1985). His stance was supported by Jack London who noted that some of the principles underlying the practice of andragogy were as well applicable in the context of pedagogy; hence education could be seen as a unit rather than a dichotomous entity, categorized into pedagogy and andragogy (Davenport et al., 1985). Reaffirming the critics' stance that andragogy was only a misguided theory to enhance adult learning, Elias (1979) noted that andragogy could simply be identified as progressive education which could as well be seen in pedagogical practices.

Malcolm Knowles (1978, 1984) suggested that the theory of how children learn and how adults learn could not be classified as the same. He termed andragogy as the way adults learn. To Knowles, individuals who are adults and are ready to learn should be given freedom to lead their learning, thus, they should be able to control and negotiate their own learning processes and develop pathways for their career (Hillier, 2002:91). Learning involves not only knowledge acquisition but also guiding students to understand how their learning fits into their lives, how it is applicable to their roles and responsibilities, and, ultimately, how it is relevant to their life experiences (Hooks, 1994; Tennant & Pogson, 1995; Elias & Merriam, 1995; Kasworm, 2008; Kanuka, 2011).

According to Holton et al. (2001:120), six basic principles underlie the theory of andragogy: the need for adult learners to learn something; the need for adult learners to rely on self-directed learning which is based on the self-concept; identifying prior experiences as a learning resource that could be developed; the need to develop the competences of adult learners through the integration of individual knowledge, skills and understanding; the drive to fulfil an obligation or cope with a life situation which may require further knowledge and skills in the field; and an internal motivation for adults to learn rather than just relying on external motivation. The principles of andragogy provide justification for the development of unique teaching and learning methods for adult learners, even though its claim of being an entirely different approach limits the strength of the theory. The process of developing the knowledge, skills and attitudes of adult learners in the engineering field requires some learning processes such as simulation, industrial attachment and laboratory sessions which are not explained in andragogy. While andragogy provides a cogent argument for identifying the learning needs of adult learners, it does not provide avenues for integration with other theories.

While andragogy has been identified as a theory that promotes adult learning, Elias (1979) considers it as a misguided theory developed to enhance adult learning although it could be seen in pedagogical practices. Similarly Hartree (1984) observed that the term andragogy had three basic unresolved challenges to practitioners: there was no clarification of the theory relating to teaching or learning; the difference in learning between the adult learner and the child learner was still not clear; it was not clear if the term andragogy was a theory or concept and finally that there were challenges with the principles underlying the term.

Although it is important to note that adult learners require varied experiences to make meaning of the concepts and theories they are introduced to in class, a careful study of the constructivist approach will provide justification for the need to develop the skills, knowledge and attitude of adult learners. The next section discusses experiential learning which emerged as a theory that considers the relationship between what individuals learn and perform through reflection, conceptualisation and practical work.

3.2.6 Experiential learning

The most well-known version of experiential theory was developed by Kolb in 1984, known as Kolb's learning cycle. According to Hillier (2002:92), Kolb's learning cycle provides leads through which individuals are able to make generalisations from concrete experiences and devise ideas for future experimentation using their reflections. According to Seng (2001, cited in Thorsen & DeVore, 2013), the process of reflection usually involves reconstruction of professional knowledge which is obtained from

experiential knowledge and the teacher is expected to blend theory and practice to meet the lesson outcomes. In a recent study, Bell, Mladenovic and Segara (2010) showed that most lecturers prefer to reflect on technical, practical and critical areas of their teaching rather than providing theoretical knowledge without relating that to what is happening in the environment.

To re-affirm the significance of Kolb's learning cycle in the development of the cognitive abilities of adult learners, Illeris (2009) further introduces the incentive and content dimensions which he considers to be activated by the external interaction and the internal psychological processes which allow easy and more comprehensive learning to take place. The interaction between the content and the incentive dimensions suggests that knowledge acquisition cannot only be seen as cognitive, but more importantly, the effect of other factors such as students' interest, attitude and mobilization of mental energy should be taken into account. Therefore the learning process involves the adult learner's own organisation of his/her mental structures which is very important in the learning process.

The concept of experiential learning relates to the learning of adults who are considered to be older, can better understand issues and make their own meanings in the environment in which they find themselves. Learning involves a combination of processes throughout the lifetime of individuals (Jarvis, 1987) which consist of the active involvement of a person's body and mind through social experiences (Svinicki & McKeachie, 2010). It is important to add that within social settings, individuals develop themselves through cognitive transformation that arises from both biological and environmental factors. Our daily experiences through interaction enable us to develop our minds and understanding of basic concepts in life.

Illeris (2007:7) focuses on the biological make-up of the learner and defines learning as "any process in a living organism which leads to permanent capacity change and which is mainly due to biological maturation or ageing". According to Illeris (2009:8), learning involves the fusing of two different processes: the external interaction process between the learner and his/her cultural, material and social environment and the internal psychological process, which involves elaboration and acquisition.

Learning that does not include both processes, according to Illeris, does not cover the entire field of learning. In addition to the above propositions, Illeris (2009) describes the learning process as consisting of the content, incentive and the environment. The content describes the knowledge, skills, opinion, meaning, insight, attitudes, values, strategies, ways of behaviour which develop the understanding of the learner, especially the adult learner. The goal of the learner is to put together meanings and in addition,

to resolve the challenges that confront him/her daily. The incentive dimension, according to Illeris (2009), provides and guides the mental energy that is necessary for the learning process. The constituents of the incentive dimension are volition, motivation and feelings or emotions.

From a post-modern perspective, Usher (2009:171) posits that experiential learning can be used in discipline-based curriculum as well as competency-based curriculum; this has also been the argument of critical theorists. Furthermore, application, expression, autonomy and adjustments are the continua around which the pedagogy of experiential learning is structured. It is important to note that one of the particularly relevant aspects of experiential learning is that experiences about learning are not mutually exclusive.

An important critique of Kolb's learning cycle is that the theory is incomplete because it does not include social and interactive elements, which are necessary in the learning process. This critique has been amplified by Jarvis (1987, 1992) who posits that learning always starts with social experience. Later, Jarvis (2006) described existentialism as the beginning of learning because most academic disciplines focus on the individual as an implicit theory of learning. Social form of learning is considered as important for the development of learners because it identifies the environment where learners find themselves while developing appropriate techniques to address issues within the environment.

The next section discusses the constructivist theory which also serves as a point of departure in the different theories discussed and also argues for the development of an integrated constructivist theory that are necessary when designing adult learning programmes.

3.2.7 Constructivism

The structure of society is not only interpreted in terms of individual ideas, knowledge and relationship patterns, but more importantly, depends on the formal institutional arrangements which support different forms of knowledge dissemination and acquisition, especially among adult learners. By this the researcher refers to the internal structures of HEIs which serve as the foundation for nurturing and developing the knowledge of adult learners who are pursuing degree programmes. Distinguishing between knowledge and skills development in the natural and social sciences, Danermark, Ekström, Jakobsen and Karlsson (2002) argue that in the natural sciences generative mechanisms can be manipulated and controlled in an experiment whereas the same cannot be said of the social sciences. They argue that because society is made up of systems that operate in isolation and are independent of each other, researchers in the social sciences who work in an open system attempt to find answers to complex social situations by means of

abstraction. Abstraction also requires that individuals acknowledge the source from which they reason and take decisions.

Social structures can be seen as flexible, historically different, but not fundamentally diverse entities when compared to natural objects and forces, because they contain well-organised causal mechanisms which are present in all observable events, and also provide a description of these mechanisms which may be generalised to other cases (Reed, 2008:103).

Yilmaz (2008) argues that constructivism could be identified as a theory with three different facets, namely sociological, psychological and radical constructivism. Additionally, the different types of constructivist theory draw on the epistemological assumption that knowledge is constructed in the minds of learners and not inherent or given by society.

Psychological constructivism, which describes the learning theories associated to knowledge and skills acquisition among learners, provides a better understanding of the facet of constructivism that is required in developing relevant curriculum for adult learners. Psychological constructivism also explains the process used by learners to construct meaning of the environment in which they find themselves. When these meanings are shared by other members of a group or community, they become formal knowledge (Yilmaz, 2008).

While the social structures form the basis of reproduction, the ideas that support the structures, which create knowledge patterns, are referred to as schemata (Bennett-Goleman, 2001; Fry et al., 2009). Schemata provide the basis for adult learners to make meanings from what is taught in the lecture room and what they experience on the job. The constructivist approach to teaching and learning suggests that adult learners construct their own understanding of the world in which they live through experiences and reflection. The experiences of adult learners are very important in the process of teaching and learning because they construct their own meanings to the theories and practical work they undertake. Further argument in support of the constructivist theory is that it provides students with the environment, support and conditions that will help them create meanings from their social life. From a behaviourist perspective authors such as Tennant (1997) and Light and Cox (2001) have argued that this notion relegates the function of the teacher to that of a non-essential provider of knowledge that is needed for the cognitive development of the student. Whereas the behavioural theory posits that the behaviour of students could be shaped and directed through a teacher's direction and control (Stewart, 2013), the constructivist theory identifies the construction of mind patterns and cognitive restructuring as necessary to human thinking

and understanding (Sackney & Mergel, 2007; Keating, 2015). Wadsworth (1996) showed that knowledge is acquired through exploration which is promoted by intellectual autonomy, development of the learner's knowledge through interaction with previous knowledge and the enhancement of relevant skills by building upon the learner's own previous skills. The continuous construction and amending of knowledge structures or schemata (Fry et al., 2009) persist in changing the thinking pattern of adult learners through processes such as new experience, understanding and information.

Biggs (1999) argues that one of the most important elements in the development of curriculum is the principle of constructive alignment. Constructive alignment takes into consideration the institutional climate, including policies and practices, the curriculum which is followed by faculty, the teaching methods and the assessment systems that also relate to the learning outcomes (Fry et al., 2009; Biggs, 1999). A major advantage of constructivism is that it does not prescribe rigid learning outcomes, instructional procedures, teaching and learning rules and procedures for constructing a learning environment as may be found in other theories. Cooperstein and Kocevar-Weidinger (2004) showed that constructive theory involves the facilitation of the teaching and learning process where learners are actively involved in the planning of the lecture room activities. In espousing a flexible mode of teaching and learning within the constructivist approach, Anthony (1996) suggests that a significant level of autonomy and control of learning activities should be given to the learner. It is important to note that learning must be positioned in a real setting which integrates assessment of students' learning (Rovai, 2004; Cooperstein et al., 2004; Sackney et al., 2007).

Not only can institutions and learners consider positioning learning in real settings, but more importantly, there is the need to identify the connection between the constructivist episteme and the knowledge education seeks to provide through a comprehensive and encompassing curriculum. In relating this process to a more practical illustration, Alters and Nelson (2002) argue that when facilitators lecture for more than 50 minutes, the process tends to be ineffective because they do not incorporate other method of teaching and learning which promotes discussion and knowledge sharing among learners. Such methods include group discussion, creation of mind maps, presentations and group brainstorming which are all forms of constructivist learning.

Buchanan and Smith (1998) propose a four-stage approach (as shown in Figure 3.2) to designing courses in higher education based on constructivist theory. In establishing the relevance of developing an effective programme structure for adult learners in higher education, I have adapted the framework of Buchanan and Smith (1998) to reflect the current ideal practices in the design of programmes for adult learners in

HEIs. The researcher will briefly explain the framework and the elements within the framework that support adult learning activities in the Telecommunications and Electrical Engineering programmes in Ghana.

The study considers the **first stage** (the engagement stage) of the adapted model as projecting the need for lecturers to support students to construct their own knowledge and skills through interactions with their environment; this is very important in the engineering field. The engagement stage usually involves several dimensions. Firstly, the adult will have to re-adjust to fit into the new environment where he[13] is made to know that he is an adult, hence will be made to direct his learning. He then needs to quickly settle in to assume this new role. According to Knowles (1978), when the adult learner realizes that he can go through the learning process successfully, he begins to learn with deep ego involvement which enables him to develop himself. As he grows in terms of his being the identity of the individual changes, he begins to see himself as occupying several roles which hitherto would not have been the case. The self-concept factor then comes in, paving the way for a completely new role which becomes his self-directing personality, meaning that he controls his life based on the various roles he is expected to carry out in society.

The **second stage** (connecting new knowledge with past experiences) provides students with the basis to reflect on the new knowledge acquired with previous experiences through a conscientious process of cognitive development which is termed as schemata. The learning climate of the adult is very important for the process of connecting new knowledge with past experiences. The learning climate should support the personal development of the adult learner in the programme. Additionally, there should be a conducive psychological climate in the form of cordiality between the students and the teacher, and finally, the behaviour of the teacher should be of a kind that draws students closer to him rather than scares them away. When teachers develop a meaningful relationship with students it promotes open interaction and the creation of a real learning environment out of which emerges critical self-reflection among them (O'Reilly, 1998; Cranton, 2006; Carusetta & Cranton, 2009).

Another important factor in the second stage is the diagnosis of needs where the learner is able to identify his or her peculiar needs. This could be seen as a process of managing the self-concept and the self-directivity of the adult learner. Rogers (1999:225) describes the diagnosis of needs as an essential motivation for adult learners who often learn to meet 'an immediate goal', and after that goal is met,

[13]All pronouns denoting the male gender are inclusive of the female gender.

become less motivated to learn. Knowles (1996) provides three main considerations in the process of needs diagnosis by the adult learner. First, there should be a consolidation of the expectations of all interest groups (the adult learner, the teacher, the institution, the employer and the society). This actually builds up the determination of the adult learner to achieve in his given field. Secondly, the items marked for achievement in the first factor should be measurable and achievable by the adult learner, using his own parameters, while at the same time ensuring that they are in line with the expectation of the other parties. Finally, the adult learner must be supported to measure his achievements, and based on his own judgments, drive his success through determination.

The **third stage** is the application of new knowledge to the working environment. This is considered as consider particularly fit for the development of relevant adult learning curricula in the engineering field, because this means that adult learners are able to apply new knowledge and theories to the field of work. The third stage usually requires that the adult learner is able to connect the new knowledge gained in the learning environment to the experience at the workplace. This process involves the planning of the programme that is intended to support the adult learner's own development through the design of a learning matrix. During the planning stage the expectations of the adult learner and those of other parties are put into achievable codes where the adult learner is able to discuss the possibility of him achieving those set objectives or targets. Here, the role of the teacher is not that of a facilitator, but more importantly, a resource person who helps the adult learner achieve his learning goals through a deliberate process of planning and monitoring those goals. Although this point has often been misconstrued to mean that the adult learner controls all his learning activities, it rather encourages the transfer of knowledge through arrangements such as teaching teams, consultation groups and project task forces.

The **final stage** identifies the need for an evaluation of the learning process through reflection and analysis of the extent to which the application of new knowledge to the working environment has been achieved. The evaluation of learning should also be done by both the adult learner and the 'resource person' as Knowles (1996) puts it. Self-evaluation is carried out by the learner while he goes through the programme. What the researcher identifies as important here, however, is the greater involvement of the employer who will be using the services of the adult learner. It is also important that the learner evaluates the programme so that the suggestions that come out of the evaluation process could be considered in future.

Educators who use the constructivist approach provide additional benefits to students in the learning process by involving them in problem solving activities and opportunities to create their own understanding of the various topics taught by applying their experiences and prior knowledge in the

learning process (Fosnot, 1995; Kamii & Ewing, 1996; Buchanan et al., 1998; Tynjälä, 1999; Boev et al., 2013).

Constructivism involves a process of making meaning, constructing knowledge and reflecting on the knowledge constructed through interaction with the environment. Maclellan and Soden (2004, cited in Yilmaz, 2008) summarise the constructivist process as follows: learners generate their own knowledge through interaction with the environment, the teaching and learning process is designed to shape the knowledge of learners and the interaction between the facilitator, resources and the learner shapes the knowledge of the learners. The constructivist approach to teaching and learning of adult learners in higher education institutions stimulates deep thinking by meeting their cognitive, social, physical and emotional needs which are essential for solving very complex theoretical and practical problems as well as providing learning experiences that are required for the job setting (Buchanan et. al., 1998:62).

Although constructivist and cognitive theories both emphasise the relevance of schemata building in the development of the knowledge and experience of an individual, what separates the two is the underlying epistemology (Sackney et al., 2007). While the cognitive theory is developed on the basis of objectivism, constructivist theory is constructed on the basis of subjectivism, which means that social reality is formed in the mind of the learner by drawing on previous experiences and new knowledge to make meaning out of his world. The essential premise of constructivism is that the learner is able to make sense of the set of information and constructs that is provided to him or her. The four stages of a constructivist approach to designing adult learning programmes are represented in Figure 3.2 below.

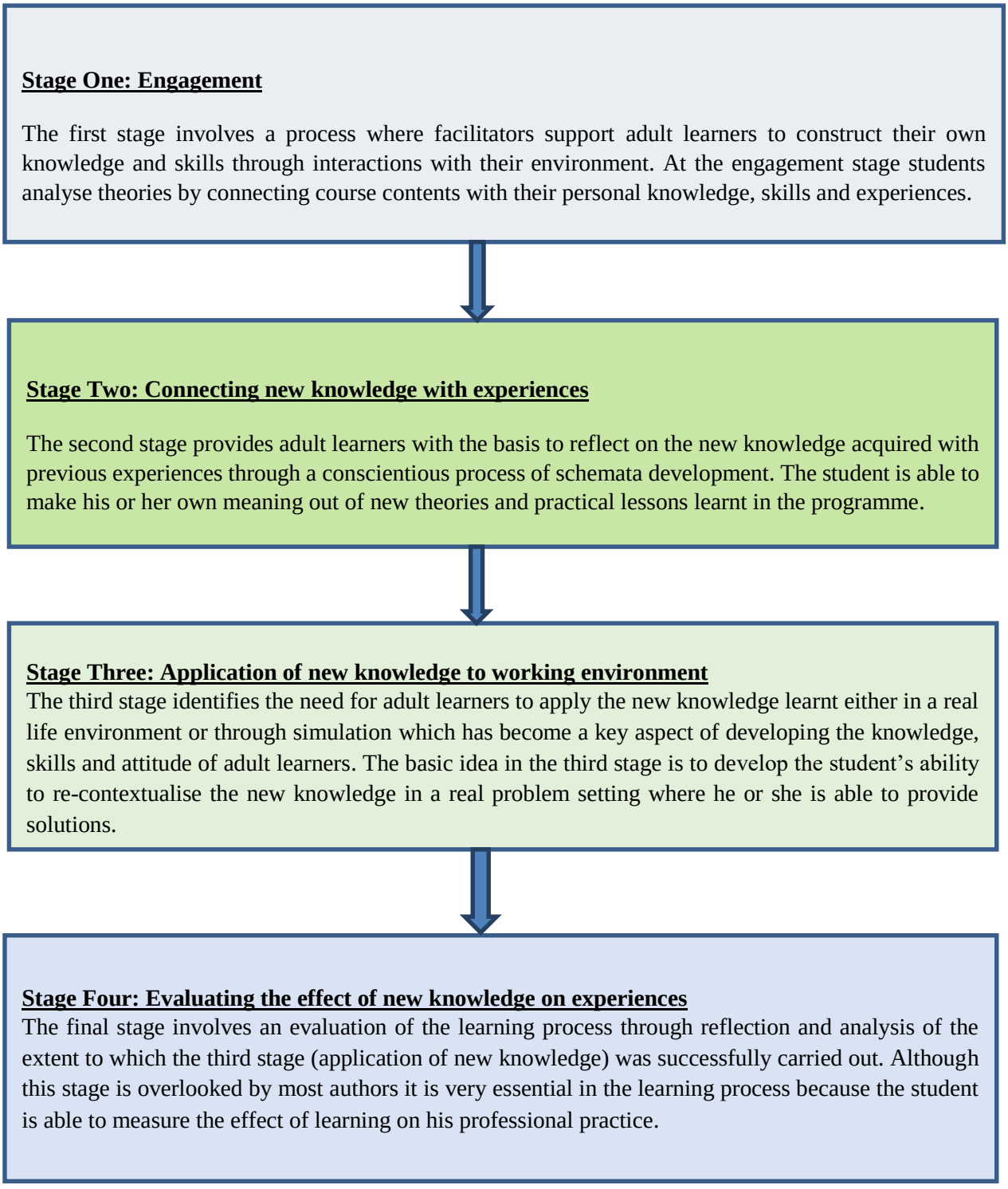

Figure 3.2: Constructivist approach to designing adult learning courses in higher education

Source: Adapted from Buchanan et al. (1998).

While espousing the strengths of the constructivist approach, Yilmaz (2008) argues that designing curricula requires that programme facilitation is provided by the instructor through enhancing learning rather than controlling it and reducing reliance on learning outcomes. This statement does not suggest that learning outcomes are not relevant in adult learning, especially in higher education institutions; rather, it seeks to establish the relevance of multiple approaches in providing adult learners with the relevant knowledge, skills and attitudes. Additionally, outcome-based teaching and learning is relevant to higher education practices because it creates the condition for maintaining high standards, improving teaching and learning, and measuring real achievements against set standards (Biggs & Tang, 2007:5). In other words, outcome-based teaching and learning provides the blueprint for designing and implementing course content.

Notwithstanding the strengths of the constructivist model, adapted from Buchanan and Smith (1998), its limitation is that, the model does not provide room for evaluation of teaching and learning which is important in higher education (the researcher has provided alternate means of generating feedback from both facilitators and students on the basis that the theory cannot be applied in isolation). The next section discusses the conceptual framework that connects the theories discussed in the previous sections of this chapter and also provides the background for the empirical study.

3.3 CONCEPTUAL FRAMEWORK: A CONSTRUCTIVIST INTEGRATED MODEL FOR ADULT LEARNING ENGINEERING PROGRAMMES

Building on the framework of Buchanan and Smith (1998) of a constructivist approach to designing adult learning programmes in higher education, this study adopts a conceptual framework that integrates seven different learning theories and can be used to develop curriculum for adult learners pursuing Telecommunications and Electrical Engineering programmes in Ghana. It is also important to note that no single theory provides the answers to all the relevant questions that are sought by adult learners to develop their skills, knowledge and attitude (Merriam et al., 2007). Six key variables were identified as necessary ingredients for developing the curriculum of adult learners in engineering in Ghana and these variables were used in designing the interview schedule and the questionnaire items for respondents which will be discussed in detail in Chapter six of this study. These variables are core knowledge in engineering, relevance of the programme to the needs of adult learners, programme planning and motivation for self-directed learning, the teaching and learning methods, the connection between the

courses offered by education providers and their relevance to work of adult learners and employability skills development.

3.3.1 Developing the core knowledge and skills of adult learners in Engineering

The development of relevant curriculum for adult learners requires education providers to identify the core skills needs of adult learners to be able to design relevant programmes for them. Core knowledge in engineering could be considered as the relevant technical know-how that adult learners are able to demonstrate on completion of their programme. This is premised on the behavioural theory.

Although adult learners enter the university with deep knowledge of their work processes, which are often gathered through several years of experience, they require additional training that provides them with a blend of theory and practical work procedures. Additionally, new technologies, tools, laboratory activities and simulators are used to develop the knowledge and skills of the adult learners. Similarly, engineering education requires practical field sessions and e/laboratory exercises and simulation activities that provide adult engineering students with hands-on experience, and opportunities to test principles and theories of the discipline from which innovation emerges (Davies, 2008; Case, 2008; Dickens et al., 2009). The goal of providing adult learners with enhanced knowledge in engineering can only be achieved when the curriculum is developed to provide them with relevant knowledge and skills needed for their work (Joseph, 2011; Slattery, 2012; Angelo, 2013).

This variable in the framework combines the behavioural, experiential and constructivist theories. The behavioural theory provides meaning to educational concepts such as competency-based learning, practical field work, instructional design models, simulation, programming language and application and laboratory sessions that are relevant in electrical and Telecommunications engineering programmes. Keating (2015) showed that the behavioural theories support the development of skills among learners while providing the desired behaviour expected of learners. Additionally, through repeated action on a practical task, the introduction of rewards through certification and provision of scores or grades after a course taken, adult learners are able to develop their knowledge and skills.

The outcome of the processes of developing the knowledge and skills of the adult learners involves experiential learning because adult learners enter the universities with experiences that are transformed through concrete experience, theorising (introduction to new theories), experimenting (through simulations and laboratory activities) and reflection. These four processes as explained by Kolb (1984) are important in knowledge and skills acquisition. For adult learners, while the behavioural theory

provides concrete learning environments such as laboratory sessions, field trips and simulators, experiential learning theory provides the process that enables them to acquire relevant knowledge and skills. The second element in the framework is programme planning and motivation for self-directed learning which focuses on how adults organise their learning processes through negotiation with facilitators, developing individual learning objectives and how they evaluate their knowledge and skills development.

3.3.2 Planning programmes for self-directed learning

Planning programmes for self-directed learning is very important in the development of adult learning curriculum, chiefly because motivation serves as the innate urge for adult learners to obtain higher credentials, even though they may not have the resources to do so. Self-directed learning focuses on liberal education that allows adult learners to plan, develop and provide input in the delivery of their programme. The constructivist theory dovetails some processes in the humanist theory and one of these is self-directed learning. Cooperstein et al. (2004) and Rovai (2004) showed that constructivist theory supports the active involvement of students in the planning and actualisation of their learning activities.

Partnership is seen as one of the main ingredients in self-directed learning, and it is important for a partnership to be developed between the facilitator and the learners in order that the goals of the programme could be achieved (Brocket et al., 1991:109). The notion of self-directed learning continues to gain ground in many education discourses. The introduction of Massive Open Online Courses (MOOCs) is based on the humanist theory of learning and is a particular manifestation of self-directed learning where individuals are free to choose programmes of their choice and are eventually awarded certificates based on participation and the completion of certain basic course requirements. A similar programme design for adult learners in Telecommunications and electrical/Electrical Engineering may, however, not provide the best results because students would require practical field work and laboratory sessions to augment their learning processes.

The notion of self-directed learning has been theorized by several authors such as Kulich (1970), Tough (1979), and Knowles (1975). Earlier writers did not factor in the internal state of learners and the social context in which learning takes place; this is considered a major limitation to the earlier definition and description of the term (Brocket et al., 1991; Merriam et al., 1997). To address the gaps earlier definitions and explanations provided, and to make a stronger case for self-directed learning as an applicable tool in adult learning programmes, Brocket et al. (1991) developed the Personal Responsibility Orientation (PRO) model. They proposed that self-directed learning be viewed from two perspectives, firstly, as a

model that focuses on teaching and learning and secondly, as one that relates to the characteristics and attitude of the learner which are in part shaped by social elements. Further discussion on programme planning (curriculum web) and negotiating teaching and learning processes (Cook's model) is found in Chapter four of this study. Programme planning and motivation to advance self-directed learning can be implemented through appropriate teaching and learning practices that also identify the knowledge and skills needs of adult learners.

3.3.3 Developing effective teaching and learning methods for adult learners

Transformative, constructive and cognitive learning theories are considered essential for developing relevant teaching and learning methods for adults. The process of teaching adult learners requires facilitators to focus on the needs of adult learners and apply teaching and learning processes that allow them to develop analytical and critical thinking. Often described as learner-centred education (Merriam et al., 1997; Rovai, 2004) where the focus in teaching is the learner, the facilitator actively involves learners in the process of knowledge and skills acquisition through negotiation. The transformative theory suggests that adult learners should be taught based on the experiences they bring into a course, thus, their prior experiences and the knowledge they have become an important foundation for developing the expert knowledge[14] and skills required for their work.

The constructivist learning theory in higher education and specifically in Telecommunications and Electrical Engineering hinges on the ability of adult learners to construct meaning, develop their prior knowledge in engineering, enhance learning through social interaction, and actively engage in the learning process through simulations and practical activities. Although the constructivist theory (as shown in Figure 3.2) involves teaching and learning processes such as engagement, connecting new knowledge with past experiences, application of new knowledge and an evaluation of the learning process, transformative and cognitive theories continue to play an important role in knowledge and skills acquisition.

Transformative learning among adult learners in the engineering field explains the learners' ability to develop their frames of reference through mind patterns. Herbaman (1981) distinguishes between instrumental and communication learning. While adult learners may apply instrumental learning by manipulating their environment to develop their own understanding of processes, they could also adopt

[14]Tynjälä, Välimaa and Sarja (2003) suggest that expert knowledge consists of formal theoretical knowledge, informal practical knowledge and self-regulative knowledge (which describes adult learners' interpretation of their work processes and knowledge).

communication learning by understanding the actions of other people when they communicate through diagrams, maps, books or demonstrations in the laboratory. Practically, communication learning is enhanced among learners through group discussions, joint project and brain storming activities where adult learners share knowledge and information on theoretical and practical aspects of their programme. Similarly, facilitators are able to engage learners in communication learning by providing them with relevant feedback that also shape their understanding of theory. The goal of communication learning, according to Mezirow (2009), is to arrive at the best judgment and not necessarily to assess a truth claim as pertains in the case of instrumental learning. Instrumental learning is actualised through activities such as simulation, demonstration in laboratories, observing work processes on a factory floor, engaging in industrial attachment programmes (Litchfield, Javernick-Will & Maul, 2016), using empirical research methods to address challenges in the discipline and reflecting critically on theories and practical lessons.

Cognitive theory which is the third theory considered in the framework is essential because the development of the knowledge of adult learners is driven by their understanding of theory and by practical sessions. While transformative learning connects the prior knowledge and experiences of adult learners in the learning process, the constructivist theory focuses on how adult learners develop meanings and perceptions through interpretation of the information they receive and the activities they perform. One of the most important conceptualisations of the cognitive theory is the learning taxonomy[15] which includes knowledge[16], understanding, application, analysis, synthesis and evaluation of knowledge acquisition by adult learners.

Teaching cannot be considered adequate and effective when the focus of both processes (teaching and learning) is on teaching rather than developing the interpersonal and learning components of the engagement (Chernoff & Howe, 2010); this is why the constructivist theory is indispensable in any intervention for adult learners. Richardson (2003, cited in Yilmaz, 2008) refers to the classroom structures, teaching methods and activities that support a constructivist approach to learning as *constructivist pedagogy*. When adult learners adapt to the teaching and learning regime through a gradual process, they then develop their own meaning based on a structured arrangement that identifies them as

[15]Bloom's learning taxonomy is widely used by education providers to develop the knowledge of students although there have been modifications to the original taxonomy.

[16]Krathwohl (2002) suggest that knowledge could be further categorised as factual, conceptual, procedural, and metacognitive with reference to the cognitive process domain.

capable of recreating their own meaning through a well-planned pattern. In the Telecommunications and Electrical Engineering fields, all three learning theories identified are essential in providing adult learners with requisite knowledge and skills that are relevant for their work and promoting their well-being.

3.3.4 Developing employability skills

Employability skills refer to those sets of skills that employers require potential employees to have when they are employed, and which HEIs often posit as graduate attributes in generic terms, and as a set of learning outcomes to reflect the teaching and learning in a particular programme (Stefani, 2009:41).Employability skills include research and inquiry, information literacy, personal and intellectual autonomy, and ethical, social and professional understanding. Additionally, Crebert, Bates, Bell, Patrick, and Cragnolini (2004) identify communication skills, problem solving, analysis and teamwork as key generic skills that are required in employment. They added that work placements or industrial attachments provide an excellent avenue for students to learn and progress to the workplace and further develop their skills. Chapter four provides detailed information of the specific skills required of adult learners in the engineering field.

3.3.5 Developing a protocol for engineering curriculum

In developing a protocol for electrical and Telecommunications engineering curriculum, it would be necessary for education providers to first understand the needs of adult learners from the different engineering fields. The engineering protocol should consist of the other five elements in the framework to provide meaning to what educational providers would require to develop the knowledge, skills and attitudes of adult learners pursuing Telecommunications and Electrical Engineering programmes. The relevance of Telecommunications and Electrical Engineering to the needs of adult learners is key to the development of a curriculum that seeks to provide intervention to meet the knowledge and skills needs of industry. The protocol must also identify the specific needs of industry, the technology used in the industry, the skills (including soft skills) requirements of industry and the future expectations of the industry in terms of skills needs.

Additionally, the protocol for developing an engineering curriculum should provide adult learners with opportunities to further develop their skills needed for their careers as engineers. Several authors (Sackney et al., 2007; Kanuka, 2011; Amadio, Opertti & Tedesco, 2014) suggest that curriculum could be considered as the outcome of a process that provides learners with indispensable skills, requisite knowledge and values required for self-development and achieving group goals. In conceptualising transformative learning, adult learners should be challenged to identify their work processes and develop

new ways of resolving work place problems. There should be avenues for adult learners to share their experiences with their colleagues and facilitators.

The protocol should create the opportunity for adult learners to interact with industry through field trips and industrial attachment (Litchfield et al., 2016). The researcher will return to this theme in Chapter four where detailed information on the effect of industrial attachment on the knowledge and skills needs of adult learners is provided. Additionally, the collaboration between industry and HEIs should provide adult learners the opportunity to complete a skills matrix that allows facilitators to identify the learning needs of adult learners through a formal feedback sheet (matrix) that shows the competences developed by the adult learner over time. While the framework developed by Buchanan and Smith (1998) identified four main processes as relevant for the integrated constructivist model provides six key ingredients necessary for considering the development of curriculum for Telecommunications and Electrical Engineering programmes in Ghana.

3.3.6 Evaluating the programme

Programme evaluation is a necessary element of the development of curriculum for adult learners. When education providers develop curriculum for adult learners in the engineering discipline, it is important for an evaluation of the teaching and learning methods and other factors considered in the integrated framework to be done to assess its impact on knowledge and skills acquisition among adult earners. Additionally, it is only when teaching and learning activities are evaluated that education providers can prescribe changes in the curriculum which would promote the development of the knowledge and skills of learners. Universities should have quality assurance systems that monitor teaching and learning processes as well as the administrative structures that provide support to students and facilitators.

The role of regulatory agencies and industry is very important, not only during the evaluation stage of adult learning programmes, but more importantly during the implementation of the other elements discussed in the integrated model. The development of core curricula and evaluation are characterised by factors such as the decisions of regulatory agencies that are often embedded in accreditation processes, policies of HEIs, international comparative considerations (Heitmann, 2005) and the expectations of professional bodies. It is also imperative that when undertaking an evaluation of a programme for adult learners in the engineering field, the input of other key players are considered. The relevance of programme evaluation has been amplified by Knowles (1996) and Buchanan et al. (1998). Similarly Fry et al. (2009:50) and Thijs and Van den Akker (2009) provide detailed arguments in support of programme evaluation.

3.4 CONCLUSION

This chapter provided an orientation to theories of adult learning and their relevance to adult learning structures in HEIs. The various theories undergirding the concept of adult learning were reviewed to provide enough basis for the adoption of integrated constructivist theory in the design of programmes for adult learners who are pursuing Telecommunications and Electrical Engineering programmes in HEIs. The chapter also discussed the framework developed by Buchanan and Smith (1998) and provided justifications for the adoption of that model in an integrated framework. The framework consisted of six main considerations; developing the core knowledge and skills of adult learners in Engineering; programme planning and motivation for self-directed learning; developing effective teaching and learning methods for adult learners in engineering; employability skills, protocol for engineering curriculum and programme evaluation. The framework discusses how, while focusing on the core tenets of the constructivist approach, the different learning theories could be integrated to develop a robust curriculum for adult learners.

While this chapter provided an overview of the integrated framework for the design of adult learners' curriculum in the engineering field, Chapter four discusses in more detail the considerations for designing curriculum for adult learners in the Telecommunications and Electrical Engineering field. Using the information from the integrated framework developed in this chapter, Chapter four will advance arguments in favour of the adoption of different learning theories in the design of adult learning curricula by providing practical examples of how the integrated framework could support teaching and learning among adults.

CHAPTER FOUR

CURRICULUM FOR ADULT LEARNERS

4.1 INTRODUCTION

This chapter discusses the components of adult learning curricula that form the basis for developing adult learning programmes in HEIs with a constructivist theoretical underpinning. While building on the learning theories discussed in Chapter three of this dissertation, this chapter also highlights the relevance of using appropriate curriculum in providing adult learners with opportunities to acquire and develop important skills, knowledge and attitudes in the field of engineering. Curriculum development encompasses the processes of curriculum design, curriculum dissemination, curriculum implementation, curriculum benchmarking and curriculum evaluation. Although curriculum could be viewed from historical (Kliebard, 1970), philosophical (Moore, 2000; Taba & Spalding, 1962; Bobbit, 2009; Klein, 1986) and technological (Moore & Voltmer, 2003; Cooper & Ferreira, 2009) perspectives, this chapter focuses on the philosophical approach. The philosophical approach to curriculum can be categorised into three main domains namely knowledge, social preparation and personal development (Tyler, 1949). The chapter sets out by identifying the relevance of curriculum philosophy to HEIs, adult learners, facilitators of adult learning programmes and the sources of knowledge that shape such curricula.

The second part of the chapter discusses the six main variables that were used in the empirical study, and explains how the conceptual framework developed in Chapter three could be actualised by HEIs, students, regulatory agencies and industry. It further explains how the six variables developed in Chapter three interrelate and could contribute to providing adult learners with opportunities to develop relevant knowledge, skills and attitudes that are required by employers. Additionally, the chapter identifies the relevance of Telecommunications and Electrical Engineering programmes to the needs of adult learners as the independent variable of the six variables. The other five variables, namely core knowledge in engineering; programme planning and motivation for self-directed learning; teaching and learning methods; the connection between the courses offered by education providers and their relevance to work of adult learners and employability skills development all depend on the quality of the programmes that are developed by education providers in the three cases of the study. The chapter also serves to establish the theoretical benchmarks against which the planning and implementation of Telecommunications and Electrical Engineering programmes in the three cases would be measured.

4.2 CURRICULUM PHILOSOPHIES

Curriculum philosophies provide HEIs, adult learners and facilitators of adult learning programmes with a framework for developing, organising and evaluating teaching and learning processes in institutions. Adult learners require curricula that correspond to their knowledge and skills needs while studying in a learning environment that support sharing experiences and constructing meanings to their everyday activities in the classroom. Learning theories can be well explained when they are conceptualised through the development of appropriate structures in the form of programmes which show the connection between the theories and the practical arrangements made to promote knowledge sharing and acquisition (Moore, 2000). The lecture rooms, laboratories and practical field locations in the Telecommunications and Electrical Engineering programmes serve as formal learning settings for students to acquire relevant knowledge, skills and attitudes.

The ingredients for developing curriculum for students have been espoused by Klein (1986:32) who suggest that "individual and group behavioural objectives, time on teaching activities, sequential learning, positive reinforcement, direct instruction by the teacher, achievement testing, mastery in skills and course content, and teacher accountability are important concepts" in curriculum development. Bitzer and Botha (2011) and Lusted (1986) corroborate the argument by Klein by stating that the concept of curriculum could be described as a programme of activities involving learners and facilitators that are designed to enable learners to attain the intended academic objectives. While contextualising the relationship between learning theories, knowledge and the curriculum, Thijs et al. (2009) suggest that curriculum development be discussed at five levels namely:

- the supra level, in reference to international curriculum adopted by HEIs in different countries;
- the macro level that implies curriculum at the national or system level;
- the meso level that identifies curriculum in HEIs;
- the micro level that involves the arrangement between facilitators and students; and
- the nano level that shows how curriculum is developed to suit specific needs of individual students.

This study focuses on the relevance of the curricula of adult learners at the micro and nano levels of curriculum development. Additionally, the learning theories discussed in Chapter three connect with curriculum development for adult learners at the micro and nano levels. Similarly, Taba & Spalding (1962:83) argues that understanding any curriculum would require an in-depth analysis of the learning theories that support its existence. Chapter three provides the theoretical foundation for discussing

Telecommunications and Electrical Engineering curriculum that serves the needs of adult learners. This section considers three curriculum philosophies (behavioural, progressive and practical) that are relevant in developing the curriculum of adult learners in the field of Telecommunications and Electrical Engineering programmes in three diverse universities in Ghana. The rationale for selecting the three main curriculum philosophies were derived from the learning theories discussed in Chapter three. Without veering from the ideals of the constructivist approach to adult learning which served as a point of departure among the theories discussed in Chapter three, this section also identifies possible strategies that HEIs could use in the development of curriculum for adult learners studying Electrical Engineering and Telecommunications engineering programmes in Ghana.

4.2.1 The behavioural approach to curriculum and instruction

The behavioural approach to curriculum development suggests that the knowledge, skills and attitudes of students should be enhanced through a process that reveals their observable behaviours. In relating the behaviourist philosophy to adult learners' curricula, Tyler (1949, cited in Kanuka, 2011) introduced a needs assessment method to designing curricula and instruction that has been adopted by various education institutions in many countries. The needs assessment[17] method seeks to identify the specific needs of adult learners and provide them with the necessary support that will improve their academic performance and attitude while meeting their skills needs. The needs assessment provides that four key principles must be considered in the design of any curriculum and planning of instruction:

i. What educational purposes should the institution seek to attain?
ii. What educational experience can be provided that is likely to attain these purposes?
iii. How can these educational experiences be effectively organised?
iv. How can we determine whether these purposes are being attained? (Tyler, 1949, cited in Kanuka, 2011).

In espousing the relevance of curriculum objectives to the development of the technical skills and cognitive abilities of students, Thijs et al. (2009) posit that the development of curriculum is usually influenced by the cooperative efforts of groups which may consist of institutions, policy makers, teachers, professional associations, industry and students (in the case of adult learners). The relationship between the various stakeholders in the delivery of relevant curriculum content could be described as whole network relations (Fenwick & Edwards, 2013:56) which are derived not only from the behaviourist

[17]The needs assessment method of developing the knowledge and skills of adult learners includes the design of skills matrix that is used by education providers to monitor the specific knowledge and skills acquired by adult while on the programme.

philosophy but also from the practical and progressivism curriculum. Network relations refer to knowledge, identities, rules, routines, behaviours, new technologies and instruments, regulatory regimes and learning. Relating network relations to the design of curricula for adult learners within the behaviourist philosophy, it is important that HEIs, government agencies, adult learners and industry consent to the programme content for teaching and learning (Santoro, 2000; Santoro & Gopalakrishnan, 2000).

While there could be an academic approach to curriculum development, it is essential to amplify other factors such as industry requirements and the requirements of professional bodies that are also relevant in the development of curricula. When curriculum is designed from the behaviourist approach, the object of developing a curriculum from an engineering perspective will be: to enhance the observable behaviour of adult learners; providing adult learners with relevant knowledge, skills and experiences that are applicable in the Telecommunications and Electrical Engineering sectors; and engaging adult learners in activities that develop their employability skills. Employers who use the services of the adult learners who complete their programmes of study from HEIs will look forward to identifying their skills and knowledge and also assess their impact on the organisation's production or service levels. This study considers the behavioural approach to curriculum design as important to curriculum evaluation because it provides educators, employers and adult learners with fair bases of measuring students output by observing them while they work. Curriculum development does not end when the observable behaviour of students who exit HEIs is assessed: their knowledge needs and skills are also considered. This factor is amplified by progressivism, which is a well-known philosophy of curriculum development.

4.2.2 Progressivism as an approach to curriculum and instruction

Progressivism as an approach to the study of the aims, means and ends of education focuses on the development of the individual mind and the individual self. Progressivism was developed by Dewey (1916) as a philosophical approach to the study of education and was further amplified by Carl Rogers in the 1950s to counter psychoanalysis and behaviourism as major learning theories in psychology.

This study considers the elements within progressivism as complementary to those espoused by the constructivist perspective (see section 3.2.7) because the underlying principles such as liberation, ethical values, trust, participatory practice, individualised learning and affective domains of learning are relevant for adult knowledge and skills development (Nafukho, Amutabi & Otunga, 2005). The principles of liberation, ethical values and trust are also espoused by the proponents of transformative learning

although they fall short of identifying the aspect of self-directed learning which is essential in the learning process of the adult.

Progressivism as an approach to curriculum development is one that views support for individual growth and self-actualisation as key to knowledge advancement among adult learners (Kanuka, 2011). The main focus of progressivism in terms of curriculum development is seen in constructs such as freedom and autonomy, trust, active cooperation and participation, and self-directed learning (Kanuka, 2011); these are derived mainly from the field of psychology and applied in engineering settings. Progressivism also identifies the need for adult learners to be creative, learn independently and initiate discussion and learning activities in class.

Progressivism as a curriculum approach demands the existence of an emotional relationship between teacher and students that allows the teacher to provide emotional nurturing and materials needed for development, and create challenging situations to facilitate teaching and learning (McNeil, 1981:5). This approach to curriculum development is very important in the development of the cognitive abilities of adult learners, because it promotes learning through participatory processes that also allow them to openly respond to the teaching. Furthermore, it allows adult learners to create their own learning patterns based on their understanding of the programme, the time available for learning and their experiences - this is very important for the construction of meaning to what they learn.

Although progressivism as a philosophical approach to curriculum development provides facilitators and learners with the freedom and participatory processes to develop the knowledge, skills and attitudes of learners, a major weakness of this approach is its over reliance on consensus and acceptance by learners as key to its success, thereby allowing changes to be made to the planned curriculum.

The influence of progressivism is reflected in some of the shifts in terminology, described by Biesta (2012:37) as follows;

> the tendency to refer to teachers as facilitators of learning, to teaching as the creation of learning opportunities, to schools as learning environments, to students as learners and adults as adult learners, to the field of adult education as that of lifelong learning, and to the very idea of education as that of teaching and learning...

The use of this new 'language' is derived from the postmodern critique of authoritarian forms of education and the neo-liberal assertion that individuals and not the state should provide for their learning (Biesta, 2012). These developments have to some extent changed the actual role of the teacher in school settings and made the learner determine the type of teaching and learning he or she wants to have.

Additionally, the knowledge that is of most worth may not be the kind that is provided in the school curricula but may be found in other documents or from the experiences of students. It has therefore become necessary for HEIs to develop complementary ways of advancing knowledge and skills of students in the form of shared experiences, self-development, self-motivation, experiences gained from industrial attachment, peer coaching and co-curricula activities.

While progressivism as an approach to curriculum development could be seen as a move towards the structuring of teaching and learning, especially among adults, it is important to state that it cannot be used in isolation. What is more, there are elements of other philosophies such as practical curriculum or vocational pedagogy that should be incorporated in the development of adult learning curriculum.

4.2.3 The pragmatic approach to curriculum and instruction

While the behavioural philosophy identifies the need to condition adult learners and institute rewards systems, progressivism espouses the development of conducive environments for adult learners to learn. Vocational pedagogy or the pragmatic curriculum, as used in this study, serves to merge these two philosophies into a meaningful approach that identifies with constructivism as a theory that develops the knowledge and skills of adult learners. Some theorists (Schwab, 1978; Bobbit, 2009) have indicated that there are no specific philosophies that support the development of curricula at any level of education. What these authors have sought to do is to identify what they term the 'ideal' model or framework for the design of curriculum for students; this study adopts the pragmatic approach to curriculum development as essential in the field of Telecommunications and Electrical Engineering.

Pragmatic curriculum (also referred to as vocational pedagogy) could be viewed in three main ways, namely the practical, the quasi-practical, and the eclectic (Schwab, 1978).

The practical curriculum identifies the difference between actual and theoretical methods of learning which emerges from the goal of a programme, the source of practical problems and the different learning outcomes (Schwab, 1978). While the outcome of the theoretical is warranted and confidence inspiring knowledge consisting of general and universal statements, the outcome of the practical is decision and

application in the field of work. The practical curriculum also provides information on how adult learners connect the work they do with the courses they take in a programme. Additionally, laboratory sessions, field trips and industrial attachment exercises are forms of practical curriculum. When conceptualising the practical curriculum, Bobbit (2009:17) suggests that the philosophy could be viewed in two ways; first, "it is the entire range of experiences; undirected and directed, concerned in unfolding the abilities of the individual, and secondly; it is the series of consciously directed training experiences that schools use for completing and perfecting the unfoldment". While directed experience involves the purposeful design of programmes or courses intended for learners within a defined setting, undirected experiences are those that the learner acquires either at the workplace or in other social settings. According to Schwab (1978), decisions that arise out of the practical approach can only be judged in comparison with other approaches. Similarly, Barnett (2006) suggests that the demands of professional practice which includes practical operating procedures, design strategies and empirically derived practical knowledge, are some of the factors that influence practical curriculum.

Although the definition by Bobbit (2009) provides a simple approach to understanding practical curriculum, a major weakness in his argument relates to the notion that the knowledge acquired by individuals cannot be reduced to only the experiences they gain. While elements such as human abilities, habits, systems of knowledge and values (progressivism curriculum) may be required in the teaching and learning processes of adult learners, other factors such as critical reflection, experimentation and reformulation of meaning through interaction areas important.

The extended definition of practical curriculum as proposed by Bobbit (2009) is what Schwab (1978) explains as the quasi-practical curriculum. The quasi-practical curriculum ensures that while a student is developing his or her critical thinking abilities, he/she also acquires abstract knowledge which is relevant for understanding the theoretical and practical components of a course. Quasi-practical curriculum also provides the basis for analysing events, theories and phenomena through different perspectives which are integrated to make meaning to recipients of the information. A major source of constructing and reconstructing collective learning and knowledge is the reformulation of practice which is carried out by learners through a process involving experienced people and the critical roles of their colleagues (Loureiro et al., 2013). In relating the practical and quasi-practical curriculum, Wheelahan (2007) suggests that the development of the critical thinking abilities of learners involves a careful process of induction of the learner into a classified and insulated body of knowledge with the associated technical and professional expectations.

The eclectic perspective that is the third way in which the pragmatic curriculum can be viewed suggests that while the practical curriculum is essential for knowledge and skills development, the theoretical assumptions underlying the theories are very essential to learners. Therefore when adult learners understand the theories that support the practical aspects of what they learn, they are able to modify the processes involved in getting work done and also ensure that these modifications are recorded and analysed. Additionally, eclectic perspective is important in decision-making because, firstly, theories are used as bodies of knowledge comparable with the Skinnerian theory (used as knowledge of learning process) and the Freudian theory (used as knowledge of personality). Secondly, theories can be used to explain the terms and differences in curriculum through interaction and active sharing of ideas and knowledge between facilitators and students (Schwab, 1978:295). Because theories cannot speak to issues or questions relating to what, who and how to teach Schwab (1978), the activities of HEIs and students define what constitutes curriculum in every academic setting. In expounding the need for HEIs and education providers to focus on developing practical curriculum rather than relying on theories and philosophies, Schwab (1978:287) identifies the incoherent nature of curriculum and its attendant problems with respect to failure of some curriculum in schools to the intrusions from the philosophies.

Each of the three philosophies discussed (behaviourism, progressivism and pragmatism) provides elements that are relevant for the development of adult learning programmes for students in the Telecommunications and Electrical Engineering discipline. The curriculum philosophies discussed in this chapter in various ways give effect to the constructivist learning theory as the ‘ideal’ theory for the development of the technical skills and cognitive abilities of adult learners (Tynjälä 1999:363-364). The development of any curricula for adult learners rooted in the constructivist theory suggests a collection of different processes and practices used by the three curriculum philosophies which have been discussed above. It will suffice to state that in practice, no single curriculum philosophy can serve all the knowledge, skills and attitude needs of adult learners. While the curriculum of every programme provides information on the mode of delivery, structure, content and duration of each course, it is important to evaluate these against a conceptual framework that could inform educational providers in HEIs to develop relevant curricula for adult learners. Building on the conceptual framework that was developed in Chapter three, the remaining sections of this chapter connect the different variables with the pragmatic curriculum discussed above.

4.3 THE ADULT LEARNER CURRICULUM – A FOCUS ON THE CONCEPTUAL FRAMEWORK.

This section focuses on contextualising the variables developed in Chapter three: core knowledge in engineering, relevance of the programme to the needs of adult learners, programme planning and motivation for self-directed learning, the teaching and learning methods, the connection between the courses offered by education providers and their relevance to work of adult learners and employability skills development. While Chapter three focused on the theoretical underpinning of the six variables developed for the empirical study, Chapter four provides an application of the variables in developing a well-knit adult learners' curricula in the Telecommunications and Electrical Engineering fields.

4.3.1 Core knowledge in Engineering

Investigating the type of knowledge that should be embedded in Telecommunications and Electrical Engineering curriculum for adult learners could be seen as both an epistemological matter and a practical one which should provide answers to issues of what adult learners should be taught and what they should learn at every stage of their academic endeavours. Shay (2013) argues that the difficulty in conceptualising knowledge is the lack of clarity of the difference between theoretical knowledge and practical knowledge. Other viewpoints, especially those of post-modernists and poststructuralists suggest that knowledge is not explained from a single stance, hence the diversity of explanations and ideological positions that ultimately negates any arguments that tie curriculum to theories of knowledge (Shay, 2013). Post-modernist and post-structuralist views are that knowledge is arbitrary, and the ability, interests and concerns of students in the design of curricula cannot be simply accommodated by maintaining traditions and the status quo.

There are different forms of knowledge that ultimately affect the design and structure of curriculum across the different disciplines (Muller, 2000; Maton, 2000; Moore, 2007; Wheelahan, 2007; Young, 2011; Shay, 2013). Moore and Voltmer (2003:454) identify ten ingredients necessary to develop curriculum for students in the engineering field; art of design, critical thinking, independent learning, systems engineering, collaborative proficiency, professionalism and ethics, liberal studies, natural world principles, mathematical fluency and laboratory expertise. The importance of knowledge to curriculum design is amplified by Shay (2013) who argues that knowledge cannot be described solely as a social object but rather as an independent ontological enquiry which describes the goal of education that learners, employers and education providers consider when developing the curriculum. Thus, for adult learners in the Telecommunications and electrical fields to have access to powerful knowledge, the curricula of learners, must have some epistemic access to theoretical knowledge (Wheelahan, 2007; Shay,

2013). This study has focused on providing a link between theories of learning (as explained in Chapter three) and the practical curriculum of adult learners in the engineering field that also support teaching and learning processes.

Key to the concept of adult learning in the Telecommunications and electrical disciplines is the teaching and learning styles of adults that support the process of knowledge acquisition. Individuals have different levels of experience, forms of knowledge and learning preferences (Hillier, 2002) which are all relevant features to consider when investigating and developing methods of teaching and learning in HEIs. Powerful knowledge, that is, knowledge agreed on by people in a particular field as the truth, although subject to debate, has two key characteristics; firstly, that it is specialised and secondly, that it is differentiated (Young, 2013).

Specialised knowledge such as power systems and wireless communications, which is not general knowledge, could be understood basically through how it is produced, transmitted and expressed by individuals usually in the disciplines or subject. In effect, what Young (2013) suggest is that cross-disciplinary research and learning depend on discipline-based knowledge which is often specialised and focused. Similarly, the development of discipline-based knowledge such as electrical and Telecommunications engineering requires quality standards of students because the emphasis in recent years has been on identifying their core competences rather than their prior entry qualifications (Dickens et al., 2009).

The second type of knowledge is differentiated knowledge. This type of knowledge is derived from the experiences adult learners bring to the institution, and these are often expressed through the knowledge applied every day. Although powerful knowledge provides the framework for developing curricula for students, its application transcends theoretical expositions, and this gives credence to the adoption of vocational pedagogy by this study. Loureiro et al. (2013) show that constructing and reconstructing knowledge among adult learners are driven by experimentation, mutual help, reflection and negotiation of meaning by individual learners. Through participation in practice, a consistent pattern of dialogue involving critical roles is built among learners, while the group members construct and reconstruct collective knowledge (Springer, Stanne & Donovan, 1999; Gibbs, 2009; Loureiro et al., 2013). The current structure of curricula of many HEIs requires students to demonstrate knowledge not only in their field of specialty, but more importantly, to apply knowledge from different fields.

4.3.2 Relevance of Engineering programmes to the needs of adult learners

The structure of programmes[18] in HEIs often reflects the development agenda of a country. In Chapter two of this study the researcher demonstrated how the development agenda of Ghana between 1950 and 1960 led to the development of programmes in universities to provide training to students in specific areas. More so, HE programmes represent the detailed processes and practices which institutions and students follow to acquire requisite knowledge, skills and attitudes that culminate in the promotion of the goals of society. As education providers continue to seek interventions for the design of relevant curricula in engineering education, the challenges that confront HEIs are increasing. Similarly, the responsibility that lies on HEIs to develop relevant programmes that meet the knowledge and skills needs of adult learners in the Telecommunications and Electrical Engineering fields in Ghana is enormous.

The challenges confronting engineering education in the modern era include:

> ....globalisation which has changed the labour market and working conditions to include attitudes such as transferrable skills and social competences that are not often obtained by graduates; societal demands for engineering education to include environmental and sustainability issues, entrepreneurship and social and ethical issues; reducing numbers of students enrolling in higher education institutions which calls for the development of relevant programmes and improved learning environment; advanced ICT-based teaching and learning methods, tools and technologies need to be applied and integrated in the programmes of Engineering students; and the rapid pace of change requires an explicit focus on life-long-learning and the education of an adult learner, who has learned how to learn and is able to organise his or her own personal development (Heitmann, 2005:447-448).

It is important that providers of higher education in the engineering adult learning environment develop programmes that are aimed at providing students with the requisite skills, knowledge and attitudes to meet their daily technological, social and economic needs. The development of a course in any higher education environment, be it online or face-to-face, should consist of key elements such as the learning outcomes or learning objectives, teaching activities, learning activities, relevant graduate attributes,

[18]Programme is used in this section instead of curricula. Programme as used in this context includes content, course load, credit structure, scheduling of lecture periods, laboratory and field sessions and the teaching methods (face-to-face, blended or online learning) used by education providers and course facilitators.

learning resources, feedback activities, assessment tasks and grading standards (Angelo, 2013; Thijs et al., 2009). Stefani (2009:41) posits that the tendency for many higher education institutions to develop institutional missions and graduate attributes in generic terms often shapes the learning structure of a programme through a set of learning outcomes.

The development of curriculum for adult learners would be relevant if education providers constantly review the curriculum to reflect changing technology and skills expectations of employers. Heitmann (2005:447) and Crawley et al. (2014:2) suggests that engineering education requires constant reviews in order to respond to changing demands from industry and this process should include developing programs, improving curricula and teaching and learning processes to provide the relevant knowledge and skills needs to students. A comprehensive review of the tools needed by education providers and facilitators in the adult learning environment to develop the knowledge, skills and attitudes of learners is provided in the next section, mainly because it is considered as the foundation for designing an effective programme for adult learners.

4.3.3 Connection between course content and the skills needs of adult learners

The development of Telecommunications and Electrical Engineering curricula often requires detailed information from engineers who are experts in the field, laboratory technicians, professional associations, regulatory agencies and government. Similarly, the content of adult education is in part determined by professional bodies, work-related needs (that are sometimes referred to as remedial or compensatory education), the role of the adult in society and the type of modern technology used in studying (Merriam et al., 1997). The design of course contents often begins with the selection of learning objectives for the course, followed by the organisation of the contents and the delivery of the course by facilitators.

In the field of Telecommunications and Electrical Engineering as it pertains to Ghana, the input of the Ghana Institution of Engineers is considered as important because they define the signature pedagogies[19] that are used by personnel in the field. In addition to the input of industry experts, elements needed in the design of HEI curricula for adult learners are drawn from different theoretical perspectives[20] (constructivist, behavioural, experiential, transformative and humanism) to arrive at the ideal programme structure for the adult learner.

[19]The development of the skills, knowledge and attitudes of adult learners for specific professions has been termed as signature pedagogies (Shulman, 2005).
[20]Detailed information on the learning theories has been provided in Chapter 3.

The development of relevant course content to meet the needs of adult learners is necessary for the knowledge and skills development of adults. Additionally the development of the content of the courses should include the overall expectations of the learners and their ability to connect the courses to the work they do at their work places. The course content of any HE engineering programme should provide relevant information on the knowledge students and lecturers are expected to have and share. Furthermore, the field of engineering requires the application of structured knowledge to unstructured issues (Land, 2013) which involve practitioners to be creative and up-to-date in the technology needed to solve problems (Svinicki et al., 2010). Similarly, Hunt et al. (2013) argue that it is important to identify the prior learning attainment of the students and also the understanding of each student when developing the content of a course.

The design of the content of an adult learning course requires an understanding of students' strengths and cognitive abilities that can be inferred when students apply for admission into the institution. Hunt et al. (2013:24) further argue that it is often important to rely on the subject objectives which provide detailed information on what facilitators expect students to know and to learn. This they differentiate into the must-know knowledge and the nice-to-know knowledge. The development of course content for adult learners in the engineering field also involves careful selection of relevant materials[21] and resources to ensure that students are not provided with information that is irrelevant to their practice (Chalmers & Partridge, 2013).

Hillier (2005:86) suggests that clear definition of the subject knowledge and the technical and skills requirements is necessary; this can be done by categorising the course content into Knowledge, Skills and Attitudes (KSA). Hillier (2005:87) suggests that two main questions are very important when developing the course contents of adult learners, namely how can instructors help learners if they do not know their skills needs before developing their higher order skills, and do instructors understand how best to prepare the course contents and set the right conditions for learning?

Although adult learners often enter institutions of higher learning from different environments and industries, it is important for programme facilitators to provide the most relevant set of lesson objectives which best fit the learning goals of the students. This process could be carried out by seeking the input of industry players (Santoro, 2000; Santoro & Gopalakrishnan, 2000; Crebert, Bates, Bell, Patrick &

[21]Relevant material in this context refers to the tools, equipment and field activities that students require to develop their knowledge, skills and attitude for their jobs.

Cragnolini, 2004) as well as potential students from different working environments who may provide relevant information for designing the course content.

The organisation of course content is important to both learners and facilitators because this ensures that the learning needs of every student are met during course delivery. Hunt et al. (2013:26) posit that the organisation of course content should involve connecting new knowledge with what students already know, providing detailed information on what students will be learning, the tasks required of students during learning, the learning materials to be used and the presentation methods which may consist of lectures, tutorials and workshops. The design of learning modes is usually the responsibility of course facilitators and may include identifying small groups in which adult learners learn, designing workshops to develop effective learning, creating effective learning environments and encouraging self-reflection (Hunt et al., 2013).

The overall expectation of adult learners who enrol in higher education institutions is to attain requisite knowledge, skills and attitude (signature pedagogies) that will help them perform their jobs satisfactorily while they also attempt to meet the needs of their family members as well as their community and society. The signature pedagogies of engineers in the Telecommunications and Electrical Engineering field in the context of this study include; networking, instrumentation and measurement techniques and team work skills.

4.3.4 Programme planning for adult learners in engineering

One of the main ingredients of developing adult learning curricula for engineering students is programme planning. The planning of adult learning programmes should involve the programme logic, topics, timelines, suggested outcomes and most importantly, individual knowledge and skills (Hillier, 2002:99).

Programme planning for adults involves four major steps (Hillier, 2002): the pace, level, sequencing of material and the theories or issues to be used. The pace and level describe the requisite content students should be given at a specific stage in their education and this is complemented by the sequencing of materials and theories that students should be taught. Hunt et al. (2013:31) suggest that planning is essential in every stage of the course design process because it provides the basis for analysing the benefits, effects and demerits of making different choices in obtaining the best course structure for adult learners. Programme planning as used in this study involves: the motivation of adult learners to pursue higher education; the aims and objectives of the programme; the learning resources and materials, and

the grouping of students and location of learning centre which are described by Thijs et al. (2009) as relevant ingredients for programme planning.

4.3.4.1 The motivation of adult learners for learning

The rationale for enrolling in either Telecommunications or Electrical Engineering programmes is often a personal decision that is made by the adult learner[22] and this decision is often made at the nano level of analysis. Without making any claim to existing philosophies, Martin (2012) notes that motivation is an essential process which shapes the behaviour and intellect of individuals while supporting their actions and behaviours which are articulated at different life stages and time. In other words, using individual characteristics to develop explanations for adult learning motivation may not be complete since other relevant factors are drawn from one's immediate environment and social structure.

Jarvis (2004) maintains that the concept of motivation in adult learning is important to the understanding of the characteristics of the adult learner and it is relevant for education providers to understand the motivation of adult learners when developing their curriculum. Six key factors are necessary when considering the motivation for adult learners to enrol in engineering programmes and these are: attitudes, needs, stimulation, emotion, competence and reinforcement (Wlodkowski, 1985 cited in Jarvis, 2004).

Similarly, Frith et al. (2012) show that motivation for adult learners can be categorised into the following: studying to advance prospects for personal growth; extending their knowledge and skills in a special field of interest; receiving an academic title; gaining knowledge and skills for everyday life; increasing chances of finding jobs; gaining promotion and to avoid job loss. The need for adult learners studying electrical and Telecommunications engineering programmes to acquire further knowledge which cannot be provided through other forms of learning such as in-service training, workplace learning, workshops and on-the-job training gives a stronger justification for the development of relevant course content, presentation methods and relevant resources. Adult learners who decide to enrol in HEIs have expectations that need to be met and these expectations are often the motivating factors that spur them on until they complete their programmes. The motivation of adult learners to obtain higher qualification is driven in part by the programme aims and objectives.

[22]The decision by adult learners to obtain higher education qualification could be described as a nano level consideration and here education providers can engage them in programme planning which is an aspect of curriculum development.

4.3.4.2 Objectives and aims of the programme

The objectives and aims of the programme is the second factor identified by Thijs et al. (2009) as relevant in the planning of programmes in HEIs. When the objectives of the programme are defined at the beginning, adult learners are able to connect their personal goals with the objectives of the programme. Additionally, learning objectives provide general information about the knowledge to be acquired by learners at the end of the programme. In adult learning, the learning objectives are often less detailed making room for the input of the learners themselves who can contribute rich experiences that can shape the course. However, the general theories of the course are often left unchanged. For adult learners in the engineering field, they would be interested in finding out if the course would have aspects of practical sessions, simulations, field trips (behaviourist curriculum philosophy) and theoretical studies. It is important for education providers to develop learning objectives that clearly indicate the intended achievement for learners. Each course must have its own learning objectives, so that the learner should always have the learning objective clearly in mind during teaching.

The responsibility of education providers in this case would be to inform adult learners of the aims and objectives of the programme and also provide avenues for adult learners to explain their knowledge and skills expectations. In addition to the aims and objectives of the programmes, the learning resources and materials should be properly planned.

4.3.4.3 Learning resources and materials

The learning resources for engineering students include the time, laboratory equipment, lecture schedule, staffing, libraries, learning management system, physical infrastructure and students' support services. It is very important to involve adult learners when planning the timing of a programme, of individual sessions, assignments and assessment activities. In order to develop the competences of adult learners, it is important to identify elements such as effective lecture sessions with appropriate learning tools (technology), incorporating elements of enquiry and problem based learning, undertaking adequate practical work, using web-based laboratories and computer-aided assessments (Heitmann, 2005; Dickens et al., 2009; Boev et al., 2013; Romiszowski, 2016).

4.3.4.4 Location

Location of the learning centre is very important for adult learners because some may have to take evening courses, especially when they combine work activities with learning. If institutions are located in areas where adult learners are able to easily move from their workplace to the education institution, it reduces the time needed to travel over long distances. It is also important for the lecture halls assigned to adult

learners to be close to each other so that in cases where they are required to change halls, they will not spend additional time in reaching the lecture hall. Similarly, it is important for education providers to situate laboratories on campuses and where learners are required to visit the laboratories of other organisations, proper arrangements are made to transport them.

The responsibility of education providers to offer favourable times or sessions for learning is very important to adult learners. Especially the commencing time for evening lectures should be suitable for all learners and would not make them arrive late. It is also important that the course and credit loads[23] are designed to help adult learners achieve their learning goals while making good use of the limited time they have. Session planning is an important component of instruction for the adult learner. Session planning is driven by considerations such as the aims and objectives of the course, the teaching methods to be used, the resources needed, the learning outcome as designed by the facilitator and the evaluation methods to be used (Hillier, 2005:92). It is important for facilitators to think through the four considerations (pace, level, sequencing of material and the theories or issues to be used) outlined by Hillier (2005) when planning every teaching session. Additionally, the four considerations are necessary in meeting the teaching and learning objectives of the facilitator and the learners in an adult learning environment.

4.3.4.5 Negotiating the curriculum with adult learners

The responsibility for teaching and learning in the adult learning environment does not rest on the facilitator alone but more importantly, should be fulfilled through the concerted effort of the learners as well. Cook (1992) and Hiller (2005) suggest that it is important for the facilitator to negotiate the timing of assignments, devise varied learning activities to improve skills and knowledge, pay attention to seating arrangement in class, learning groups and practical components that rely greatly on the experiences of adult learners. Figure 4.2 diagrammatically represents the various components of learners' requirements when negotiating the curriculum.

[23]Course load refers to the various activities required by education for students to successfully complete a course. The course load often comprises the theoretical, practical and field visit components. Credit load refers to the credits given to the theoretical, practical and field visit components in a course and these are often set by the faculty.

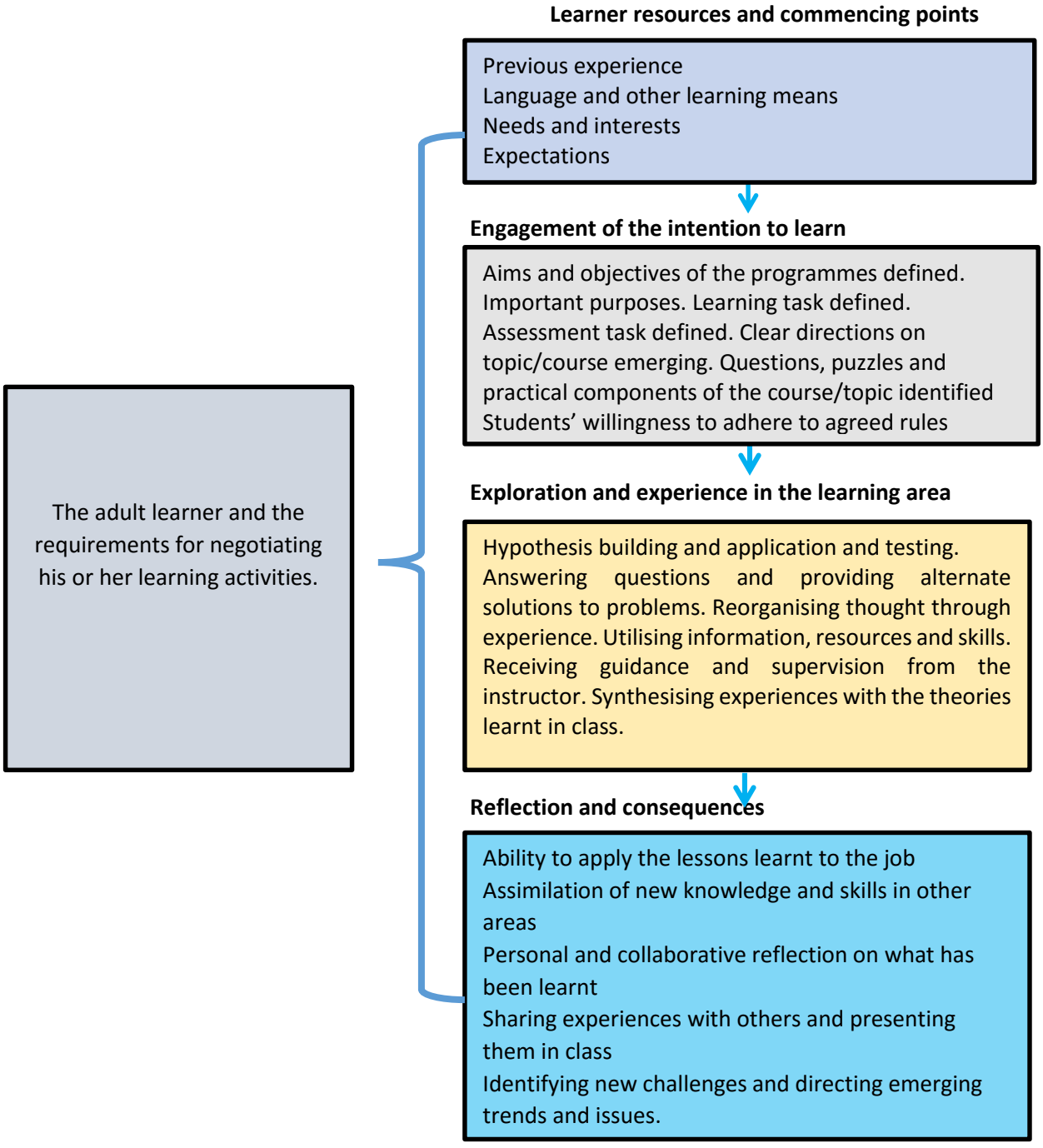

Figure 4.1: Learners' requirements in negotiating the curriculum

Source: Adapted from Cook (1992:16).

In espousing the advantages of involving adult learners in the planning of programmes Cook (1992:16) adds that negotiation of the curriculum provides the learner and the facilitator with the best means of

achieving the goals of teaching and learning in the classroom. Negotiating the curriculum also enables the students to learn better, discover their own ideas and understanding of the subject, ask questions and contribute meaningfully in any discussion in class. The adult learner can learn best when he or she negotiates his or her curriculum through the following:

i. Engagement: When the adult learners are involved in classroom activities, including discussions and assignments, they become purposeful in their approach to the learning process and demonstrate their ability to control the learning process. The involvement of the adult learner in the negotiation process also explains what is expected of him/her and why he/she must engage in the learning process. The engagement process should align to the negotiated means of teaching and learning although some minor variations may occur. Overall, the learner should be motivated to engage in his or her learning process in order to achieve the desired results, especially when the experiences at the workplace and general life experiences support the learning process.
ii. Exploration: Adult learners develop new knowledge when they interact with each other and engage in activities that require them to apply experience and ideas. Exploration in the field of engineering include: hypothesis building, application and testing; reorganising thought through reflection and experience; solving problems, answering questions and providing alternate solutions to problems; making use of information resources and skills; receiving guidance and supervision from the instructor and synthesising experiences with the theories learnt in class.
iii. Reflection: This identifies the ability of the learner to critically evaluate the learning process by identifying what he or she has achieved in the learning process. Reflection can be carried out individually or collectively by the group and it is useful in examining what was achieved, what could not be achieved and how best to develop skills and knowledge through possible other methods (Cook, 1992).

Figure 4.1 shows adult learners' requirements in negotiating their curriculum (Cook, 1992). This study projects the various tools that support learning among adult learners, namely engagement, exploration and reflection that are required for negotiating the curriculum because they are considered as complimentary to the learning process.

Firstly, the learner resources and commencing point require the learner to engage with the course, explore the best means of achieving his or her aim and reflect on how these can support his or her learning. The next stage, which is intention to learn, requires the learner to fully adapt to the learning environment and contribute to the teaching and learning processes in class. The third stage, which involves exploration and experience in the learning area, is critical to the learning process because it forms the basis for assessing

how the adult learner has achieved his or her aims in enrolling in the programme. Here the learner should be able to develop his or her own understanding of the lessons taught and the achievement of core competences required by the course. Finally, the reflection stage allows the learner and the class to think about the entire learning process and make the necessary evaluation.

In amplifying the rationale for reflection among adult learners in HEIs, it will suffice to state that reflection has been described as an important tool in the teaching and learning process as well as the daily activities of individuals. In addition, reflection emerges as a result of the need to identify learning outcomes from an activity which involves contextualisation of basic concepts which are important to the process of knowledge acquisition (Bell et al., 2013:2).The advantages of undertaking a reflective practice by facilitators and adult learners could be seen through enhanced learning activities by students and facilitators (this is discussed in detail in the next section), critical thinking and quality engagement of students in the teaching process, conscious and careful development of the cognitive abilities of students and provision of quality learning resources to both facilitators and students (Kahn, 2006; Rogers, 2001 cited in Bell et al., 2013; Romiszowski, 2016).

The reflective practices in teaching and learning among adults can be seen as part of efforts by education providers to serve adult learners with relevant skills, knowledge and attitudes that represent changes in the pedagogy of most disciplines, including engineering. Although Schön's description of reflection has been challenged by some authors, it still remains one of the most referred to theory in reflective practice. Schön (1987) in his earlier writing developed two main types of reflection namely reflection-on-action and reflection-in-action and this was later followed by the third category, reflection-for-action, which was propounded by Killion and Todnem (1991).

It is important to identify reflective practice in the design of curriculum for adult learners because that provides them with the opportunity to reconcile the practical knowledge and skills acquired. By identifying the need to include reflective practices in the teaching of adult learners, there is also recognition of the need to provide for the different forms of reflection identified by Schön (1987). Hill (2014:64) showed that teaching and learning among adults in HEIs is more effective when the practice moves beyond the basic provision of course design and teaching methods to include developing critical self-reflection and the opportunity to apply their experiences to the learning process.

The planning of curriculum is not only important for the students but also for the facilitators who lead the teaching and learning sessions and who are expected to carry out their tasks based on the institutional

culture, ethos, mission, vision, provisions and structures (Stefani, 2009:41). It is important to plan the content with adult learners because they come from diverse backgrounds (age, sex, ethnicity and cultural background). Their level of experience in either Telecommunications or energy fields may also be assessed to know exactly what their expectations are likely to be and how teaching and learning activities should be structured.

4.3.5 Teaching and learning activities

Teaching and learning activities provide the detailed processes used by facilitators in meeting the goals of a course for adult learners. The teaching and learning activities usually spell out the period marked for lecturing, presentations, workshops, laboratory sessions, field trips and industrial attachment. The teaching and learning activities for adult learners must be well planned to ensure that learners have structured programmes to enable them to obtain the expected knowledge, skills and attitudes. Additionally, modern teaching activities have developed to include, for example, concept-mapping methods (Kinchin & Hay, 2000) signature pedagogies (Shulman, 2005), threshold concepts which are particularly useful in teaching adults, mechanical dissection which is particularly useful for students in the engineering field and forensic problem-solving (Land, 2013). This section discusses three components of teaching and learning among adult learners as described by Buchanan and Smith (1998): assessment tasks, controlling classroom settings and the role of technology in the teaching and learning processes.

Taking into account individual levels of knowledge and skills in order to provide every student with the needed support is equally important. Hillier (2005:87) notes that it is important to accommodate the existing level of knowledge of students while enhancing their knowledge construction. Therefore, in presenting progressively differentiated ideas, it is important for the instructor to integrate them with old ideas that have already been taught. This should also involve a process of identifying differences and similarities among the theories and concepts. All the teaching activities should serve to promote the development of cognitive abilities. Fry et al. (2009) argue that threshold concepts, key principles, theories, concepts, and processes in a specific discipline need to be understood by the learners first before they can appreciate the course taught by a facilitator.

Personnel constitute a direct connection between the providers of adult education (institutions) and the adult learners themselves. The role of a facilitator in the learning process can be viewed from one of two perspectives: those who deliver the learning opportunities and those who receive them or benefit from them (Merriam et al., 1997). The role of a facilitator in engineering could be identified as: determine and monitor the aims and objectives of the curriculum; determine the instructional method to be used to attain

the curriculum objectives and aim; determine the sequence of instruction; and evaluate the extent to which the aims and objectives were achieved (Heywood, 2005). When lecturers develop a meaningful relationship with students it promotes open interaction and a real learning environment from which emerges critical self-reflection (O'Reilly, 1998; Cranton, 2006; Carusetta & Cranton, 2009). Furthermore, it is important for teachers and learners to develop a relationship which is based on open communication, affirmation, listening, humility, respect and safety (Vella, 2008). Additionally, safety is relevant to teaching and learning because from it emerges trust in the knowledge and competency of the facilitator which students need for their learning (Hill, 2014).

Another important contribution of personnel in the implementation of any teaching and learning programme for adult learners is programme administration, which includes planning. Programme planning (as discussed in section 4.3.4) is also known as programme development and it is an important building block in the delivery of courses. Programme planning thus is connected to the teaching and learning process because it explains how decisions concerning what programmes to offer, how to offer the programmes and the programme evaluation are carried out.

As far as teaching and learning activities are concerned, Knowles (1978:86) argues that Dewey's idea of effective teaching was developed around the concepts of experience, democracy, continuity and interaction. These considerations, together with the role of the facilitator, are very important in the design of curriculum for adult learner. Knowles (1978) suggests that:

> the role of the teacher must shift from that of a transmitter of information to facilitator and resource to self-directed inquiry and to regard education as a lifelong process" (Knowles, 1978:165).

Clouston (2005:51) suggests that facilitation should be person-centred, collaborative, a process of synthesis including shared learning, conducive learning atmosphere and enhanced student learning environment and a means of developing critical thinking among students. The object of facilitation in any adult learning environment is to develop students' independent learning abilities while ensuring that they are given the requisite guidelines and directions needed for their cognitive and self-development without altering the rules which govern their behaviour in that academic environment. The relationship between learners and facilitators should be cordial to promote open learning and effective communication. Vella (2008) enumerates the characteristics of such a relationship as comprising open communication, affirmation, listening, humility, respect and safety.

In considering methods of learning for adult learners, it is important that education providers consider the most suitable modes of knowledge transmission. Adult learners are able to connect work situations and experiences with the theoretical aspects of the course and it is important for these factors to be considered when developing the method of learning. Angelo (2013) suggests that the learning activities for each course must show the various types of activities given to students individually or in groups to develop their cognitive abilities and also meet their personal learning goals and those of the university. Teaching in higher education could be considered as very important to the development of learners and it often requires the teacher or facilitator to structure the content in a more logical, flexible and comprehensive manner which challenges students to develop their cognitive abilities, independent study and application of key concepts (Cowan, 2006; Hunt et al., 2013). The sessions for each course must be well planned so that the right activities occur at the right time. Some courses require detailed introduction[24] which are often designed to provide students with a better understanding of the course. Merriam et al. (1997) suggest the following as constituents of learning activities:

- Brainstorm
- Question and answers
- Group work
- Case studies
- Discussions
- Simulations
- Practicum
- Role play
- Games and quizzes
- Individual presentation and group presentation
- Learning sets

Similarly Beard and Wilson (2005:7) provide a typology of learning activities to include the following: creating a sense of a learning journey for students with details of what is required of them and what they should expect from the instructor; creating simulation and reality to provide students with learning guidelines; acknowledging feelings, values, targets; and allowing students to address certain important aspects of the discussions and allowing students to share their experiences in class.

[24]Introduction courses are sometimes referred to as foundation courses. They serve to provide all students, especially those who may not have relevant basic knowledge, with preparatory sessions so that they can understand the theories and basic requirements of the course.

Adult learners are able to adapt to learning methods that suit them and these refer to mostly the methods that allow them to apply their experiences to the theory they learn in class. Feedback also provides students with the needed information to improve on their learning activities as well take the necessary measures to develop relevant proficiency in specific areas marked for improvement. Feedback systems should have provisions to help students to develop their own understanding of the nature and type of feedback rather than identifying the areas needed for improvement without providing appropriate support (Sambell, 2011).

4.3.5.1 Assessment tasks

Assessment tasks provide students with details of specific requirements intended to either test or bring out their special skills and abilities. Sambell (2011) identifies three main rationales for assessment: they measure and certify the learning processes of students; they develop students' knowledge in designing their own learning and assessment patterns; and finally, they help students in their learning processes. Assessment tasks in higher education could be either formative or summative (Nicol & MacFarlane-Dick, 2006) and can consist of both norm-referenced and criterion-referenced assessments (Biggs et al., 2007). Formative assessments usually are designed to enable students to understand specific standards set by course designers which can be compared with the students' own expectations (Sambell, 2011). In providing the difference between criterion-referenced and norm-referenced assessment, Biggs et al. (2007) posit that norm-referenced assessment refers to awarding grades to students based on how they perform in specific assignments, while criterion-referenced assessment measures students' performance in terms of how their performance meet learning outcomes. This study considers **grading standards** as an important factor in the assessment of the learning outcomes of adults**.** The grading standards provide students with specific institutional benchmarks that are essential for the award of certificates, although it may not represent a learner's total knowledge attainment within the period of study.

4.3.5.2 Controlling the size of an adult learning class

The benefits of maintaining a small class for teaching and learning especially in the engineering field, have been well articulated (Biggs et al., 2007; Griffiths, 2009; Hunt et al., 2013; Land, 2013; Angelo; 2013). Although the ideal class size for effective teaching and learning is quite small, some authors provide detailed guidelines for controlling and applying effective teaching and learning conditions for students who find themselves in big classes (Biggs et al., 2007; Corder, 2009; Griffiths, 2009; Hunt et al., 2013). Griffiths (2009:73) posits that the ideal class size for teaching is between 2 and 20.

Adult learners are often placed in smaller groups in order to provide them with effective teaching (Griffiths, 2009). While small class size may be considered as necessary for effective teaching and learning, Biggs et al. (2007) identify the possibility of the facilitator drifting from the core topic to other areas, which are peripheral to the lesson. With good coaching and effective structures of teaching and learning, large classrooms could also be very effective, especially when the facilitator is able to arrange his presentation slides and other necessary materials well ahead of schedule and also delivers his content well (Biggs et al., 2007; Fry et al., 2009; Griffiths, 2009). Corder (2009:29) argues for the need to create good learning groups and this requires the facilitator and students to have detailed knowledge about the group dynamics.

Gibbs (2009) argues that group work has the tendency to improve students' performance in a course, and to enhance participation, output, general scores and ability to recall key terminologies and content during group activities. Group work could be described as a tool that yields better learning attainments for students than individual endeavour (Gibbs, 2009) and this relates to the social construction of knowledge within the constructivist theory.

4.3.5.3 The role of technology in the teaching and learning process

Emerging trends in engineering continuously require education providers to focus on developing curriculum to meet the challenges of resolving complex issues by using appropriate techniques, methodical processes and advanced technologies and tools (Moore & Voltmer, 2003; McLinden, 2013). Similarly, modern course delivery in the field of engineering has become more complex with the introduction of technology aided teaching and learning programmes.

Although the development of knowledge thrives on several factors that includes planning and development of course content, technology serves as the unifier because it integrates different teaching and learning processes on one platform. And in the electrical and Telecommunications field where a practical approach to solving real problems is required, it is important to integrate the various learning theories that support quality and effect learning among adult learners.

Furthermore, the increasing rate of knowledge-intensive work, advanced use of information communication technology (especially in the engineering field) and modern work arrangements that require team effort and network (Tynjälä, 1999; Svinicki et al., 2010) have contributed to the changing expectation of employers in organisations. Advanced knowledge in engineering, diversified social communication, cooperation skills, ability to work with other people from other fields or disciplines and

the application of technology in the job sector (Tynjälä, 1999:357) are examples of the expectations of employers in the work environment.

For adult learners who often find themselves engulfed in heavy schedules at the workplace, these programmes could help them cope with the volume of work that comes with additional responsibility of learning (Stefani, 2009). However, the achievement of relevant skills and competences depends on the patterns of teaching and learning in HEIs including laboratory activities and simulation. Knowles (1978:166) argues that the first assumption for competency development for life roles is that "the purpose of education is the development of competencies for performing various roles required in human life" (Knowles, 1978:166).

According to Case (2008:19) "in engineering education, we can therefore think of ourselves as working to produce technologically literate graduates – with literacy used here in the broad sense of being able to use a particular specialist engineering discourse". Additionally, most publications in the engineering field do not focus on the theoretical underpinnings of their discipline thus leaving the field open without any specific linkage to existing learning theories (Case, 2008).

The process of connecting theories to practical work environments in the engineering field requires field trips and laboratory activities. Davies (2008) proposes cogent factors for determining the rationale for involving students in laboratory tasks which include developing students as autonomous lifelong learners, developing their skills for professional engineering careers and developing students' understanding of scientific enquiry and analysis. Davies (2008:2) enumerates the challenges of laboratory work as it being expensive to carry out, lack of specialist equipment and the continuous use of obsolete equipment. A study by Cooper and Ferreira (2009) showed that where the cost of laboratory equipment may be prohibitive, or where equipment is not capable of being shared among a large class size or when students are studying from distant locations, remote laboratories serve to provide students with ideal platform to get into an e-laboratory setting.

Gibbs et al. (1997 cited in Davies, 2008) and Dickens et al. (2009) propose key elements that are necessary for developing the skills and practical knowledge of students in laboratory sessions as: developing the practical skills of students; developing the experience of particular pieces of equipment/tools; developing the data-recording and analysis skills of students; teaching students to plan on a testing programme; teaching students to develop links between theory and practice; developing

personal skills, problem-solving skills and how to use judgments in scientific enquiry and developing ICT skills.

The development of the skills of adult learners requires experiential learning because students are usually expected to apply their knowledge acquired during previous learning stages to their learning situations. Dickens et al. (2009) argue that practical sessions including laboratory exercises provide engineering students with hands-on experience, opportunity to test principles and theories of the discipline and coming out with innovation. There are also the e-laboratories (Dickens et al., 2009) that are also referred to as virtual or remote laboratories, which are built to provide practical experiences to students using digital modes and simulations.

Knowles (1980) posits that technological implications for adult learners are often based on the following considerations;

i. Emphasis on experiential techniques. A major catalyst for the development of the knowledge and skills of the adult learner is the experience they bring to bear when they are learning. Thus techniques such as laboratory methods, demonstrations, group discussion, case study, critical-incident process, simulation exercises and work conferences are very good avenues for the adult learner to contribute his/her rich ideas.
ii. Emphasis on practical application. This involves the application of the various theories to real life situations. Here the adult learner is expected to demonstrate his ability to relate the theories to real life events.

Technological applications for adult learners in a higher education setting will generally include timing of learning, grouping of learners, orientation of adult educators, organisation of the curriculum and design of learning experiences. Knowles (1980) suggests that because adult learners are interested in resolving real life problems, the sequencing of their learning should be based on problem areas rather than mere subjects.

4.3.6 Development of employability skills

Employability skills, which are also called soft skills (Barrie, 2004; Raybould & Sheedy, 2005) or generic skills (Mason, Williams & Cranmer, 2009; Martin, Maytham, Case & Fraser, 2005) are essential in curriculum development because they provide learners with skills that are relevant for the work environment. Adult learners could benefit from employability skills embedded in the HE curriculum primarily because they add on to their existing knowledge and skills which employers also consider as

important. Education providers are required to develop the employability skills of students through the curriculum they design for learners and it is the responsibility of facilitators to ensure that adult learners are given relevant skills for their jobs.

Employability skills include: teamwork, problem-solving skills, leadership abilities and technical abilities (Barrie, 2004; Raybould & Sheedy, 2005; Mason, Williams & Cranmer, 2009; Crawley et al., 2014). While there is no evidence to suggest that employability skills development at various departments in universities has a significant effect on labour market outcomes (Mason, Williams & Cranmer, 2009), it provides learners with skills that employers expect students to have. In developing the curriculum for adult learners in the Telecommunications and Electrical Engineering fields, education providers need to understand the relevant skills required by employers in order to serve the learners better. Additionally, the field of engineering requires specific soft skills such as problem solving skills and creativity (Heitmann, 2005), which can be provided by HEIs through a well-developed curriculum that also considers the needs of employers and adult learners.

Martin et al. (2005) show that engineering graduate attributes are driven by factors such as management, teamwork, communication, interpersonal skills, technical knowledge and technical skills. Additionally, they found that there exists a strong relationship between technical competency and communication; technical competency and teamwork and teamwork and communication.

4.4 CONCLUSION

This chapter discussed key considerations for designing adult learning programmes in the fields of Telecommunications and Electrical Engineering by first identifying the curriculum philosophies and the variables that influence the development of relevant curriculum for adult learners. Building on the learning theories discussed in Chapter three of this study, this chapter also reviewed the relationship between the theories of learning, knowledge, society and the adult learners' motivation to enrol in an engineering programme. The relevance of using appropriate techniques in providing adult learners with the right skills, knowledge and attitudes in the field of engineering was discussed in detail using six key considerations. Through a continuously evolving global context, it is important that educational providers identify best practices that promote learner-facilitator contact, cooperation among adult learners, active learning, focus on prompt feedback, attention to time on task, respect diverse talents and ways of learning and communicating high expectations to learners (Chickering & Gamson, 1987). From the review of the

various theories of adult learning provided in Chapter three, this study posits that no single curriculum philosophy of adult learning provides answers to the bourgeoning questions regarding the development of relevant curricula for adult learners in the engineering sector albeit the pragmatic philosophy was considered relevant for this study.

Chapter five discusses the research design, which serves as the research guideline for data collection and analysis. The chapter explains how the constructivist approach to teaching and learning alongside other relevant theories could be empirically studied to provide adult learners with the needed knowledge and skills to effectively contribute to the growth of the energy and Telecommunications sectors in Ghana.

CHAPTER FIVE

RESEARCH METHODOLOGY

5.1 INTRODUCTION

This chapter covers the research methodology adopted for the study and discusses the research paradigm, research methodology, research design, data collection techniques, data analysis techniques, validity and reliability of the data and the ethical considerations in conducting the research. At the same time, the choice of research design and data collection and analysis techniques is justified in the context of the investigation into the curricula of adult learners pursuing Telecommunications and Electrical Engineering. Figure 5.1 portrays the 'architecture' of the study, and demonstrates how paradigm, research design and data collection and analysis are interwoven and interconnected. The research study was situated in an interpretive paradigm which provides understanding to individuals' socially constructed meanings to a phenomenon and the relative ontology. The research methodology as shown in Figure 5.1 describes the processes used in undertaking the empirical research. The embedded multiple case study diagram first discusses interpretive paradigm and it shows how adult learners express their experiences in a social phenomenon through the how and what of social reality. The relative ontology was also adopted in this study because the knowledge constructed by adult learners pursuing Telecommunications and Electrical Engineering are obtained through interaction, application of knowledge and experiments within a social setting. Transactional epistemology served to provide information on the type of knowledge adult learners required to make meaning of the information they received through learning and experiments. Using the explorative research design, the study investigated the structure and methods used by three diverse universities in Ghana to provide relevant knowledge and skills to adult learners pursuing Telecommunications and Electrical Engineering.

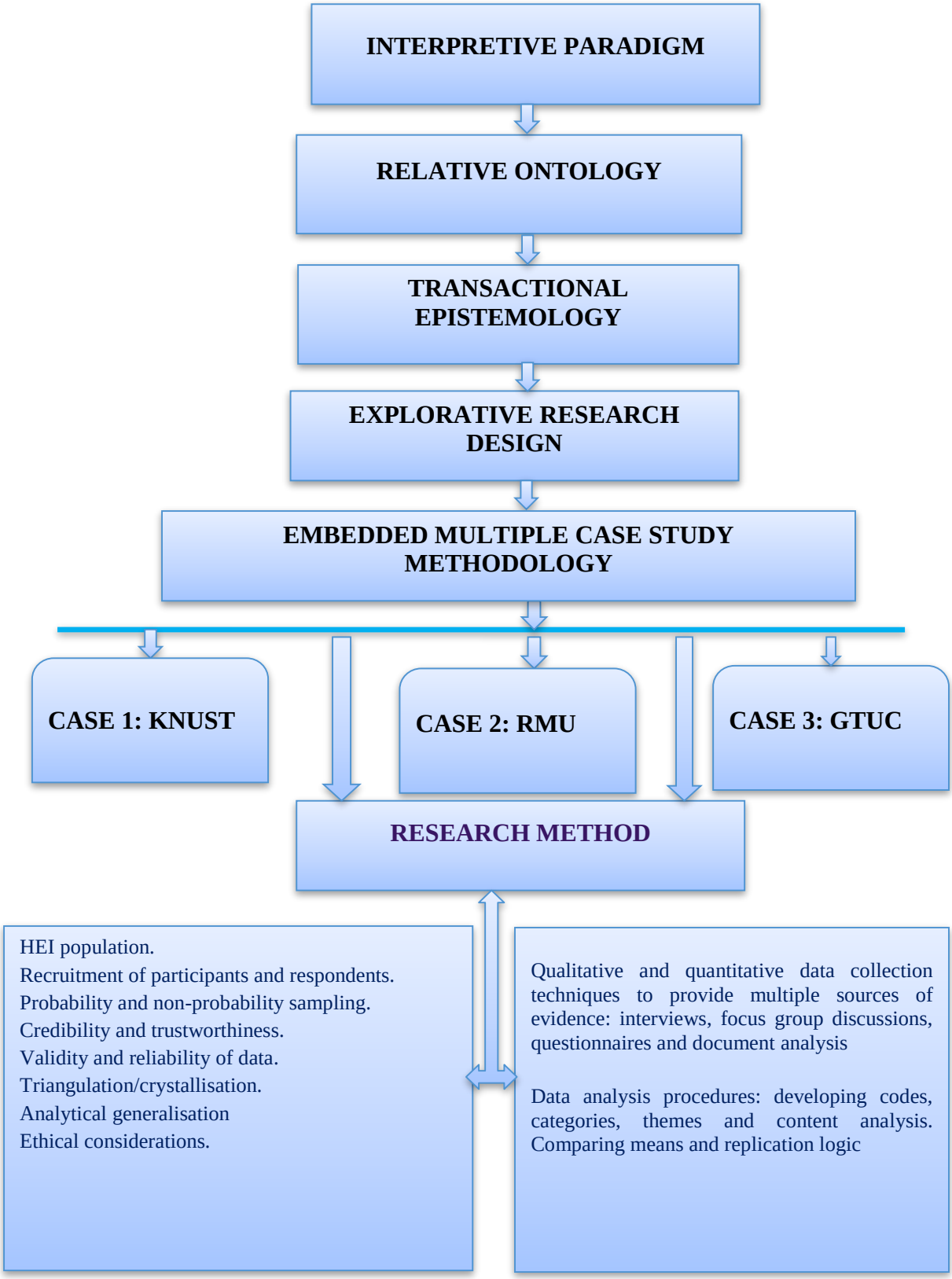

Figure 5.1: The research methodology

Source: Adapted from Gable (1994)

5.2 INTERPRETIVE PARADIGM

The idea of a research paradigm emerged in the early 1960s through Thomas Kuhn in his book entitled, '*the structure of scientific revolutions'* which was published in 1962 (Kuhn, 2012). The scientific revolution as explained by Kuhn (2012) referred to the philosophy of science which focused on scientific enquiry of a phenomenon that is transformed through stages rather than the linear accumulation of knowledge. The importance of a research paradigm in every enquiry is that it helps researchers choose theory based on accuracy (identifying relevant empirical observation and experiments), consistency (aligning with theory and empirical procedures), simplicity, broad scope (covering other related theories) and being fruitful (reporting the exact result that the research sought to establish from a particular phenomenon). Similarly, Mertens (2005:2) defines a paradigm as the process of "understanding, describing, predicting or controlling an educational or psychological phenomenon or to empower individuals in such contexts". The term paradigm could also refer to "a loose collection of logically related assumptions, concepts, or propositions that orient thinking and research" (Bogdan & Biklen (1998:22). The basic assumption underlying the term paradigm in relation to a research study undertaken is that it defines the nature, type and processes of investigating a phenomenon that an individual or group may adopt to obtain a specific outcome which will be understood and agreed by people who identify with that type of reasoning (Guba & Lincoln, 1994; Jones, Torres & Arminio, 2014). The context in which a particular phenomenon can be understood may be either diverse, inter-related or both and in this study, the programmes of three diverse HEIs and their relevance to adult learners provides the logical framework that describes the study within a diverse and interrelated setting.

A major factor in identifying a paradigm is to recognise its constituents. According to Denzin and Lincoln (2005:183) a paradigm consists of four key components; the ethics (axiology), the ontology, the epistemology and the methodology. While the ethical component of a paradigm seeks to answer questions about values, morals, rights or responsibilities, its epistemology seeks to present the process through which the enquirer can understand a phenomenon (the known). The ontology provides basic answers to issues of reality in the world and the nature of human being in the world. The methodology finally seeks to provide the best method, arrangement and procedure in obtaining the relevant knowledge about the world or phenomenon. While Denzin et al. (2005) suggest that a paradigm consists of four main components, Lincoln and Guba (2000 cited in Denzin et al., 2005:184) argue that a paradigm has seven main components namely: the axiology (consisting of ethics and values), accommodation and commensurability (connoting how different paradigms fit into each other), action (the practical aspect of what the researcher does), control (who directs the research and asks the questions), foundations of truth,

validity and voice. Following the argument of Denzin et al. (2005), this chapter provides information on the ontology, epistemology, methodology and axiology of the interpretive paradigm in relation to this investigation into the relevance of HE programmes to the needs of adult learners.

The interpretive paradigm evolved out of Edmund Husserl's phenomenology, and work done by Wilhelm Dilthey and other German philosophers on interpretive understanding by human beings. This further developed into hermeneutics (Mertens, 2005; MacKenzie & Knipe, 2006). According to Holstein and Gubrium (2005:484) "interpretive practice engages both the how and what of social reality; it is centred on both how people methodically construct their experiences and their worlds, and the configurations of meaning and institutional life that inform and shape their reality constituting activity".

The importance of using interpretive practice in this study arises from the need to study behavioural patterns of individuals (adult learners) through association and practice. In other words, the closer we draw to issues and identify with the main actors (as in Actor Network Theory – ANT), the better our understanding of those issues and the more we tend to proffer solutions to those issues. In other words, understanding how the programmes of adult learners are structured and finding solutions to how these programmes could meet the needs of adult learners in the Telecommunications and Electrical Engineering fields in Ghana.

Practically, the interpretive paradigm lends itself to the adoption of a variety of methodologies by identifying the relationship between the actions of individuals and the development of concepts and frameworks that are necessary in describing human interaction and relationship. O'Brien (1998: np) suggests that,

> .....with its emphasis on the relationship between socially-engendered concept formation and language, it can be referred to as the interpretive paradigm. Containing such qualitative methodological approaches as phenomenology, ethnography, and hermeneutics, it is characterised by a belief in a socially constructed, subjectively-based reality, one that is influenced by culture and history. Nonetheless it still retains the ideals of researcher objectivity, and researcher as passive collector and expert interpreter of data.

According to Lincoln et al. (2000 cited in Denzin et al., 2005:184), the interpretive paradigm adopts relative ontology (relativism), a transactional epistemology, and a hermeneutic and dialectical

methodology, and researchers who use this paradigm are oriented to the production of reconstructed understanding of the social world. Similarly, Alvermann and Mallozzi (2010) suggest that the interpretive paradigm is an approach that is used to provide understanding of social life.

Burrel and Morgan (1979 cited in Goles et al., 1999) argue that the interpretive paradigm could be described as subjective and guided by regulations. The regulation in any subjective enquiry such as the interpretive paradigm ensures that the teaching and learning processes among adult learners generate appropriate outcomes. Additionally, reality in its true state is multifaceted, and forged from the interpretations and interactions of individual actors in an enquiry (Goles et al., 1999:257). This study adopted the interpretive paradigm in order to obtain relevant information on the lived experiences of students studying Telecommunications and Electrical Engineering programmes as well as those of HODs in three diverse universities and CEOs of selected organisations. Table 5.1 (page 116) provides a summary of the interpretive paradigm as used in the study.

Table 5.1: The interpretive paradigm and how it is used in the study

ITEM	Description/Type	Nature of interrogation	How it is used in this study
Paradigm	Interpretive	Interpretive understanding of a phenomenon based on the subjective views of the actors which are socially constructed. Through interaction with actors, the researchers make meaning from events in the social settings.	Meaning was given to how the programmes of adult learners are structured and how these programmes meet the needs of adult learners in the Telecommunications and Electrical Engineering fields in Ghana.
Ontology	Relative ontology	Relative ontology is based on the assumption that reality as we know is constructed (which may be local and specific or co-constructed) through the meanings and understandings developed through social means or through experiments.	The reality in this study was the knowledge acquired by adult learners studying electrical and Telecommunications engineering programmes in three universities.
Epistemology	Transactional and co-created findings.	The epistemology of the interpretive paradigm is that researchers cannot separate themselves from what they know. Thus, the researcher and the object of research are linked in a way that their 'self' and how they understand the world becomes an essential component of how they understand	The researcher and the object of research (electrical and Telecommunications engineering programmes designed for adult learners) and the respondents in the study were connected in a way that provided clearer

		themselves, others and the world.	understanding of the phenomenon studied.
Methodology	Dialectical enquiry which takes place within case studies.	The use of the interpretive paradigm favours quantitative and qualitative approaches to empirical research. This study was designed as a case study enquiry and was intended to draw on the lived experiences of adult learners, HODs and CEOs. The meanings given to the phenomenon and issues being investigated emerge from the research process.	Dialogue between the researcher and the respondents was established and achieved in a coherent and purposeful manner. Specific methods such as interviewing, focus group discussions, questionnaire and analysis of documents were utilised.

Source: Adapted from Cohen, Manion and Morrison (2011)

Table 5.1 shows the research paradigm configurations as used by the author in the study. It starts by explaining the interpretive paradigm as the scientific mode of inquiry and the relative ontology as its world-view. The table also describes the epistemology and the methodology used in the study.

The interpretive paradigm suggests that reality does not exist separately from the knowledge of the researcher because the values of the researcher are present in all the research processes through negotiation with truth;

i. "Findings or knowledge claims are created as an investigation proceeds. That is, findings emerge through dialogue in which conflicting interpretations are negotiated among members of a community.
ii. Pragmatic and moral concerns are important considerations when evaluating interpretive science. Fostering a dialogue between researchers and respondents is critical. It is through this dialectical process that a more informed and sophisticated understanding of the social world can be created.

iii. All interpretations are based in a particular moment. That is, they are located in a particular context or situation and time. They are open to re-interpretation and negotiation through conversation" (RJWF, 2008: np).

Gray (2009) concurs that the interpretive tradition is associated with social reality that is identified as socially constructed, thus interpretation should be used as the main means of getting information about reality rather than explanation and description.

5.3 EXPLORATIVE RESEARCH DESIGN

The research design relates to the logic and purpose of the study and the overall arrangement for connecting the conceptual research problems to the empirical research. Based on the ontology and epistemology of this study, the researcher considered the case study research design as the most appropriate design to use in investigating the relevance of electrical and Telecommunications engineering programmes to the needs of adult learners in HEIs in Ghana.

According to Yin (2003:18), "case study inquiry copes with the technically distinctive situation in which there will be many more variables of interest than data points as one relies on multiple sources of evidence, with the data needing to converge in triangulation" However, the triangulation provides the prior development of theoretical propositions which guides the researcher in before, during and after data collection and analysis. Therefore case study can be seen as a comprehensive research strategy (Stoecker, 1991).

Nisbet and Watt (1984 cited in Cohen et al., 2011) explain that a case study would usually illustrate a general principle in a phenomenon and establish cause and effect. According to Merriam (1998:19)

> case study design is employed to gain an in-depth understanding of the situation and meaning for those involved. The interest is in the process rather than the outcomes, in context rather than a specific variable, in discovery rather than confirmation. Insights gleaned from case studies can directly influence policy, practice and future research.

One of the distinguishing features of a case study design is the opportunity it gives to key actors to provide information of their lived experiences in a non-coercive and non-intrusive manner and it usually follows a well-rehearsed pattern that is carefully constructed by the researcher. Bromley (1990 cited in Nieuwenhuis, 2012) posits that case study involves a methodical investigation into an occurrence which

explains the underlying factors or features of that occurrence. This study adopted an educational case study and this explained in detail by Bassey (1999:58) who observes that an educational case study is an empirical enquiry, which is:

a. conducted within a localised boundary of space and time
b. an interesting aspect of an educational activity, programme, institution or system
c. mainly in its natural context and within an ethic of respect for persons
d. designed to inform the judgments and decisions of practitioners or policy makers or of theoreticians who are working to these ends and such that sufficient data are collected for the researcher to be able to:
    i. explore significant features of the case
    ii. create plausible interpretations of what is found
    iii. test for the trust worthiness of these interpretations
    iv. construct a worthwhile argument or story
    v. relate the argument or story to any relevant research in the literature
    vi. convey convincingly to an audience this argument or story
    vii. provide an audit trail by which other researchers may validate or challenge the findings or construct alterative arguments.

The provision of relevant teaching and learning support to adult learners is in part influenced by the structure, policy directions and traditions of HEIs in Ghana. While some institutions are able to quickly vary their teaching and learning strategies to meet emerging market trends and global developments, others require time and detailed processes to adopt new methods and trends while others are not able to adjust to provide the needed support to adult learners. This study explored the significant features of the three diverse universities used and provided plausible interpretations of the structure of the Telecommunications and Electrical Engineering programmes. Similarly, the researcher ensured that the interpretation provided were trustworthy meaning that the respondents chosen for the focus group discussion, interviews and questionnaire were adult learners, HODs, representatives of Telecommunications and energy firms or regulatory agency. The instruments used in collecting data were developed from adult learning theories and curriculum development in the Telecommunications and Electrical Engineering disciplines.

Yin (2009) identifies four different types of case study namely; the embedded multiple case design, single case design, embedded single case design and the multiple case design. The embedded multiple case study design is used where different sub units are designed to fit in different cases with different units of

analysis. While the single case study emphasises the design of a unique case, the embedded multiple case design focuses on using more than one unit of analysis in a design. Multiple embed case study design refers to the design where different cases are planned to investigate a particular phenomenon which may be replicated.

This study is situated within the embedded multiple case design and it seeks to investigate the relevance of higher education programmes to adult learners pursuing programmes in Telecommunications and Electrical Engineering in three diverse universities in Ghana. The methods used in gathering, analysing and presenting data from adult learners, heads of academic departments in the three universities and the CEOs of some selected business organisations conformed to the processes used in any case study enquiry.

The embedded multiple case study approach provides an appropriate method of investigating the different phenomena that affect the teaching and learning processes among adult learners in HEIs and especially adult learners studying engineering programmes. Adult learners have specific learning needs that can best be addressed through an open and flexible approach (yet formally structured) which will satisfy all interest groups. In order to identify those learning needs among adult learners in three different institutions, the researcher considered the multiple case study approach as essential to the study. Particularly important when adopting an embedded multiple case study approach is the identification of the different cases and their characteristics. Yin (2009 cited in Cohen et al., 2011) suggests that embedded multiple case study approach provide the basis for comparing a particular phenomenon in different environments, thereby allowing for in-depth investigation into that phenomenon.

In addition to providing an appropriate method of investigating the phenomenon under scrutiny, embedded multiple case study design was chosen because the research investigated the underlying philosophies and structures of electrical and Telecommunications engineering programmes in three different universities and their relevance to the needs of adult learners. Additionally, this study used an embedded multiple case design because the researcher explored significant features of the three universities while focusing on the relevance of their Telecommunications and Electrical Engineering programmes for adult learners

According to Nieuwenhuis (2012:76) the advantages of embedded multiple case-study include; the application of different sources and techniques of gathering data, providing in-depth information and comprehension of complex events and detailed analysis of data gathered. Although embedded multiple case study designs require extensive resources and time, they provide evidence that is more compelling

and robust and provides a basis for better generalisation across similar studies (Yin, 2003; Nieuwenhuis, 2012). In embedded multiple case study design, the 'replication logic' and 'sampling logic' could be used. Case studies can employ different modes of enquiry namely; explorative, descriptive, explanatory, predictive and evaluative. The researcher chose the explorative approach because it describes the type of study which can provide answers to the burgeoning questions regarding the development of relevant programmes to suit the needs of adult learners in HEIs in Ghana. More so, the explorative approach used in embedded multiple case study provides a reference theory for researchers to collect, analyse and discuss cases (Scholz & Tietje, 2002; Gerring, 2007; Yin, 2009; Cohen et al, 2011) and describe the characteristics of a sample case. The method for collecting and analysing data in this study consisted of the qualitative and quantitative approaches and this approach has been corroborated by authors such as Gable (1994), Scholz et al. (2002), Gerring (2007), Korzilius (2010), Chmiliar (2010), Cohen et al (2011:289) and Runeson, Host, Rainer and Regnell (2012).

Korzilius (2010) posits that one key characteristic of case study design is multiple sources of evidence which includes quantitative analysis. Similarly, Scholz et al. (2002) and Gerring (2007) posit that in embedded multiple case study design, the unit or object of analysis cannot be limited to only qualitative analysis, thus, the need for different sources of evidence automatically draws in quantitative analysis. Quantitative data analysis in a case study design requires a careful evaluation of the type of information necessary, the phenomenon under study, the sample and research questions needed to answer specific research problems (Scholz et al., 2002; Gerring, 2007; Korzilius, 2010; Cohen et al, 2011; Runeson et al., 2012). Qualitative analysis in a case study research could include data conversion into numbers and ranks (while maintaining the original ideas or meanings from the respondents) and the development of matrixes to guide the analysis of data (Miles and Huberman, 1984). Similarly, a study conducted by Ampatzoglou, Gkortzis, Charalampidou and Avgeriou (2013) showed that using embedded multiple case study in an engineering environment provides succinct results.

The rationale for integrating the quantitative data collection and analysis in this study was to obtain multiple sources of data which could provide varied evidence to support the veracity or otherwise of the factors that influence curriculum design for adult learners and the perception of students offering engineering programmes in HEIs in Ghana. More so, the descriptive research design provides detailed procedure for obtaining relevant information on a phenomenon through the population, sampling technique, data collection and data analysis. These are thoroughly discussed in the next paragraph.

5.3.1 Selection of cases and research setting

The case study was based on an explorative mode of enquiry which sought to identify the relevance of HE curricula to the needs of adult learners studying Telecommunications and Electrical Engineering programmes in three diverse universities in Ghana. The three cases were selected based on their diverse nature (regional, public and private universities) and they were also considered because of their proximity to the capital city, Accra.

In the case studies of the three universities in Ghana, the unit of analysis in each case was the Telecommunications and Electrical Engineering programmes in the universities. The units of observation consisted of adult learners, HODs, sample curricula and ten Telecommunications and Electrical Engineering firms in Ghana.

Focus group discussions were arranged with adult learners pursuing Telecommunications and Electrical Engineering programmes in Kwame Nkrumah University of Science and Technology, Ghana Technology University College and Regional Maritime University. Structured interview questions were designed for Heads of Departments of the three selected HEIs and for Chief Executive Officers of business organisations in the Telecommunications and energy sectors in Ghana. Questionnaires were also distributed to respondents in all the three universities. The study also adopted purposive selection to choose business organisations.

Three cases were used in the study and these consisted of; case 1: Telecommunications and Electrical Engineering programmes at the Kwame Nkrumah University of Science and Technology, case 2: Marine Electrical Engineering programmes at the Regional Maritime University and Case 3: Ghana Technology University College. The process of gathering and data for the study in the various cases are described below;

5.3.1.1 Case 1- Kwame Nkrumah University of Science and Technology

The Kwame Nkrumah University of Science and Technology, formerly known as the Kumasi College of Technology, was opened in January 1952 to provide university education in the areas of arts, applied sciences, health and engineering. According to George (1974), the first engineering courses were presented in 1952. Most of the students who pursued these engineering courses were products of the technical institutes that were established to provide skilled training for individuals who wished to pursue an engineering profession in the country.

After the University was mandated to award its own degrees and certificates, new diploma and certificate courses were introduced to provide training for middle-level personnel who were needed for various industries in Ghana. In addition to providing education at the certificate and diploma levels, the University also served as the last resort for individuals who graduated from the various polytechnics and technical institutes. George (1974) points out that the changes that were made to the education system, especially in the engineering field, involved the creation of pre-technical programmes that included vocational and craft courses as well as general courses in engineering which were offered by vocational and technical institutions.

In June 2014, the University had five colleges, five institutes and thirty-five departments. One of the institutes is the Institute of Distance Learning that was established in 2005 to provide tertiary education to adult learners and workers who live in other regions and could not access education at the campus in Kumasi. The Institute provides administrative support to departments in the University including the Department of Electrical and Electronic Engineering that is responsible for the academic offerings to adult learners. This study was carried out at the IDL campus in Accra where the departments of Telecommunications and Electrical Engineering run programmes in Telecommunications and Electrical Engineering.

Telecommunications and Electrical Engineering programmes are offered at the college of engineering and the programmes are managed by the heads of department. Telecommunications Engineering is the name of the first programme used in this study and it leads to the award of Bachelor of Science in Telecommunications Engineering. Electrical/Electronic Engineering is the name of the second programme and it leads to the award of Bachelor of Science in Electrical/Electronic Engineering. The admission requirements for the programmes are as follows; West African Senior Secondary School Certificate (WASSCE) and mature applicants. The admission requirements for mature applicants are: Mature applicants should be 25 years and have credit passes in Five (5) GCE 'O Level subjects including English Language and Mathematics and should pass an entrance examination and /or Interview. Similarly, WASSCE or Senior Secondary School Certificate (SSSCE) holders must have an aggregate score of 24 or better in the relevant area of study. HND holders are required to have three (3) years relevant working experience and aggregate 24 or better at WASSCE/SSSCE or Five (5) GCE O' Level Credit passes including Mathematics and English Language.[25]

[25] Information on the electrical/electronic and Telecommunications engineering programmes were obtained from the University's website: www.knust.edu.gh

Table 5.2: Operationalisation of the research design in Case 1 - KNUST

RESEARCH QUESTIONS	RESPONDENTS	RESEARCH INSTRUMENT
How relevant are Telecommunications and Electrical Engineering programmes at KNUST to the needs of adult learners?	Adult learners, Heads of Academic Department and CEOs of business organisations.	Focus group discussion, interview and questionnaire.
What type of knowledge, skills and attitudes are required by adult learners in the Telecommunications and Electrical Engineering fields?	Heads of Academic Department and CEOs of business organisations.	Interview and questionnaire.
How can relevant curriculum in engineering serve as the basis for any intervention that is aimed at providing adult learners with the relevant knowledge and skills?	Heads of Academic Department and CEOs of business organisations.	Interview and questionnaire.
How are electrical and Telecommunications engineering programmes in KNUST presently structured to meet the needs of adult learners?	Adult learners, Heads of Academic Department and CEOs of business organisations.	Focus group discussion, Interview and questionnaire.
How can more relevant content and presentation in Telecommunications and electrical/Electrical Engineering for adult learners be developed?	Adult learners, Heads of Academic Department, Executive Secretary of NAB and NCTE and CEOs of business organisations.	Focus group discussion, Interview and questionnaire.

5.3.1.2 Case 2 – Regional Maritime University

The Regional Maritime University (RMU) – which was formally known as Ghana Nautical College – was established in 1958. The RMU presently occupies the premises of the former Ghana Nautical College, which was established in 1958 to train Naval Officers for the erstwhile State Shipping

Corporation (Black Star Line). On October 1, 1982, the Government of Ghana promulgated the Regional Maritime Law of 1982 which was followed by the signing of the instrument of transfer which saw the handing over the College to the then Ministerial Conference of West and Central African States on Maritime Transport (MINCONMAR). MINCONMAR was later renamed the Maritime Organisation of West and Central Africa (MOWCA) and it negotiated for the regionalisation of the Maritime College. The College was later re-named The Regional Maritime Academy (R.M.A.) and the formal inauguration of the R.M.A. took place on Thursday 26th May, 1983 with the Republics of Cameroon, The Gambia, Ghana, Liberia and Sierra Leone as member states.

The Regional Maritime University has developed into a multi-national university with students from countries such as Ethiopia, Gambia, Sierra Leone, Liberia, Togo, Nigeria Cameroon and Ghana and others. The university is an internationally accredited tertiary institution and became the 1st International maritime university in West and Central Africa on 25th October, 2007 when it attained its university status. It has also achieved the status of an ISO 9001-20000 certified status which was obtained in September 2007.

The governance structure of RMU is different from the traditional public and private universities in Ghana. The present governance structure consist of a Board of Governors that is the highest policy making body of the university and include Ministers of Transport from member states, the Secretary General of Maritime Organisation of West and Central Africa (MOWCA) and the Rector. The university is presently managed by the Rector as the Chief Executive who is responsible for the day-to-day activities of the university and manages of the University with a five- member team comprising of the Deputy Rector, the Director of Academic Affairs, the Director of Administration and Director of Finance. [26]

[26] Information on Regional Maritime University was obtained from the University's website: www.rmu.edu.gh

Table 5.3: Operationalisation of the research design in case 2: RMU

RESEARCH QUESTIONS	RESPONDENTS	RESEARCH INSTRUMENT
How relevant is the electrical programme at RMU to the needs of adult learners?	Adult learners, Heads of Academic Department and CEOs of business organisations.	Focus group discussion, interview and questionnaire.
What type of knowledge, skills and attitudes is required by adult learners in the Electrical Engineering fields?	Heads of Academic Department and CEOs of business organisations.	Interview and questionnaire.
How can relevant curriculum in engineering serve as the basis for any intervention that is aimed at providing adult learners with the relevant knowledge and skills?	Heads of Academic Department and CEOs of business organisations.	Interview and questionnaire.
How is the Electrical Engineering programme in RMU presently structured to meet the needs of adult learners?	Adult learners, Heads of Academic Department and CEOs of business organisations.	Focus group discussion, interview and questionnaire.
How can more relevant content and presentation in Electrical Engineering for adult learners be developed?	Adult learners, Heads of Academic Department, Executive Secretary of NAB and NCTE and CEOs of business organisations.	Focus group discussion, interview and questionnaire.

Programmes offered by the University are BSc Nautical Science, BSc Computer Engineering, BSc Ports and Shipping Administration, BSc Marine Electrical and Electronic Engineering, BSc Logistics Management and BSc Marine Engineering.

The Marine Electrical and Electronic Engineering programme is offered at the Faculty of Engineering Maritime University. The programme leads to the award of Bachelor of Science in Marine Electrical and Electronic Engineering. The admission criteria for the Marine Electrical and Electronic Engineering programme include the following; West Africa Senior Secondary School Certificate, General Certificate

of Examination (Ordinary and Advanced level), International Baccalaureate, Higher National Diploma, Advanced Technician Diploma in Electrical and Electronic or Telecommunications Engineering, City and Guilds, Technician Diploma in Electrical and Electronic Engineering programme, and mature applicants. The requirements for mature applicants are as follows; applicants must be at least 25 years old. Additionally, applicants are required to pass Mature Students' Entrance Examinations which shall be conducted by the University in (English Language, Mathematics and Aptitude Test).

5.3.1.3 Case 3 – Ghana Technology University College

Ghana Technology University College (GTUC) – which was originally known as Ghana Telecom Training Centre (GTTC) – was established in 1948 by the Post and Telecommunications Department of the then Gold Coast as a Telecommunications training school. The rationale for establishing the training centre was to instruct technicians and linesmen to install operate and maintain Telecommunications equipment and installations. Prior to 1948, the centre was used as a training ground for the British Royal Air Force during the Second World War. The centre was later handed over to Cable and Wireless to train Telecommunications technicians in areas such as civil aviation, the military, police, maritime industry, and meteorological services for the English speaking countries in West Africa.

The centre was upgraded in 1968 with the support of the International Telecommunications Union (ITU) which was engaged to train instructors of the centre in Course Development and Instructional Technology. During the same period, the first Electro-Mechanical Switch and the Microwave Training Unit of Philips NV of the Netherlands were installed for training purposes.

In 1989, the then GTTC again engaged the services of the ITU under an IDA loan agreement to upgrade the facilities at the centre and also develop the human resource capacities of staff. This move was aimed at meeting international standards in training through competency-based training (CBT) methods. During that period, multi-disciplinary training programmes such as Management, Finance, Marketing and Information Technology, Air-Condition, Energy System and Multimedia Studies were introduced to strengthen the existing programmes as well develop the competencies of students who were trained for various sectors of the economy. In line with modern trends, instructional methods such virtual classroom programmes and through the use of the internet were introduced.

The road to becoming a fully-fledged University commenced in July 1998 when the then Ghana Telecom in collaboration with the Multimedia University (MMU) of Malaysia introduced the Diploma Programme in Telecommunications Engineering (DTE) to meet the growing needs of industry and skilled technician

in the field. The programme was sustained for four (4) years and ended in August 2003. In 2002, Ghana Telecom signed a management contract with Telenor of Norway. The new management upgraded the infrastructure and equipment at GTTC in anticipation of upgrading the institution to a university. The Centre was named Ghana Telecom University College (GTUC) and obtained institutional accreditation in November 2005. It was inaugurated on August 15, 2006.[27]

The school of Engineering at the Ghana Technology University College (as is now called) runs two main undergraduate programmes: Telecommunications Engineering and Computer Engineering. Only the Telecommunications Engineering programme was included in this study. This programme leads to the award of Bachelor of Science in Telecommunications Engineering. Students who enrol in this programme include holders of Higher National Diploma, Advanced Technician Diploma in Electrical and Electronic or Telecommunications Engineering, International Baccalaureate, City and Guilds Technician Diploma in Electrical and Electronic Engineering programme, West African Senior Secondary School Certificate and mature applicants. The criteria for selecting mature applicants into the programme include the following: applicants must be 25 years at the time of submitting the application, they must have either five credits at the "O" Level including Mathematics, English Language, Physics and Chemistry OR WASSCE/SSSCE credits in three (3) Core Subjects (Mathematics, English Language and Integrated Science), plus credits in three (3) Elective Subjects (Mathematics, Physics and Chemistry).

[27] Information on Ghana Technology University College was obtained from the University's website: www.gtuc.edu.gh

Table 5.4: Operationalisation of the research design in case 3 - GTUC

RESEARCH QUESTIONS	RESPONDENTS	RESEARCH INSTRUMENT
How relevant is Telecommunications Electrical Engineering programme at GTUC to the needs of adult learners?	Adult learners, Heads of Academic Department and CEOs of business organisations.	Focus group discussion, interview and questionnaire.
What type of knowledge, skills and attitudes are required by adult learners in the Telecommunications engineering fields?	Heads of Academic Department and CEOs of business organisations.	Interview and questionnaire.
How can relevant curriculum in engineering serve as the basis for any intervention that is aimed at providing adult learners with the relevant knowledge and skills?	Heads of Academic Department and CEOs of business organisations.	Interview and questionnaire.
How is the Telecommunications engineering programme at GTUC presently structured to meet the needs of adult learners?	Adult learners, Heads of Academic Department and CEOs of business organisations.	Focus group discussion, interview and questionnaire.
How can more relevant content and presentation in Telecommunications engineering for adult learners be developed?	Adult learners, Heads of Academic Department, Executive Secretary of NAB and NCTE and CEOs of business organisations.	Focus group discussion, interview and questionnaire.

5.3.2 Population

Higher education in Ghana is characterised by a rapid increase in the number of universities especially those in the private sector. Presently, there are about sixty (60) universities and university colleges with

the break down as follows; nine (9) state-owned universities, one (1) regional university and fifty (50) private universities and university colleges. Of these, only 20% offer degree programmes in electrical and Telecommunications engineering. The researcher considered the size of the institution, number of students, type of programmes offered, mode of delivery and the type of institution (regional, public and private) in selecting the universities for this study.

According to Yin (2003), in multiple case designs, 'replication logic' is used instead of 'sampling logic' and these are developed from theories that form the basis of the study. Yin (2003) provides two logics underlying the use of multiple cases; first is that, they predict similar results and secondly, that they predict contrasting results but for predictable reasons. The replication logic provided me with the basis to identify the unique philosophies and structures of Telecommunications and Electrical Engineering programmes within the three universities. The research methodology, the population and sample connect with the data collection methods and after explaining the sampling procedures in the next paragraph the researcher will discuss the data collection processes used for the study.

5.3.3 Sampling plan

Two different sampling techniques were used in this study; the probability sampling technique and the non-probability sampling technique.

Probability sampling method creates an accurate representative sample that can also provide mathematically predictable errors and is often used in quantitative research (Neuman, 2005). Simple random sampling method was used to obtain respondents for the questionnaires and this was replicated in the three cases for the study. The rationale for using a simple random sampling method was to select only adult learners who entered the various institutions when they were aged 25 or above. Two hundred and fifty (250) questionnaires were distributed to adult learners from each of the departments in the three universities used in the study while the total number of questionnaires received and analysed were two hundred (200). The sampling logic used in arriving at the number of respondents was based on the researcher's prudence (Cohen et al, 2011) in ensuring that the list of adult learners received from each of the departments used for the study was representative of the total number of adult learners in level 300 and 400. This procedure however did not warrant the use of a mathematical formula in arriving at the sample size. Additionally, the error margins that the researcher considered as appropriate for sample size in the study was expressed in terms of the confidence level (see Chapter six and seven for further details).

Non-probability sampling procedure, specifically, purposive sampling was used as a means of selecting the most suitable respondents for the focus group discussion and interviews with the HODs of departments, industry representatives and an official each from a regulatory agency and the TUC. Merriam (1998) and Patton (2002) suggest that purposeful sampling is best used in qualitative research. According to Teddie and Yu (2007 cited in Cohen et al., 2011) purposive sampling could be used for several reasons in a research study namely; to achieve representativeness in a given population, to provide the basis for comparison, to perform an extensive investigation into a particular phenomenon and to develop theory. When sampling is done in an embedded multiple case study, the emphasis is on the uniqueness of a particular phenomenon being studied and how the investigator and respondents provide the necessary information that is aimed at reaching a meaningful conclusion. Purposive sampling was chosen for the interview schedule rather than random sampling because the study was not designed to allow for generalisation across different populations. In addition, the study was designed to exhaust the possibilities of using the data to confirm adult learning theories in the Telecommunications and Electrical Engineering disciplines in the three cases studied.

Purposive sampling was used to obtain the views of respondents in academic departments namely; the heads of Electrical Engineering and Telecommunications engineering at the Kwame Nkrumah University of Science and Technology, the head of department of Telecommunications engineering at Ghana Technology University College and the head of department of Electrical Engineering at the Regional Maritime University.

Purposive sampling was also used to obtain the views of respondents from industry, the National Accreditation Board and the Trades Union Congress. A representative each for the various organisations provided answers to the interview questions.

According to Cohen et al. (2011) purposive sampling rather than simple random sampling is used in qualitative research in order to access relevant information from individuals or groups who are identified as knowledgeable in a particular discipline. These knowledgeable individuals could be professionals in a particular field of study or experienced in a chosen discipline. Most of the Heads of Department interviewed in the study had worked in industry for many years and in addition had gained practical and theoretical knowledge in the Telecommunications or Electrical Engineering fields. The specific purposive sampling method used in this study was the reputational case sampling method which according to Teddie and Tashakkori (2009 cited in Cohen et al., 2011) the sample is chosen from an array of key informants

who may either be recommended by other people or may be chosen because of their exceptional knowledge in a particular field.

The second level of sampling used in the study was mainly to pick students for the focus group discussions and the completion of a structured questionnaire. Here convenience sampling was used based on the rationale that students were chosen on account of their availability and willingness to provide their views on the subject. Convenient sampling method was used in selecting nine (9) students from each of the departments in the three universities to participate in the focus group discussion and the total number of students used for the focal group discussion was 27. Additionally, two hundred and eighty (280) structured questionnaires were distributed to seventy students from each of the departments used in the study. Although the number of questionnaires distributed to respondents was seventy for each of the four departments, fifty (50) respondents each from the four departments completed the questionnaires.

Cohen et al. (2011) argue that convenience sampling, which is also known as accidental or opportunity sampling, involves selecting the nearest individuals who can serve as respondents in the study. Therefore the emphasis in the selection process is not on an individual's specialist knowledge of a phenomenon, but rather the availability of the respondent during the data gathering process.

The sample sizes of the different groups of participants were not based on a specific statistical formula, rather, it was based on the purpose of the study, the nature of the population being studied, the level of accuracy needed and the expected response rate. In addition to the factors provided above, the researcher also considered the number of students and heads of business organisations that could provide the needed information on the relevance to the needs of adult learners of the Telecommunications and Electrical Engineering programmes in the three universities chosen.

5.3.4 Data collection methods

The data collection process was developed to make use of multiple methods and triangulation which are considered as very important in coming to an understanding of the nature of programmes designed for adult learners in three diverse institutions in Ghana. The rationale for using multiple data collection method was to provide depth, accuracy and scope regarding information on the phenomenon and also gives corroborative evidence of the data obtained from the different instruments used (Meriam, 1998; Creswell, 1998; Scholz et al., 2002; Denzin et al., 2003; Yin, 2009; Korzilius, 2010; Chmiliar, 2010; Runeson, Host, Rainer & Regnell, 2012). The data instruments used in this study were; interviews, focus group discussion, document analysis and structured questionnaires.

The study collected the following data from the three universities: data on the curriculum structure, data on students' views on the relevance of their programmes to their job needs and the structure of their programmes data on the characteristics of student-respondents and data on the processes the universities go through to develop curriculum for adult learners.

The data collection process was planned and executed to find answers to each research question and sub-questions. This meant that the data were collected purposely to confirm if the existing teaching and learning structure, content and methods in the electrical and Telecommunications engineering programmes actually match the theories of adult learning as discussed in the literature review. The various data gathering techniques used in this work are discussed in the following sub-sections.

5.3.4.1 Interviewing

Interviewing is based on the concept of neutrality (Fontana & Frey, 2005) where the investigator seeks to obtain information about the perception or understating of respondents on a phenomenon. Interviews can explore broad areas within a social, cultural and political consensus and individuals' personal, private and special understanding (Arksey & Knight, 1999). Holstein and Gubrium (2005) argue that interviewing goes beyond asking of questions and receiving responses to the questions. The process should involve discussions that lead to the creation of understanding in the dialogue to provide meaning to the researcher.

LeCompte and Preissle (1993 cited in Cohen et al., 2011) identify six types of interviews namely; standardised interviews, in-depth interviews, ethnographic interviews, elite interviews, life history interviews and focus group interviews. Other types of interviews are; semi-structured interviews, explorative interviews, informal interviews, interview guide approaches, standardised open-ended interviews and closed quantitative interviews (Cohen et al., 2011). The researcher chose the structured interview type over the other forms of interviews because it provided standardised, institution-specific information regarding the development of courses in the electrical and Telecommunications engineering field and the personalised view of the interviewees. Additionally, the research ensured that the same basic questions were asked of all interviewees in the same categories. This was meant to create standardised questions that were relevant for obtaining the relevant information from the interviewees. The standardisation of the interview schedule was also meant to facilitate and compare the responses of the interviewees and reduce the likelihood of biases in interpreting the responses.

Cohen and Manion (2000 cited in Gray, 2009:370) state that interviews can be used in the following ways; "they are used as a means of gathering information about a person's knowledge, values, preferences and attitudes; they can be used to test a hypothesis or to identify variables and their relationships; they can be used in conjunction with other research techniques such as surveys"

In conducting the interviews this study, particularly with the Heads of Departments, a responsive approach was adopted in order to get closer to them so that all relevant information could be obtained. Also, in interviewing the managers at the various organisations, the researcher sought to identify with them as an administrator at the university who sought to promote the skills of employees by engaging them in discussions that could enhance the careers of their students.

According to Arksey and Knight (1999 cited in Gray, 2009:370), "interviewing is a powerful way of helping people to make explicit things that have hitherto been implicit – to articulate their tacit perceptions, feelings and understanding". In order to obtain detailed feedback from the participants the researcher chose for this study, interview took the form of face-to-face verbal interaction. In carrying out the interviews in this manner, the researcher was able to obtain relevant information that led to contextually based transcripts and results.

According to Nisbet and Watt (1984:82), interviewing is a basic research instrument in case study research. In structured interviews, where the questions are predetermined, the approach to reliability is similar to that of a questionnaire survey. Thus, when interviews are undertaken as part of a case study research, they may be semi-structured or unstructured; allowing each respondent to answer it his own way. It must be noted that it is more difficult to ensure reliability using unstructured or semi-structured interviews because of the deliberate strategy of treating each participant as a potentially unique respondent. The study provided structured interview schedules to the Heads of Department and CEOs in the industry organisations. In order to observe research ethics and confidentiality, letters of consent were written to all the research participants to assure them of the confidentiality of the information they provide in the data collection exercise (see details in Section 5.4). The letters also indicated the commitment of the researcher to abide by all regulations regarding data collection policies and procedures in the universities and organisations.

In order to strengthen the validity of the structured interview schedules, the study used the following procedures which is described by Arksey and Knight (1999:375) and Gray (2009) as relevant in conducting all types of interviews; the researcher developed a close rapport with the respondents and this

provided a convenient 'environment' that made them provide all the relevant information they needed to give; the researcher ensured that the questions asked were connected to the research objectives and the literature used for the research; intermittently, the researcher reminded respondents of the need to provide simple and clear answers to the questions and where it involved technical clarification, there were follow-up questions; the researcher kept the interviews within the agreed time of not more than forty minutes while ensuring that the various topics were thoroughly discussed. An interview guide was designed and used to conduct the interviews in other to focus on the research objectives and on the research questions.

5.3.4.2 Focus group discussion

Marshall and Rossman (2011) argue that the purpose of focus group discussion is to bring together people who share certain characteristics to provide information, share perceptions and describe their experiences and understanding of a particular phenomenon. Focus groups could be described as an inherently social phenomenon and it is useful especially in understanding the complex and dynamic social and cultural setting in which the group discussion is held (Hollander, 2004 cited in Stewart, Shamdasani & Rook, 2007). It is usually the responsibility of the interviewer in focus group discussion to create a supportive environment, encourage dialogue and the expression of divergent opinions and ask focused questions to stimulate critical thinking (Marshall et al., 2011:149).

Stewart et al. (2007) enumerate the advantages of focus group discussion as: the possibility of obtaining detailed information about the subject matter, simulating new ideas and creative concepts, diagnosing potential problems with a phenomenon and learning how respondents talk about a phenomenon. Marshall et al. (2011) state that the other advantages include; studying participants within a social setting (based on the assumption that attitudes, opinions and beliefs are socially constructed), and secondly, participants may rely on the opinions of others to make a better judgment of the issues. Participation is enhanced through a relaxed atmosphere that also supports social networks among participants.

Stewart et al. (2007) argue that features of a group in a focus group discussion should include;

i. group cohesiveness which shows the attraction to the group by a common purpose which is often driven by the interviewer. In order to achieve group cohesion among the individuals picked for the focus group discussion, discussants were informed that it was important for them to reach consensus on what they considered as answers to the questions they were provided. They were also informed of the essence of discussing the questions and thinking about them before presenting their answers.

ii. group compatibility and homogeneity is important when conducting focus group discussion. The study created the focus groups in all three cases based on the programmes of study of the participants. The researcher separated students studying Telecommunications engineering from students studying electrical and electronic engineering.

iii. social power as used by the interviewer has an influence on the respondents. The researcher controlled the focus group discussion and informed the participants that their views were important in the research because what I required was a consensus of opinion and views on issues concerning their programmes.

The researcher conducted the focus group discussion in all three cases selected, namely; the Kwame Nkrumah University of Science and Technology, Ghana Technology University College and the Regional Maritime University. In all the cases chosen for the study, three groups consisting of three students in each group (9 students per programme) contributed to the discussions. Participants who were chosen for the focus group discussion were either in their third year or final year of studies. The discussions with each group were held at different times. Conducting focus group discussions at different periods with different sets of respondents provides the interviewer with the opportunity to identify trends in the perceptions and opinions expressed; these are revealed through systematic and careful analysis (Krueger & Casey, 2008 cited in Marshall et al., 2011:149). The researcher also ensured that the participants focused on the topic without introducing topics that were not in the focus group schedule and this done by following the interview guide discussed in section 5.3.5 above. As part of the ethical consideration in undertaking the study all participants in the focus group discussion were informed that the session would be recorded and used for the purpose of this research.

The recruitment of participants for the focus group discussion in all three cases was done with the consent of the heads of department of the Telecommunications and electrical/engineering Departments. The researcher requested the names and telephone numbers of third and final year students who were willing to participate in the study from the learning centers and department. Follow-up calls were made on phone and three students from each of the departments in the cases were made to participate in the study. The date and time for the discussions were communicated to them. Discussants were also informed of the duration of the discussion, which was one hour.

Although focus group discussion has several benefits, there are challenges such as lack of independent opinion by each group member and the likely provision of cues by the interviewer during the discussion (Stewart et al., 2007) which could influence the responses. The researcher reduced the possibility of

providing cues by informing the participants that he did not have detailed information and knowledge of the programme they were pursuing and in addition, that the only support they could receive was seek clarification on questions they had difficulty providing answers.

5.3.4.3 Questionnaire

Questionnaires were used as a data collection method to enhance triangulation in this study and also to corroborate the research findings. Although the questionnaire is described as a purely quantitative instrument (Wilson & McLean, 1994), it has been argued that it can be very useful when used in qualitative study such as case study (Sturman, 1997 cited in Cohen et al., 2011; Chmiliar, 2010). According to Wilson et al. (1994) a questionnaire is suitable for collecting survey information and structured data and is usually easy to administer.

The general purpose of using questionnaire in this study was to obtain the views of adult learners on the relevance of their programmes to their job needs. The questionnaire was thus designed to get the views of many adult learners in order to obtain a wider opinion of the respondents on the subject. The specific objective of the questionnaire was to obtain the views of respondents about the teaching and learning processes in the universities with particular emphasis on the course content, the mode of course delivery, the resources available to enhance teaching and learning and the structure of the courses to meet the needs of industry. Questionnaires were administered to only adult learners in all the three cases used. Self-administered questionnaires were completed, not in the presence of the researcher. The rationale for using the self-administered questionnaire was to allow the respondents to provide their answers without being influenced by the researcher. The challenge in using this form of questionnaire administration was that the researcher could not clarify any issues that arose during the process of answering the questions.

5.3.4.4 Document gathering

Data from a variety of documents provided rich information on the phenomenon. The researcher used data from the three institutions that served as cases namely; the Kwame Nkrumah University of Science and Technology, Ghana Technology University College and Regional Maritime Institute. The researcher also used data gathered from the National Council on Tertiary Education on enrolment statistics in the various institutions and the number of adult learners in the institutions. Data from the Ministry of Education, Ghana gave more information about government involvement in the development of human capital from the colonial to the post-colonial era. In selecting documents for the data collection process the researcher considered the following forms of documents (Nieuwenhuis, 2012); official documents that are very essential to this study as well as data that are approved by HEIs as credible; recent publication

from the institutions; empirical data that are collected from the field; data that was prepared specifically for advancing the cause of adult learners in the Telecommunications and Electrical Engineering fields; the relevance of the information in the document to the study and the connection between the research methodology and document as a data collection tool.

Reliability is a major advantage of content analysis of documents (Cohen & Manion, 1994; Robson, 1994). Robson (1994) however, recommends that two people should be involved in coding text to improve reliability. In the case of this research, the researcher was the only individual involved in the document analysis.

5.3.5 Data analysis methods

Quantitative and qualitative data analysis was used for analysing data sets gathered from the cases studied. One advantage of embedded multiple case study is that it provides the grounds for analysing complex quantitative data at the different sub-units (units of analysis) and discussing them with the qualitative data obtained (Scholz et al., 2002; Korzilius, 2010; Runeson et al., 2012). It is important to note that when using embedded multiple case study design, the goal is not to advance statistical generalisation but rather analytical generalisation which supports results within a broader theory (Scholz et al., 2002; Runeson et al., 2012). Case selection is focused on achieving a reflection of the diversity of the phenomena in a population.

Quantitative data analysis for this study was done using statistical software; statitica. First, was to establish the interrelationship among the variables used in the study and second was to conduct an analysis of variance to examine the differences in the means of the four groups of respondents from three diverse universities.

Analysis was first conducted using Pearson's correlation coefficient to establish statistically significant relationships among respondents' perceived relevance of the Telecommunications and Electrical Engineering programmes and their impact on adult learners (ROPAK), their core knowledge in engineering (CKE), their motivation for self-directed learning (MOTIV), connection between their course content and job (COS N JOB) and the teaching and learning methods (TLM).

The objective of qualitative data analysis was to find patterns, concepts, insights, emerging themes, theories and understanding of a phenomenon (Patton, 2002). Analysis of qualitative data in this study

was based on an inductive approach and analytical framework which involved the development of patterns, themes, categories and codes that were derived from the data gathered. Znaniecki (1934, cited by Cohen et al., 2011) calls the process used to describe data analysis in qualitative study (as distinct from the quantitative approach) as analytic induction. Qualitative analysis is often not deductive because the data categories and themes are often not predetermined or imposed by the researcher but rather derived from the data sets that are collected from the field of study. The procedure for analysing the data collected is discussed in the following paragraphs.

5.3.5.1 Procedure used in organising data for analysis

The process of organising and presenting quantitative and qualitative data is considered as very important in qualitative research and it is often regarded as salient to providing interpretation of a phenomenon under study. Cohen et al. (2011) suggests seven ways of organising and presenting data in a study namely; presentation by people, group, issue, theme, instrument, narrative account and case study. While the different methods of data organisation and analysis have their own strengths and weaknesses, the researcher used three main methods namely; the embedded multiple case study (arranged according to three diverse cases, CEOs and regulatory bodies), the research questions and the instrument (drawn from the interview schedule and focus group discussion, questionnaires and documents).

The reasons for combining the three methods of data organisation and analysis were;

i. to draw relevant information from a data pool in order to present an issue that seems very important to the outcome of the study.
ii. to preserve the coherence of the data sets and develop relevant codes, themes and concepts from the data pool.
iii. to present the responses provided by the respondents based on the instruments used (interviews, focus group discussion, questionnaires and documents) and the themes.
iv. to identify specific issues regarding adult learners and the structure of their programmes across three diverse universities in Ghana. The features of the various cases were also drawn and analysed for better interpretation.
v. to identify common themes, issues and concepts through selective means in the three diverse universities and provide explanations for these.

The above items (i-v) provide the basis for selecting three main methods for organising and analysing the data collected. It also served to present the data collected in a more systematic way which allows for better understanding of the issues, themes and concepts while ensuring that the analysis presented is coherent and shows the type of instrument used in deriving the needed information.

5.3.5.2 Content analysis

Content analysis is defined as a systematic approach to qualitative data analysis that focuses primarily on summarising data sets in the form of message content (Nieuwenhuis, 2012:101). It involves the process of selecting key words and texts from a data set with the view of identifying specific words that are either similar or different in the cases being studied and identifying what issues are relevant to the phenomenon. Flicks (1998 cited in Cohen et al., 2011:563) posits that content analysis is a "research technique used for making replicable and valid inferences from texts to the content of their use". The concept of using a research technique in another setting within a particular study frame could also be termed as 'replication logic' (which is described in Figure 5.1 and used in the three diverse cases of this study).

Content analysis in this study was used procedurally, first, by identifying the units of analysis which were adult learners in three diverse universities studying electrical and Telecommunications engineering, heads of departments, and CEOs of selected organisations in the Telecommunications and energy fields. After defining the units of analysis, categories were then formed based on text reviews. This made it easy for key words to emerge from which codes and categories developed. The following steps in content analysis, developed by Flick (2009 cited in Cohen et al., 2011:564), were followed in the analysis of data for the study;

i. breaking down texts from the datasets into units of analysis
ii. identifying the units of analysis
iii. determining what and how datasets will be paraphrased
iv. paraphrasing key texts of the data sets
v. undertaking data reduction and deletion by identifying what texts and issues are relevant to be developed into codes
vi. developing the categories from the codes through the use of texts and statements that can be further reduced into identifiable unit
vii. matching the themes with the underlying theories of adult learning and curriculum design for adult learners.

5.3.5.3 Preliminary inspection of the data

Preliminary inspection of the data was done with the help of research assistants. The processes involved outlining, summarising and mapping the data collection process with the analysis conducted and identifying how the data collection process affected the data analysis. Cohen et al. (2011) suggests that preliminary note taking provides the researcher with additional thought patterns that allow for reflexivity,

ideas comments, mapping, and insights that support data analysis and also serve as secondary data. Preliminary inspection of the data as used in this study was meant to identify how the research questions were addressed in the data collection and the analysis processes, and reduce the volume of data to be analysed by concentrating only on those aspects that directly support the enquiry especially in the focus group discussion where some comments were not directly related to the subject matter. According to Miles et al. (1994) the data analysis process includes; data reduction, data display and drawing conclusion on the data collected and analysed.

During the data analysis stage pattern matching was undertaken in order to align the data collected to the theoretical prepositions. The process of pattern matching is often carried out by merging two patterns; one which is drawn through theoretical analysis and the other through observed patterns that are fielded as codes. This was done by identifying the concept maps derived from the theories of adult learning and comparing them to the correlation matrix that was derived from the observed phenomenon in all three universities,. The main items sought in the analysis were; existing correlation among the various categories (observed phenomenon and theories of adult learning) and validating the theories of adult learning reviewed in the study.

5.3.5.4 Pre-coding

Pre-coding techniques involve descriptive coding, attribute coding, in vivo coding, value coding and process coding. Descriptive coding was used to identify the variables used in the empirical study namely; relevance of Telecommunications and Electrical Engineering programmes to the needs of adult learners; core knowledge in engineering; programme planning and motivation for self-directed learning; teaching and learning methods; the connection between the courses offered by education providers and their relevance to work of adult learners and employability skills development.

In vivo coding was used to analyse the views of CEOs of industries who were interviewed on their expectation of HEIs to design relevant programmes for their employees who are enrolled in the programmes. The expectations of the HEIs to deliver relevant content to students in their institutions as expressed by the HODs were also coded and the specific technical terms used in the analysis of the data.

5.3.5.5 Coding

Saldana (2013) describes a code as a sentence, phrase or word that represents aspects, specific portions or the entirety of the data that are collected through interviews, documents observations and field notes. Coding involves a systematic process of arranging, categorising or classifying data analysed and interpreted to better understand a phenomenon. Kerlinger (1970 cited in Cohen et al., 2011) identifies

coding as the translation of question responses and information from respondents into specific categories, themes and theories for the purpose of analysis. Coding is necessary for reducing volumes of data that are gathered into smaller identifiable units, for providing deeper understanding of a phenomenon, developing theories, and developing constructs through categories (theoretical, qualitative and subjective means) themes and concepts (Cohen et al., 2011; Saldana, 2013).

The researcher employed the open coding method rather than analytical, axial or selective coding because in addition to generating categories, open coding also defines the properties and dimensions of a particular phenomenon and can be filtered and reused during data analysis.

Coding of the data gathered from the respondents and documents was done by labelling the ideas emanating from the data collected from the three universities and the CEOs of selected organisations. The ideas were labelled, linked and connected to the initial questions asked; this served to provide a 'heuristic ground' for analysing the data sets. Several strands developed from the codes and these were categorised for further use in a cyclical approach that could be referred to as filtering. The main ideas from the data were represented by the first strand of codes, this was then followed by another process of extracting sub-ideas from the main data sets to obtain the second strand of codes. Depending on the nature of the question and the input of the respondents, the researcher developed additional strands of codes to obtain the needed information for the analysis which was mainly centred around the learning theories used in the theoretical framework, the existing method of teaching and learning among adults pursuing electrical and Telecommunications engineering in the three universities, the views of employers on the skills required of employees compared to what is provided by HEIs and the views of HODs.

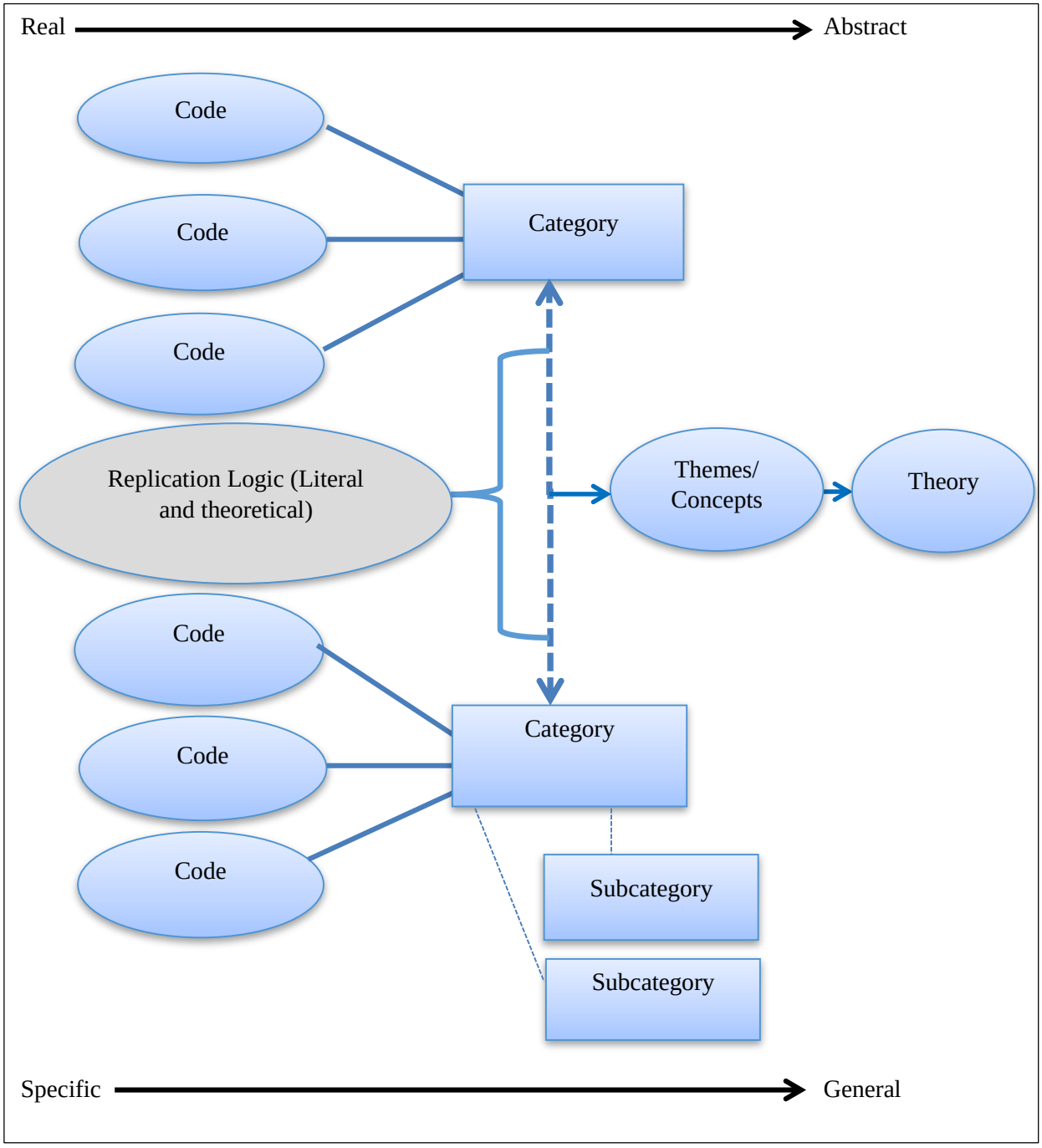

Figure 5.2: The coding process.

Source: Adapted from Saldana (2013)

Figure 5.2 shows the scheme that was used in coding the data sets gathered from the three cases and the CEOs of selected business organisations. The process started with the development of codes, then categories and sub-categories, themes and concepts and finally, the confirmation of theories used in the theoretical framework.

Categories were developed from words or phrases that were picked from the codes derived from the datasets. Cohen et al. (2011) suggest that categories are the main groupings of texts (codes), which show the relationship between the different units of analysis in a study. The unit of analysis as used in developing categories in this study were; data from adult learners, HODs, industry representatives and representatives of a regulatory agency and TUC. The categories were then developed into themes which were also matched with the theories used in the study.

5.3.6 Research validity

Validity defines how instruments used in a research study measure specifically what they are supposed to measure or that a phenomenon is accurately represented by the features intended to explain, demonstrate or theorise that phenomenon (Winter, 2001 cited in Cohen et al., 2011).

According to Bush (2005:65) validity is used as a tool to judge "whether the research actually describes the phenomenon" which it intended to describe. Challenges for validity in qualitative research include; the natural setting which is the principal source of data, data socially situated and socially and culturally saturated, the researcher is an active part of the process, the use of descriptive data, emphasis on process rather than outcome, data is analysed deductively and the importance of respondent validation (Lincoln et al., 1985 cited in Cohen et al., 2011).

Factors that enhance validity in qualitative research include developing instruments with honesty, openness, and respect for participants' background (religious, academic experience, social and cultural), richness of the data sets used, triangulation of the research processes and the researcher's objectivity (Winter, 2001 cited in Cohen et al., 2011). The validity of this study was strengthened by avoiding bias in interpreting the respondents' opinions in the interview sessions and focus group discussions, and by the structured questionnaire schedules. Other features of case study design that were considered in enhancing validity of this study included the deployment of instruments (focus group discussion, interview session and questionnaire) in a natural setting, its uniqueness as a study focusing on adult learners studying electrical and Telecommunications engineering programmes and the reliance on qualitative descriptions of respondents' opinions. The following types of validity as described by

Maxwell (1992) were used to ensure that the instruments actually measured what they were intended to measure;

5.3.6.1 Construct or theoretical validity

Construct or theoretical validity relates to the veracity of an operational measure in research. Cohen et al. (2011) argue that theoretical validity requires accurate explanation of events or a phenomenon being studied, and that respondents are informed to describe those events or phenomenon as accurately as possible. Theoretical validity also provides cues on the extent to which a set of instruments used in a study conforms to the theoretical background in which the study is positioned. This study maintained construct validity by ensuring that the use of multiple sources of evidence such as the views of employers, heads of academic departments and students provided and established a chain of evidence. Construct validity was also strengthened by checking the veracity of the information provided by participants; this was done by requesting participants to review the draft of the analysed data which also showed the codes, categories and themes drawn from the data collected.

5.3.6.2 Internal validity

Internal validity explains whether there is a valid causal relationship between different conditions or variables that is distinguished from specious relationships. Internal validity is usually ensured by means of pattern development, explanation building, addressing rival explanations and using logical models. Internal validity in this study was used to check the extent to which the data sets from the focus group discussion, the interview session and the questionnaire provided the relevant information on adult learners and the programmes they study in the three universities. The main concern here was to establish whether each question posed to respondents provided the appropriate feedback which could persuade the researcher of the accuracy, truth, consistency, dependability, neutrality and consistency of his findings when compared to the actual phenomenon.

Lincoln and Guba (1985, cited in Cohen et al. 2011) argue that the following are necessary considerations to strengthen the internal validity in a research study; extended engagement in the field, continuous observation in the field, triangulation, using non-experts to give unbiased opinions on a phenomenon, and member checking of the data sets to avoid errors and authenticate the veracity of the analysis done. In order to ensure the veracity of the data and the interpretation given, the study was checked against the following threats which according to Onwugbuzie and Leech (2006 cited in Cohen et al, 2011) could affect the internal validity of a research; ironic legitimation, paralogical legitimation, rhizomatic

legitimation, voluptuous legitimation, descriptive validity, observational and researcher bias, reactivity, confirmation bias and illusory confirmation, causal error and effect size (see Table 5.5).

Table 5.5: Internal validity and procedures used to minimise the threat in the study

Type of threat to internal Validity	**Description of the threat**	**Procedure used to either minimise or avoid the threat in this study**
Observational bias	Observational bias arises from inadequate selection of words, observation and behaviours in a study.	The research instruments were designed with the use of simple language which was easy to understand. The research assistants were also trained on how to ask questions and obtain feedback from respondents.
Researcher bias	Researcher bias is often described as the tendency to prejudice the outcome of a research or to determine the result of a study by influencing the response.	The instruments used in the study were designed and reviewed to check against any bias.
Ironic legitimation	Ironic legitimation shows how far the research describes different realities and interprets them without providing contradictory report and information.	The interview session and the focus group discussions were designed to provide responses that represented the opinion of respondents without changing the meaning of what they said. The different instruments used were also analysed separately without distorting their information provided.

Paralogical legitimation	Paralogical legitimation seeks to prevent paradoxes in the research by identifying all such contradictions either in the instrument or in the data analysis.	The study was designed to make room for the removal of all contradictory opinion either provided by respondents or those that were seen during the data analysis. Such paradoxes were not reported in the analysis and findings of the study. This was especially identified during the focus group discussion where the respondents provided contradictory information regarding their opinion on the relevance of their programmes to their job needs.
Rhizomatic legitimation	Rhizomatic legitimation protects data sets against loses during the analysis stage.	The codes categories and themes developed from the data were analysed based on the type of instruments used in collecting data.
Voluptuous legitimation	Voluptuous legitimation tends to protect data sets from wrongful interpretation by the researcher. The main idea under this type of threat is that the researcher is prone to providing his or her own interpretation of the data sets as exactly as they are because of either the volume of the data or weakness of the data sets.	The data analysis was carried out solely with the use of the information provided by the respondents. The researcher did not attempt to provide interpretations that were not supported by the data collected.

Descriptive validity	Descriptive validity shows how accurate the information provided by the researcher is. The assumption underlying descriptive validity is that the interpretation of the data sets should reflect exactly what was provided by the respondents.	The information provided by the respondents were recorded, transcribed and analysed without changing the content and meaning. Data from the focus group discussion, interview session and the questionnaire were interpreted based on the responses provided by the respondents.
Reactivity	Reactivity shows how far the research changes the phenomenon under study or the respondents in the study.	All respondents (adult learners, HODs of the academic departments and CEOs of the business entities used) were informed to provide information based on their understanding of the relevance of the electrical and Telecommunications engineering programmes of the HEIs.
Confirmation bias	Confirmation bias arises when the findings of research does not confirm what the research was intended to establish.	Although hypotheses were not developed for the study, the study objectives served as the sign post throughout the study and emphasis were placed on answering the research questions accurately.

Illusory confirmation	Illusory confirmation occurs where the researcher attempts to draw conclusions of identify relationships that do not actually exist in the study.	The findings of this study were based solely on the analysis of the responses of respondents as derived from the data sets and compared to the guiding theories (constructivist approach to learning, experiential learning, andragogy, self-directed learning and transformative learning).
Causal error	Causal error arises when researchers attempt to infer causal relationships in a particular study when in fact, they do not exist.	The study did not focus on establishing causal relationships.
Effect size	Effect size describes the process of taking numerical figures and providing qualitative interpretations to such figures. This is often done to enrich the data analysis.	The researcher used effect size in interpreting some of the data sets and this was mostly done during analysis of the questionnaires distributed to adult learners in the three universities.

Source: adapted from Onwuegbuzie et al. (2006, cited in Cohen et al., 2011)

5.3.6.3 Interpretive validity

Interpretive validity provides the researcher with the needed information that makes meaning, interprets a particular phenomenon, terms and intentions of respondents. In this study, the interpretive validity was checked during the focus group discussion with the students and the interview sessions with the heads of academic department in the universities and CEOs of the organisations chosen for the study.

5.3.7 Reliability of research

The concept of reliability provides that if a research study is carried out in a defined setting and repeated in another setting within the same context using the same category of respondents and time, then the results should be similar. Reliability has been described as an alternative expression for consistency, dependability, credibility and replicability of the data collection process, instruments used and the respondents used in a particular study (Cohen et al. 2011). In order to promote the reliability of the instruments used for the study, a preliminary interview and focus group discussion were conducted to ensure that the instruments measured exactly what they were intended to measure.

Case study is a type of enquiry that uses multiple sources of evidence and different methods of data collection (Johnson 1994); this could enhance but also complicate reliability. A case study usually investigates a contemporary phenomenon within its real life context when the boundaries between the phenomenon and contexts are not clearly evident. Bush (2005) suggests that the main data collection instruments in case study are interviews, observation and document analysis and these processes should be consistent, dependable and replicable. According to Yin (1994:146), the purpose of reliability is to ensure that investigators follow the same procedures set for a particular case, even if they are conducted repeatedly. The goal of reliability therefore is to minimise possible errors and biases in a particular study.

Although replicability has been argued to be associated with quantitative research (Guba et al., 1994), it is very important in qualitative research, and particularly in case study, to maintain similar data collection methods in the different cases. The researcher ensured that the various data collection methods used was replicated. Reliability of this research was considered by the use of the same instruments in all the three universities and respondents chosen for the study were from the same category of persons and adult learners. Reliability was also maintained during the data analysis stage and this was done by using study protocols and developing a database for the study.

5.3.8 Issues of credibility and trustworthiness

Credibility and trustworthiness of data sets and the entire research process is very important because this provides the basis for the acceptance and integrity of the outcome of the research. According to Nieuwenhuis (2012:80) multiple methods of data collection such as; observation, focus group discussions, interviews and document analysis enhance the trustworthiness of a study. To ensure that the instruments chosen in investigating the relevance of electrical and Telecommunications engineering to the needs of adult learners in Ghana actually measured what they were intended to measure, the researcher

undertook a preliminary data collection exercise to test the instruments. Detailed discussions on the elements that were considered very important for building credibility and trustworthiness in the research in the following sub-section.

5.3.9 Triangulation

According to Stake (2005:454) "triangulation has been considered as a process of using multiple perceptions to clarify meaning, verifying the repeatability of an observation or interpretation". Triangulation is considered a traditional means of strengthening the validity and reliability of data sets and research (Nieuwenhuis, 2012:80). Bush (2005) however, defines triangulation as the process of comparing many sources of evidence in order to establish the accuracy of phenomena. The basic object of triangulation is cross-checking data to establish its validity.

Cohen et al. (1994, 2011) argue that triangulation could be seen as the use of two or more data collection sets in a study involving human behaviour. They argue that triangulation could be seen in two ways; first by using several methods to explore the same issue (methodological triangulation), and secondly, asking the same question to different participants or respondents (respondent triangulation). In order to ensure that the data sets and research process have stronger validity and reliability, I used four key data collection methods and sources namely; observation, focus group discussion interviews and document analysis (methodological triangulation). I also involved different groups of respondents namely students, heads of departments, and employers (respondent triangulation).

Denzin (1970, cited in Cohen et al., 2011) distinguishes six types of triangulation namely; time triangulation, space triangulation, combined levels of triangulation, investigator triangulation, methodological triangulation and theoretical triangulation. This study employed investigator triangulation, theoretical triangulation and methodological triangulation. Investigator triangulation was used in all three data collection methods namely; the focus group discussion, the interview session and the questionnaires. Some questions in the interview session for the HODs and CEOs were also used in the focus group discussion and the questionnaire for adult learners. This was meant to check the divergent opinion among the different respondents and also to check the similarities in answers to some of the questions.

Theoretical triangulation was used in the analysis of respondents' opinions on the different types of learning which were from different schools of thought namely, transformative learning, self-directed learning, andragogy and experiential learning. The last type of triangulation used was methodological

triangulation and specifically within-method triangulation which was used to replicate the method of data collection among different groups (adult learners in three different universities, CEOs of business organisations and HODs of academic departments in three different universities) and among the same groups (adult learners in focus group discussions and adult learners who participated in interview session). The object of using within-case methodological triangulation was first, to check the reliability of the data sets and secondly, to confirm the theories of adult learning used in the design of adult learners programme in Telecommunications and Electrical Engineering.

5.3.10 Crystallisation

The process of crystallisation ensures that researchers search and obtain deep understanding of the phenomenon that is investigated which the quantitative method of interrogation may not be able to bring about (Nieuwenhuis, 2012:81). The basis for distinguishing between triangulation and crystallisation is the fact that triangulation involves the investigation of fixed objects with defined instruments and the data sets are compared to each other (Richardson, 2000 cited in Nieuwenhuis, 2012:81) while crystallisation identifies the multiplicity of realities that needs to be looked into.

This study employed a number of different data collection methods, including survey, interviews, critical incident reports, and a focus group interview all intended to investigate the multiplicities of actualities relating to the relevance of HE curricula to the needs of adult learners in the Telecommunications and Electrical Engineering fields. By this approach, a high level of data triangulation was achieved in this research study.

5.4 ETHICAL CONSIDERATIONS

In order to conduct the research within local and international standards, the researcher adhered to the ethical guidelines set for research students by the Department of Curriculum Studies of Stellenbosch University and those set by the institutions where study was conducted. The researcher also observed the ethical rules set by the American Anthropological Association which has been accepted by many institutions all over the world. In line with the rules of the Departmental Ethics Screening Committee, the researcher obtained institutional consent and ethical clearance to enable him to conduct research in the HEIs and business organisations.

The American Anthropological Association prescribes in its ethical principles, seven ‘rules’ that should be followed by researchers. These rules are; do no harm, be open and honest regarding your work, obtain informed consent and necessary permissions, weigh competing ethical obligations due to collaborators

and affected parties, make your results accessible, protect and preserve your records and finally, maintain respectful and ethical professional relationships (AAA, 2012). The researcher ensured that the research process satisfied these internationally accepted principles as outlined by the American Anthropological Association.

The second measure the researcher took in ensuring the ethics of the research process and the integrity of the study was to contact all respondents and participants in the research for their consent to participate in the research and provide all necessary information regarding the study. The researcher also obtained permission from the universities before conducting the focus group discussions, which was one of the data collection methods. In addition to receiving the consent of all respondents and participants in the study, respondents and participants in this study were provided with an informed consent form to sign. Also in line with the ethical considerations, the will of prospective participants who refused to be interviewed or respond to the questionnaire were respected.

The third ethical standard the researcher observed in the research was to adopt an open and honest approach. The researcher made sure that all the necessary information needed by the respondents was made available to them. In distributing the data collection instruments, the researcher informed respondents that all the information they provided would be kept confidential, and in addition, their names and addresses would not be entered in the research database. The researcher also ensured that information used for the research that were obtained from different sources such as books, journals and internet publications were properly referenced.

Another ethical standard that was observed in this study was to make all the data and findings of the research open to all interested individuals and organisations who intend to use the information for other purposes or make reference to any portion therein.

The information and data which were used for this study have been saved on an electronic device and safely stored. The researcher also stated in the consent letters to participants and respondents that the information that was provided by the respondents would be safely and confidentially kept.

Finally, the researcher maintained a professional relationship with all participants in the research no financial benefits or any other form of gains accrued from this study.

5.5 CONCLUSION

Chapter five identified the various procedures used in undertaking the research. The research paradigm, the research design, data collection techniques, data analysis techniques, validity and reliability of the data sets and the ethical consideration in conducting the research were extensively discussed. Key to the study was collecting data on the curricula of the electrical and Telecommunications engineering programmes, students' perception of the relevance of the existing programmes to their career needs, the views of the Heads of Departments on the considerations made in designing the curricula of the engineering programmes and the expectations of employers on the existing programmes in the universities. Methods used to collect data and methods of analysing the datasets were also discussed.

Chapter six which is the next chapter discusses the analysis of the data collected and the techniques and software used in analysing the data.

CHAPTER SIX

DATA ANALYSIS AND DISCUSSION

6.1 INTRODUCTION

This chapter presents the analysis of the different units of observation drawn from three diverse cases. The views of adult students, heads of department, industry representatives, regulatory agency and the Trades Union Congress in the development and promotion of adult learning practices in HEIs are discussed in this chapter.

The rationale for adopting an embedded multiple case study was to obtain emerging themes, insights, patterns, concepts, theories and understanding of the relevance of adult learning programmes in higher education institutions in Ghana. Using an inductive approach and analytical framework which involved codes, patterns, themes categories and concepts that were derived from the data gathered from the research field, this chapter connects the research questions and study objectives to the theories discussed in Chapter three. The data sets analysed in this chapter are; focus group discussions in all three cases, interviews with heads of department at the HEIs and CEOs or their representatives from industry, interviews with the Deputy Executive Secretary of the National Accreditation Board and the Deputy General Secretary of the Trades Union Congress of Ghana and survey of 200 adult learners in three universities chosen for the study. This chapter concludes by showing the relationship between the five key variables used in the study and the impact of these variables in the development of relevant programmes for adult learners pursuing Telecommunications and Electrical Engineering programmes in Ghana.

This chapter provides detailed information on the three cases used for the study and the researcher will discuss each of the case studies, using a similar structure. Additionally, comparison of the three cases will be done in Chapter seven.

6.2 Structure of questionnaire for adult learners

The structure of the questionnaire for adult learners as explained in this section applies to all the three cases analysed in this chapter. The information provided in this section refers to the processes used in deriving relevant feedback from adult learners in all the three cases used in the study. The questionnaire was made up of a total of 30 questions. Nineteen questions required respondents to provide their responses

on a 5-point likert scale, where 5 represented 'strongly agree' and 1 represented 'strongly disagree'. The remaining 11 questions were open-ended questions requiring respondents to provide their own narrative responses. The questionnaire was divided into six sections as shown in table 6.1. Section A recorded demographic information on respondents; section B recorded information on respondents' core knowledge in engineering; section C recorded information on respondents' views on the relevance of the programme and its impact on knowledge; section D recorded information on respondents' motivation for self-directed learning; section E recorded information on the relationship between course content and job while section F recorded respondents' opinion on the teaching and learning methods[28] (see addendum C for further details on the questionnaire items).

The questionnaire was divided into six sections. Table 6.1 below depicts the various sections.

Table 6.1: Structure of questionnaire and output of Cronbach's alpha

SECTION	CAPTURED DATA	CRONBACH'S ALPHA
A	Demographic information on respondents.	-
B	Information on respondents' core knowledge in engineering.	α=0.81
C	Information on respondents' views on the relevance of the programme and its impact on the knowledge of adult learners.	α=0.89
D	Recorded information on respondents' motivation for self-directed learning.	α=0.89
E	Information on the relationship between programme content and job	α=0.82
F	Respondents' opinion on the teaching and learning methods	α=0.77

[28]Information regarding the constructs and variables used in the questionnaire as presented is the same as those used for the other cases. The information here is not repeated in the discussion of the other cases.

Prior to the computation of the correlation analysis, a reliability analysis was conducted on the constructs. Cronbach's alpha (measuring reliability of the constructs in the variable) showed a high level of internal consistency for items in the programme relevance domain (section C) as well as the programme planning and motivation domain (section D), with α=0.89 for both domains. The course and job domain (section E) also showed a high internal consistency of α=0.82, followed by the core knowledge in engineering domain (section B) where α=0.81, while the teaching and learning domain recorded the lowest internal consistency of α=0.77.[29]

6.3 CASE 1- KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

This section discusses the survey data and the focus group discussions gathered from electrical and Telecommunications engineering students of Kwame Nkrumah University of Science and Technology. Additionally, the views of the HOD regarding the relevance of Telecommunications and electrical and Telecommunications engineering programmes are discussed at the end of the section. The rationale for providing the results of the survey first was to establish relationship between the different variables used in the study and then find out how they were discussed by the discussants in the focus group discussion.

6.3.1 Survey results of adult learners studying Electrical Engineering

The respondents were level 300 and 400 students studying Electrical Engineering at the Institute for Distance Learning Centre (Accra Campus) of Kwame Nkrumah University of Science and Technology. The total number of respondents was 50.

6.3.1.1 Demographic data

Demographic data obtained from the respondents are presented in Table 6.2 below:

[29]Analysis for internal consistency of the constructs was computed for all 200 respondents from the three cases used for the study.

Table 6.2 Demographic data of KNUST EE respondents

Level	Age	Gender	pre – qualification	work experience	Funding
Level 300 - 15	26 yrs. – 9	Male - 48	Diploma – 37	1year – 4	PS – 6
Level 400 - 35	36 yrs. - 30	Female - 2	WASSCE – 2	4years – 12	SF – 43
	46 yrs. - 10		Tech Cert – 11	8years -21	GL – 0
	56 yrs. – 1			13years – 6	PFFE – 1
				18 years – 6	SLWP – 0
				21 years – 1	

1. Age – yrs. describes the average age of respondents in a ten-year range category
2. Pre-qualification – WASSCE is the West African Senior Secondary Certificate Examinations/ TECH CERT is Technical Certificate
3. Funding – PS is Parental Support/ SF is Self-Financing/ GL is Government Loan/ PFFE is Partial Funding from Employers/SLWP is Study Leave with Pay

Table 6.2 show the demographic data of the respondents. The minimum age for admission of mature students into HEIs in Ghana is 25 years. Respondents were requested to provide their ages as part of the information gathered for analysis. The number of respondents who were aged 36 to 45 was 60% and these categories of respondents were the highest age group of respondents who responded to the questionnaire. Adult learners who were aged 46 to 55 represented 20% of the total number of respondents and this group was second highest number of respondents in the age analysis. The percentage of respondents who were aged between 26 and 35 was 18% while 2% of total respondents was 56 years of age. What the age distribution provides is that respondents who were aged 36-45 and also working were the highest number of respondents in the survey for the EE programme. Respondents who were males were 96% while 4% were females. Although the study did not place much emphasis on sex as a determinant of students' satisfaction with the Telecommunications and Electrical Engineering programmes in the university the number of females were very low.

The work experience domain shows the number of years that respondents had worked in industry. The percentage of respondents who indicated that they had worked in industry for 8 years was 42% while respondents who indicated that they had worked in industry for 4 years constituted 24% of the total

number of adult learners. Respondents who indicated that they had worked in industry for 13 and 18 years represented 12% each of the total number of respondents. The number of respondents who indicated that they had worked in industry for 1 year was 8% while 1 respondent representing 2% indicated that he had worked in industry for 21 years. The number of adult learners who indicated that they had worked in the engineering industry for 8 years was the largest among the respondents and this showed that adult learners pursuing the EE programme at the KNUST had industry experience before gaining admission into the programme.

The questionnaire required respondents to provide information on the type of funding for their education. The responses from the respondents showed that 86% revealed that they were self-financing their education while 12% indicated that they received support from their parents to pay for their education. One respondent representing 2% of the number of respondent indicated that she had partial funding from her employers. The distribution show that majority of the respondents were responsible for paying their fees while only 1 respondent stated that he/she received partial funding from an employer.

Regarding the pre-qualifications of the respondents, 74% indicated that they entered the university with Diploma, while 22% of respondents indicated that they entered the university with technical certificates 2(4%) respondents stated that they entered the university with WASSCE.

6.3.1.2 Relationship between variables

Correlation in research describes the relationship between variables in a study. The Pearson product moment correlation as used in this chapter explains interval and ratio data as derived from the questionnaire feedback from adult learners in three diverse universities in Ghana. Cohen et al. (2011:632) argue that correlation techniques basically answer questions about: the relationship between two variables; the direction of the relationship and the magnitude of the relationship. The R-value demonstrates the strength of the association, and the p-value shows whether the association is statistically significant.

Pearson's correlation coefficient were computed to find out whether statistically significant relationships exist among respondents' perceived relevance of the EE programme and its impact on adult learners (ROPAK), their core knowledge in engineering (CKE), motivation for self-directed learning (MOTIV), connection between their course content and job (COS N JOB) and the teaching and learning methods (TLM). Table 6.3 below shows the correlation coefficient of the five interrelationships among the

variables. Significant correlations are indicated with asterisks. Details of the correlation between the variables and the interpretation of the figures are presented after the table.

Table 6.3: Pearson's correlation coefficient matrix for observed variables

VARIABLE	CKE	ROPAK	MOTIV	COS N JOB	TLM
CKE	1.000				
ROPAK	.528***	1.000			
MOTIV	.3654**	.244	1.000		
COS N JOB	.6771***	.5651***	.204	1.000	
TLM	.6218***	.3539**	.179	.6404**	1.000

n=50, *P<.05, **P<.01, ***P<.001

CKE – Core knowledge in Engineering
ROPAK-Relevance of the programme to the needs of adult learners
MOTIV-Motivation for self-directed learning
COS N JOB-Relationship between the courses and their job
TLM- Teaching and learning methods

Respondents' appreciation of core knowledge in EE and their understanding of the connection between the courses and their job showed a high statistically significant relationship (r =.68, p = 0.001). The correlation suggests that respondents who were of the opinion that they were able to connect the courses taught to their jobs also perceived their core knowledge in EE as adequate. Forty-six percent (R^2=0.46) of the variance in the perception of respondents' appreciation of core knowledge in EE could be explained as their ability to connect what they learn to the jobs they do. Discussants in the focus group discussion provided detailed information on the relationship between the core knowledge they had obtained in engineering and how it connects with the work they do.

Secondly, respondents' understanding of the connection between the courses and their job and the teaching and learning methods used showed a statistically significant relationship (r =.64, p = 0.001), meaning that respondents who indicated either high or low levels of course-job connection also indicated high or low levels of appreciation of teaching and learning methods used. Additionally, 41% (R^2=.41) of the variance in the respondents' understanding of the connection between the courses and their job and the teaching and learning methods used could be explained.

Thirdly, a statistically significant relationship was found between respondents' perceived appreciation of core knowledge in EE and their motivation to engage in self-directed learning (r =0.37, p = 0.01). This correlation suggests that respondents who were satisfied with the core or specialist knowledge in their programmes were motivated to advance self-directed learning. This explains only 14% (R^2=0.14) of the variance. The focus group discussion presents additional information on specific factors adult learners consider as setbacks in their programme.

A statistically significant relationship was found between respondents' appreciation of core knowledge in EE and the teaching and learning methods used (r = 0.62, p = 0.001), meaning that respondents who indicated either high or low levels of programme relevance to their needs also indicated high or low levels of satisfaction with teaching and learning methods used.38% (R^2=0.38) of the variance in the respondents' appreciation of core knowledge in EE and the teaching and learning methods used could be explained. The discussants in the focus group discussion provided detailed information on the teaching and learning methods and also how it impacts on the programme.

Respondents' perception of the relevance of the EE programme and their understanding of the connection between the courses and their job showed a statistically significant relationship (r =.57, p =0.001). The correlation suggests that respondents who were of the opinion that they were able to connect the courses taught to their jobs also perceived the relevance of the EE programme as good. 32% (R^2=0.32) of the variance in the respondent's perception of the relevance of the EE programme could be explained as their ability to connect the courses they learn to the jobs they do.

A statistically significant relationship was found between respondents' perception of the relevance of the EE programme and the specialist knowledge required (r=0.53, p = 0.001), meaning that respondents who indicated high levels of programme relevance to their needs were also satisfied with the core knowledge in engineering they obtained from the programnme. Twenty-eight per cent (R^2=0.28) of the variance in respondents' agreement on the relevance of the EE programme to their needs was accounted for by their perception of adequate core knowledge in engineering obtained. The focus group discussion presents detailed information on the views of the adult learners and attempts to provide explanation to the 72% variance that could not be explained by the responses.

Sixth, a statistically significant relationship was observed between respondents' perception of the relevance of the EE programme to their needs and the teaching and learning methods used (r =.35, p = 0.01). This correlation suggests that respondents who were satisfied with the teaching and learning

methods used also perceived the relevance of the EE programme to their needs as satisfactory. Only 12% (R^2=0.12) of the variance could be explained. The correlation at this level is limited and the explanation of the variances may not be significant. The focus group discussion provides detailed information on adult learners' views on the variables.

Although a positive correlation was found between respondents' perception of the relevance of the EE programme and their motivation for self-directed learning (r =.24, p>0.05), the relationship was not statistically significant at p = 0.88. Similarly, although a positive correlation was found between respondents' understanding of the connection between the courses and their jobs and their motivation for self-directed learning (r =.20, p>0.05), the relationship was not statistically significant at p = 0.16. A positive correlation was found between the teaching and learning methods used and their motivation for self-directed learning (r =.17, p>0.05), but the relationship was not statistically significant at p =0.21. Detailed explanation of the variables and the factors that influence the perception of adult learners are provided in the focus group discussion.

6.3.2 Analysis of focus group discussions with Electrical Engineering adult learners

This section covers information gathered from the same group of KNUST adult learners studying Electrical Engineering. The students were organised into three groups for the focus group discussion. The items on the focus group schedule were organised into five sections or categories that were based on theoretical propositions (Yin 2009) relating to; work processes with core knowledge and skills expectation from the programme; relevance of the EE programme and its impact on adult learners; programme planning and motivation for self-directed learning; teaching and learning methods and employability indicators. The three (3) focus groups were given codes for easy identification; Group 1 – G1, Group 2 – G2 and Group 3 – G3. Additionally, the groups discussed the questions and arrived at a consensus response, which was then recorded as the group response and this explains why there is only one response per group.

6.3.2.1 Provision of core knowledge in engineering

The development of relevant curriculum is very important because this provides the foundation for the learners' knowledge and skills advancement (Hillier, 2002; Hunt et al., 2013; Angelo, 2013).

The first item for discussion in this category sought to determine what additional content or knowledge the adult learners considered as important, but not present in the course offering they had. G1 stated that "*we consider what is presently taught as relevant",* while G2 answered that *"every course taught here is*

important". G3 indicated that they could not suggest any additional content or knowledge they considered as important but not present in the course outline provided. Adult learners often enter HEIs with deep knowledge of work processes which is gathered through several years of experience, and they are therefore frequently able to suggest additional courses that could enhance their knowledge and skills on the job.G2 and G3 described their course content as either relevant or important, thus identifying the value of the course offerings. The responses of the discussants are also explained by the high correlation recorded by questionnaire responses that showed that their core knowledge in EE was influenced by their ability to relate their courses to the jobs they do (r =.68, p = 0.001).

The discussants provided additional information to the first item. G2 indicated that "e*very course taught is relevant to our daily activities"* while the other groups posited that "*all the courses taught here are relevant"*. The answers provided by the discussants showed that adult learners pursuing electrical and electronic engineering programmes in Case 1 agreed that the courses offered by the University were not lacking in any area and not considered **'outmoded'**.

What courses/content would you add to the existing ones (providing justifications for the additions) was the third question put to the three groups. While G1 and G2 indicated that they could not prescribe additional courses to the present courses offered, G3 indicated that "*we consider automation and control systems as very important courses for practical work"*.G3 suggested that *automation and control systems if introduced to their course offerings would help them on their jobs*. The response of G1 and G2 suggested that most adult learners were content with the courses offered by the University.

The fourth item for discussion sought to find out from the discussants how the additional courses they provided in their response to item 3 could enhance their performance on the job. G3 which indicated that they would prefer to add automation and control systems stated that *"most of the work we do requires automation and control systems so it will be very relevant to have those courses in our curriculum"*. G1added that automation and control systems are required in electrical and electronic engineering especially in this modern era when most machines operate on automated systems.

Following on item 3, the fifth question that the groups were asked related to new technologies, tools, laboratory equipment or simulators the institution would require to implement the proposed additions to the course. According to the literature, practical field sessions and e/laboratory exercises provide adult engineering students with hands-on experience, opportunity to test principles and theories of the discipline and stimulate innovation (Davies, 2008; Case, 2008; Dickens et al., 2009; Boev et al., 2013).

In response to question 5, G1 indicated that *"this depends on the specific area we work (in). Some of our colleagues work in the power sector while others are in the automation area. Our laboratories should have the different tools for the various sectors".*

Although most of the adult learners come from different backgrounds, meeting their knowledge and skills needs is very important when developing their curriculum. When curriculum is developed to suit the needs of learners and provide them with relevant knowledge and skills, then it would have achieved its goal of changing the aims and practices of education (Joseph, 2011; Slattery, 2012; Angelo, 2013).

6.3.2.2 Relevance of the EE programme and its impact on adult learners

Adult learners often identify knowledge and skills needs which they anticipate HEIs would help them meet and develop. These knowledge and skills which are referred to as signature pedagogies (Shulman, 2005 cited in Hunt et al., 2013) are important for adult learners because they are expected to demonstrate certain competences after obtaining their certificates.

The first question in the next section that the discussants were asked, was, does the present curriculum provide opportunities to further develop your skills needed for careers? Curriculum could be seen as the outcome of a process that is aimed at providing the learner with essential skills, indispensable knowledge and values (Kanuka, 2011; Amadio et al., 2014) that are needed for self-development and achieving group goals. G1, G2 and G3 stated that the current curriculum does provide opportunities for them to develop the skills needed for their individual careers. G2 added that *….and we consider that as very important to our learning".* Although the curricula of HEIs must provide the requisite knowledge and skills required of students, there could be precincts because not all relevant knowledge and experiences needed could be found in one block of curricula (Kanuka, 2011).

The object of the second question was for the discussants to relate their work processes to the course offering. G2 indicated "*Matlab and control theory"* while G3 stated that Matlab[30] was one of the relevant job skills they have been introduced to in the programme. The third group indicated that "*the introduction of Siemens PLC[31] in our course work has given us new ideas for our work processes*". Practically, the adult learning process involves the organisation of mental structures that is very important in the

[30]Matlab (Matric Laboratory) is a programming language that can easily interact with other programming tools such as C++, Java Technologies and FORTRAN and is able to handle Matrix and Algorithm operations.
[31] Siemens PLC is a course that introduces students to Supervisory Control and Data Acquisition (SCADA) systems which is able to control remote installations and equipment through coded signal over communication channels.

development of the adult learners' cognitive abilities. Connecting theory and work is one the advantages adult learners have. This means that they are able to develop mind maps while lectures take place and their responses confirm that they easily relate their skills needs to the course content and delivery.

The third item for discussion was, are adult learners encouraged to take up placement in other organisations aside their own workplace? All groups responded in the negative but gave different reasons for their responses. G1 responded: "*We are all workers and most of us are not on study leave so we have enrolled on this course on our own".* G2 stated that *"we rather embark on field trips and site visitation"*, while G3 noted that, "*We have only Saturdays and Sundays for our course and that makes it very difficult to have time for attachments"*. Although industrial attachment are often designed to provide students with practical work experience, the scheduling of such activities, according to the discussants, did not make this practicable. Field trips and site visitations are often arranged for engineering students by the University, and the students indicated that those excursions were beneficial because they introduced them to different work environments and new technology.

How work experience contributes to skills development while adult learners are on the programme was the fourth item for discussion. The experiences of adult learners often serve as building blocks for them when they enrol in HEIs (Hill, 2014). The object of transformative learning is to transform problematic frames of reference (mindset, habit of mind and meaning perspectives) into more inclusive, open and reflective ones (Mezirow, 2009:92) that are able to adjust to changing environments. Additionally, Quinnan (1997) suggests that identifying individual experience, helping the learner to develop critical reflection, developing dialogue within the learning environment, making learners aware of the context and encouraging positive relationships between learners and the facilitator are essential to the learning process of adults. G1 stated that, *"we are able to discuss our work processes and share ideas. Most of the theories connect to the work processes so we are able to discuss them with our facilitators"*, whereas G2 indicated that, *"we are able to connect what we do at our work place with the theories we learn in class"*. G3 noted that, *"we consider it as a blend of our experiences and theory but there is always some differences in the way we perceive things. But we are able to understand the theories better because we are on the field"*. The responses from the discussants show that experiences and knowledge are shared; secondly, that the process of developing knowledge through experiences involves connection with relevant theories, and thirdly, that individuals develop their own frames of reference with guidance by facilitators. These expressed views of the discussants are corroborated by the data gathered from the questionnaire with a relatively high correlation between the relevance of their programme and how it relates to their work (r =.57, p = 0.001).

The fifth question discussed by the adult learners was, how often do you complete a skills matrix to show the areas in which you would require support from your lecturers? Not one of the groups indicated that they completed a skills matrix. G1 noted that, *"there is no skills matrix for us to complete. We pay our own fees"*. G2 stated that, "*we pay for our education so we do not receive skills matrix from our employers*". G3 wrote that, "*we do not complete skills matrix*". The responses from the discussants suggested that skills matrix was not used to support the development of adult learners and to evaluate their learning processes. The answers provided by the discussants mirrors the weak correlation between students' perception of the relevance of their programme and its impact on their needs and their motivation to advance self-directed learning ($r = 0.24$, $p>0.05$).

Whether they consider their experience as important in the teaching and learning process was the sixth item for discussion. The object of the sixth question was to find out from adult learners how they perceived their experiences as complementary to the teaching and learning processes in the University. All the groups noted that they considered their experience as very important in the teaching and learning process. G2 stated that, "*yes our experiences really support our classroom activities*". The responses of the discussants showed that adult learners who work in different engineering firms were able to make significant inputs in the learning process, thus creating a knowledge sharing environment where the facilitator also benefits from the interaction.

6.3.2.3 Programme planning and motivation for self-directed learning

Programmes in HEIs mostly represent the detailed processes and practices which students need to follow to acquire requisite knowledge, skills and attitudes that culminate in certification. The design of engineering programme should consist of key elements such as; learning outcomes, learning objectives, teaching activities, learning activities, learning resources, feedback activities, assessment tasks and grading standards (Angelo, 2013; Thijs et al., 2009).

The first item in this section discussed by the groups was the extent to which they were involved in the planning of their programme.G1 stated that they are not involved in programme planning. *"We came to meet the course as it is and we know that they have been designed by the experts who are the subject lecturers (KNUST and IDL)*". G2 also noted a lack of involvement in programme planning. "*We only enrol and follow the structure of the programme*". G3 said "*No. We only register to take courses at the beginning of the semester. Due to our tight schedule we do not have the time to change the schedule*".

A follow-up question was; to what extent do you contribute to scheduling of lectures for each course and the duration of the lecture sessions? Similarly all three groups indicated that they are not involved in the scheduling of lectures. Although adult learners cannot plan the content of their course, the facilitator can negotiate the timing of assignments, devise varied learning activities to improve skills and knowledge, pay attention to seating arrangement in class, form learning groups and other components that rely greatly on the experiences of the adult learners. Fasokun et al. (2005:53) consider these arrangement and re-arrangement as conditioning among adult learners. The responses from the discussants showed that planning of teaching and learning processes within the classroom environment are not negotiated as the constructivist approach to learning suggests. Additionally, the adult learners considered the teaching and learning arrangement as one that was not negotiable or amendable because they attended lectures twice every week which was on Saturdays and Sundays. Similarly the ability of adult learners to negotiate the teaching and learning processes is informed by the scheduling of courses which provides information on lecture session and the courses to be taken. However, other considerations such as seating arrangement, providing groups for assignments and presentations and the timing of assignments could be done.

The second item for discussion in this section was the role adult learners believed employers should play in the design of the curriculum. The development of curriculum is usually influenced by the cooperative efforts of groups, which consist of institutions, policy makers, teachers, professional associations, industry and students (Carl, 2012). Santoro (2000), and Santoro and Gopalakrishnan (2000) argue that the relationship between industry and universities could be seen as a two-way communication where industry could make use of the knowledge and research skills of universities, while universities could obtain research funding from industry.G1 stated that "*we suggest that faculty should allow industry experts to develop the courses based on modern systems and expectations*". G2 said, *"employers should team up with faculty to provide us with relevant skills for industry*", while G3 indicated that "*employers should work with KNUST to develop content that easily connects with what we do differently in our area of specialisation*". The keynotes from the views of the discussants were; modern engineering practices require that industry and HEIs collaborate and develop programme content that is relevant to industry needs; collaboration between HEIs and industry enhances the knowledge and skills of students, and thirdly, the diverse skills and knowledge needs in the area of electrical and electronic engineering can be met through collaboration between HEIs and industry. Additionally, students could use the very sophisticated emerging technologies, which cannot be procured by the universities for their laboratories.

The third task for the discussants was to list the resources and support they required as adult learners to enable them to successfully complete their programme of study. Learning resources are made up of time,

laboratory equipment, lecture halls, lecture schedule, staffing, libraries, internet connectivity, learning management system, assessment procedures and structure, and students' support services. Learning resources help adult learners to develop their core competences (Dickens et al., 2009), while they provide facilitators with relevant quality tools and materials needed to equip adult learners (Kahn, 2006; Rogers, 2001 cited in Bell et al., 2013). G1 stated that they considered "*library, internet connectivity, laboratory and avenues for practical work activities"* as the relevant resources needed to successfully complete their programme of study. G2 did not list particular resources but said that, "*we are okay with the resources and it is important to note that this facility is only rented by KNUST and when we are ready to move to the new campus we should have the laboratories and the library ready for use*". G3 stated that, they considered "*Library and Laboratory at the Accra Campus (rather than transporting them to Kumasi for the laboratory sessions)*" as essential. The views of the discussants suggest that library, internet connectivity, laboratory and avenues for practical work activities were the important resources they consider relevant to successfully complete their programmes of study.

6.3.2.4 Teaching and learning methods

The process of teaching and learning should result in the acquisition of knowledge by learners which could be either tacit or codified (Young, 2011), specialized or differentiated (Young, 2013), theoretical or practical (Shay, 2013). The types of knowledge to be required by learners are often considered when designing the curriculum. The first question in this section was: do the learning activities for each course show the various types of activities you are required to do individually or in groups to develop your thinking abilities and also meet your personal learning goals? The question sought to glean from the discussants their knowledge of the various activities they were expected to perform in each of the courses they were taking. G1 and G3 said: "*Yes the learning goals including the expected activities for each of the courses were clearly spelt out at the commencement of each course"*. G2 agreed that "*The learning activities are clearly defined and they show what we are expected to know at each time*". The submissions from the discussants suggest that they could easily identify the learning goals of each course and they could also understand the learning activities expected of them. The discussants were provided a table with some learning resources. They were also asked to select the resources they considered relevant to achieving their learning goals. The resources selected by each of the groups are presented below:

Table 6.4: Relevant resources needed for the programme

Response of discussants in Group 1	Response of discussants in Group 2	Response of discussants in Group 3
- Availability of internet connectivity. - Flexibility of choosing courses to suit your busy schedule. - Lecturers' use of project assignments and other applied assessment modules. - Availability of physical space and flexible timetable. - Availability of laboratory equipment and consistent laboratory work. - Simulation exercises and work conferences.	- Availability of internet connectivity. - Flexibility of choosing courses to suit your busy schedule. - Lecturers' use of project assignments and other applied assessment modules. - Availability of physical space and flexible timetable. - Availability of laboratory equipment and consistent laboratory work. - Simulation exercises and work conferences.	- Availability of internet connectivity. - Flexibility of choosing courses to suit your busy schedule. - Lecturers' use of project assignments and other applied assessment modules. - Availability of physical space and flexible timetable. - Availability of laboratory equipment and consistent laboratory work. - Simulation exercises and work conferences.

The choice of resources identified by the various groups as shown in Table 6.4 above describes what they posited as necessary for achieving their learning goals. The concept of adult learning based on the humanist perspective suggests that the planning and actualization of teaching and learning must focus on developing the potential of the person through a learner-centred approach (Tennant et al., 1995; Fasokun et al., 2005; Savicevic, 2008). The constructivist theory suggests that instructional procedures, teaching and learning rules and procedures for constructing learning environments should be flexible (Anthony, 1996) to enable adult learners cope with the work challenges. Similarly, creating a flexible mode of teaching and learning requires that learners should be able to contribute significantly to their learning activities (Anthony, 1996; Sackney et al., 2007).

The third item that was discussed by the groups was, are the course contents structured to challenge you to develop your analytical skills, independent study and application of key concepts to your professional roles? All three groups indicated that *the course contents were structured in a flexible way which could help them combine work and study*. When teaching and learning processes are flexible, adult learners are able to effectively combine work and studying while meeting their social obligations. Similarly, the views

of the respondents corroborates the assertion by Clouston (2005) that facilitation which is the best way to organize teaching and learning processes among adult learners should be; a process of synthesis including shared learning, conducive learning atmosphere, enhance student learning environment, person-centred, a means of developing critical thinking among students and collaborative.

How often do you share your professional experiences in class, was the third item discussed by the groups. This was meant to gather evidence on knowledge sharing among adult learners (Beard and Wilson, 2005). G1 stated that "*when we meet as a group to do an assignment*", in other words they do share professional knowledge. G2 indicated that "*we always share our experiences with our colleagues*" while G3 stated that "*we always do that during one to one interaction and during course assignments"*.

Teaching and learning processes in HEIs cannot be complete without laid-down processes for reporting the performance of students in either formative or summative assignments and tests. The rationale for assessment could be grouped into three main domains; they measure and certify the learning processes of students, they develop students' knowledge in designing their own learning and assessment patterns and finally, they help students in their learning processes (Sambell, 2011). Additionally, feedback activities, assessment tasks and grading standards are essential elements of curriculum design in HEIs (Thijs et al., 2009; Angelo, 2013). The fourth and fifth questions, which the discussants were asked was, how do you receive feedback from your lecturers? and, how does the feedback help you to improve on your learning activities and take the necessary measures to develop relevant proficiency in specific areas marked for improvement? G1 stated that, "*through verbal means when we meet with faculty….the feedback gives us information on what we need to improve on and what we have done*".G2 stated that; "*through interaction in class and assignment submission…..Through our interaction with our lecturers, we are able to know what was expected of us and also make the necessary adjustments*".G3 was of the opinion that they receive feedback "*through interaction in class…..It helps us develop our skills by comparing what we provided and what was expected of us by the lecturer*". The responses from the discussants suggest that feedback was often provided by facilitators through verbal means and usually through interactive sessions; that the feedback provided learners with information on areas marked for improvement and further task requirement and lastly, that the feedback allowed for some reflection based on expected output from the task and the actual output of the adult learner.

6.3.2.5 Employability indicators

Employability skills or generic attributes (Barrie, 2004) refer to those sets of soft skills that allow a learner to enter the world of work without much difficulty. Thus, many HEIs tend to develop graduate attributes

in generic terms in order to shape the learning structure of a programme through a set of learning outcomes (Stefani, 2009:41). The discussants were provided with a table with a list of employability indicators to select those they considered as relevant to their jobs. The discussants selected the following; Research and inquiry, Information literacy, Personal and intellectual autonomy, Ethical, social and professional understanding and Communication skills.

6.3.3 Survey results of adult learners studying Telecommunications Engineering

Fifty level 300 and 400 students studying Telecommunications Engineering at the IDL centre at the Accra City Campus of KNUST participated in the survey. This section presents an analysis of the responses from adult learners in Telecommunications Engineering who completed the questionnaire and discussants who volunteered to be in the focus group discussion.

6.3.3.1 Demographic data

Demographic data obtained from the respondents are reported in Table 6.5below:

Table 6.5: Demographic data of KNUST - TE respondents

Level	Age	Gender	pre – qualification	work experience	Funding
Level 300 - 21	26 yrs. - 22	Male - 48	DIPLOMA – 42	2years -6	PS - 5
Level 400 - 29	36 yrs. - 13	Female - 2	WASSCE – 2	4years - 19	SF - 34
	46 yrs. - 15		TECH CERT – 6	8years -16	GL - 3
	56 yrs. - 0			13years - 5	PFFE - 3
				18 years - 4	SLWP - 5
				21 years - 0	

1. Age – yrs. describes the average age of respondents in a ten-year range category
2. Pre-qualification – WASSCE is the West African Senior Secondary Certificate Examinations/ TECH CERT is Technical Certificate
3. Funding – PS is Parental Support/ SF is Self-Financing/ GL is Government Loan/ PFFE is Partial Funding from Employers/SLWP is Study Leave with Pay

Table 6.5 shows the demographic data of the respondents. The average age of 44% of respondents was 26 while the average age of 30% of respondents were aged between 46 and 55. The average age of 26% of the total number of respondents was 36. What the statistics meant was that the ages of 44% of the total number of respondents was less than 30 and most of these respondents also gained admission into the

university after completing their Higher National Diploma Programmes from the Polytechnics. Most respondents were male (96%) while 2(4%) were females.

The work experience domain shows the number of years that respondents had worked in industry. The data analysed revealed that 38% of respondents stated that they had worked in industry for 4 years while 32% of respondents noted that they had worked in industry for 8 years. 12% of respondents indicated that they had worked in industry for 2 years while 10% of respondents indicated that they had worked in industry for 13 years. The number of respondents who indicated that they had worked in the industry for 18 years was 8%. The statistics show that the number of respondents who had worked in industry for 2-3years was the highest and this also explains why respondents who were aged between 25 and 30 were the highest number of respondents in the survey.

The questionnaire required respondents to provide information on the type of funding for their education. The figures obtained from the field data showed that 68% of respondents were self-financing their education at the university while 10% of the respondents also noted that they had support from their parents. Similarly 10% of the respondents also indicated that they had secured study leave with pay from their employers while 6% of the respondents indicated that they had partial funding from their employers. The number of respondents who indicated that they received funding for their education through government loans was 3 and this represented 6% of the total number of respondents. The statistics show that majority of the respondents were paying their fees.

Regarding the pre-qualifications of the respondents, 84% indicated that they entered the university with a diploma while 12% of the respondents indicated that they entered with technical certificates. The number of respondents who stated that they entered the university with WASSCE represented 4% of the total number of respondents. What the statistics on the entry qualification means is that most of the respondents were adult learners who had completed polytechnic education.

6.3.3.2 Relationship between variables

Pearson's correlation coefficient were computed to find statistically significant relationships among respondents' perceived relevance of the TE programme and its impact on adult learners, the core knowledge in engineering, motivation for self-directed learning, course content and job and the teaching and learning methods. Table 6.6 below shows the correlation coefficient of the five interrelationships among the variables.

Table 6.6: Pearson's correlation coefficient matrix for observed variables

VARIABLE	CKE	ROPAK	MOTIV	COS N JOB	TLM
CKE	1.000				
ROPAK	0.5663***	1.000			
MOTIV	0.6788***	0.654***	1.000		
COS N JOB	0.4967***	0.8259***	0.6439***	1.000	
TLM	0.5754***	0.6163***	0.625***	0.7532***	1.000

n=50, *P<.05, **P<.01, ***P<.001

CKE – Core Knowledge in Engineering

ROPAK-Relevance of the programme to the needs of adult learners

MOTIV-Motivation for self-directed learning

COS N JOB-Relationship between the courses and their job

TLM- Teaching and learning methods

Respondents' perception of the relevance of the TE programme and their understanding of the connection between the courses and their jobs showed a statistically significant and strong relationship (r =.83, p = 0.001). The correlation suggests that respondents who were of the opinion that they were able to connect the courses taught to their jobs also perceived the relevance of the TE programme as very good. The percentage of variance 69% (R^2=0.69) in the respondent's perception of the relevance of the TE programme could be explained as their ability to connect the courses they learn to the jobs they do.

A strong relationship which was also statistically significant was found between respondents' understanding of the connection between the courses and their job and the teaching and learning methods used (r =.75, p = 0.001), meaning that respondents who indicated either high or low levels of course-job connection also indicated high or low levels of teaching and learning methods used. Approximately 56% (R^2=0.56) of the variance in the respondents' understanding of the connection between the courses and their job and the teaching and learning methods used could be explained.

A statistically significant relationship was found between respondents' perceived appreciation of core knowledge in TE and their motivation to advance self-directed learning (r =.68, p = 0.001). This correlation suggests that respondents who were satisfied with the core or specialist knowledge in the field were motivated to advance self-directed learning; this explains 46% (R^2=0.46) of the variance.

Adult learners' perception of the relevance of the TE programme and their motivation for self-directed learning showed a statistically significant relationship (r =.65, p = 0.001). The correlation indicates that respondents who were of the opinion that they were motivated to advance self-directed learning also perceived the relevance of the TE programme as good. About 42% (R^2=0.42) of the variance in the respondent's perception of the relevance of the Telecommunications Engineering programme could be explained as their ability to advance self-directed learning.

Respondents' understanding of the connection between the courses and their job and their motivation for self-directed learning revealed a statistically significant relationship (r =.64, p = 0.001), meaning that respondents who indicated either high or low levels of course-job connection also indicated high or low levels of motivation for self-directed learning. A little over 41% (R=0.41) of the variance in the respondents' explanation of their understanding of the connection between the courses and their job and their motivation for self-directed learning could be explained.

Adult learners' perception of their motivation for self-directed learning and the teaching and learning methods used showed a statistically significant relationship (r =.63, p = 0.001). The correlation suggests that respondents who were of the opinion that they were able to advance self-directed learning also perceived the teaching and methods as good. Nearly 40% (R^2=0.40) of the variance in the respondent's perception of their motivation for self-advanced learning could be explained as their appreciation of the teaching and learning processes.

A statistically significant relationship was also found between respondents' perception of the relevance of the TE programme to their needs and the teaching and learning methods used (r =.62, p = 0.001). This correlation suggests that respondents who were satisfied with the teaching and learning methods used also perceived the relevance of the TE programme to their needs as satisfactory and this explains only 38% (R^2=0.38) of the variance.

A statistically significant relationship was found between respondents' appreciation of core knowledge in TE and the teaching and learning methods used (r =.58, p = 0.001), meaning that respondents who indicated either high or low levels of programme relevance to their needs also indicated high or low levels of teaching and learning methods used. About 25% (R^2=0.25) of the variance in the respondents' appreciation of core knowledge in Telecommunications Engineering and the teaching and learning methods used could be explained.

A statistically significant relationship was found between respondents' perception of the relevance of the TE programme and the specialist knowledge required (r =.57, p = 0.001), meaning that respondents who indicated high levels of programme relevance to their needs were also satisfied with the core knowledge in engineering provided by the programme. Table 6.5 show that 32% (R^2=0.32) of the variance in the perception of respondents' approval of the relevance of the TE programme to their needs was accounted for by their perception of adequate core knowledge in engineering obtained.

Respondents' appreciation of core knowledge in TE and their understanding of the connection between the courses and their jobs showed a statistically significant relationship (r =.50, p = 0.001). The correlation suggests that respondents who were of the opinion that they were able to connect the courses taught to their jobs also perceived their core knowledge in TE as adequate. However, 25% (R^2=0.25) of the variance in the perception of respondents' appreciation of core knowledge in TE could be explained as their ability to connect what they learn to the jobs they do.

The analysis from table shows statistically significant relationships among the six variables and this also suggest that adult learners studying Telecommunications engineering programme at KNUST are able to connect their experiences and work processes to the theories they are provided in class.

6.3.4 Analysis of focus group discussions with Telecommunications Engineering adult learners

This section covers information gathered from adult learners of Kwame Nkrumah University of Science and Technology at the Institute of Distance Learning (Accra Campus) who are studying Telecommunications Engineering. The students were divided into two groups in which they discussed the focus group question items. Discussants in two groups were made to provide their views on; work processes with core knowledge and skills expectation from the programme; relevance of the TE programme and its impact on adult learners; programme planning and motivation for self-directed learning; teaching and learning methods and employability indicators. The two (2) focus groups were given codes for easy identification; Group 1 – G1, and Group 2 – G2.

6.3.4.1 Relating work processes with core knowledge and skills expectations from the programme

The development of appropriate curricula could be described as essential for adult learners because they provide the foundation for the learners to develop knowledge and skills (Bennett-Goleman, 2001; Hillier, 2002; Hunt et al 2013; Angelo, 2013) which are relevant to their job setting.

The first discussion item in this category sought to find out from the discussants what additional content or knowledge they considered as important but not present in the courses they were offering. G1mentioned"*practical field work"* while G2 cited *"laboratory work and advanced computer programming".* The discussants were of the opinion that practical field work, laboratory work and advanced computer programming needed to be added to the programme. They indicated that some of them were not employed in the Telecommunications industry, so regular field trips and laboratory activities could expose them to practices in the industry.

The second item the discussants provided information on was which courses they considered as outmoded or not needed for their knowledge and skills development.G2 indicated that no courses fell in this category, while G1 stated that "*electromagnetic wave theory*[32]*"*was outmoded.

Suggestions for courses/content to be added to the existing ones (providing justifications for the additions) was the third item on the interview schedule.G2 indicated that they were satisfied with the courses offered by the University. G1 suggested the addition of "*Engineering practice"* to current courses. They further explained: *"This is relevant to make some of us who wish to join the telecom companies obtain the required skills necessary to work in the industry"*. The responses of the discussants showed that not all adult learners in the class were working in Telecommunications engineering organisations, so practical field work would be relevant for their knowledge and skills development, and that practical experience would help them connect theory to actual industry activities.

The discussants were asked to indicate what new technologies, tools, laboratory equipment or simulators they considered the institution would require to implement their proposed additions. G1 stated that, *"simulation software for field work will be very useful".* Practical field sessions and laboratory exercises would also provide adult engineering students with hands-on experience and opportunities to test principles and theories (Davies, 2008; Case, 2008; Dickens et. al., 2009). In this regard e-laboratories that are also referred to as virtual or remote laboratories would also be useful to provide practical experiences to learners using digital modes and simulations[33] (Dickens et al., 2009).When curriculum is developed to suit the needs of learners and provide them with relevant knowledge and skills, it would have achieved its goal of changing the aims and practices of education (Joseph, 2011: Slattery, 2012; Angelo, 2013).

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[32] Electromagnetic wave theory describes the composition of synchronised undulating magnetic and electrical fields which operate at the speed of light.

[33]Simulation is an enactment of an actual object or process. A simulation system/software in the engineering field describes a model or set of mathematical formulae that are used in describing an actual or theoretical object. A simulation system is the model of the system. The model used can be reconfigured and redesigned (Maria, 1997)

6.3.4.2 Relevance of the TE programme and its impact on adult learners

The category of questions in this section sought to connect the various work processes of adult learners in the field of Telecommunications engineering to the current course offering.

The first question to the discussants was whether the current curriculum provides opportunities to further develop their skills needed for their careers. Both groups indicated that the curriculum did provide opportunities for them to develop the skills needed for their individual careers.

The second question in this section was whether discussants could list some of the relevant job skills they may have been introduced to in their programme. G1 indicated "*signals and systems dynamics, data communication theories and network planning*", while G2 mentioned "*data communication theories and network planning for our field work*". This demonstrates that discussants were able to connect theory and work, and confirmed that adult learners are able to develop schemata (Fry et al., 2009) when they relate the theories they are introduced to what they practically work within their job settings.

The third item discussed by the groups was whether adult learners are encouraged to take up placements in other organisations in addition to their own workplace. G1 considered their continuous engagement at their place of work as industrial attachment, although the concept may actually differ from their interpretation. They also posited that adult learners continue to improve on their work practices as they learn and construct new meaning from their daily interactions. G2 indicated that they were studying on a part-time basis, thus they could not undergo industrial attachment.

How does your work experience contribute to your skills development while you are on the programme, was the fourth question which the discussants were asked. The responses from the discussants highlights three points for consideration; firstly, that experience enhances the thinking abilities of adult learners, secondly, that experience helps adult learners to become more effective in achieving results and thirdly, that adult learners are able to make relevant contributions in class which enhances the process of teaching and learning and additionally makes the work of facilitators easier. The views of the discussants were corroborated by the respondents who completed the questionnaire. A very strong correlation was observed between respondents' perception of their core knowledge in engineering and the relationship between their course and their tasks in the workplace (r =.83, p = 0.001).

The fifth question discussed by the groups was, how often do you complete a skills matrix to show in which areas you would need support from your lecturers? All the discussants noted that they had not completed a skills matrix in their programme.

Do you consider your experiences as very important in the teaching and learning process, was the sixth question. The object of this question was to find out to what extent the adult learners perceived their experiences as complementary to the teaching and learning processes in the university. G2 stated that, "*yes…..it helps us relate practical field work with theory that is taught in class*". The process of developing schemata among adult learners requires that they connect theories to their practical experiences. A high correlation was observed between respondents' (data from questionnaire) perception of the impact of the teaching and learning methods on their core knowledge in engineering ($r = .75$, $p = 0.001$). According to Seng (2001 cited in Thorsen et al., 2013) the process of connecting theories with experiences requires reflection which involves reconstruction of professional knowledge through blending theory and practice to meet the lesson outcomes.

6.3.4.3 Programme planning and motivation for self-directed learning

Telecommunications engineering programmes in HEIs require students to follow the theoretical and practical aspects in detail. While students may have their own learning goals and objectives, it is also important that education providers shape the process effectively so that students receive relevant knowledge and skills needed in industry. Adult learners are motivated by several factors including their desire to obtain higher credentials and also meet more complex challenges at their place of work.

The first question discussed by the groups was, are you involved in the planning of your programme? If yes, how are your suggestions and ideas included in the planning and delivery of your programme. G1stated that "*no…..we only receive the course from the office*[34]*"*. G2 noted that "*no"* they were not involved in the planning of their programmes. A follow-up question was; to what extent do you contribute to scheduling of lectures for each course and the duration of the lecture sessions? Both groups indicated that they did not contribute to the scheduling of courses. The adult learners considered the teaching and learning arrangements as exclusively those of education providers. They also posited that because they attend lectures twice every week (which are on Saturdays and Sundays) it would not be possible to alter the existing arrangements.

[34] Refers to the Institute for Distance Learning Office in Accra

The discussants were asked to indicate the extent to which they considered the input of industry experts as necessary to developing their curricula. The development of curriculum is usually influenced by the cooperative efforts of groups which may consist of institutions, policy makers, teachers, professional associations, industry and students (Carl, 2012). Similarly, Santoro (2000) argues that industry and universities could enter into agreements and partnerships which could promote research and knowledge sharing.G1stated that "*they should on their own volition contact the HODs to explore ways of helping departments develop content for courses*", while G2noted that, "*employers should provide KNUST with relevant information on industry needs and requirements*".

The fourth exercise was for the discussants to list the resources and support they required as adult learners to successfully complete their programmes of study. G1 stated that they considered "*Books, internet modems and learning tablets"* as the relevant resources needed to successfully complete their programme of study, while G2 posited that "*books, library and internet connectivity*". The views of the discussants suggest that library, internet connectivity and mobile computer devices could enhance their learning activities on the programme.

6.3.4.4 Teaching and learning methods

The first question the discussants were asked was, do the learning activities for each course show the various types of activities you are required to do individually or in groups to develop your thinking abilities and also meet your personal learning goals? The question sought to obtain from the discussants inputs on their knowledge of the various activities they were expected to undertake in each of the courses. G1 and G2 stated that "yes *they do*". The discussants were provided with a table, which contained some learning resources and they were asked to select the resources they considered relevant to achieving their learning goals. The resources selected by each of the groups are presented below;

Table 6.7: Relevant resources needed for the programme

Response of discussants in Group 1	Response of discussants in Group 2
- Availability of internet connectivity - Availability of physical space and flexible timetable. - Availability of laboratory equipment and consistent laboratory work.	- Availability of internet connectivity - Flexibility of choosing courses to suit your busy schedule - Lecturers' use of project assignments and other applied assessment modules. - Availability of physical space and flexible timetable. - Availability of laboratory equipment and consistent laboratory work. -Simulation exercises and work conferences.

The humanist perspective of learning suggests that the planning and actualization of teaching and learning must focus on developing the potential of the person through a learner-centred approach (Tennant et al., 1995; Fasokun et al., 2005; Savicevic, 2008). The choice of resources identified by the two groups as shown in the table above describes what they posit as necessary for achieving their learning goals.

The third item the groups discussed was whether the course contents were flexibly structured to challenge them to develop their analytical skills, independent study and application of key concepts to their professional roles. Whereas G1 stated that they were not satisfied as "*not all the courses are well structured to meet our learning needs*", G2 noted that they were satisfied. They had also indicated in their earlier submission that some additional courses would enhance their course offerings. Writers such as Anthony (1996), Clouston (2005) and Sackney et al. (2007) suggest that facilitation should include a process of synthesis including shared learning, a conducive learning atmosphere, an environment that enhances student learning, a means of developing critical thinking among students and that it should be person-centred and collaborative. When teaching and learning processes are flexible, adult learners are able to effectively combine work and studying while meeting their social obligations.

The discussants were also asked how often they shared information on their professional experiences. While G1 were of the opinion that knowledge sharing was restricted to the management class, G2 considered both formal and informal communication as a means of exchanging professional knowledge. The views of the respondents confirmed that knowledge and experience sharing need not be restricted to formal settings.

Teaching and learning processes in HEIs require that students be provided with feedback regarding their outputs either in tests, assignments or projects. The fourth and fifth questions covered how adult learners receive feedback from their lecturers and how the feedback helps them improve on their learning activities.G1 stated that they received feedback "*through e-mails and class representatives"* and that *"the feedback Information provides us with relevant information that is necessary for our work*". G2indicated that they received feedback "*through e-mails and discussions with lecturers",* and that the feedback "*….helps us improve on our performance in class*". The submissions by the discussants showed that they consistently received feedback from their course facilitators, the mode of reporting the feedback was often through emails, and thirdly, feedback provided them with relevant information that enabled them to build on their existing knowledge and improve on their performance.

6.3.4.5 Employability indicators

The discussants were provided with a list of employability indicators from which they had to choose those that they considered as relevant to their jobs. The groups considered; research and inquiry, information literacy, personal and intellectual autonomy, ethical, social and professional understanding and communication skills as those they required.

6.3.5 Interview with the Head of Department of Electrical Engineering of KNUST

The interview with the Head of Department of Electrical Engineering covered three broad areas; essentials of curriculum design for adult learners, incorporating work experience into the curriculum and meeting the requirements of regulatory agencies. The procedures for developing curriculum at the Faculty of Engineering are the same in different departments, so the responses provided by the HOD covered both the Electrical Engineering and Telecom Engineering programmes.

6.3.5.1 Essentials of curriculum design for adult learners

The development of curriculum for engineering programmes in HEIs requires taking account of a combination of factors such as; industry skills needs, emerging technologies, appropriate knowledge, skills and attitude needs required by professional bodies, and the requirements of regulatory agencies. Responses from the head of department on the closed ended questions are provided in Chapter seven.

The head of department posited that, "*there are presently no internal consultations and discussions especially among faculty to ensure that the programme content have the required resources and personnel to run. These decisions are usually done at the faculty level and not the department level*". He

added that, "*there are no established processes to engage skilled engineers especially those from industry to provide you with specific skills needs for their sector"*.[35]In response to a question put to him regarding teaching strategy and programme objective, the HOD noted that, *"the teaching strategies and objectives for the programmes are usually revised for all undergraduate programmes but emphasis is not placed on whether the students are adult learners or not*". This he explained was because the competencies expected of all students were the same and did not differentiate between adult learners and regular students. He added that, "*the department did not consider the age range of students when designing … programme content*".

Regarding the frequency with which the department changes the content of the programmes to suit industry needs and how relevant these changes are to the needs of adult learners, the HOD noted that the policy of KNUST regarding the review of courses was five (5) years and the policy was adhered to by all faculties.

In response to a question put to him on the extent to which the department's teaching strategies, especially those involving adult learners, derive from the Ghanaian cultural values, the HOD said the following: *"Engineering programmes are often based on specific discipline requirement which identifies the theories and practices that are relevant for the skills needs of students. However, students are required to take courses in the liberal arts area"*.

The HOD was also asked about the department's philosophy and how it impacted on teaching and learning. He noted that, "*the department does not have any process to ensure that the teaching of courses especially to adult learners is based on philosophical underpinnings that seek to provide adult learners the best of teaching*", and also, "*we do not have any special arrangements for adult learners*". Additionally he indicated that the department did not manage the connection between adult learners' interests and the course content to ensure that they got the most appropriate teaching in the discipline. This was because the engineering programmes were designed for undergraduate students and they expected all categories of students to acquire the requisite competencies rather than distinguishing amongst them. "*There is no specific arrangement that emphasises the connection between adult learners' interest and the course content"* was his final comment on the issue.

[35]The interview was conducted before the signing of an MOU between MTN and KNUST aimed at strengthening collaboration between the two entities.

6.3.5.2 Appropriate knowledge, skills and attitude needs required by professional bodies

"There are no specific standards prescribed by the Ghana Institution of Engineers. However it is the National Accreditation Board that has commenced a process to ensure that institutions adhere to some specific procedures that are relevant in knowledge and skills training and as I indicated above, there are no specific guidelines and the universities are required to develop their own procedures". This response from the HOD followed a question that was put to him on how he ensures that the relevant skills needed by industry are situated within the relevant quality assurance benchmarking/standards of the Ghana Institution of Engineers in their curriculum.

6.3.5.3 Meeting the requirements of regulatory agencies

In response to a question I put to the HOD what established processes exist in his department to ensure that their programmes are aligned to the broad policy directives of the National Council for Tertiary Education, he responded as follows: *"Although we are required as a university to design our programmes based on certain relevant considerations which are approved by the National Accreditation Board, we are not necessarily obliged to follow specific procedures when we are designing our programmes. However the NAB has provided guidelines for development programmes and aligning them to certain specific criteria and this is a novel process that all institutions are required to follow. We submitted our document to the NAB on February 18, 2015"*.

The analysis in this section shows that although KNUST had developed structures to enable adult learners obtain the requisite knowledge, skills and attitudes needed to advance adult learning programmes in the institution, there is the need to identify interventions for the enhancing teaching and learning processes among adult learners. The integrated constructivist model used for the study showed high correlation among the variables which also suggest that the factors that influence effective teaching and learning among adult learners is related.

6.4 CASE 2 – REGIONAL MARITIME UNIVERSITY

6.4.1 Survey results of adult learners studying Marine Electrical Engineering

The respondents who were provided questionnaires to complete were level 300 and 400 adult learners studying Marine Electrical Engineering (MEE) at the Regional Maritime University. The total number of respondents was 50.

6.4.1.1 Demographic data

Demographic data obtained from the respondents are reported in Table 6.8 below:

Table 6.8: Demographic data of RMU MEE respondents

Level	Age	Gender	pre – qualification	work experience	Funding
Level 300 - 25	26 yrs. - 27	Male – 39	DIPLOMA - 15	2years -15	PS - 20
Level 400 - 25	36 yrs. - 15	Female - 11	WASSCE - 9	4years - 14	SF - 30
	46 yrs. - 8		TECH CERT -25	8years -12	GL - 0
	56 yrs. - 0			13years - 5	PFFE - 0
				18 years - 3	SLWP - 0
				21 years - 0	

1. Age – yrs. describes the average age of respondents in a ten-year range category.
2. Pre-qualification – WASSCE is the West African Senior Secondary Certificate Examinations/ TECH CERT is Technical Certificate.
3. Funding – PS is Parental Support/ SF is Self-Financing/ GL is Government Loan/ PFFE is Partial Funding from Employers/SLWP is Study Leave with Pay.

Table 6.8 shows the demographic data of the respondents. From the data gathered from the field, 54% of respondents stated that they were aged between 26 and 35years while 30% stated that they were aged between 36 and 45 years. Also, 16% respondents were in the 46 to 55 age category. The gender distribution showed that 78% respondents were males while 22% were females. The number of females in RMU 11 (61%) represented the highest number female respondents in the study.

The work experience domain shows the number of years that respondents had worked in industry. The data showed that 30% of respondents indicated that they had worked in industry for 2 years while 28% of respondents stated that they had worked in industry for 4 years. Comparatively, 24% of respondents stated that they had worked in industry for 8 years while 10% indicated that they had worked in industry for 13 years. The number of respondents who indicated that they had worked in industry for 18 years was 6% while 2% of respondents indicated that he had worked in industry for 21 years. The distribution of the respondents based on the number of years they have worked in industry revealed that majority of them (30%) had not worked in industry for more than 3 years and this is also explains why 54% of respondents were aged between 26 and 35.

The questionnaire required respondents to provide information on the type of funding for their education. The statistics showed that 60% of respondents indicated that they were self-financing their education at the university themselves while 40% of respondents noted that they received support from their parents.

Regarding the pre-qualifications of the respondents, 50% of respondents indicated that they entered the university with technical certificates. Comparatively, 30% of respondents indicated that they entered the University with diploma while 20% of the respondents stated that they entered the University with the WASSCE. The distribution showed that majority of the adult learners gained admission into the university with technical certificates.

6.4.1.2 Relationship between variables

Table 6.9: Pearson's correlation coefficient matrix for observed variables

VARRIABLE	CKE	ROPAK	MOTIV	COS N JOB	TLM
CKE	1.000				
ROPAK	.8234***	1.000			
MOTIV	.6723***	.8047***	1.000		
COS N JOB	.5705***	.7362***	.5738***	1.000	
TLM	.5372***	.541***	.3986**	.7204***	1.000

n=50, *P<.05, **P<.01, ***P<.001

CKE – Core Knowledge in Engineering

ROPAK-Relevance of the programme to the needs of adult learners

MOTIV-Motivation for self-directed learning

COS N JOB-Relationship between the courses and their job

TLM- Teaching and learning methods

Pearson's correlation coefficient were computed to find statistically significant relationships among respondents' perceived relevance of the Telecommunications Engineering programme and its impact on adult learners, the core knowledge in engineering, motivation for self-directed learning, course content and job and the teaching and learning methods. Table 6.9 above shows the correlation coefficient of the interrelationships among the five variables.

Respondents' perception of the relevance of the MEE programme and the specialist knowledge required showed a statistically significant relationship (r =.82, p = 0.001), meaning that respondents who indicated

high levels of programme relevance to their needs were also satisfied with the core knowledge in engineering provided by the programme. Additionally, 67% (R=0.67) of the variance in the perception of respondents' approval of the relevance of the Telecommunications Engineering programme to their skills and knowledge needs were accounted for by their perception of adequate core knowledge in engineering obtained.

Secondly, adult learners' perception of the relevance of the MEE programme and their motivation for self-directed learning showed a statistically significant relationship of high strength (r =.80, p = 0.001). The correlation suggests that respondents who were of the opinion that they were motivated to advance self-directed learning also perceived the relevance of the Telecommunications Engineering programme as good. In explaining relationship between the variables, 64% (R^2=0.64) of the variance in the respondent's perception of the relevance of the Telecommunications Engineering programme could be explained as their ability to advance self-directed learning.

Respondents' perception of the relevance of the MEE programme and their understanding of the connection between the courses and their job showed a statistically significant relationship (r =.74, p = 0.001). The correlation suggests that respondents who were of the opinion that they were able to connect the courses taught to their jobs also perceived the relevance of the MEE programme as good. Also, 55% (R^2=0.55) of the variance in the respondent's perception of the relevance of the MEE programme could be explained as their ability to connect the courses they learn to the jobs they do.

A statistically significant relationship was found between respondents' understanding of the connection between the courses and their job and the teaching and learning methods used (r =.72, p = 0.001), meaning that respondents who indicated either high or low levels of satisfaction with course-job connections also indicated high or low levels satisfaction with teaching and learning methods used. Additionally, 52% (R^2=0.52) of the variance in the respondents' understanding of the connection between the courses and their job and the teaching and learning methods used could be explained.

A statistically significant relationship was also found between respondents' perceived appreciation of core knowledge in MEE and their motivation to advance self-directed learning (r =.67, p = 0.001). This correlation suggests that respondents who were satisfied with the core or specialist knowledge in the field were motivated to advance self-directed learning; this explains only 45% (R^2=0.45) of the variance.

Respondents' appreciation of core knowledge in MEE and their understanding of the connection between the courses and their job showed a statistically significant relationship (r =.57, p = 0.001). The correlation suggests that respondents who were of the opinion that they were able to connect the courses taught to their jobs also perceived their core knowledge in MEE as adequate. Additionally, 32% (R^2=0.32) of the variance in the perception of respondents' appreciation of core knowledge in MEE could be explained as their ability to connect the s they learn to the jobs they do.

Adult learners' appreciation of core knowledge in MEE and the teaching and learning methods used indicated a statistically significant relationship (r =.54, p = 0.001), meaning that respondents who indicated either high or low levels of programme relevance to their needs also indicated high or low levels of teaching and learning methods used. Here, 29% (R^2=0.29) of the variance in the respondents' appreciation of core knowledge in Telecommunications Engineering and the teaching and learning methods used could be explained.

Adult learners' understanding of the connection between the courses, their job and their motivation for self-directed learning revealed a statistically significant relationship (r =.57, p = 0.001), meaning that respondents who indicated either high or low levels of course-job connection also indicated high or low levels of motivation for self-directed learning. However, 32% (R^2=0.32) of the variance in the respondents' explanation of their understanding of the connection between the courses and their job and their motivation for self-directed learning could be explained.

A statistically significant relationship was observed between respondents' perception of the relevance of the MEE programme to their needs and the teaching and learning methods used (r =.54, p = 0.001). This correlation suggests that respondents who were satisfied with the teaching and learning methods used also perceived the relevance of the MEE programme to their needs as satisfactory and this explains only 29% (R^2=0.29) of the variance.

Respondents' perception of their motivation for self-directed learning and the teaching and learning methods used showed a statistically significant relationship (r =.40, p = 0.01). The correlation suggests that respondents who were of the opinion that they were able to advance self-directed learning also perceived the teaching and learning methods as good. 16% (R^2=0.16) of the variance in the respondent's perception of their motivation for self-advanced learning could be explained as their appreciation of the teaching and learning processes. The analysis however showed a significant relationship between the variables that were developed from the integrated constructivist model.

6.4.2 Analysis of focus group discussion with adult learners in Marine Electrical Engineering adult learners

This section reports the perceptions of adult learners at the Regional Maritime Academy who study Marine Electrical Engineering. The programme is designed to provide students with competency based courses to control and operate automated machines and electrical systems on board modern ships and on-shore. The students were gathered into three groups to discuss the focus group items. The three (3) focus groups were given codes for easy identification; Group 1 – G1, Group 2 – G2 and Group 3 – G3.

6.4.2.1 Relating work processes with core knowledge and skills expectation from the programme

The discovery of oil in Ghana has necessitated the acquisition of skills and knowledge that will support the installations and equipment that are used in exploration and extraction of the oil by students who study Marine Electrical Engineering.

The first question in this category sought to find out from the discussants what additional content or knowledge they considered as important but not present in the set of courses they had. G1stated that "*we consider all courses as relevant to our training".* They added that, *"We will rather request that the right faculty are recruited to teach the various courses…… example is the faculty who taught us maritime law."*G2 answered that *"all courses are relevant".* G3 noted that "*simulation for Electrical Engineering systems and automation should be added to our course*". Although the discussants raised some issues with respect to their course content, the correlation between respondents' perceived core knowledge and skills in engineering obtained from the programme and its impact on their job (as shown by the data from the questionnaire) was strong (r =.74, p = 0.001).

It is important for education providers to consider the needs of learners when developing their curriculum and intermittently audit their existing courses while also keeping abreast with modern best practices; this is referred to as constructive alignment (Fry et al., 2009). Constructive alignment takes into consideration the institutional climate including policies and practices, the curriculum which is followed by faculty, the teaching methods and the assessment systems that also relate to the learning outcomes (Biggs, 1999; Fry et al., 2009).

The second question put to the discussants was, which of the courses you are presently offering are outmoded or do you consider are presently not needed? G1 maintained that they considered the entire set of courses taught to be relevant and not outmoded. However G2 and G3 stated that "*we think that Marine*

Engineering Systems and Nautical Science are not relevant to our programme". The answers provided by the discussants suggest that although all the courses were relevant, some of them could be replaced with courses students identified as more useful.

What courses/content could be added to the existing ones (providing justifications for the additions) was the third question the discussants deliberated on. G1 stated that, "*we think that programming courses should be added to the courses we are taught".* They added that, *"we think that Telecommunications engineering for mariners should be added to our course just as our colleagues reading marine engineering are taught. This would enhance our skills on completion of our programme"* In addition, they said that, "*we consider automation and control systems as very important courses for practical work"*. G3 similarly indicated that, *"we would suggest simulation and automation as very important courses for electrical engineers. These two courses are very useful when working on the field and most industry require skills in these areas"*. The discussants had a good idea of what the workplace required and they felt that it was important for their courses to include that knowledge and skills.

The fourth question sought to find out from the discussants how the additional course(s) they proposed in their response to question 3 could enhance their performance on the job. G1 stated that, *"as electrical engineers, it is relevant for us to have relevant skills in Telecommunications systems in the marine sector. This would enhance our skills on completion of our programme"*. G2 posited that, "*it will enable us to fit in all sectors of industry, especially the marine sector*". G3 opined that, "*It will help us deliver our work efficiently and promote the work we do. We can also help our organisations cut cost by employing additional workforce to do those activities"*.

The fifth question that the discussants were asked was; what new technologies, tools, laboratory equipment or simulators would the university require in implementing your additions? G1 stated that, *"our laboratories should be well resourced to enable us acquire the necessary skills in industry. Presently, we have very few laboratory sessions and as engineers, we consider this as very inadequate for our skills development. We think that our colleagues reading marine engineering are given preferential treatment because they have a simulator and a state of the art laboratory while we still use our old laboratories".* G2 noted that, "*The laboratories need to be well equipped for effective practical laboratory sessions. When we compare what our colleagues in the marine engineering programme have*

to ours then we consider ours as very old and not resourced". G3 opined that, "*we suggest that programme logic control systems*[36] *should be set up for students to use*".

6.4.2.2 Relevance of the MEE programme and its impact on adult learners

Questions in this section sought to connect the various work processes of adult learners in the field of marine Electrical Engineering to the present set course offering and discuss their importance.

In this section, the first question to the discussants was, does the present curriculum provide opportunities to further develop your skills needed for your careers as adult learners? All three groups indicated. G1 stated that that the curriculum does provides opportunities for them to develop the skills needed for their individual careers, and said that *"the present courses on our programme are very good".* They added that, "*what we would request management to do is to employ very good lecturers to teach us. They often rely on part-time lecturers who are not very good at teaching some of these core courses".* G2 responded in the affirmative and indicated that, "*we consider them as very general and we should be able to apply some of the theories on the field".* They also stated that, "*The course has been designed to provide students with practical knowledge and we think it is very good"*. G3, however, did not agree and noted that, "*they are more theoretical than practical*". The views of the discussants were also corroborated by the data gathered from the respondents who completed the questionnaire. Additionally, Sackney et al. (2007), Kanuka (2011) and Amadio et al. (2014) posit that curriculum should be seen as the outcome of a process that provides learners with essential skills, indispensable knowledge and values required for self-development and achieving group goals.

The second question the discussants were asked was to list some of the relevant job skills they may have been introduced to in their programme. The rationale for asking this question was for the discussants to connect their work processes to the course offering. The researcher considered this a relevant additional question on the interview schedule. G1 stated that, "*we have learnt lots of new things. Examples are software for designing engineering tools and for system diagnoses*". G2 indicated that, "*safety in the engineering field and marine electrical systems has been very useful"*. They added that, "*the programme has also enhanced our presentation skills*". G3 opined that, "*Matlab under Control Theory*" had been very beneficial to them. The opinion of the discussants mirrors the very strong correlation between adult

[36]Programmable logic controller is a digital computer used for automation of electromechanical process.

learners' core knowledge in engineering and the relevance of their programmes to their needs (r =.82, p = 0.001) as gathered from the questionnaire data.

The third question related to whether they were encouraged to take up placement in other organisations aside their own workplace. The groups differed in their interpretation of and response to the question. G1 stated that "*no…..some of our colleagues often undergo such industrial attachment on their own because students are not obliged to do so. We think that it should be compulsory for us to be assessed on our jobs also. Management should consider adding industrial attachment to the lists of our courses and we should be assessed on them".* G2 also indicated that *"the school does not place much emphasis on skills development through industrial attachment. Moreover, students who undergo industrial attachment are not awarded credits for the knowledge they acquire from the practical field"*. In contrast, G3 noted that, "*yes…..this is often arranged by our colleagues who are on study leave"*. The views of the discussants relates to the behavioural theory which considers industrial attachment as a deep process of learning.

How does work experience contribute to skills development while they are on the programme was the fourth question put to the discussants. The experiences of adult learners often serve as building blocks (Hill, 2014) for their learning. G1 stated that, *"Most of the work we do on the field are not related to what we learn here. This is because there are different branches of Electrical Engineering*[37] *and it would be important for us to have areas of specialisation"*. G2 was more positive and indicated that, *"we often relate the theories we learn with the relevant field work we undertake and this in a way help us to understand the course better. We are able to develop our knowledge and skills in the area"*. G3focused on particular courses and noted that, *"Yes we mostly work on power systems and machines and the course in power systems have really helped us"*. The relationship between adult learners' perception of the relevance of their programme and their motivation to advance self-directed learning was very strong (r =.80, p = 0.001). Additionally, the object of transformative learning is to transform problematic frames of reference (mind set, habit of mind and meaning perspectives) into more inclusive, open and reflective one (Mezirow, 2009:92) which assists the learner to develop critical reflection and make meaning to his environment (Quinnan, 1997).

[37]The view of the discussants on the branches of Electrical Engineering was echoed by the HOD. He explained that Electrical Engineering as a broad programme consisted of; power, communication, electronics and automation and control. Under power systems there are sub areas such as generation of electricity and transmission and distribution. Under communication, there are data and voice transmission and wave guides. Under electronics, there are; radio, amplifiers, voice transmitters and power electronics. Automation and control looks at industrial machines and automation of production and work processes.

The fifth question that was put to the discussants was, how often do you complete a skills matrix to show which areas you will need for support by your lecturers? The responses from the discussants suggest that a skills matrix is not used by adult learners in the department to support their development and evaluate their learning processes. The constructivist approach to designing learning curriculum in higher education as developed by Buchanan and Smith (1998) suggests the application of new knowledge to working environment. The development of a skills matrix often provides a simple chart which informs the learner, the employer and the facilitator of the specific achievement or additional support the student would require.

Whether they considered their experience as very important in the teaching and learning process was the sixth question. The object of the sixth question was to find out how adult learners perceived their experiences as complimentary to the teaching and learning processes in the university. G1 indicated that, "*no……the theories we learn and the laboratory works we do are quite different from what we practice on the field. Some of our colleagues are also in different fields at their work places*". G2 opined that, "*yes we are able to share with our colleagues the knowledge we have from the field. We also receive some assistance from colleagues who are well skilled in certain areas*". G3 stated that, "*yes through our practical knowledge and experiences*".

6.4.2.3 Programme planning and motivation for self-directed learning

Programme planning and motivation for self-directed learning are essential ingredients for adult learners because they consist of the processes and practices that spur them on to enrol in HEIs. The elements which are necessary for developing relevant curricula for adult learners also serve as key motivational factors.

The first question put to the discussants was: Are you involved in the planning of your programme? If yes, how are your suggestions and ideas included in the planning and delivery of your programme. G1said: "*No. We are only required to complete evaluation forms at the end of each course. Although we try to propose some changes to the way courses are planned, our suggestions (mostly to our lecturers) do not yield the necessary feedback*". G2 noted: *We think that students can request for new courses that are relevant to their job needs and they would be provided by the departments*". G3 posited that they were not involved in the planning of their courses. A follow-up question was, to what extent do you contribute to the scheduling of lectures for each course and the duration of the lecture sessions? G1 stated that "*we do not play any role in the scheduling of courses. The schedules are fixed and we are obliged to follow…the scheduling is not flexible to allow for changes*". G2 noted that "*we do not provide any input*

in the scheduling of courses. We at times agree with faculty to change some of the lecture periods or sessions". G3 indicated that, "*we don't have any input in the scheduling of our courses*". The discussants were surprised to note that as adult learners they could negotiate the planning of their programmes with their facilitators. They, however, noted that it was not a practice they were used to because the convention has been that they follow what is provided by the education providers.

The next question was on the role that employers should have in the design of their curriculum. The question was meant to identify the extent to which adult learners consider the input of industry experts as necessary to developing their curriculum. G1 stated that, "*employers should be involved in the design of curriculum for students. Such exercise would help students to develop their skills to meet the requirement of employers and the labour market*". G2 also agreed that employers should be involved in the designing of courses for them and added that *"companies in the power sector should help us with modern technology and job expectations*". G3 indicated that "w*e think that they should bring their expertise knowledge to help design our curricula*". Modern engineering practices requires that industry and HEIs collaborate and develop programme content that are relevant to industry needs; collaboration between HEIs and industry will enhance the knowledge and skills needs of students, and lastly, that the diverse skills and knowledge needs in the area of electrical and electronic engineering could be met through collaboration between HEIs and industry. Additionally, students could be introduced to the very sophisticated emerging technologies that cannot be procured by the universities for their laboratories. The views of the discussants corroborate the views of Santoro (2000) and Santoro et al. (2000) who showed that the relationship between industry and universities is a two-way interaction.

The discussants were asked to list the resources and the support they would require as adult learners to enable them to successfully complete their programme of study. G1stated that, "*we would need a state of the art laboratory. Additional courses that would help us acquire knowledge in modern engineering practices should be added to what we already have".* G2 listed, "*an e-library and a proper library. Our present library is not well stocked with books. Our laboratories also need refurbishment*". G3 stated that they considered "*simulation software, internet for students on campus, library and modern laboratories*" as necessary resources. The views of the discussants suggest that library, internet connectivity, laboratory, simulation software, additional courses with practical components and avenues for practical work activities are the important resources they consider relevant to successfully complete their programmes of study. Similarly, Kahn (2006), Dickens et al. (2009) and Rogers (2001 cited in Bell et al., 2013) have espoused the merits of providing learners and facilitators with relevant tools and resources for effective teaching and learning.

6.4.2.4 Teaching and learning methods

Curriculum for adult learners in HEIs are informed by the knowledge required by the adult learners, the pedagogy which prescribes the teaching methods used by instructors and the experiences these individual carry along (Bobbit, 2009). The first question sought to glean from the discussants their knowledge of the various activities they were expected to undertake in each of the courses to develop their thinking abilities and meet their learning goals. G1 and G2 stated that they did have this knowledge as the learning goals, including the expected activities for each of the courses, were clearly spelt out at the commencement of each course. G3 indicated that, "y*es they do and this is often provided by faculty on the first day of our meeting"*. The discussants were provided a table with some learning resources and were asked to select the resources they considered relevant to achieving their learning goals. The resources selected by each of the groups are presented below;

Table 6.10: Relevant resources needed for the programme

Response of discussants in Group 1	**Response of discussants in Group 2**	**Response of discussants in Group 3**
- Availability of internet connectivity - Flexibility of choosing courses to suit your busy schedule	- Availability of internet connectivity - Lecturers' use of project assignments and other applied assessment modules. - Availability of physical space and flexible timetable. - Availability of laboratory equipment and consistent laboratory work. - Simulation exercises and work conferences.	- Availability of internet connectivity - Flexibility of choosing courses to suit your busy schedule - Lecturers' use of project assignments and other applied assessment modules. - Availability of physical space and flexible timetable. - Availability of laboratory equipment and consistent laboratory work. - Simulation exercises and work conferences.

The choice of resources identified by the various groups as shown in table 6.10 above describes what they posit as necessary for achieving their learning goals. The concept of adult learning based on the

humanist perspective suggest that the planning and actualization of teaching and learning must focus on developing the potential of the person through a learner centred approach (Tennant et al., 1995; Fasokun et al., 2005; Savicevic, 2008).

The third question put to the discussants was whether the course contents were structured in a more flexible and broad manner that challenges them to develop their analytical skills, independent study and application of key concepts to their professional roles. G1 and G3 noted that, "*no…..we expect faculty to help us to develop these skills*" and "*no….we do not think they do*".G3 stated that "*yes they do*". The views of the discussants suggest that although the courses are structured to help them develop their skills and knowledge in the field, they are not as flexible as they expect.

The discussants were also asked how often they shared information on their professional experiences; this was meant to gather evidence on knowledge sharing among adult learners. G1 stated that, "*there are no opportunities for us to do that*". G2 indicated that "*when we have to do so, we discuss our experiences*" while the third group stated that "*When the need arises"*. The information provided by the discussants suggests that sharing of professional knowledge was not given prominence in their programmes.

Teaching and learning processes in HEIs cannot be complete without laid-down processes for reporting the performance of students in either formative or summative assignments and tests. The fourth and fifth questions which the discussants were asked was how they receive feedback from their lecturers, and how the feedback helps them improve on their learning activities and take the necessary measures to develop relevant proficiency in specific areas marked for improvement.G1 stated that, "*the feedback systems are not very good. We hardly receive our assignment sheets (projects/take home assignments) from our faculties. The feedback systems are irregular and there are no regular feedback sessions*". G2 stated that; "*Through mails and our report sheets. We are able to correct our mistakes and improve on our performance in subsequent assignments*". G3 was of the opinion that we receive feedback "*through mails….they help us to develop our skills*". Thijs et al. (2009), Sambell (2011) and Angelo (2013) showed that feedback activities, assessment tasks and grading standards are essential elements of curriculum design in HEIs and they also help students to measure their progress.

6.4.2.5 Employability indicators

The discussants were provided a table with a list of employability indicators and they were asked to select those indicators they considered as relevant to their jobs as a group.

The following employability skills could be considered as relevant for learners in the marine electrical and electronic engineering programme; research and inquiry, information literacy, personal and intellectual autonomy, ethical, social and professional understanding (which was selected by only one of the groups) and communication skills.

6.4.3 Interview with the Head of Department of Marine Electrical Engineering

The interview with the Head of Department of the Marine Electrical Engineering covered three broad areas; essentials of curriculum design for adult learners, incorporating work experience in the curriculum and meeting the requirements of regulatory agencies. Detailed information on the views of the HOD with respect to the essentials of curriculum design for adult learners is provided in Chapter seven.

When the HOD was asked about the extent to which the teaching strategies and programme objectives for adult learners were informed by the input of both faculty and experts in the Telecommunications and energy industry, he stated that "*not only do we focus on adult learners but rather all categories of students. Our faculty and industry partners provide the department with relevant information and new methods of working and technology that are important to the teaching and learning processes. Although there are constraints in procuring all the relevant laboratory equipment and tools, the information we gather from faculty and industry partners help us to update our content often at the faculty level. To answer your question on how often we change the content of your programme to suit industry needs and how relevant are these changes to the needs of adult learners, I must emphasise that we do this every three years and the processes are often reviewed by the National Accreditation Board (NAB)"*.

The HOD was asked whether the department considered the age range of their students when designing their programme content, and if they did, how they ensured that the objectives meet the needs of both regular students and adult learners. He intimated that, "*no we do not as I stated earlier in our discussion. Our focus is always on the content and not the age range because industry practices and processes are general and irrespective of the age differences the knowledge and skills provided to students should be geared at helping students achieve these competences"*.

Pressed further to describe the processes that the department go through to ensure that faculty align their teaching with the broad teaching strategies that aim at providing adult learners with the requisite teaching methods the HOD stated that: "*Kindly note that we do not separate the teaching strategies for the regular*

and the weekend students[38]*. Most of our weekend students could be considered as adult learners and often they engage faculty in very stimulating discussions that focus on relevant knowledge and skills required by industry. What we do is general to all category of students and this includes using evaluation feedbacks from students to improve our teaching and learning methods and monitoring the teaching and learning processes in the faculty"***.**

The HOD was requested to explain the extent to which their teaching strategies, especially those involving adult learners, derive from the Ghanaian cultural values. He indicated that, "*we do not consider the Ghanaian cultural values in our teaching methods because there are four other West African Countries which own this university and it is very important for us consider the international composition of the governance system when teaching. Our focus is usually on satisfying the knowledge needs of our students who also come from the four countries including other African countries".*

The HOD was asked what processes the department goes through to ensure that the teaching of courses especially to adult learners is based on philosophical underpinnings that seek to provide adult learners the best of teaching. The HOD indicated that, "*again this applies to all category of students and we ensure that course delivery is student centred and the teaching resources (projectors and laboratory equipment) are always available for faculty and students"***.**

The next question put to the HOD was: how does your department manage the connection between adult learners' interest and the course content to ensure that they get best of teaching in the discipline? He responded as follows: "*As I stated in my previous answer the weekend students are adults who are professionals and they often suggest new ways of enhancing practical work processes by engaging faculty in fruitful discussion. We do not provide them with separate curriculum but using their experiences, lecturers are able to meet their peculiar knowledge needs by connecting theories with their practical skills. We consider all these factors when reporting the course contents and proposed changes to the Academic Council".*

6.4.3.1 Appropriate knowledge, skills and attitudes required by professional bodies

The HOD was asked to explain the process the department goes through to ensure that relevant skills needed by industry are situated within the relevant quality assurance benchmarking/standards of the GIE

[38] The university runs weekend programmes for workers who do not enrol in the regular programmes because of their busy work schedule. The researcher identified students in this category as adult learners because they are workers in industries.

in their curriculum. He said: "*We presently have collaboration with the GIE. They do not control our teaching processes but they provide us with relevant input for our programmes and we often hold discussions with them on industry best practices"***.**

6.4.3.2 Meeting the requirements of regulatory agencies

When the HOD was asked about the established processes that exist in the department to ensure that their programmes are aligned to the broad policy directives of the National Council for Tertiary Education, he noted that they had always complied with the broad policy directives of the NCTE. He added that, *"we always ensure that the processes involved in the appointment of faculty, the maintenance of resources and the teaching and learning practices conform to the set standards given by the National Accreditation Board (NAB). Again these are for all categories of students and not necessarily adult learners".*

The views of respondents, discussants in the focus group and the HOD suggest that although the institution had put in place structures to support adult learners studying Marine electrical, there were still constraints in provision of relevant learning resources. The results from the correlation matrix analysis also showed that the relationship between the six variables were statistically significant.

6.5 Case 3 – Ghana Technology University College

6.5.1 Survey results of adult learners studying Telecommunications Engineering

The respondents who were provided questionnaires to complete were level 300 and 400 students studying Telecommunications Engineering at the Ghana Technology University College. The total number of respondents was 50.

6.5.1.1 Demographic data

Demographic data obtained from the respondents are reported in Table 6.10 below:

Table 6.11: Demographic data of GTUC TE respondents

Level	Age	Gender	pre – qualification	work experience	Funding
Level 300 - 18	26 yrs. - 34	Male - 47	DIPLOMA - 31	2years -25	PS - 24
Level 400 - 32	36 yrs. - 11	Female - 3	WASSCE - 14	4YEARS - 9	SF - 24
	46 yrs. - 4		TECH CERT - 5	8years - 9	GL - 1
	56 yrs. - 1			13years - 5	PFFE - 1
				18years - 0	
				21 years - 2	

1. Age – yrs. describes the average age of respondents in a ten-year range category
2. Pre-qualification – WASSCE is the West African Senior Secondary Certificate Examinations/ TECH CERT is Technical Certificate
3. Funding – PS is Parental Support/ SF is Self-Financing/ GL is Government Loan/ PFFE is Partial Funding from Employers/SLWP is Study Leave with Pay

Table 6.10 shows the demographic data of the respondents. The average age of 68% of respondents was 26 years while the average of 22% of respondents was 36 years. Comparatively, 8% of respondents were on average 46 years of age. One respondent representing 2% indicated that he/she was 56 years of age.

The work experience domain shows the number of years that respondents had worked in industry. Twenty-five respondents representing 50% indicated that they had worked in industry for 2 years while 18% of respondents stated that they had worked in industry for 4 years. Similarly, 18% of respondents stated that they had worked in industry for 8 years while 10% of respondents indicated that they had worked in industry for 13 years. The number of respondents who indicated that they had worked in industry for 21 years was 4%.

The questionnaire required respondents to provide information on the type of funding for their education. The statistics obtained from the field showed that 48% of respondents noted that they had support from their parents while another 48% of respondents indicated that they were financing their education at the university. One respondent representing 2% noted that he/she had funding from government loan while another 2% indicated that he/she had partial funding from his/her employer. The statistics shows that majority of adult learners either receive support from their parents or they were paying their fees themselves.

Regarding the pre-qualifications of the respondents, 62% indicated that they entered the university with Diploma, 28% stated that they entered the university with WASSCE while 10% indicated that they entered with technical certificates. What the statistics mean is that majority of the adult learners applied to do the degree programme with an HND certificate.

6.5.1.2 Relationship between variables

Table 6.12: Pearson's correlation coefficient matrix for observed variables

VARIABLE	CKE	ROPAK	MOTIV	COS N JOB	TLM
CKE	1.000				
ROPAK	.4815***	1.000			
MOTIV	.3688**	.4305**	1.000		
COS N JOB	.7424***	.6143***	.3436*	1.000	
TLM	.4516***	.173	.2806*	0.4699***	1.000

n=50, *P<.05, **P<.01, ***P<.001

CKE – Core Knowledge in Engineering

ROPAK-Relevance of the programme to the needs of adult learners

MOTIV-Motivation for self-directed learning

COS N JOB-Relationship between the courses and their job

TLM- Teaching and learning methods

Pearson's correlation coefficient were computed to find statistically significant relationships among respondents' perceived relevance of the TE programme and its impact on adult learners, the core knowledge in engineering, motivation for self-directed learning, course content and job and the teaching and learning methods. Table 6.11 above shows the correlation coefficient of the five interrelationships among the variables.

Respondents' appreciation of core knowledge in TE and their understanding of the connection between the courses and their job showed a high statistically significant relationship (r =.74, p = 0.001). The correlation suggests that respondents who were of the opinion that they were able to connect the courses taught to their jobs also perceived their core knowledge in EE as adequate. Furthermore, 55% (R^2=0.55) of the variance in the perception of respondents' appreciation of core knowledge in EE could be explained as their ability to connect the theories they learn to the work they do.

Adult learners' perception of the relevance of the TE programme and their understanding of the connection between the courses and their job showed a statistically significant relationship (r =.61, p = 0.001). The correlation suggests that respondents who were of the opinion that they were able to connect the courses taught to their jobs also perceived the relevance of the TE programme as good. Additionally, 37% (R^2=0.37) of the variance in the respondent's perception of the relevance of the TE programme could be explained as their ability to connect the courses they learn to the jobs they do.

A statistically significant relationship was found between respondents' perception of the relevance of the TE programme and the specialist knowledge required (r =.48, p = 0.001), meaning that respondents who indicated high levels of programme relevance to their needs were also satisfied with the core knowledge in engineering provided by the programme. However, only 23% (R^2=0.23) of the variance in the perception of respondents approval of the relevance of the TE programme to their needs was accounted for by their perception of adequate core knowledge in engineering obtained.

Adult learners' understanding of the connection between their courses and their job and the teaching and learning methods used showed a statistically significant relationship (r =.47, p = 0.001), meaning that respondents who indicated either high or low levels of course-job connection also indicated high or low levels of teaching and learning methods used. Additionally, 22% (R^2=0.22) of the variance in the respondents' understanding of the connection between the courses and their job and the teaching and learning methods used could be explained.

Respondents' appreciation of core knowledge in TE and the teaching and learning methods used indicated a statistically significant relationship (r =.45, p = 0.001), meaning that respondents who indicated either high or low levels of programme relevance to their needs also indicated high or low levels of teaching and learning methods used. The analysis also showed that 20% (R^2=0.20) of the variance in the respondents' appreciation of core knowledge in Telecommunications Engineering and the teaching and learning methods used could be explained.

Respondents' perception of the relevance of the TE programme and their motivation for self-directed learning showed a statistically significant relationship (r =.43, p = 0.01). The correlation suggests that respondents who were of the opinion that they were motivated to advance self-directed learning also perceived the relevance of the TE programme as good. Additionally, 18% (R^2=0.18) of the variance in the respondent's perception of the relevance of the Telecommunications Engineering programme could be explained as their ability to advance self-directed learning.

A statistically significant relationship was seen between respondents' perceived appreciation of core knowledge in TE and adult learners' motivation to advance self-directed learning (r =.37, p = 0.01). This correlation suggests that respondents who were satisfied with the core or specialist knowledge in the field were motivated to advance self-directed learning and this explains only 14% (R^2=0.14) of the variance.

A statistically significant relationship was found between respondents' understanding of the connection between the courses and their job and their motivation for self-directed learning (r =.34, p = 0.05), meaning that respondents who indicated low levels of course-job connection also indicated low levels of motivation for self-directed learning. Similarly, 12% (R2=0.012) of the variance in the respondents' understanding of the connection between the courses and their job and their motivation for self-directed learning could be explained.

Respondents' perception of their motivation for self-directed learning and the teaching and learning methods used showed a statistically significant relationship (r =.28, p = 0.05). The correlation suggests that respondents who were of the opinion that they were able to advance self-directed learning also perceived the teaching and methods as good. Only 8% (R^2=0.08) of the variance in the respondent's perception of their motivation for self-advanced learning could be explained as their appreciation of the teaching and learning processes.

Although a positive correlation was found between respondents' perception of the relevance of the TE programme and the teaching and learning method (r =.17, p>0.05), the relationship was not statistically significant at p = .30.

6.5.2 Analysis of focus group discussions with Telecommunications Engineering adult learners

This section covers information gathered from adult learners of Ghana Technology University College who are studying Telecommunications Engineering. The fifty students were organised into three groups for purposes of discussing the focus group question items.

6.5.2.1 Relating work processes with core knowledge and skills expectation from the programme

Adult learners require curricula that correspond to their knowledge and skills needs while studying in a learning environment that support sharing of experiences and constructing meanings to their everyday activity in the classroom (Bennett-Goleman, 2001; Hillier, 2002; Hunt et al 2013; Angelo, 2013).

The first question sought to find out from the respondents the additional content or knowledge they considered as important but not present in the courses they were offering. G1 stated that they had a need for "*CISCO*[39] *Networking Certification Training, complex programming languages and practical field training on transmissions",* while G2 answered that they needed *"extensive laboratory work, information theory and advanced computer programming".* G3 indicated that "*Linux is very relevant in many industries and we think it is important to have that as part of our course. We also consider CISCO (CCNA) is an important course that should be added*". The courses which were identified by the adult learners as necessary in their field could be facilitated through a case-based approach (Lombardi, 2007) and problem-based learning approach (Torp and Sage, 2002; Savery, 2006).

The second question tried to elicit from discussants whether any of the current courses are outmoded or not needed. Discussants in the first group indicated that none of their current courses were superfluous which suggested that all the courses they were required to cover were relevant to their knowledge and skills needs. Discussants in the two remaining groups indicated that they considered African Studies as not relevant to their course offering. African Studies is a liberal arts course that is intended to provide students with information on traditional African culture and social norms. The mainly positive responses of the discussants explain the high correlation between adult learners' core knowledge in engineering and its relationship with the work they do ($r = .74$, $p = 0.001$).

The third question put to the discussants was what courses or content they would add to the existing ones. G1mentioned "*base station installation training. The rationale is that industry employers require people who have practical skills and knowledge in the area. The second course we consider relevant is transmission of signals. The rationale for including this course is that it is very important in the Telecommunications industry and employers require skills in this area*". G2 expressed a need for "*solar and nuclear energy systems. We consider these two as very necessary of Telecommunications engineers. We need to understand the systems of power generation*". G3 repeated that "*CISCO (CCNA) is very important in all Telecommunications settings*", reiterating their response to the first question. What was evident was that the courses they considered as necessary additions were required for the work they were doing in their respective organisations.

The fourth question sought to find out from the respondents how the additional courses they mentioned in their responses to question 3 could enhance their performance on the job. According to G1"*The*

[39]CISCO is a licensed organisation that provides training and certifies learners in the field of cloud computing, data, security, video, voice and wireless communication (CISCO, 2015).

additional courses if added will increase our efficiency at work and help us apply better and modern ways of resolving transmission related activities. Additionally, we will be very confident when using new technologies at our work places". G2 noted that, "*we will be able to maintain power plants that are used at onsite installations and Telecommunications masts*", while G3 indicated that, "*it will help us have broad knowledge in the area and also enhance our work processes"*. The submissions by the three groups of discussants could be conceptualised as follows; the additional courses they suggested would enhance their efficiency in the workplace because they would be abreast of the modern technology and skills required by employers on the job; they would be confident demonstrating these acquired skills at their place of work and lastly, it would broaden their knowledge in allied fields while they are in their employment.

What new technologies, tools, laboratory equipment or simulators would be required to implement the additions, was the fifth question put to the discussants. G1 indicated that, "*routers, new and modernized servers and transmission systems and well-equipped laboratories. We will also like to have signal generators, simulation boards, oscilloscopes, antennas and frequency counters"*. G2 suggested that "*GTUC needs a well resources laboratory with state of the art equipment. We also need laboratory staff that have knowledge of modern technology and emerging technology*". G3 indicated that, "*the school needs routers, switches and packet tracers for field work*". The technologies, laboratory activities and programmes identified by the discussants are aspects of experiential learning (Davies, 2008; Case, 2008; Usher, 2009; Thorsen et al., 2013) which require learners to undertake practical tasks.

6.5.2.2 Relevance of the Telecommunications Engineering programme and its impact on adult learners

In the next section the discussants were requested to consider important skills that could enhance their credentials as graduates on completion of their programme. The points of reference for their discussions were the Telecommunications engineering curriculum and their courses on the one hand, and the job requirements in their employment.

The first question for the discussants was whether the present curriculum provides opportunities for them to further develop their skills needed for their careers. Curriculum is considered as the outcome of a process that is aimed at providing the learner with essential skills, indispensable knowledge and values (Kanuka, 2011; Amadio et al., 2014). All three groups indicated that the curriculum does provide opportunities for them to develop the skills needed for their individual careers. Both G2 and G3 considered technical report writing as an essential course in the programme.

The second question related to the relevant job skills discussants may have been introduced to in their programme. The object of this question was for the discussants to relate their work processes to the courses they were taught. G1 stated that, "*teamwork, data encryptions using software and Ethernet cable clipping".* G2 posited that they had been introduced to "*technical report writing, morals and ethics, basic economics, accounting and management, engineer and society and broadband wireless technology*. G3 indicated that they had been introduced to "*technical report writing, mobile and satellite communications, proposal writing and broad band wireless communications*".

The third question put to the discussants was whether adult learners are encouraged to take up placement in other organisations aside their own workplace. Discussants from two groups stated that their programme required them to undergo industrial attachment while the third group indicated that although they were assessed on industrial attachment, the department made no effort at providing them with work placements.

How does your work experience contribute to your skills development while you are on the programme – this was the fourth question which was put to the discussants.G1 stated: *"The experiences we bring from our individual work place helps us to connect the theories we learn in class with what we do on the field. We are able to understand the theories behind the work processes in our job settings"*. G2 indicated that, *"we are able to make relevant contributions in class and this helps the facilitators when they are teaching. As compared to our colleagues who do not have working experience, we consider our contributions as emanating from our experiences on the job"*. G3 noted that, *"We are able to easily relate the theories we learn in class with the field experiences. This helps us to understand the course better"*. The views of the discussants could be derived from transformative learning which suggests that adult learners transform problematic frames of reference into inclusive, open and reflective one (Mezirow, 2009:92). Additionally, through continuous interaction and application of their experiences, they are able to develop critical reflection and dialogue within the learning environment (Quinnan, 1997; Oxendine, Robinson & Willson, 2004).

The discussants were asked how often they completed a skills matrix to show the areas in which they required support from lecturers. The responses from the discussants suggest that a skills matrix is not used by adult learners to support their development and evaluate their learning processes.

Do you consider your experience as very important in the teaching and learning process was the sixth question. G1stated that, "*yes and this is seen during lecture sessions where our lecturers are able to discuss the practical aspects of our work and the theories that support them. Our course facilitators do not have challenges when explaining the theories behind the technologies and machines we use and how they enhance work processes. We are also able to share our experiences with the facilitators*".G2 noted that, "*Yes but our expectation is that faculty would have additional practical knowledge when teaching. It helps us ask questions and seek further explanations to the theories*". G3 indicated that, "*yes*" their experience were necessary in the teaching and learning processes. Hill (2014) suggests that the experiences of adult learners are necessary when developing their skills knowledge and skills.

6.5.2.3 Programme planning and motivation for self-directed learning

The first question put to the discussants was, are you involved in the planning of your programme? G1 and G3 indicated that "*no…we are not involved in the planning of our programmes* while G2 noted that, "*no we only request for changes in the examination schedule when they don't suit our work schedule and at times we request for rescheduling of our lecture period"*. A follow-up question was: to what extent do you contribute to scheduling of lectures for each course and the duration of the lecture sessions? G1 opined that "*we are able to arrange with some facilitators to either change our schedule for lectures or reschedule them to a convenient time which would be favourable for all of us*". G2 however stated that "*we usually discuss the scheduling of lectures with our facilitators at the beginning of the semester and this is done with the consent of our colleagues in the evening class. We also suggest that lectures should not be more than 2 hours*". G3 indicated that, "*We are not contacted in the scheduling of courses*".

What role do you suggest that employers should have in the design of your curriculum? The second question was meant to identify the extent to which adult learners considered the input of industry experts as necessary to developing their curricula. The opinion of G1 was that "*we think that there should be consultations among employers in the Telecommunications industry and such consultations should result in identifying courses and key skills needed for specific types of jobs in the industry. GTUC should not be left out in such discussions*". Similar to what G1 noted, G2 stated that, "*We expect the University to meet with industry players frequently to identify specific industry skills needs which can be met. This will help the university train students who will be required for the field*". G3 added that, "*Employers should be allowed to inform the University of the Specific Courses they require students to undertake in order to meet their needs on the job market*".

The third task required of the discussants was to list the resources and support they required as adult learners to successfully complete their programme of study. Learning resources consist of time, laboratory equipment, lecture halls, lecture schedule, staffing, libraries, internet connectivity, learning management system, assessment procedures and structure and students' support services. G1 stated that they considered "*well-equipped laboratory, good internet connectivity and consistent power supply."* as the relevant resources needed to successfully complete their programme of study. G2 opined that, "*provision of detailed hand-out by facilitators, fast internet connectivity, simulation exercises and work conferences*". However, G3 considered "*Simulators and well equipped laboratories*" as relevant resources needed. Simulators, internet connectivity, constant power supply, laboratory and avenues for practical work activities could be considered as important resources for adult learners.

6.5.2.4 Teaching and learning methods

This session sought to collate the views of adult on the teaching and learning processes at the department. The first question put to the discussants was whether the learning activities for each course show the various types of activities they are required to do individually or in groups to develop their thinking abilities and meet their personal learning goals. The view of G1 was, "*yes the learning activities for each course show the various types of activities we are required to do individually or in groups to develop our thinking abilities and also meet our personal learning goals*" Similarly G2 opined that "*yes especially during group discussions where we share ideas and knowledge.*". G3 indicated that, "*yes the learning activities for each course show the various types of activities we are required to do individually or in groups to develop our thinking abilities and also meet our personal learning goals*".

The discussants were provided a table with some learning resources and were asked to select the resources they considered relevant to achieving their learning goals. The resources selected by each of the groups are presented on page 208:

Table 6.13: Relevant resources needed for the programme

Response of discussants in Group 1	Response of discussants in Group 2	Response of discussants in Group 3
- Availability of internet connectivity - Availability of physical space and flexible timetable. - Availability of laboratory equipment and consistent laboratory work. - Simulation exercises and work conferences	- Availability of internet connectivity - Lecturers' use of project assignments and other applied assessment modules. - Availability of physical space and flexible timetable. - Availability of laboratory equipment and consistent laboratory work. - Simulation exercises and work conferences.	- Availability of laboratory equipment and consistent laboratory work.

The choice of resources identified by the various groups as shown in table 6.12 above describes what they posit as necessary for achieving their learning goals. The respondents however did not consider flexibility of choosing courses to suit their busy schedule as a relevant item for consideration in identifying the resources and tools they require to successfully complete their programme. The views of the respondents corroborated that views of authors such as (Tennant et al., 1995; Fasokun et al., 2005; Savicevic, 2008) who suggest that the planning and actualisation of teaching and learning must focus on developing the potential of the person through a learner centred approach.

Creating a flexible mode of teaching and learning requires that a significant level of autonomy and control of learning activities should be given to the learner (Anthony, 1996) and that they must be positioned in real settings in order to integrate assessment of students' learning as part of the education programme (Clouston, 2005; Sackney et al., 2007; Keating, 2015).

Are the course contents structured in a more flexible and broad manner which challenge you to develop your analytical skills, independent study and application of key concepts to your professional roles was the third question? G1and G3 noted that the course contents were structured in a flexible way which could help them combine work and study. G2, however, did not agree and stated that, "*no they do not apply to all areas of study. Example is mathematics where we only need to solve complex questions without necessarily undertaking rigorous analysis*". G3 opined that, "*yes…..we chose the programme because of the flexible schedule and we consider the course content as very relevant to our job*". While G1 and G2

were of the opinion that the courses were structured in a flexible way to allow for the development of their analytical skills, G2 thought differently. Although the discussants indicated that they were satisfied with the structure of the programme, a weak correlation was observed between the teaching and learning methods and the relevance of the programme to their needs ($r = .17$, $p > 0.05$).

The fourth question was, how often do you share information on your professional experiences? Cook (1992) and Beard et al. (2005) argue that knowledge sharing among learners is important for their learning processes. G1 and G3 noted that "*very often*". G2 indicated that "*when the need arises we share our experiences.*" The information provided by the discussants suggest that sharing of professional knowledge takes place when they do, they able to share experiences and ideas.

Feedback is considered as an important tool in the teaching and learning process (Sambell, 2011). Feedback activities, assessment tasks and grading standards are also essential elements of curriculum design in HEIs (Angelo, 2009; Thijs et al., 2009) and these processes provide adult learners with necessary information for improvement.

How do you receive feedback from your lecturers was the fourth question? The following is a summary of the submission of the three discussants; that feedback is often provided by facilitators through verbal means and usually interactive sessions; that the feedback provides learners with information on areas marked for improvement and helps in their preparation before the next lecture session; that the feedback serves as motivation to adult learners because they are able to note that performance and prepare for future assignments.

6.5.2.5 Employability indicators

The discussants were provided a table with a list of employability indicators and they were asked to select indicators they considered as relevant to their jobs. From the submission of the discussants, the following employability skills could be considered as relevant for learners in the electrical and electronic engineering programme; research and inquiry, information literacy, personal and intellectual autonomy, ethical, social and professional understanding (which was selected by only one of the groups) and communication skills.

6.5.3 Interview with the Head of Department of Telecommunications Engineering

The interview with the Head of Department of Telecom Engineering covered three broad areas; essentials of curriculum design for adult learners, incorporating work experience in the curriculum and meeting the requirements of regulatory agencies.

6.5.3.1 Essentials of curriculum design for adult learners

The development curriculum for engineering programmes in HEIs require a combination of factors such as; industry skills needs, emerging technologies, appropriate knowledge, skills and attitude needs required by professional bodies and the requirements of regulatory agencies.

The head of department noted that there are internal consultations and discussions especially among faculty to ensure that the programme content has the required resources and personnel to run. He added that "*programme contents are reviewed at the beginning of every academic year by a Content Review Committee which is headed by the Head of Department*".

Regarding established processes to engage skilled engineers, especially those from industry, to provide the department with specific skills needs for their sector, the HOD indicated that "*there are periodic consultations with professionals from industry and the benefits of such interaction are the introduction of new technologies and approaches which are added into the syllabus during the reviews"***.**

The HOD was of the opinion that the teaching strategies and programme objectives for all learners, and not specifically adult learners, are informed by the input of both faculty and experts in Telecommunications and energy industry. He added that, "*to a very large extent, these additions help in improving adult learning and learning in general*".

The researcher sought to find out from the HOD how often the department changes the content of their programme to suit industry needs and how relevant these changes are to the needs of adult learners. The HOD was of the opinion that the "course *contents are updated every year".* The HOD added that, "*the department does not consider the age range of your students when designing your programme content*". "*Our department does not have special offering for adult learners although we have top-up programmes for adults. The courses and content are almost the same*" was the response of the HOD after he was asked if there were philosophical underpinnings that sought to provide adult learners the best of teaching. "*In fact the needs of adult learners are not considered when developing course contents for learners because our target populations are often high school leavers*" was his final remark on the issue.

The HOD was asked what processes the department followed to ensure that faculty aligned their teaching with the broad teaching strategies that aims at providing adult learners with the requisite teaching methods. He noted that, "*the department has not considered undertaking such strategies"*. He was also of the opinion that, *"the teaching strategies of the department were not derived from the Ghanaian cultural values"*.

6.5.3.2 Appropriate knowledge, skills and attitude needs required by professional bodies

The HOD was of the opinion that the department ensured that relevant skills needed by industry are situated within the relevant quality assurance benchmarking/standards of the Ghana Institution of Engineers in your curriculum. He added that, "*this is achieved through collaborative discussions with experts in the Telecommunications industry in Ghana"***.**

6.5.3.3 Meeting the requirements of regulatory agencies

What procedures have you put in place in your department to ensure that your programmes are aligned to the broad policy directives of the National Council for Tertiary Education? This question sought to glean from the HOD the how the department handles the demands of regulatory agencies regarding the programme. He indicated that, *"the department does not have any such arrangements now"*

6.6 Industry perspective on relevant skills and knowledge required for work

This section provides in-depth information on the views and expectations of industry on the relevant knowledge and skills required by engineers in the Telecommunications and energy sectors in Ghana. Although five organisations were selected and consented to provide relevant information on the issue, four readily granted interviews without institutional challenges. For reasons of confidentiality as agreed with the organisations, the researcher labelled the corporate entities as; Telecommunications Company 1, Telecommunications Company 2, Telecommunications Company 3 and Power Company.

6.6.1 Telecommunications Company 1

Telecommunications Company 1 is a multi-national Telecommunications company which has several subsidiaries in Ghana. The first item for discussion was the learning activities of employees who were studying in HEIs and the measures put in place by the organisation to monitor their performance and to ensure that they obtain relevant knowledge needed to perform their work. The Head of Human Resources (HRM) of the organisation stated that, "*the company has a learning and development policy which allows employees to enrol in programmes that will help them to develop their core competences. For instance,*

Higher National Diploma (HND) holders are encouraged to do professional courses and staff are able to apply for re-imbursement". The HRM added that, "*the organisation does not consider the benchmarks of the Ghana Institute of Engineers as key to the training of staff in the organisation*". He added that the company had developed a manual for training staff hence it was not necessary to rely on the benchmarks of the GIE.

The learning process involves not only knowledge acquisition by adult learners but additionally guiding them to comprehend how their learning fits into their lives, how it can be applied to their roles at the job setting and how relevant it is to their life experiences (Hooks, 1994; Kanuka, 2011; Kasworm, 2008). The researcher sought to find out from the HRM how often the organisation interacts with HODs in the universities where his staff are enrolled to ensure that they agree on the specific knowledge needs of their staff. He noted that, "*we do not follow-up on our staff who are undertaking programmes in higher education institutions. Our interest lies in developing the younger students who are in the universities. We participate in career fairs organized by some HEIs in Ghana. During such meetings, we inform them of our expectations and skills requirement for the industry*". He added that, "*We rather inform students during career fairs and when they come on attachment of what competences and skills we require of them. Again, our goals are mostly derived from our unique business strategies so they are not necessarily connected in any way with the goals of HEIs*".

In the modern era technology has become a relevant tool in the delivery of course contents in flexible learning environments and HEIs are expected to make flexible provision (Pollard, Newton & Hillage cited in McLinden, 2013) to meet the needs of adult learners. The HRM was asked to list some technology and tools his organisation consider as essential to the training needs of adult learners in Telecommunications industry. He opined that, "*I will rather state that most of the fresh graduates we receive here lack basic skills in Microsoft applications (word, excel, access and power point). I think these are basic skills which should be developed at the universities before students are employed. It is very challenging to train fresh graduates on these tools when they should have known them so that the work could advance*". He indicated that his organisation is not involved in the design of Telecommunications engineering curriculum for HEIs although industry input is very important.

The HRM noted that there were opportunities for work experiences/placements for students studying Telecommunications engineering and other disciplines and that the focus is usually not on adult learners but students who do not have relevant industry experience. Regarding the engagement of students on

national service[40] personnel, he added that, "*we have identified the Rewards Assessment Exit Process and the basic aptitude test which we require all fresh graduates to take. We do not consider adult learners because our focus is always on the younger ones. Those who do well are given internship placements and then later asked to come back for their national service. Those who show satisfactory progress are employed after their national service*".

His concluding remarks were that, "*project management competences, six sigma training and execution skills which is the application of set objectives and strategies are skills the Telecommunications industry require employees to have*".

The key issues raised in the interview were;

i. The company has a learning and development policy which allows employees to enrol in professional programmes that will help them to develop their core competences.
ii. The organisation does not consider the benchmarks of the Ghana Institution of Engineers as key to training of their staff.
iii. There are presently no arrangement to monitor the progress of staff who are enrolled in HEIs.
iv. The organisation participates in career fairs organised by HEIs where they share with young and inexperienced students' industry expectation of graduates and relevant skills needs.
v. The organisation provides opportunities for students' industrial attachment and national service.
vi. The organisation considers project management competences, six sigma training execution skills in core networking and engineering as relevant skills in the Telecommunications industry.

6.6.2 Telecommunications Company 2

Telecommunications Company 2 is a multi-national Telecommunications company and one of the Telecommunications giants in Africa with several subsidiaries in Ghana. The first item for discussion was the learning activities of employees who were studying in HEIs and the strategies put in place by the company to monitor their performance and also to ensure that they obtain relevant knowledge and skills in the industry. The Head of Corporate Social Responsibility (HCRS) of the organisation stated that, "*although our staff are allowed to develop themselves by undertaking degree and advanced degree programmes in HEIs the company has its own specific training programmes. We offer training to staff based on their specific needs and note that these are often short training that are aimed at equipping them with the knowledge and skills needed for their jobs. The training programmes are also derived from*

[40] In Ghana, graduates fresh from the polytechnics and universities are required by law to do one year of national service in either private or public organisations.

the annual appraisal reports which often mark weak areas of staff and require urgent attention. Our training are often geared towards equipping the employee to help achieve the mission and vision of the organisation. We encourage our staff to take on e-learning courses which are very flexible. We also highlight on the attitude and behaviour of our staff which we consider as very essential in the development of the individual". The Head of Network (HN) noted that, "*I don't think there are any benchmarks especially in the area of Telecommunications Engineering. I must emphasize that the Ghana Institution of Engineers are completely detached from industry and they do not know what goes on in the various organisations*". The submission by the HN was in response to a follow-up question I put to him on the role of the Ghana Institution of Engineers.

The researcher sought to find out from the HCRS how often the organisation interact with HODs in the universities where their staff are enrolled to ensure that they agree on the specific knowledge needs of their staff. The HCRS stated that, "*we do not focus on our staff but students in tertiary institutions*". The Head of Networking (HN) added that, "*quite recently, we entered into agreement with KNUST to have our staff go to their campus to support the Telecommunications Engineering Department. Our staff also holds discussions with students and provides them with the needed support by way of practical demonstration of the mobile network systems and distribution. We are also developing cell sites that are aimed at increasing connectivity to students and faculty to enable them have access to our network facilities in their halls of residence and departments. Our Business Solutions Department is spearheading that task and I am aware that they communicate with the Vice Chancellor of KNUST*". Pressed further to state if the company had prescribed learning goals/objectives which they discuss with their staff who are students and the HODs in the universities, the HCSR responded that, "*no…. our attention has not been on our staff or matured students but rather on the students in tertiary institutions who are young and do not have requisite skills in Telecommunications engineering*".

The role of technology in modern era has become necessary especially in the delivery of course contents in flexible learning environments and HEIs are expected to make flexible provision (Pollard et al., cited in McLinden, 2013) to meet the needs of adult learners and business organisations. The HN was asked to list some technology and tools his organisation considers as essential to the training needs of adult learners in Telecommunications industry. He opined that, "*This question cannot be answered directly because the industry is dynamic and there are innovations every time. It is the responsibility of industry players to focus on what is essential for work processes. Example is the introduction of 2G, 3G, 4G, and yet to be*

released 5G network[41] *and IP/MPLS* [42]*which are very important in the industry. Note also that fibre technology is also very essential in the industry and these are not difficult to adapt. The curriculum at the universities provides students with basic theoretical knowledge in Digital Signal Processing, Antennas and Wave Propagation, Digital systems and others. General standards exist and it is important for students to develop these skills when they enter the universities…it is the systems and principles which are practiced on the field. We know the shortfalls of our universities and so when fresh graduates join us, we do not expect so much from them but we require them to learn quickly on the job based on the theories they are taught in school*".

The HN stated that although they are not involved in the design of Telecommunications engineering curriculum in any of the universities, "*we have a collaboration agreement with KNUST to support their Telecommunications Engineering Faculty*". The HCSR indicated that, "*the company provides industrial attachment opportunities for students and also they accept students on national service*". The HN further noted that relevant skills required in the Telecommunications industry presently for employees to have were "*attitude, high application knowledge and skills*". He added that, "*there is also the need for individuals to be very meticulous, need for individuals to be team players, adaptability (because we have very limited time to dedicate special attention to individuals who are unable to adapt) and dexterous. The Telecommunications engineering field is very broad and students are expected to learn all the different constituents of the area*". The HN added that although he trained as an electrical engineer at the undergraduate level, he has been able to fit in the Telecommunications industry because he is able to apply relevant concepts and knowledge.

6.6.3 Telecommunications Company 3

Telecommunications Company 3 is a Ghanaian Telecommunications company which is based in Accra. The first item for discussion was the learning activities of employees who were studying in HEIs and the measures put in place by the organisation to monitor their performance and also to ensure that they obtain relevant knowledge needed to perform their work. The Chief Executive Officer (CEO) stated that, although his organisation was not big in terms of workforce, he reviewed the academic performance and checks with the HEI. He noted that he considers the benchmarks of the Ghana Institution of Engineers as key to the training engineering students in Ghana. "*We interact with HODs in the universities where our*

[41]2G, 3G, 4G, 5G networks refer to generations of mobile network which allow users to send and receive information on an electronic device. The higher the generation definition, the stronger or faster the transmission of information.
[42] IP/MPLS Multi-Protocol Label Switching is a technique used by network personnel or engineers to direct data from one network node to another using short path labels rather than the traditional long network addresses and this prevents complex lookups in a routing table (CISCO, 2015).

staff are enrolled to ensure that they understand the knowledge needs of your staff at least once a year. I am also a member of the Ghana Institution of Engineers so I am able to advice on the relevant industry needs".

The researcher asked the CEO if the organisation had prescribed learning goals/objectives, which they discuss with the students and the HODs in the universities. He indicated that, "*we do not necessarily prescribe specific learning goals although we require the students to demonstrate some key competences while they are enrolled in programmes….The technology and tools I consider as essential in the training of students who are pursing first degree programmes in Telecommunications/Electrical Engineering in universities in Ghana are; E-Library services, data base design systems, OPNET*[43]*, MATLAB, SIMULINK*[44] *and CAD*[45]".

The CEO stated that he is indirectly involved in the design of the curriculum for Telecommunications engineering through support and advisory functions. He noted that, "*we do that indirectly by providing inputs into the students' final year projects*". Pressed further to provide information on the role his organisation plays in the design of curriculum for adult learners, he added that, "*we provide input into what specific needs exist in industry and how studies into those needs could provide solutions to organisations. All these are addressed in the project work of students*".

The CEO noted that his organisation accepts Telecommunications engineering students on industrial attachment and national service. He concluded that the relevant skills required in the Telecommunications industry which are necessary for employees to acquire to be able to maintain their jobs are "*two fold…. technical competences (core Telecommunications engineering skills) and soft skills (presentation and communication skills)*".

[43] OPNET (Optimized Network Engineering Tools) is a range of optical transmission and communication network equipment and Telecommunications network access was manufactured in 1991 by OPNET Technologies. http://www.opnet.com.tw. Accessed on 17/09/2015

[44] SIMULINK is a block diagram environment which is also integrated with MATLAB algorithms for wide purpose simulation and Model-Based Design. It enables simulation, automatic code generation, continuous test and verification of embedded systems (http://www.mathworks.com) Accessed on 17/09/2015.

[45] CAD (Computer-Aided Design) refers to the application of computer technology for design and design documentation. CAD software which comes in 2D and 3D models replaces manual drafting with an automated process (http://www.autodesk.com/solutions/cad-software). Accessed on 17/09/2015.

The views of the CEO suggest that it is important for Telecommunications companies to interact with HODs on the progress of their staff in the institutions. Additionally, the benchmarks of the Ghana Institution of Engineers was relevant in the training of Telecommunications Engineers in the country.

6.6.4 Power Company

The power company is a state-owned entity that provides power to households and organisations in Ghana. The first item for discussion was the learning activities of employees who were studying in HEIs and the strategies put in place by the company to monitor their performance and also to ensure that they obtain relevant knowledge and skills in the industry. The Head of Human Manpower Planning (HHMP) noted that, "*The present policy of the organisation regarding further studies is that, employees can apply for study leave after working with the company for a minimum of five years. The applications are often considered based on the needs of departments and the organisation. Aside the study leave which are given to employees, there is also the self-development policy which requires employees to voluntarily embark on further studies either in professional programmes or higher education programmes".*

Pressed further to explain the support they provide to such adult learners, he added that, "*Employees who enrol in higher education programmes on their own are not obliged to submit reports on their academic progression unlike those who are given study leave. Although they are not funded by the organisation, employees who embark on further studies (self-development) must seek the consent of their Heads of Department and approval by the company before they commence their programmes. Where an employee is not given study leave, he or she must ensure that his studies do not interfere with the work or task assigned and the employee must also submit his or her certificate to the head of Human Resources after the programme. The company does not follow up on the performance of employees at their institutions of higher learning but we often receive reports on the performance of our students who are granted study leave".*

The HHMP stated that the organisation does not consider the benchmarks of the Ghana Institute of Engineers as key to the training engineering students in Ghana. He further explained that, "*There is no form of interaction between the company and departments of the various institutions where our students learn. Regarding your question on the collaboration between our organisation and other HEIs, we do not have such arrangements. We have rather embarked on a programme to send our engineering staff on attachment to the foreign power generating companies. We realize that they have state of the art tools and equipment which our staff can use to sharpen their knowledge and skills*".

It is also important to note that, "*we do not have prescribed goals and objectives for our staff when they pursue further studies. However, they are always required to demonstrate advanced knowledge and skills in their area of specialty when they complete their programme and that is the essence of further training*".

The HHMP was asked what technology and tools the organisation considered as essential to the training needs of students who were pursing first degree programmes in Electrical Engineering in universities in Ghana. He noted that, "*there are different departments and units in this organisation and each of the departments (engineering and administrative) have specific expectations of staff and the technology/skills they should demonstrate. In the engineering field employees should be able to understand and apply basic power systems as well as power generation. There are several branches of power and each of the units have specific tools and technology required for performing specific tasks*". He added that the organisation was not involved in the design of curriculum for Electrical Engineering programmes at the various HEIs.

Asked if the organisation accepts students on industrial attachment and national service, he indicated that, "*we accept students on industrial attachment and National Service Persons. This is meant to provide them with the needed skills and work experience*". His final remarks on the relevant industry skills were that, "*We expect our staff to be able to demonstrate mastery in their assigned tasks and roles. Additionally those who return from their period of study leave are required to go through promotional interviews before they are promoted".*

The organisation considered granting study leave to staff as very important to the development of the knowledge and skills of adult learners. They also considered the benchmarks of the Ghana Institution of Engineers as international standards.

6.6.5 Interview with the Deputy Secretary General of the Trades Union Congress

The interview schedule with the Deputy Secretary General (DSG) of the Trades Union Congress (TUC), Ghana was done purposely to gather relevant information from the perspective of labour union on their policies regarding staff development and to find out what the relationship between the union and HEIs was.

The DSG was asked to provide brief information on the TUC and its role in the development of welfare of workers in Ghana including their education. "*The Trades Union Congress (Ghana) was founded in 1945 and the primary objective of setting up the union was to promote the welfare of employees or workers in the then Gold Coast. Education and Training is one of the important aspects of the Trade*

Union Congress (Ghana). The TUC consist of eighteen (18) unions and affiliates and these groupings have their own education and training programmes that are designed to benefit members". In describing the types of training programmes the union organizes for members and the benefits they derive from such programmes, the Deputy Secretary General stated that, "*most of the training programmes we organize here are aimed at equipping union leaders with requisite knowledge and skills in labour negotiations and collective bargaining processes. We have also introduced Certificate, Diploma and Executive Post Graduate Certificate programmes in labour studies with the University of Cape Coast. Although the programme is limited to only labour studies, it has been very beneficial to members of the union*".

Another issue that was discussed was the role of the TUC in the design of programmes for adult learners. The DSG stated that, "*Although Higher Education Institutions do not contact the Trades Union Congress when designing their curriculum we have entered into collaboration agreement with the University of Cape Coast to train members in labour studies. We have signed a memorandum of Understanding with the Kwame Nkrumah University of Science and Technology to promote research in labour issues. Again, we serve on Trade Test Council which is responsible for issuing trade test certificates and run the National Vocational Training Institute. It is important to consider the input of Trades Union Congress when designing the curriculum for students in Ghana although our primary focus is on the worker***.**"

The DSG was of the opinion that the TUC had made the necessary arrangements to provide workers with a pool fund that will enable them to finance their education when they want to continue. He added that, "*Act 651 (10) makes provision for the setting aside of funds by the TUC to promote the well-being of members which includes education. Presently the Danish Union has provision for members which allows them to access funds from the pool for their education. Our goal is to set up such funds to support our members pursue further studies in higher education institutions. We are also exploring the possibility of accessing funding from the Ghana Education Trust Fund (GET Fund) for our members. Some challenges we are presently facing in this regard include; employers' objection to releasing members to undertake programmes in HEIs, implementing pool fund where employees could access funding for their education and the absence of policies to implement these objectives".* He also noted that*, "it is important to note that the creation of a pool fund will involve the government, employers and unions and the monies that are generated will be used solely for the intended purpose. By establishing this pool fund, employers will not solely bear the responsibility of financing the education of their employees*".

The researcher asked him if the TUC had plans to liaise with the Ghana Employers Association to promote the participation of workers in higher education. He indicated that, *"We have bilateral*

relationship with the Ghana Employers Association and the relationship is built around tripartite issues such as pensions and conditions of service".

The responses from the Deputy Secretary General of TUC revealed the broad role of the union in the development of the knowledge, skills and attitude of adult learners. The challenges often faced by employees in the acquisition of requisite knowledge and skills are at times hampered by the refusal of employers to either approve study leave for these workers or grant them permission to combine work with schooling. The role of the TUC in the provision of quality education for all workers could be considered as very important because they are able to negotiate for training and educational programmes for workers especially

6.6.6 Interview with the Deputy Executive Secretary of NAB

The National Accreditation Board is a state institution that is responsible for accrediting higher education institutions in Ghana. The interview was granted by the Deputy Executive Secretary (DES) of the National Accreditation Board of Ghana (NAB). The researcher asked the DES what role the National Accreditation Board plays in the provision of education for adults who are in employment and would want to further their education. He stated that "*The NAB is responsible for setting the requirements for the admission of students into HEIs in Ghana. This is clearly provided by the 2004 government White Paper on tertiary education in Ghana. We have clearly defined entry requirement for adults who seek admission into these institutions. We however do not control the teaching and learning processes of adult learners separately from all others but we often advise institutions to provide offers to adult learners".* Pressed further to state the policies in the past which have helped in the development of adult learning in HEIs in Ghana, he noted that, *"The NAB does not directly control or promote adult learning in HEIs. The responsibility for increasing access to adult learners rest with the Ministry of Education (MOE) and the National Council for Tertiary Education (NCTE) and this is contained in the Tertiary Education Report Series. We work with institutions to ensure that they adhere to the standards for admitting students and providing the needed resources for effective teaching and learning*".

The DES also explained the role of the various state agencies in the provision of access to higher education. He noted that, "*Although the NCTE has oversight responsibilities for defining the entry criteria of adult learners into HEIs, the NAB ensures that these regulations are adhered to by the institutions*". He also stated that, "*NAB has developed national access policies which encourage the admission of adult learners in the various HEIs in Ghana"*. In explaining further the access policies he noted that, "*HEIs are advised often to provide opportunities for adult learners and the entry requirement for adult learners*

have been designed to give them the needed support. Most universities organize and run mature entrance examinations for adult applicants and these are ways of increasing access. The Ministry of Education, NCTE and the NAB have agreed on the mature age as 25 although some schools prefer to vary this provision. Example is the University of Ghana which has set age 27 as the base age for mature entrance application. It is important to note that quotas for mature entrance examinations are usually set by the HEIs".

The researcher asked the DES if the criteria set out by the National Accreditation Board for the admission of students into HEIs affect the admission of adult learners in HEIs in Ghana. "*No. We have flexible requirements and this promotes participation of adult learners in HEIs*". He added that, "*HEIs are autonomous and so we do not restrict their intake of adult learners. However, we encourage them to admit adult learners in their institutions*". *Similarly, adult learners' increased access to HEIs should be a collaborative arrangement between the MOE, the NCTE and for the NAB, we will continue to encourage HEIs to admit adult learners.*

In conclusion, the DES stated that, *"the NAB continues to encourage industry-academia collaboration".* He added that, "*the NAB verifies such collaboration together with documents supporting students' engagement with industry especially where the course is practically oriented and we often do this when we embark on academic auditing exercises where we request for the Memorandum of Understanding documents*".

The interview session with the DES of the NAB revealed that universities in Ghana could develop institutional policies to promote adult learning in their universities. Additionally, they could develop special programmes to meet the knowledge and skills needs of adult learners.

6.7 CONCLUSION

This chapter presented the analysis and discussion of the units of observation drawn from three diverse cases. The real experiences of adult students, heads of department, industry representatives, regulatory agency and the Trades Union Congress in the development and promotion of adult learning practices in HEIs were discussed. The chapter also discussed the data gathered from adult learners who completed questionnaires in the three cases using Pearson's correlation to show the relationship among the variables used in the study. The quantitative data analysed served to provide additional evidence on the perception of adult learners on different constructs in the five variables and these variables were also used in framing

questions for discussants in the focus group discussion, thus providing a direct link between the questionnaire items and the focus group schedule.

Based on an inductive approach and analytical framework which involved the development of codes, patterns, themes categories, concepts and the quantitative data(as explained in Chapter five) the study identified the practices and policies that influence adult learning in HEIs in Ghana with emphasis on Telecommunications and Electrical Engineering. The HODs, DES of the NAB, representatives of industry and the DSG of TUC, Ghana provided information on their roles in the development of relevant programmes for adult learners in Ghana.

Although the views of the discussants from the different cases used for the study varied, the challenges faced by the discussants in the acquisition of relevant knowledge, skills and attitudes could be described as similar in the universities studied. The study showed that although a constructivist approach to learning plays a key role in the training of the adult learner, different learning theories converge to provide adult learners with the requisite knowledge and skills needed for their jobs. Similarly, any intervention in the curriculum of adult learners would require an analysis of the learning theories that support knowledge and skills acquisition. The relationship between the variables used in the study showed a positive correlation which also suggests that the perception of respondents on one variable influenced their perception on another variable. A close study of the constructs in the variable shows a close relationship between the factors that influence the development of curriculum in HEIs and students' perception of their needs.

Chapter seven discusses the cross-case synthesis and provide the similarities and differences in the perception of adult learners, the views of HODs and industry representatives. The chapter also provides the conclusions and the implications for the study as regards, policy, practice and theory.

CHAPTER SEVEN

CROSS-CASE SYNTHESIS

7.1 INTRODUCTION

This chapter provides a cross-case discussion of the three diverse universities used for the study by interrogating the similarities and differences between the policies, practices and interventions used in developing programmes that are aimed at developing the knowledge and skills of adult learners. Using six variables that were developed from theories of adult learning and conceptualised (see Chapter four) for the empirical study, the cross-case synthesis explores the relevance of Telecommunications and Electrical Engineering programmes in three diverse universities in Ghana. The data analysed in this chapter is presented according to the three key categories of respondents: adult learners, education providers and industry representatives. The views of industry representatives, DSG of the Trades Union Congress of Ghana (TUC) and the DES of the National Accreditation Board (NAB) are interwoven into the cross-case discussion. The data analysis presented in Chapter six served as the basis for drawing cross-case conclusions, and these provide answers to the research questions identified in Chapter one. This chapter therefore focuses on answering the main research question: how relevant are Telecommunications and Electrical Engineering programmes at universities in Ghana to the needs of adult learners?

7.2 CROSS-CASE SYNTHESIS – PERSPECTIVES OF ADULT LEARNERS

The cross-case synthesis discusses the similarities and differences between three diverse cases selected for this study. The section sets out by comparing the perspectives of adult learners on five key variables developed from Chapter four and identifies common practices and policies used by the three universities studied. In addition, the discussion draws on the views of industry representatives and representatives of the NAB and TUC to provide a chain of evidence for conclusions reached on the relevance of Telecommunications and Electrical Engineering programmes in Ghana.

7.2.1 Core knowledge in Engineering

This section focuses on the views of adult learners on what they considered as necessary programme ingredients for the development of Telecommunications and Electrical Engineering knowledge and skills, and what they perceived as sources of relevant knowledge and skills. Additionally, this section answers the research sub-question 2 which sought to explore the type of knowledge, skills and attitudes are

required by adult learners in the Telecommunications and Electrical Engineering fields. Two related variables namely core knowledge in engineering, and the connection between programme and job have been combined in this section to provide a better understanding of the themes and concepts which emerged from the focus group discussion and the questionnaires.

A one-way analysis of variance was used to examine the differences in mean CKE (core knowledge in engineering) scores of adult learners from four different departments in three universities.

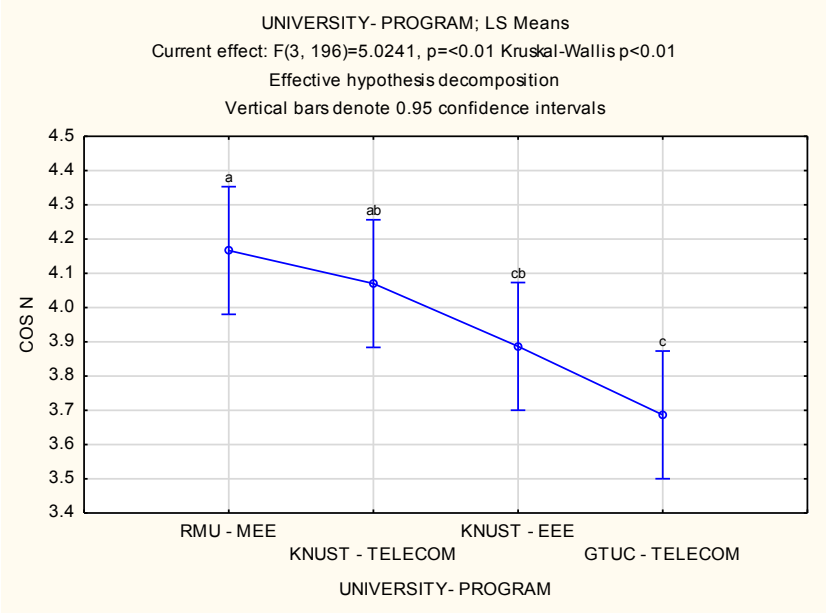

Figure 7.1: Means plot for adult learners' core knowledge in engineering

Figure 7.1 shows the means plot for respondents' perception of the importance of core knowledge in engineering as offered by the programme.

The analysis of variance showed significant differences among the means of CKE which explains the views of adult learners on their core knowledge in engineering as offered by the programme. The computed F-statistic is F (3, 196) = 5.02, with p-value, p=0.01. The respective means and standard deviations are: KNUST EE: Mean = 3.89, SD = 0.58, GTUC TE: Mean = 3.69, SD = 0.63, RMU MEE: Mean= 4.17, SD = 0.71 and KNUST TE: Mean= 4.07, SD = 0.74. Detailed cross-case discussions of the data and the responses from the focus group discussants are presented below.

The analysis showed high means in the responses of the RMU MEE respondents (M = 4.17, SD = 0.71) on their perception of the effect of the M/EE programme on their core knowledge in engineering as compared to the KNUST EE respondents (M = 3.89, SD = 0.58). The results suggest that although the respondents considered the set of activities that enriched their core knowledge in engineering as not

complete, they were able to gather the needed knowledge required for their jobs. Additionally, an analysis of variance showed a higher mean in the responses of the KNUST TE respondents (M = 4.07, SD = 0.74) on their perception of the effect of the TE programme on their core knowledge in engineering when compared to the GTUC TE respondents (M = 3.69, SD = 0.63).

The analysis also shows that although adult learners at KNUST, RMU and GTUC considered their programme as somewhat adequate, they identified some additional courses as necessary for developing their knowledge and skills in their field. Notable courses such as **automation and control systems, simulation for Electrical Engineering systems and automation Telecommunications engineering for mariners programme logic control systems; CISCO networking certification training; complex programming languages; practical field training on transmissions; Linux; information theory; advanced computer programming; base station installation training; transmission of signals, and solar and nuclear energy systems** were identified by the adult learners as very important for **practical field work.** The significance of identifying special course needs by adult learners is that, they are able to easily relate their job demands with the theories and laboratory work they do. The development of the knowledge and skills of adult learners does not depend on theories alone, laboratory work and practical field sessions are also necessary in the development of their knowledge and skills. Therefore, when **laboratories are well resourced** adult learners are able to **acquire relevant skills needed in the industry.** Any shortfall in the provision of relevant knowledge in engineering will **not allow for adequate skills development which is required for practical work.**

The analysis also revealed a growing need for the introduction of advanced computer programming courses and tools in electrical and Telecommunications engineering programmes. Advanced computer programming courses and tools enhance the knowledge and skills of adult learners and also enable them to demonstrate mastery in the use of modern software and technology. Courses such as **data base design systems, OPNET, MATLAB, SIMULINK and CAD** are relevant for all engineering students who require them in modern engineering environment (Moore et al., 2003; Heitmann, 2005; Angelo, 2009; Cooper et al., 2009). It is clear that there is the need to improve practical sessions and equip laboratories with modern technologies and tool for engineering education in HEIs in Ghana. Heitmann (2005), McLinden (2013) and Crawley et al. (2014) provide arguments to support the view that technology plays a key role in the training of students in the engineering field.

The key consideration that emerged from this section was that the design of Electrical Engineering curriculum should take into account the following: the **relevant skills needs** of adult learners in industry,

their **employability skills** (because some of them were looking forward to taking more challenging roles on completion of their programmes) and enriching the curriculum with more **programming courses.**

7.2.2 Relevance of Engineering programmes to the needs of adult learners

This section discusses the results of a one-way analysis of variance that was computed to examine the differences in mean of ROPAK scores of adult learners from four different departments in three universities. This section answers the main research question which sought to investigate the relevance of the Telecommunications and Electrical Engineering programmes to the needs of adult learners.

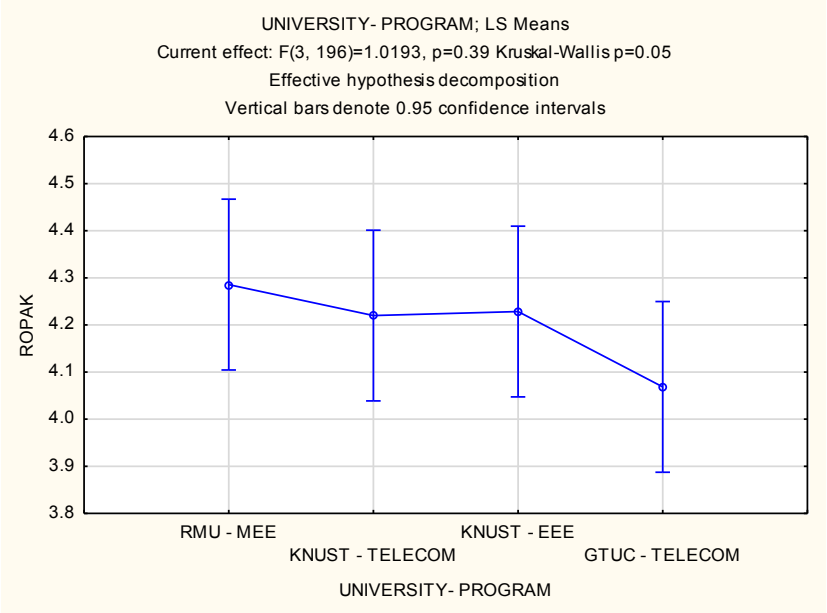

Figure 7.2: Means plot for relevance of programme to adult learners

Figure 7.2 show the means plot for respondents' perception of the relevance of their programmes to their knowledge and skills needs. The analysis of variance showed significant differences among the means of ROPAK which explains adult learners' perception of the relevance of programmes on their core knowledge in engineering and skills needs. The computed F- statistic is F (3, 196) = 1.02, with p-value, p= 0.05. This indicates that the four means do not differ significantly. Since the residuals are not normally distributed, this analysis was repeated non-parametrically with the Kruskal-Wallis test, which confirmed the result of the F-test that there are no significant differences among the four programmes (p>0.05). The respective means and standard deviations are: RMU: Mean = 4.29, SD = 0.62, KNUST EE: Mean = 4.23, SD = 0.57, KNUST TE: Mean = 4.22, SD = 0.79, and GTUC TE: Mean = 4.07, SD = 0.59.

Adult learning programmes include the curriculum, resources, teaching and learning methods, laboratory sessions and arrangements at the various faculties to support effective skills and knowledge transfer. Detailed explanations of the data and the responses from the focus group discussants are presented below.

7.2.2.1 Electrical Engineering (KNUST and RMU)

The analysis showed that curriculum provides adult learners with opportunities to develop their knowledge and skills needed for careers as engineering. Adult learners explained that although some of the courses offered by the department met their knowledge and skills needs, others were **more theoretical rather than practically oriented**. In amplifying that assertion, the adult learners also showed that **they required more practical field/laboratory work** to enable them develop their **practical knowledge in the different fields**. The responses of the RMU MEE respondents (M = 4.29, SD = 0.62) on the relevance of their programme to their knowledge and skills needs showed high means scores as compared to those recorded by the respondents from KNUST EE (M = 4.23, SD = 0.57). The means and standard deviation shows that respondents from RMU and KNUST considered the relevance of their programme to their knowledge and skills needs as high.

The introduction of relevant courses in adult learning programmes provides additional knowledge to adult learners who require them for their work. The study showed that the introduction of Matlab and Siemens PLC in their programme had given adult learners at KNUST new ideas for their work processes. Similarly adult learners from RMU also indicated that they had **obtained new knowledge after studying Matlab under Control Theory and** these were relevant for their day to work processes.

Although industrial attachments are required for all engineering students, the structure of the adult learning programme at KNUST did not allow them to engage in industrial attachment because they attended lectures only on weekends. Additionally, the study revealed that because many adult learners did not have the support of their employers to pursue further studies, they could not take up attachment in a different workplace. What this implies is that they are not assessed on industrial attachments which, as confirmed by the DES of the NAB, are a requirement for all students offering engineering programmes in Ghana. The study also showed that adult learners at RMU were not obliged to undergo industrial attachments although it is a requirement.

Adult learners from KNUST and RMU noted that their work experiences contributed to their skills development while on the programme, the learners indicated that they often **discussed their work**

processes and shared ideas. They added that most of the theories connect to their work processes so they were able to discuss them with their facilitators.

Regarding the completion of skills matrix, the adult learners indicated that they did not complete skills matrix because they were responsible for paying their own fees and their employees did not contribute in any way to their learning activities. The responses from the discussants at RMU corroborated the views of their colleagues at KNUST. They noted that a skills matrix was not used by adult learners in the department to support their knowledge and skills development. They were of the opinion that since most of them were responsible for funding their education, it was not possible for their employers to develop a skills matrix for them to work with. Although the completion of skills matrix by adult learners, academic department and employers are currently not done it is necessary for HEIs to begin to use them because it provides relevant information on how adult learners progress in their studies. Through the skills matrix also, employers are able to identify additional work functions to give the adult learners.

On whether the learners considered their experiences as important in the teaching and learning process, the discussants from KNUST noted that **their experiences supported their classroom activities.** The study showed that adult learners who worked in different engineering firms are able to make significant inputs in the learning process thus, creating knowledge sharing environment where the facilitator benefitted and shaped the understanding of the students. The responses from the adult learners at RMU were similar to what those at KNUST stated. Adult learners at RMU were of the opinion that although they had challenges with their laboratory session, they considered the connection between their experience and what they were taught in class as related.

7.2.2.2 Telecommunications Engineering (KNUST and GTUC)

Adult learners at KNUST and GTUC agreed that their curriculum provided them with opportunities to further develop their skills needed for their jobs. While adult learners from GTUC indicated that they considered **technical report writing** as very necessary and that it had **enhanced their writing skills**, those from KNUST noted that **signals and systems dynamics, data communication and network planning, data communication theories and network planning for field work** were some useful additions. **Team work, data encryptions using software and Ethernet, cable clipping, morals and ethics, basic economics, accounting and management, engineer and society, broadband wireless technology, mobile and satellite communications and proposal writing** are some of the tools and courses that are considered necessary for adult learners' skills and knowledge development in engineering**.**

The study showed that adult learners from GTUC were obliged to undergo supervised industrial attachment and students were required to receive credit for their activities while on attachment.

With reference to how their work experience contributed to their skills development whilst on the programme, adult learners from KNUST noted that their **experiences enhances our thinking abilities and helps us to achieve simple ways of achieving results**. Additionally, they indicated that they were able to make relevant contributions in class and this enhanced teaching and learning processes. Adult learners from GTUC shared similar views. The satisfaction of the discussants in the focus group discussion regarding the relevance of the TE programme to their knowledge and skills needs mirrored the responses gathered from the respondents who completed questionnaires. An analysis of variance computed showed high means in the responses of the KNUST TE respondents (M = 4.22, SD = 0.79) as compared to the GTUC TE respondents (M = 4.07, SD = 0.59). Additionally, the means showed that respondents from GTUC TE also considered the relevance of their programme as relevant to their skills and knowledge needs as high although it was lower than what was recorded for the KNUST TE respondents.

The responses from adult learners provide three main considerations for theory and practice; first is that experiences and knowledge are shared, second, that the process of developing knowledge through experiences involves connection with relevant theories (Kanuka, 2011; Shulman, 2005 cited in Hunt et al., 2013; Amadio et al., 2014) and third, that individuals develop their own frame of reference which should be known and shaped by facilitators. Additionally, the views of the respondents from the three universities showed that experiences enhance the critical thinking abilities of adult learners (Barkley, 2009; Sambell, 2011), second, it helps adult learners to develop easier ways of working and achieving results by connecting work practices to theories (Dickens et al., 2009) and third, adult learners are able to make relevant contributions in class which enhances the process of teaching and learning and additionally make the work of facilitators easier. The importance of industrial attachment was amplified by discussants who indicated that it provided them the opportunity to connect the theories they learnt in class with the practical requirements of the programme. Their views corroborates the opinions of authors such as Prosser et al. (1999), Santoro (2000), Santoro et al. (2000), Ramsden (2003), Crebert et al. (2004), Biggs et al. (2007) and Litchfield et al. (2016).

7.2.3 Programme planning and motivation for self-directed learning

Programme planning and motivation for self-directed learning was the third variable discussed in the study. This section discusses the results of a one-way analysis of variance that was computed to examine the differences in mean MOTIV (programme planning and motivation for self-directed learning) scores of adult learners from four different departments in three universities. This section focuses on answering the main research question which examines the relevance of adult learning programmes to the needs of adult learners. Rather than focusing on only the knowledge and skills needs of adult learners, this section identifies the relationship between programme planning and adult learners' motivation to obtain higher education. Respondents were required to provide information on their views regarding programme planning and motivation for self-directed learning.

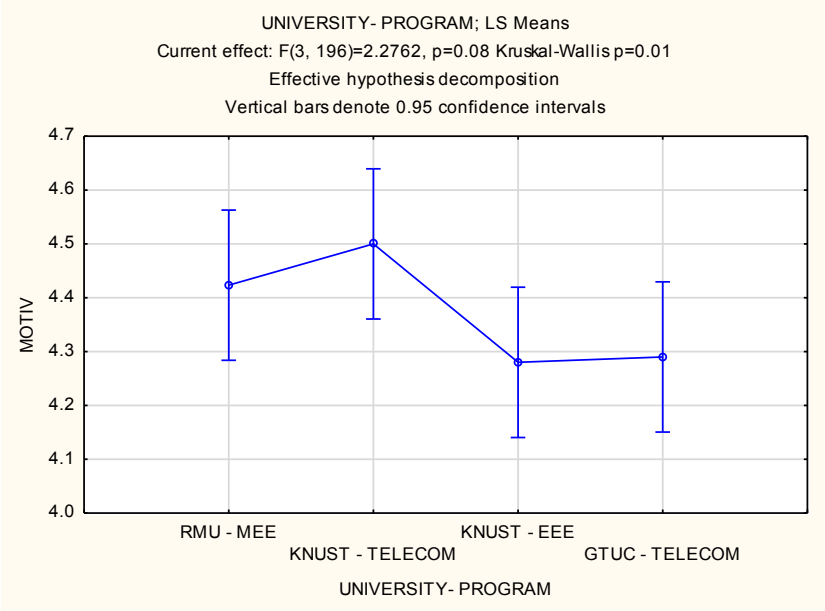

Figure 7.3: Means plot for adult learners' motivation to advance self-directed learning

Figure 7.3 shows the means plot for respondents' perception of the programme planning and their motivation for self-directed learning. The analysis of variance showed significant differences among the means of MOTIV which explains programme planning and motivation for self-directed learning among adult learners. The computed F-Statistic is F (3, 196) = 2.28, with p-value, p= 0.01. This shows that the four means do not differ significantly. The respective means and standard deviations are: KNUST TE: Mean = 4.50, SD = 0.50, RMU MEE: Mean = 4.42, SD = 0.59, GTUC TE (Mean = 4.29, SD = 0.40 and KNUST EE: Mean = 4.28, SD = 0.50. Detailed explanations of the data and the responses from the focus group discussants are presented in the write up below.

7.2.3.1 Electrical Engineering (KNUST and RMU)

Adult learners from KNUST showed that **teaching sessions were not negotiable or amendable** because they attended lectures twice every week (which were on Saturdays and Sundays) and there was no room for changes. Similarly the ability of adult learners to negotiate the teaching and learning processes was informed by the scheduling of programmes which provides information on lecture session and the courses to be taken. However, they considered the decisions of education provided as satisfactory hence the need to keep them. Adult learners from RMU intimated that although they at times tried to propose some changes to the way programmes were planned, their suggestions (mostly to facilitators) did not yield the needed feedback.

Adult learners from KNUST and RMU noted that although they faced challenges in negotiating the teaching and learning processes in their programmes, they were motivated to advance self-directed learning and this was evident in the analysis of the responses of adult learners who completed questionnaires. The means plot as shown in figure 7.3 suggest that respondents from RMU MEE (M = 4.42, SD = 0.59) were highly motivated to advance self-directed learning compared to the mean of KNUST EE (M = 4.28, SD = 0.50). The difference in mean suggest that adult learners in the KNUST EE programme considered the teaching and learning process as not negotiable because of the limited time they had (Saturdays and Sundays). Another factor for the low mean recorded was the non-availability of library and laboratory facility at the Accra Campus; they indicated that the absence of those facilities meant that they could not have access to relevant resources that could promote learning.

7.2.3.2 Telecommunications Engineering (KNUST and GTUC)

Adult learners from KNUST indicated that they were not involved in the planning of their programmes at the university. They indicated that their packed lecture periods made it impossible for them to alter the arrangements made by the programme managers. Adult learners from GTUC also shared similar concerns, they indicated that **they usually discussed the scheduling of lectures with their facilitators at the beginning of the semester and this was often done with the consent of their colleagues in the evening class.**

Regarding the extent to which adult learners considered the input of industry experts as necessary to developing their curricula, adult learners from KNUST and GTUC considered the input of industry experts in the design of the programmes as very important.

Adult learners from KNUST identified **library, books, internet modems and learning tablets** as the resources they would require to successfully complete their programmes. **Well-equipped laboratory, consistent power supply, provision of detailed hand-outs by facilitators, fast internet connectivity, simulators and work conferences** were the resources discussants from GTUC identified as relevant to the successful completion of their programmes. The responses from the discussants in this section showed a weak relationship between education providers and adult learners in the planning of programmes. An analysis of variance computed showed high means in the responses of the KNUST TE respondents (M = 4.50, SD = 0.50) as compared to the GTUC TE respondents (M = 4.29, SD = 0.40). The means and standard deviation showed that respondents from KNUST TE considered programme planning and motivation to advance self-directed learning as satisfactory although they had some challenges in obtaining the relevant resources for their studies. The mean of respondents from KNUST was however higher than those recorded by respondents from GTUC who also indicated that there were challenges in their programme planning and motivation to advance self-directed learning. While some of the respondents were of the opinion that their roles were limited to following the schedule and programmes designed for them, others were of the opinion that there should be arrangement for adult learners to propose some additional courses for their study.

Cook (1992) showed that the process of negotiating teaching and learning processes with adult learners develops their critical thinking abilities; it enhances reflective practice among facilitators and adult learners and creates a knowledge creation environment. Similarly, findings by Hill (2014:64) suggest that teaching and learning among adults in higher education institutions is more effective when the practice moves beyond the basic provision of course design and teaching methods to include providing direct instruction in teaching, developing critical self-reflection and the opportunity to apply their experiences to the learning process.

7.2.3.3 The motivation of adult learners for learning

The study showed that adult learners pursuing Telecommunications and Electrical Engineering programmes in addition to the teaching and learning processes require effective planning of their programmes by the departments. The research question sought to examine the relevance of the Telecommunications and Electrical Engineering programmes to the needs of adult learners in three diverse universities in Ghana. Although the rationale for enrolling in either Telecommunications or Electrical Engineering programmes is often a personal decision, the role of education providers is very important in the acquisition of relevant knowledge and skills of adults. In shaping the knowledge and skills of adult learners, it is important for education providers to involve adult learners in the planning of

programmes for teaching and learning activities. The study showed that adult learners were not actively involved in the planning of Telecommunications and Electrical Engineering programmes, hence, neglecting the needs of the adult learner. Jarvis (2004) and Frith et al. (2012), however, suggest that the concept of motivation in adult learning is relevant to the understanding of the characteristics and needs of adult learners and developing appropriate programmes that would help them obtain relevant knowledge and skills in their discipline.

7.2.3.4 Objectives and aims of the programme

In addition to the motivation for adult learners to acquire further knowledge in engineering, the objectives and aims of the programme are designed to provide the requisite tools and resources that are relevant for impacting knowledge and skills that are essential for work place activities and self-development. The relationship between motivation for adult learners (see section 7.2.3.3) and the objectives and aims of the programme is that, the learning objectives are less detailed therefore, providing avenue for the input of adult learners to the programme. Additionally, when the objectives of Telecommunications and Electrical Engineering programmes are defined at the beginning, adult learners are able to connect their personal goals with the objectives of the programme (Thijs et al., 2009). The empirical study showed that departments in the three diverse universities ensured that the aims and objectives of the programmes were clearly communicated to adult learners prior to the commencement of the programme. However, the inputs of these adult learners are not considered when developing the aims and objectives of the programmes.

7.2.3.5 Learning resources and materials

Learning resources for adult learners are very important when examining the relevance of the Telecommunications and Electrical Engineering programmes to the needs of adult learners. Resources include; laboratory equipment, lecture schedule, libraries, learning management system, physical infrastructure, time, staffing and students' support services. The views of adult learners in the three universities showed that the provision of learning resources was a major challenge especially laboratory equipment and libraries. Heitmann (2005) and Dickens et al. (2009) show that learning resources in the field of engineering provides additional tools needed to develop the competences of adult learners. Similarly, it is important for HEIs to provide effective lecture sessions with appropriate technology, incorporate elements problem based learning in lecture rooms, engage students with practical work, provide web-based laboratories and computer-aided assessments. Adult learners in all three cases posited that they required more learning resources such as simulators, laboratories with modern equipment and uninterrupted internet connectivity. While the cost of equipment for laboratories may be expensive, HEIs

could collaborate with industry to either use their work floors during off-peak periods or secure funding for equipment. Cooper et al. (2009) showed that Remote laboratories and sophisticated equipment for teaching and learning process could be accessed from industry work floors and this could account for an effective collaboration between HEIs and Industry. Similarly, HEIs could access remote laboratories from educational institutions outside the country through collaboration and joint research projects.

7.2.3.6 Negotiating the curriculum with adult learners

Developing adult learning programmes in engineering requires education providers to adopt teaching and learning environment that promotes continuous discussions and knowledge sharing activities between facilitators and students. The role of the facilitator should not be limited to only providing adult learners with requisite knowledge and skills but also devise varied learning activities to improve the knowledge and skills of adult learners, negotiate the timing of assignments, decide with adult learners on appropriate seating arrangement in class, advise on learning groups and providing practical components that draws on the experiences of adult learners (Cook, 1992; Hiller, 2005). The study showed that adult learners were not involved in negotiating the curriculum as expected based on the theories discussed and although some form of negotiations were identified, it was only limited to the scheduling of courses with some facilitators. Cook (1992:16) suggests that the benefits of negotiating the curriculum of adult learners include: providing the facilitator as well as the adult learners with the best means of achieving the goals of teaching and learning in the classroom; creating an environment that enables adult learners to learn better; encouraging adult learners to discover their own understanding of the subject and develop new ideas; participate in lecture room activities by asking questions and contributing meaningfully in discussions.

7.2.4 Teaching and learning methods

Teaching and learning activities are central to the process of providing adult learners with relevant knowledge and skills needed in the work environment and for their self-development. This section seeks to answer the research sub-question on the type of knowledge, skills and attitude required of adult learners. For the purpose of this study, assessment tasks, controlling the size of adult learning class and the role of technology in the learning environment are considered as elements of teaching and learning. The section begins with the results of the analysis of variance computed for respondents in the three diverse universities.

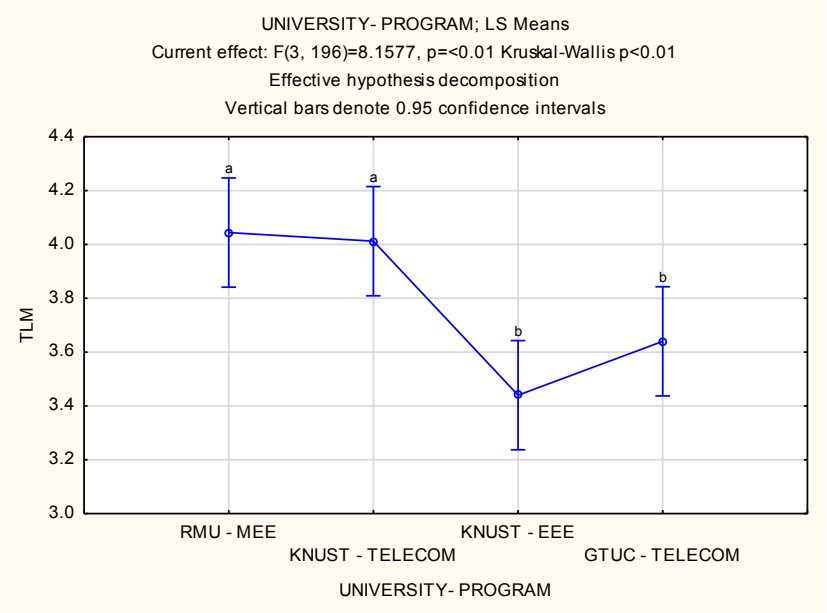

Figure 7.4: Means plot for teaching and learning methods

7.2.4.1 Electrical Engineering (KNUST and RMU)

Figure 7.2 shows the means plot for respondents' opinion on the teaching and learning methods used by the departments in developing their knowledge, skills and attitude. The analysis of variance showed significant differences among the means of TLM which explains the teaching and learning methods used by the departments. The computed F-statistic is F (3, 196) = 8.16, with p-value p=0.01. The respective means and standard deviations are: KNUST EE: Mean = 3.44, SD = 0.68, GTUC TE: Mean = 3.64, SD = 0.78, RMU MEE: Mean = 4.04, SD = 0.81, KNUST TE: Mean = 4.01, SD = 0.61. Detailed explanations of the data and the responses from the focus group discussants are presented in the write up below.

Adult learners from KNUST considered their **learning activities as often clearly defined and they show what students are expected to know every week.** The responses from adult learners in RMU were same as those of the KNUST. They indicated that the learning goals including the expected activities for each of the courses were clearly spelt out at the commencement of each course.

The response from adult learners from KNUST and RMU showed that the following resources were necessary for effective teaching and learning; **availability of internet connectivity, flexibility of choosing courses to suit your busy schedule, lecturers' use of project assignments and other applied assessment modules, availability of physical space and flexible timetable, availability of laboratory equipment and consistent laboratory work, simulation exercises and work conferences.**

Regarding the sharing of experiences on the programme, the adult learners from KNUST indicated that **they often shared their experiences through interaction either during discussions when they met as a group or class sessions. They did not provide evidence for formal arrangement that provided them with opportunity to share their experiences**. Adult learners from RMU shared similar information and indicated that they often shared their experiences when they met as a group.

Discussants from KNUST stated that their courses were structured in a more flexible and broad outlook, which challenged them to develop their analytical skills, independent study and application of key concepts to their professional roles. They added that, **they considered their lecture sessions on Saturdays and Sundays as very convenient and they were also able to meet the course requirements although they stayed in for longer hours when they get to school. They also added that they were able to share their experiences with their colleagues when they met either in class or when working on projects.** In contrast with the views of discussants from KNUST, respondents from RMU were of the opinion that although they met only during weekend, the EE programme could be enhanced to provide students with better understanding of the practical components of their programme and also help them develop their analytical abilities. Figure 7.4 show the means plot with the distribution of the respondents views on the teaching and learning methods in the University. Responses from the RMU MEE respondents (M = 4.04, SD = 0.81) on the quality of teaching and learning methods showed high means scores as compared to those recorded by the respondents from KNUST EE (M = 3.44, SD = 0.68). The low mean recorded for the respondents from KNUST EE suggest that they considered the non-availability of learning resources as a weak link in the teaching and learning methods in the department.

Feedback provides relevant information for self-reflection and development. Adult learners from KNUST maintained that feedback was often provided by **facilitators through verbal means and usually interactive sessions**. They were also of the opinion that the **feedback provided learners with information on areas marked for improvement and further task requirement** and allowed for **some reflection based on expected output from the task** and the actual output of the adult learner. The responses of the discussants from RMU regarding the feedback systems established to help them improve on their performance was quite different from what was provided by discussants from KNUST. The discussants noted that the feedback systems were not same for all courses. They indicated that while feedbacks were received through verbal means for some courses (depending on the lecturer), some faculty did not provide them with the necessary feedback.

7.2.4.2 Telecommunications Engineering (KNUST and GTUC)

The responses of adult learners from KNUST showed clearly what was expected of them and what resources were needed to complete the programme successfully. Similar to what their colleagues from KNUST stated, those from GTUC opined that their courses spelt out the activities and the different resources needed to successfully complete the programme. They added that, **the learning activities for each course showed the various types of activities required of students as individuals or as groups to develop their thinking abilities and also meet their personal learning goals.**

Discussants from KNUST and GTUC were of the opinion that the following resources were necessary for effective teaching and learning; **availability of internet connectivity, flexibility of choosing courses to suit your busy schedule, lecturers' use of project assignments and other applied assessment modules, availability of physical space and flexible timetable, availability of laboratory equipment and consistent laboratory work, simulation exercises and work conferences.**

Discussants from KNUST noted that not all the courses were structured in a more flexible and broad manner which challenges them to develop their analytical skills, independent study and application of key concepts to their professional roles. Although discussants from GTUC shared similar opinion as those provided by discussants from KNUST, they added that most of the courses required them to apply critical thinking and analysis.

Regarding the number of times discussants met to share their experiences on the programme, those from KNUST indicated that **although they shared their experiences as individuals, the programme did not create enough room for sharing ideas and experiences**. The responses provided by discussants from GTUC was quite different from those provided by discussants from KNUST. The discussants from GTUC were of the opinion that it was a common practice for them to share their experiences.

Feedback from faculty according to the discussants from KNUST was adequate and they received the feedback through e-mails and their class representative. They added that, the **feedback information provided them with relevant information that was necessary for their work** and **helped them improve their performance in class.** The views of discussants from KNUST were same as those provided by the discussants from GTUC who indicated that they often received feedbacks **through e-mails and the class representatives**. They indicated that **feedback helped them to prepare before each lecture, it helped them to improve on their performance and to understand key concepts which were very useful for their job settings.**

The views of discussants under the teaching and learning domains were mixed. However, what emerged was that the teaching and learning processes could be improved. An analysis of variance computed showed high mean in the perception of respondents from KNUST TE (M = 4.01, SD = 0.61) as compared to those from GTUC TE (M = 3.64, SD = 0.78). The mean and standard deviation showed that respondents from GTUC TE considered the teaching and learning methods used as adequate although it was lower than what was recorded for the KNUST TE respondents.

The process of teaching and learning requires students to develop critical reflection and dialogue, critical thinking abilities, independent study and application of key concepts (Quinnan, 1997; Cowan, 2006; Carusetta et al., 2009; Loureiro et al., 2013; Hunt et al., 2013; Hill, 2014). While some of the discussants indicated that their courses were structured to enable them apply critical thinking and analytical skills, others were of the opinion that the teaching and learning processes could be improved. Their views corroborates the views of Litzinger et al. (2011) who posit that Engineering curricula and teaching methods are often not well aligned with to the goals of engineering education which requires technical and professional proficiency.

7.2.4.3 Assessment tasks

Adult learners require assessment to enable them measure their understanding of the teaching and learning processes in class and on the practical field. An assessment task provides adult learners with detailed information on specific requirements that are intended to either test or bring out their abilities, knowledge and special skills. Furthermore, assessment enable adult learners to: develop their knowledge by designing their own learning and assessment patterns in relation to those provided by the facilitators; measure and certify the learning process and provide useful feedback that allow for reflection and improvement (Sambell, 2011; Nicol et al., 2006). Similarly, the focus group discussants were also of the opinion that their courses provided detailed information on assessors' expectation of students, the resources required for the courses and the learning outcomes. The views of authors such as; McNeil (1981), Angelo (2009) and Thijs et al. (2009) corroborate the opinion of the discussants.

Feedback systems from assessment are very important for the development of the knowledge and skills of adult learners. Sambell (2011) argues that a feedback system designed for learners should have provisions to help students to develop their own understanding of the type of feedback rather than identifying the areas needed for improvement without providing detailed support for the students. Discussants' views on feedback systems show that there were differences in feedback reporting systems

by course facilitators. While facilitators may have varied views on the mode of providing feedback to students, it is important that departments, faculties, institutes and schools in HEIs develop a broad framework for teaching and learning.

7.2.4.4 The role of technology in the teaching and learning process

Technology in modern engineering practices is considered as very important because most organisations have technology and equipment that require detailed knowledge and skills to operate or control. In the field of Telecommunications and Electrical Engineering, technology is considered as very important. Since the Telecommunications and energy industries are dynamic, the expectations of employers are that employees should be abreast with new technology and have knowledge of emerging tools and equipment. The role of facilitators is to introduce students to modern state of the art equipment and technologies by visiting industry work floors or making use of remote laboratories all in other universities. Similarly simulation software could be used in exposing adult learners to modern technology. In relating technology to the teaching and learning processes, the role of technology has become very necessary due to the evolvement of online course deliveries in flexible learning environments.

7.2.5 Employability indicators

All groups of discussants from the three universities were of the opinion that the following employability indicators were important to their knowledge and skills needs; **Research & inquiry, Information literacy, Personal & intellectual autonomy, Ethical, social & professional understanding and Communication.** Adult learners who are in employment require additional knowledge and skills to remain in industry. Similarly employees may expect additional skills and competences from the adult learners upon completion of their programme.

7.3 CROSS-CASE SYNTHESIS: HEADS OF DEPARTMENTS

This section provides the case synthesis on the structure of the Telecommunications and Electrical Engineering programmes in the three universities used for the study and the teaching and learning systems put in place to support adult learners.

Table 7.1: Cross-case synthesis: Heads of departments

THEME	KNUST	RMU	GTUC
Establishment of separate class and schedule for adult learners.	The University has an institute which is responsible for adult learning programmes. In addition to organising adult learning programmes, the institute coordinates the teaching and learning processes by different departments.	The University has a weekend school which provides lectures for workers who are not able to enrol for the regular programme.	The University has a separate class for adult learners who are unable to enrol for the regular class. This group of students meet in the evenings and the teaching and learning processes are coordinated by the department.
Existence of internal consultations and discussions among facilitators to ensure that the programme content have the required resources and personnel to run.	The consultations and discussions are often held at the college level and departments implement the decision of the College. The department does not hold separate consultations.	The internal consultations are carried out by the Department and the University's Quality Assurance Unit. The consultations are usually carried out at the beginning of every semester; faculty and the quality assurance unit meet to discuss the content, resources and personnel needed to run the programme.	Programme content are reviewed at the beginning of every academic year by a Content Review Committee which is headed by the Head of Department.
Existence of established processes to engage skilled engineers especially those from industry to	The department has reached an agreement with one of the leading Telecommunications company to provide them	The department has collaborations with two power generating companies to provide support to students	Through meetings and discussions, new technologies and approaches are added

provide you with specific skills needs for their sector.	with internet connection and practical training opportunities for students. In addition to providing internet and training opportunities to students, the company has also established an innovation fund for teaching and research.	through workshops and discussions. Their advice is often considered during teaching sessions and the focus is not only on adult learners but all students.	into the syllabus during the reviews.
Industry experts' contribution to the design of curriculum for engineering students.	Industry experts do not provide support in the design of the electrical and Telecommunications engineering programmes.	The Faculty and industry collaborate to provide the department with relevant information and new methods of working and technology that are important to the teaching and learning processes.	The contributions of industry expert to a very large extent help in improving adult learning and learning in general.
Frequency with which programmes are reviewed to suit industry and the needs of adult learners.	The teaching strategies and objectives are usually revised for all undergraduate programmes but emphasis is not placed on whether the students are adult learners or not.	The department reviews programmes every three years and the processes are often reviewed by the National Accreditation Board (NAB).	Course contents are updated every year.
Development of content specifically to meet the needs of adult learners.	There are no specially developed programmes for adult learners although there is an institute	The focus of the department is always on the content and not the age range because industry practices and	The department does not consider the age range of students when designing their course contents.

	specially set up to serve the needs of adult learners.	processes are general and irrespective of the age differences the knowledge and skills provided to students should be geared at helping students achieve these competences.	
Ensuring that students embark on supervised industrial attachment that is assessed by the department.	Industrial attachment for adult learners at the Accra City Campus is not done due to the schedule of the students.	Although students are given introduction letters to go on industrial attachment the activity is not assessed.	The department ensures that all students undergo supervised industrial training and they are awarded marks for their engagement.
Existence of broad policy guidelines to direct facilitators on the teaching and learning methods at the department.	There are no broad policy guidelines to direct faculty/facilitators on the teaching and learning methods of the university.	The department uses teaching evaluation reports to monitor the performance of students and this process is for all categories of students and not adult learners only. Teaching and learning processes are also monitored by the department.	The department has not considered undertaking broad policy guidelines to direct facilitators on the teaching and learning methods.
Aligning teaching strategies to reflect Ghanaian cultural values.	The present curriculum does not have special design to ensure that teaching and learning are aligned to the Ghanaian cultural values. Engineering programmes are often based on specific	The University is a Regional one so they consider the backgrounds of different countries when designing the programmes. They do not consider the	The department does not consider Ghanaian values when designing programmes.

	discipline requirement which identifies the theories and practices that are relevant for the skills needs of students. However, students are required to take courses in the liberal arts area.	Ghanaian cultural values when designing their programmes.	
Development of teaching philosophies to guide facilitators and students.	The departments do not have teaching philosophies that guide facilitators and students.	The department considers the needs of students so they ensure that course delivery is students' centred and the teaching resources (projectors and laboratory equipment) are always available for faculty and students.	The department does not have special offering for adult learners although there is a top-up programme for adults. The courses and content are almost the same.
Aligning programme objectives and procedures to the broad objectives of regulatory agencies.	The university has the right to design its programmes based on certain relevant considerations which are approved by the NAB. The departments are not necessarily obliged to follow specific procedures when designing programmes. However, the NAB provides guidelines for the development of programmes and they	The department ensures that the processes involved in the appointment of faculty, the maintenance of resources and the teaching and learning practices conform to the set standards given by the National Accreditation Board (NAB). The arrangements are for all categories of students	The department does not work directly with the regulatory agencies. These are often done at the university level.

	align them to certain specific criteria and this is a novel process that all institutions are required to follow.	and not necessarily adult learners only.	
Meeting the teaching and learning needs of adult learners.	There department has no specific arrangement that emphasises the connection between adult learners' interest and the course content.	The department has not developed a separate curriculum for adult learners. However, facilitators consider their experiences when teaching and so they are able to meet their peculiar knowledge needs by connecting theories with their practical skills. These factors are considered when reporting the course contents and proposed changes to the Academic Council.	The department does not consider the needs of adult learners when developing course contents for students because the target population are often high school leavers.
Application of the benchmark standards of the Ghana Institution of Engineers in the design of curriculum	There are no specific standards prescribed by the Ghana Institution of Engineers. The department does not follow standards set by the GIE.	Although the department has a collaboration with the Ghana Institution of Engineers. They do not control the teaching processes. They provide the department with relevant input for the programmes and discussions are often	This is achieved through collaborative discussions with experts in the Telecommunications industry in Ghana.

		held with them on industry best practices.	

7.3.1 The structure of the programmes in the three cases.

The first two questions sought to address the second sub-research question on the structure of Telecommunications and Electrical Engineering at the three different universities. The Heads of Department noted that although the universities considered the knowledge, skills and attitude development of adult learners as important, their curriculum were not designed to meet the needs of specific group needs. They indicated that the departments developed their curriculum based on industry needs and specialist skills rather than the needs of adult learners. Regarding the review of curriculum to meet the needs of employers and students, all the HODs stated that the review of curriculum was often done to meet the needs of students and employers. While HODs stated that curriculum review process was often initiated by the faculty, others indicated that the Quality Assurance Department was responsible for initiating curriculum reviews. The views of the HODs suggest that the needs of adult learners were not addressed when they develop curriculum for students and this did not enhance effective teaching and learning among adult learners. The study also revealed that the academic departments in all the three cases did not consider the relevant learning theories when developing programmes for students in their departments.

7.3.2 The relevance of Telecommunications and Electrical Engineering programmes to the needs of adult learners.

This sub-section sought to answer the main research question on the relevance of adult learning programmes to the needs of adult learners. The HODs stated that they had not developed special curricula to meet the knowledge and skills needs of adult learners. They emphasised that the target group in the teaching and learning processes were often the young students who had completed high schools although they had special arrangement to satisfy the busy schedule of adult learners. Conclusively what emerged from the interaction with the HODs was that the structure of HEIs Telecommunications and Electrical Engineering programmes in the three universities were not designed to respond to the learning needs of adults.

Teaching philosophies are necessary for education providers because they show the orientation of the departments with regard to the teaching and learning methods that are adopted and facilitators are obliged to follow these philosophies when they engage students. Two of the three HODs stated that their

departments did not have teaching philosophies which guided teaching, learning and research activities at the department. Similarly, some discussants in the focus group discussion noted that some of the facilitators could not teach as required of them and this was often noticed by the students during lecturers. The design of a teaching and learning manual for facilitators could help develop appropriate teaching and learning methods that were required of them. Some adult learners also indicated that it would be necessary for facilitators to have some practical experience to be able to deliver some core engineering courses properly. The views of students corroborates those of Trevelyan (2010) who showed that engineers require knowledge (written and unwritten), social interaction and critical technical expertise to resolve the burgeoning challenges in the field of engineering education.

The role of experienced facilitators in developing the knowledge and skills of young and inexperienced facilitators cannot be underestimated. Experienced faculty have several roles to play in the development and evaluation of curriculum in a faculty; instructional design and strategies, effective teaching and role modelling through the application of learner-centred theories and preserving the philosophy of curricula and meeting the institutional and national requirements (Ambrose et al., 2010; Keating, 2015). It is important for departments in HEIs to harness the knowledge and skills of experienced facilitators to the benefit of the inexperienced ones through mentoring and coaching.

Supervised industrial attachment is a pre-requisite for the award of degrees for engineering students and this was confirmed by the Deputy Executive Secretary of the NAB who also noted that Board verifies students' engagement with industry when they visits HEIs. The study revealed that supervised industrial attachment was obligatory for all categories of students in only one of the three universities. Although adult learners are often employed in organisations, they could be informed to make the necessary arrangements to be assessed on the job using specific indicators that compare their activities to what is required of them as discussed in class.

7.4 INDUSTRY AND HEI COLLABORATION

This section sought to answer the research question on how industry and HEIs could collaborate to provide adult learners with requisite practical knowledge and skills that are relevant for their jobs. Industries have many roles to play in the development of relevant curriculum for effective teaching and learning. Collaborations between industries and HEIs promote mutual exchange of information, resources and ideas that are not only relevant for the industries and HEIs but the students who benefit from the knowledge that emerge from such collaborations. The interview session with some organisations revealed

that Telecommunications companies and energy producing companies have resources which could be shared with HEIs. This assertion was actualised with the signing of a memorandum of understanding between KNUST and a leading Telecommunications company in Ghana. The agreement was designed to benefit both entities including students. Similarly some of the HODs indicated that they were working with some organisations to provide support to their departments and students.

The views of adult learners selected for this study in relation to industry-HEI collaboration was that it was relevant for employers to play key role in the design of programmes for adult learners in HEIs because modern engineering practices required that industry and HEIs collaborate to develop programme content that are relevant to industry needs. Another consideration is that students could use the very sophisticated emerging technologies which could not be procured by the universities for their laboratory sessions. The study showed that employers should be involved in the design of curriculum for students because their input would help students to develop their skills to meet the requirement of employers and the labour market**.**

Industry respondents were of the opinion that they had their own training schedules for their staff which were independent of what HEIs could offer. Another important area of cooperation is the training of staff where organisations could send their employees to HEIs for short term training. Although some of the HEIs organise training sessions for employees of corporate bodies, there could be improved collaboration in this area. One of the industry respondents noted that his organisation had planned sending some of their staff to competing organisations in the same industry to understudy their work processes and application of state of the art equipment. Similarly, HEIs could send their staff to Telecommunications and power producing companies to learn the practical aspects of the courses they teach and enrich their knowledge in the field.

Crebert, Bates, Bell et al., (2004) found that employers were willing to support HEIs in the development of relevant curricula to meet industry needs through the provision of placement opportunities that develops students' generic skills in employment. Representatives of all the four organisations who were interviewed stated that their establishments always accepted students for supervised industrial attachment. The relationship between HEIs and Industry could be improved to enhance knowledge, skills and resource sharing.

The role of the Trade Union Congress, albeit very minimal, has the potential of providing adult learners with financial and administrative support (as stated by the DSG of the TUC, Ghana). Labour Unions such

as the TUC can garner support from government to compel organisations to allow workers who wish to further their education do so without constraints.

7.5 CONCLUSION

This chapter interrogated the similarities and differences between the policies and practices and interventions used in developing the knowledge and skills of adult learners in the three universities through cross-case synthesis. The researcher discussed the six variables developed for the empirical research by analysing the means of respondents' views on: the relevance of Telecommunications and Electrical Engineering programmes to the needs of adult learners; core knowledge in engineering; programme planning and motivation for self-directed learning; teaching and learning methods; the connection between the courses offered by education providers and their relevance to work of adult learners and employability skills development. This chapter also analysed the relationship between industry and HEIs that is necessary for the development of the knowledge and skills of adult learners. The study identified some benefits from such collaboration as transfer of knowledge and skills, exposing students to state of the art equipment and technology that HEIs cannot procure and providing adult learners with practical field experiences.

The chapter also identified the gap between facilitators of courses in the various programmes and the lack of curriculum negotiation between facilitators and adult learners. Additionally, adult learners are often not motivated when the expectations in a programme are not met. The chapter concludes by providing a cross-case analysis of the structure of adult learning programmes in three diverse universities in Ghana.

Chapter eight discusses the possible implications of this study in relation to policy, practice and research. The chapter concludes by identifying the limitations of this study.

CHAPTER EIGHT

POSSIBLE IMPLICATIONS OF THE STUDY

8.1 INTRODUCTION

The transformation of Ghana's economy requires the development of the knowledge and skills of workers in all sectors of the economy. The energy and Telecommunications sectors are among the fastest growing sectors in Ghana and they employ many skilled workers who occupy different positions in the organisations. Most of these skilled workers receive their training from either technical training institutes or polytechnics that provide training in engineering and other applied sciences. When these workers work for some years, they decide to advance their qualifications by enrolling in universities with the aim of securing challenging positions in their employment and also receive better remuneration.

When these skilled workers enter the universities, their expectations are to receive relevant training in their area of specialisation and also develop their knowledge, skills and attitudes in other disciplines. It is important for education providers to develop the competencies of these adult learners when they enrol in the engineering programmes using their experiences as the building blocks for further training. The concept of adult learning is a longstanding one and findings from this study have implications for theory, practice and policy. This chapter discusses in detail the theories and results from the empirical study focusing on possible implications of the study with regard to adult learning theories, policy decisions at the micro and meso levels, practice and further research.

8.2 POSSIBLE IMPLICATIONS FOR ADULT LEARNING THEORIES

The second sub-research question sought to investigate how adult learning theories could serve as the basis for any intervention that is aimed at providing adult learners with the relevant knowledge and skills needed for their work processes.

Although the theoretical orientation of this study was the constructivist approach to adult learning, the findings from this study suggest that other theories such as the transformative, behavioural, humanist, experiential and cognitive theories of learning play key roles in the development and implementation of adult learning programmes. The researcher refers to the third chapter of this study where the different learning theories that influence the development of adult learning programmes are thoroughly discussed.

The premise on which this study commenced was from a purely constructivist approach drawn from a social realist ontology (with possible strains of other theories) in what could be considered as the constructivist model to developing programmes for adult learners.

Findings from this study has shown that the development of Telecommunications and Electrical Engineering programmes does not hinge on one dominant theory but a set of learning theories that work together to provide adult learners with relevant knowledge, skills and attitude. I will briefly describe the role of the various theories identified from the study and the specific roles they play in the development of relevant programmes for adult learners in the Telecommunications and Electrical Engineering.

The development of the knowledge and skills of adult learners requires experiential learning because these learners are often expected to apply knowledge acquired during previous learning stages and their experiences to connect to new knowledge. The study showed that practical field sessions and laboratory exercises provide adult learners in the engineering field with hands-on experience and opportunities to test principles and theories of the discipline and come up with innovative applications. Hofstein and Lunetta (2004), however, suggest that teaching and learning can be enhanced through a process of reflection where students are guided to understand the learning outcomes and reflect on the activities they carry out during the laboratory sessions. These hands-on experiences include; learning through simulators, application of complex programming tools and designing systems through a process of experiencing, conceptualisation, reflection and active experimentation (Kolb, Boyatzis & Mainemelis, 2001; Crawley et al., 2014). Emerging technology and applications of complex programming tools require visualisation that is effected through experiential learning. These findings have been confirmed by authors such as Davies (2008), Case (2008), Dickens et al. (2009) and Crawley et al. (2014).

The study showed that transformative learning is required in the teaching and learning process of adults because there is a continuous process of recreation of knowledge through the application of individual beliefs, values and feeling. Transformative learning draws on the prior experience of adults as the primary medium of alteration in adult learning. The prior experiences of the adult learners also serve as the foundation for identifying beliefs and ideologies, constructing meanings and directly relating these to the environment in which he or she lives or works. Similarly, adult learners are able to develop their frame of reference by connecting practical work procedures with the theories and new knowledge they gain from the lecture room. These views emerged from the focus group discussion where discussants provided interpretations to the different constructs based on their own understanding and beliefs rather than what was provided by other persons. Education providers can develop the knowledge, skills and attitudes of

adult learners by constantly engaging them in activities that draw on their experiences and allow them to reflect on theories and activities by connecting them to their values and beliefs. The findings of this study corroborates the views of authors such as Mezirow (1991), Kitchenham (2008), Keegan (2009), Fry et al. (2009), Taylor et al. (2012) and Taylor et al. (2013) on the importance of transformative learning on adult learners.

Work placement and practical field activities for Telecommunications and Electrical Engineering students were identified as a competence-based form of learning which draws from behavioural theories. Behavioural theory often amplifies the relevance of developing the skills of adult learners in a formal work setting with emphasis on feedback systems; this was confirmed by the adult learners during the focus group discussions. The development of structures and policies by education providers would ensure that adult learners obtain requisite practical field experience. Additionally, adult learners would be able to adhere to work procedures and practices while developing their frame of reference (schemata) as identified by transformative learning. Another aspect of behavioural learning identified by the study was the feedback systems put in place by education providers to inform adult learners of their performances in their various courses. This principle is amplified by Crawley et al. (2014) and Keating (2015). Seeing that many discussants were of the opinion that the feedback systems were not properly organised, education providers must develop more effective procedures for providing performance feedback to adult learners.

The humanist perspective of learning, advocated by authors such as Tennant et al. (1995), Fasokun et al. (2005), and Savicevic (2008), suggests that the planning and actualisation of teaching and learning processes should focus on developing the potential of the individual through a learner centred approach. Although humanist theory identifies specific activities such as programme planning, freedom to choose courses, ability of the learner to direct his or her own learning and participation in teaching and learning processes, the study showed that these manifestations of the humanist perspective are limited in the teaching and learning processes of adult learners.

This study was premised on the constructivist approach to learning which suggests that adult learners are able to construct their own meaning, learn by building on their prior knowledge and experiences, learn through social interaction, and develop meaning through practice and active experimentation in experiential learning. This study thus challenges the assertion by Kirschner, Sweller and Clark (2006:78) that constructivism does not lead to effective pedagogic techniques. This is because the principles,

practices and procedures governing disciplines such as engineering require considerable engagement by the adult learner with guidance from the facilitator in an open, non-rigid and interactive environment.

The connection between learning theories was observed throughout this study and gave credence to the assertion by Cooperstein et al. (2004) that the application of different learning theories 'smoothens the path' in the teaching and learning processes. Additionally, this study has shown that the process of teaching and learning relies on the incorporation of different learning theories and not necessarily on a specific learning theory, even though the impact of constructivism could be seen as dominant. The framework that was developed from Buchanan et al. (1998) shows the integration of activities in the development of curricula and the teaching and learning process, which requires methods and procedures from a variety of learning theories.

8.3 POSSIBLE IMPLICATIONS FOR POLICY

The role of universities, industry and regulatory agencies in the enforcement of policies could be described as necessary in the development of relevant programmes for adult learners. The interview session with the DES of the NAB revealed that although policies have been established to guide the operations of universities in the development and implementation of curricula, there were still challenges in their adherence. The study showed that the MOE, NCTE and the NAB could push for the enforcement of policies at the various universities. Strict adherence to policies such as industrial attachment programmes, access policies for adult learners, establishment of laboratories, provision of library resources and building collaborations with industry would enhance the quality of programmes developed for adult learners in universities.

The responses of the discussants revealed that modern engineering practices require industry and HEIs to collaborate and jointly develop programme contents that are relevant to industry needs, that industry can help departments in HEIs develop relevant course structures that meets industry needs, and that there is the need for continuous deliberations between industry and HEIs to explore ways of helping industry obtain highly skilled university products. Additionally, this study points out the weakness in the argument of Knight and Yorke (2003) that focuses exclusively on HEIs (education providers and faculty) as providers of employability skills to learners. What the authors glossed over was the impact of industry in developing the knowledge and skills of students through an integrated approach such as planned industrial attachment and research collaboration which have been amplified by Crawley et al, (2014) and Huff, Zoltowski and Oakes (2016). While their opinion that first cycle higher education emphasis on generic skills may be true in some programmes, the same cannot be said of the engineering field that requires

technical knowledge and abilities and the support of industry practitioners. Although soft skills such as problem-solving skills, team work, presentation skills, group management techniques and effective listening skills as emphasised by industry representatives from the interviews may be provided theoretically during lectures, signature pedagogies can only be acquired through constant practice in the field of work.

The responses from industry representatives suggest that employers have laid down procedures for employees to apply for study leave and that they expected all employees to adhere to laid-down procedures. What this meant was that adult learners would have to either wait till they are due for study leave at their work places or pay their own fees while they are enrolled in universities. Secondly, not all the organisations used for the study have study leave arrangement and employees in such organisations would have to make their own arrangement to further their education. The industry representatives indicated that when their organisations visit institutions for career fairs, their focus was usually on the young or regular students and not on adult learners, and this also applied to industrial attachments and national service positions.

8.4 POSSIBLE IMPLICATIONS FOR PRACTICE

This section seeks to provide answers to the research question that sought to examine the type of knowledge, skills and attitudes that are required by adult learners in the Telecommunications and Electrical Engineering fields. The section is divided into three sub-sections namely: teaching and learning methods, programme planning and motivation for adult learners and provision of learning resources.

8.4.1 Teaching and learning methods

The study showed that the teaching and learning processes were considered satisfactory by the discussants and respondents to the questionnaire. The focus group discussion, however, revealed that the non-availability of learning resources such as simulators, laboratories with modern equipment and uninterrupted internet connectivity were affecting the teaching and learning processes. Discussants in all three cases stated that the learning outcomes for each course were clearly discussed at the beginning of every semester and this helped them to prepare for each class. However, feedback activities and practices were weak in some of the universities with discussants stating that they were not provided with feedback, which is very important for the teaching and learning process. All the discussants stated that they would request education providers to introduce advanced computer programming courses in their curriculum to enable them meet the demands of employers and the requirements of modern technology. This view was corroborated by one of the industry respondents. Similar studies conducted by Lizzio, Wilson and Simons

(2002) showed that students' perception of good teaching environments informs their attitude to the teaching and learning methods adopted by facilitators.

An important area for consideration by universities is the development of curricula that allow adult learners to critically analyse, reflect and apply the concepts and theories that they are introduced to in class. While the process of teaching and learning requires students to develop critical reflection and dialogue competences, critical thinking abilities, independent study skills and application of key concepts, the role of education providers would be to develop curricula that will enable these adult learners to successfully acquire these proficiencies. The relevance of developing curricula that enable students to develop their critical thinking abilities has been espoused by Quinnan (1997), Cowan (2006), Carusetta et al. (2009) Loureiro et al. (2013) Hunt et al. (2013), Crawley et al. (2014) and Hill (2014).

8.4.2 Programme planning and motivation

The study showed that adult learners are motivated by their desire to obtain higher credentials and also meet more complex challenges at their place of work. The implementation of the processes and practices that support their learning processes during their studies would enhance their participation in programme planning, teaching and learning. Although the discussants in the focus group discussion revealed that they did not participate in the planning of the content of their courses, facilitators can play very important roles in enhancing adult learners' participation in the timing of assignments, designing learning activities to improve their skills and knowledge, devising seating arrangement in class, creating learning groups and planning field trips. Fasokun et al. (2005:53) consider such participation by adult learners as essential.

8.4.3 Provision of learning resources

Learning resources are very important in the development of the knowledge and skills of adult learners. Learning resources consist of laboratory equipment, lecture halls, lecture schedule, staffing, libraries, internet connectivity, learning management systems, assessment procedures and students' support services. Additionally, learning resources help adult learners to develop their core competences while providing facilitators with relevant quality tools and materials needed to equip adult learners. Universities should begin to look at alternative ways of generating funds through partnership and collaborations with industry and government to procure the resources necessary to promote teaching and learning. This view has been espoused by Kahn (2006), Cooper et al. (2009), Rogers (2001 cited in Bell et al., 2013) and Dickens et al. (2009).

8.5 POSSIBLE IMPLICATIONS FOR FURTHER RESEARCH

This study investigated the relevance of Telecommunications and Electrical Engineering programmes in three diverse universities in Ghana. As the study was limited to only engineering programmes, the findings could not be generalised to other programmes such as business, arts and social science, education and applied sciences in Ghanaian universities. A study of practices in other disciplines would provide additional evidence on how adult learning programmes are structured in Ghanaian universities. This study revealed that stronger evidence could be gathered to support research in education by adopting both quantitative and qualitative approaches to data collection and analysis.

8.6 LIMITATIONS OF THE STUDY

This study focused on only the structure of Telecommunications and Electrical Engineering programmes in three diverse universities in Ghana. Furthermore, the theories of adult learning reviewed were limited to only those that the researcher considered relevant to the knowledge and skills needs of adult learners studying Telecommunications and Electrical Engineering. Although there are about fifty universities in Ghana, the study considered only three universities based on their governance structure and ownership. The researcher acknowledges that the number of universities used for this study could be increased to include those from other regions in the country. Finally, the researcher studied only two programmes in the power and Telecommunications engineering field due to resource and time constraints. Hence, the result of this study cannot form the basis of any generalisation across different disciplines and in other universities that were included in the study.

8.7 CONCLUSION

This study aimed at identifying the relevance of Telecommunications and Electrical Engineering programmes to the needs of adult learners in three diverse universities in Ghana using four departments as the units of analysis. The study also sought the views of HODs of the departments on the current processes and practices used in developing adult learning curricula in the three universities. Industry representatives from power producing and Telecommunications companies were contacted to provide information on their possible role in the development of relevant programmes for adult learners.

The study revealed that although all three universities made provision for the teaching of adult learners in their departments, the curriculum, teaching and learning methods and the planning of the programmes were the same as those used for regular students who entered the universities from senior secondary schools. The views of adult learners who participated in the study suggest that they expect education providers to adopt more appropriate teaching and learning methods and provide them with the needed

resources that are relevant for their knowledge and skills development. Additionally, the study revealed that adult learners do not negotiate the planning of their programmes and this limited their input in the teaching and learning process.

Advanced computer programmes were identified by all the focus groups as essential to their knowledge and skills development and for their practice, because many employers in the Telecommunications and Electrical Engineering field required employees to demonstrate appreciable knowledge in programming. Other courses they identified as necessary but which were not offered included automation and control systems, information theory, simulation for Electrical Engineering systems, programme logic control systems, data base design systems, OPNET, MATLAB, SIMULINK and CAD. The courses were also mentioned as necessary by some of the industry respondents.

The study also showed that different theories are essential for the development of relevant programmes for adult learners and this was confirmed by some of the HODs. What this means for theory is that although a university may have a strong leaning to adopt a single theory in the design of programmes, other theories could provide alternative methods of developing robust courses that will help students acquire relevant knowledge and skills. The study points out the weakness in the findings by Neumann, Parry and Becher (2002:414) that, “the basic competencies that students require to enter and successfully complete a degree programme are not commonly spelled out” by HEIs. The competences required by adult learners are clearly defined even before they enter the universities seeing that they are closely related to the skills required by industry. For the development of the burgeoning energy and Telecommunications sectors in the Ghanaian economy it seems imperative that HEIs pay more attention to devising and implementing appropriate programmes for adult learners.

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LIST OF ADDENDA

Addendum A – Ethical clearance approval letter

UNIVERSITEIT•STELLENBOSCH•UNIVERSITY
jou kennisvennoot • your knowledge partner

Approval Notice
New Application

25-Apr-2014
Owusu-Agyeman, Yaw Y

Proposal #: DESC/Owusu-Agyeman/2014
Title: The relevance of Telecommunication and Electrical Engineering Programmes to the needs of adult learners in Ghana.

Dear Mr Yaw Owusu-Agyeman,

Your **New Application** received on **06-Mar-2014**, was reviewed
Please note the following information about your approved research proposal:

Proposal Approval Period: **27-Mar-2014 -26-Mar-2015**

Please take note of the general Investigator Responsibilities attached to this letter. You may commence with your research after complying fully with these guidelines.

Please remember to use your **proposal number** (**DESC/Owusu-Agyeman/2014**) on any documents or correspondence with the REC concerning your research proposal.

Please note that the REC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

Also note that a progress report should be submitted to the Committee before the approval period has expired if a continuation is required. The Committee will then consider the continuation of the project for a further year (if necessary).

This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki and the Guidelines for Ethical Research: Principles Structures and Processes 2004 (Department of Health). Annually a number of projects may be selected randomly for an external audit.

National Health Research Ethics Committee (NHREC) registration number REC-050411-032.

We wish you the best as you conduct your research.

If you have any questions or need further help, please contact the REC office at 0218089183.

Included Documents:
permission letter 2
DESC application
Questionnaire
Research proposal_Owusu-Agyeman
permission letter 3
permission letter 1
Consent form 2
Consent form 1

Sincerely,

Clarissa GRAHAM
REC Coordinator
Research Ethics Committee: Human Research (Humanities)

Investigator Responsibilities

Protection of Human Research Participants

Some of the general responsibilities investigators have when conducting research involving human participants are listed below:

1.Conducting the Research. You are responsible for making sure that the research is conducted according to the REC approved research protocol. You are also responsible for the actions of all your co-investigators and research staff involved with this research. You must also ensure that the research is conducted within the standards of your field of research.

2.Participant Enrollment. You may not recruit or enroll participants prior to the REC approval date or after the expiration date of REC approval. All recruitment materials for any form of media must be approved by the REC prior to their use. If you need to recruit more participants than was noted in your REC approval letter, you must submit an amendment requesting an increase in the number of participants.

3.Informed Consent. You are responsible for obtaining and documenting effective informed consent using **only** the REC-approved consent documents, and for ensuring that no human participants are involved in research prior to obtaining their informed consent. Please give all participants copies of the signed informed consent documents. Keep the originals in your secured research files for at least five (5) years.

4.Continuing Review. The REC must review and approve all REC-approved research proposals at intervals appropriate to the degree of risk but not less than once per year. There is **no grace period.** Prior to the date on which the REC approval of the research expires, **it is your responsibility to submit the continuing review report in a timely fashion to ensure a lapse in REC approval does not occur.** If REC approval of your research lapses, you must stop new participant enrollment, and contact the REC office immediately.

5.Amendments and Changes. If you wish to amend or change any aspect of your research (such as research design, interventions or procedures, number of participants, participant population, informed consent document, instruments, surveys or recruiting material), you must submit the amendment to the REC for review using the current Amendment Form. You **may not initiate** any amendments or changes to your research without first obtaining written REC review and approval. The **only exception** is when it is necessary to eliminate apparent immediate hazards to participants and the REC should be immediately informed of this necessity.

6.Adverse or Unanticipated Events. Any serious adverse events, participant complaints, and all unanticipated problems that involve risks to participants or others, as well as any research related injuries, occurring at this institution or at other performance sites must be reported to Malene Fouch within **five (5) days** of discovery of the incident. You must also report any instances of serious or continuing problems, or non-compliance with the RECs requirements for protecting human research participants. The only exception to this policy is that the death of a research participant must be reported in accordance with the Stellenbosch Universtiy Research Ethics Committee Standard Operating Procedures. All reportable events should be submitted to the REC using the Serious Adverse Event Report Form.

7.Research Record Keeping. You must keep the following research related records, at a minimum, in a secure location for a minimum of five years: the REC approved research proposal and all amendments; all informed consent documents; recruiting materials; continuing review reports; adverse or unanticipated events; and all correspondence from the REC

8.Provision of Counselling or emergency support. When a dedicated counsellor or psychologist provides support to a participant without prior REC review and approval, to the extent permitted by law, such activities will not be recognised as research nor the data used in support of research. Such cases should be indicated in the progress report or final report.

9.Final reports. When you have completed (no further participant enrollment, interactions, interventions or data analysis) or stopped work on your research, you must submit a Final Report to the REC.

10.On-Site Evaluations, Inspections, or Audits. If you are notified that your research will be reviewed or audited by the sponsor or any other external agency or any internal group, you must inform the REC immediately of the impending audit/evaluation.

Addendum B – Informed consent letters

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CONSENT TO PARTICIPATE IN RESEARCH

You are kindly asked to participate in a research study conducted by Yaw Owusu-Agyeman, a PhD candidate, from the Department of Curriculum Studies at Stellenbosch University. Please note that the result of this questionnaire will contribute to his thesis. You were selected as a possible participant in this study because of your knowledge and experience in the Telecommunications and Electrical Engineering industry. Your contributions will be very useful in advancing quality education for adult learners in HEIs.

1. **PURPOSE OF THE STUDY**

   This study seeks to assess the relevance of Telecommunications and Electrical Engineering Programmes to the needs of adult learners in Ghana.

2. **PROCEDURES**

   If you volunteer to participate in this study, you will be required to participate in a semi-structured individual interview. This should not require more than 30 minutes of your time.

3. **POTENTIAL RISKS AND DISCOMFORTS**

   Please note that there are no foreseeable risks, discomforts or inconveniences in participating in this interview and we will be grateful if you could inform the researcher of any reservation you may have while participating in the interview.

4. **POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY**

   The result of this study is expected to provide options for HE institutions and other stakeholders in Ghana to design relevant curricula to meet the knowledge needs of adult learners.

5. **PAYMENT FOR PARTICIPATION**

   Please note that you will not receive payment for participating in this study.

6. **CONFIDENTIALITY**

   Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of blind coding procedures and plans to safeguard data, including where data will be kept and who will have access to it, are in place.

7. PARTICIPATION AND WITHDRAWAL

Please note that you can choose whether to participate in this study or not. If you volunteer to participate in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer any questions you don't want to answer and still remain in the study. The investigator may withdraw you from this research if circumstances arise which warrant doing so.

8. IDENTIFICATION OF INVESTIGATORS

If you have any questions or concerns about the research, please feel free to contact Yaw Owusu-Agyeman on 0202698223 or e-mail yoagyeman@yahoo.com or Mr. Kwaku Asamoah on 0547862330/0202698224 or e-mail kwax8612@yahoo.com.

9. RIGHTS OF RESEARCH SUBJECTS

You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research subject, contact Ms Maléne Fouché [mfouche@sun.ac.za; 021 808 4622] at the Division for Research Development, Stellenbosch University.

SIGNATURE OF RESEARCH SUBJECT OR LEGAL REPRESENTATIVE

The information above was described to me by [name of relevant person] in English/other language (specify) and I am in command of this language or it was satisfactorily translated to me. I was given the opportunity to ask questions and these questions were answered to my satisfaction.
I hereby consent voluntarily to participate in this study. I have been given a copy of this form.

_____

Name of Subject/Participant

_____

Name of Legal Representative (if applicable)

_____ _____

Signature of Subject/Participant or Legal Representative Date

SIGNATURE OF INVESTIGATOR

I declare that I explained the information given in this document to _____ [name of the subject/participant] and/or [his/her] representative _____ [name of the representative].

[He/she] was encouraged and given ample time to ask me any questions. This conversation was conducted in [Akan/*English/*Ewe/*Other] and [no translator was used/this conversation was translated into _____ by _____].

_____ _____

Signature of Investigator Date

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STELLENBOSCH UNIVERSITY

CONSENT TO PARTICIPATE IN RESEARCH

You are kindly asked to participate in a research study conducted by Yaw Owusu-Agyeman, a PhD Candidate, from the Department of Curriculum Studies at Stellenbosch University. Please note that the result of this interview schedule will contribute to contribute to thesis. You were selected as a possible participant in this study because as the Head of Department in a Higher Education Institution, your contributions will be very useful in advancing quality education for adult learners in HEIs.

1. **PURPOSE OF THE STUDY**

   This study seeks to assess the relevance of Telecommunications and Electrical Engineering Programmes to the needs of adult learners in Ghana

2. **PROCEDURES**

   If you volunteer to participate in this study, we would ask you to do the following things:

Procedure in completing this interview schedule

I will kindly request you read the questions on this instrument carefully and if there are statements or words that may seem ambiguous, kindly seek clarity from the research assistant. You will kindly need twenty-five minutes to respond to some questions and we will be grateful if you could kindly provide us with your objective opinion on the issues.

Please read the interview schedule for some few minutes before the actual interview. We will be very grateful if you could inform us of the questions you consider as not relevant to your discipline. Please note that information concerning your bio data is very confidential and we will not use them for any other purpose than what has been stated above.

3. **POTENTIAL RISKS AND DISCOMFORTS**

   Please note that there are no foreseeable risks, discomforts, inconveniences, in completing this interview schedule and we will be grateful if you could inform the research assistant of any reservation you may have while completing this interview schedule.

4. **POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY**

   Unfortunately we are unable to provide you with any benefits from participation due to budget constraint. The result of this study is expected to provide options for HE institutions and other stakeholders in Ghana to design relevant curricula to meet the knowledge needs of adult learners.

5. **PAYMENT FOR PARTICIPATION**

Please note that you will not receive payment for participating in this study.

6. CONFIDENTIALITY

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of blind coding procedures and plans to safeguard data, including where data will be kept and who will have access to it.

7. PARTICIPATION AND WITHDRAWAL

Please note that you can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer any questions you don't want to answer and still remain in the study. The investigator may withdraw you from this research if circumstances arise which warrant doing so

8. IDENTIFICATION OF INVESTIGATORS

If you have any questions or concerns about the research, please feel free to contact Yaw Owusu-Agyeman on 0202698223 or e-mail yoagyeman@yahoo.com or Mr. Kwaku Asamoah on 0547862330/0202698224 or e-mail kwax8612@yahoo.com.

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SIGNATURE OF RESEARCH SUBJECT OR LEGAL REPRESENTATIVE

The information above was described to [me/the subject/the participant] by [name of relevant person] in [Afrikaans/English/Xhosa/other] and [I am/the subject is/the participant is] in command of this language or it was satisfactorily translated to [me/him/her]. [I/the participant/the subject] was given the opportunity to ask questions and these questions were answered to [my/his/her] satisfaction.

[I hereby consent voluntarily to participate in this study/I hereby consent that the subject/participant may participate in this study] I have been given a copy of this form.

_____

Name of Subject/Participant

_____

Name of Legal Representative (if applicable)

_____ _____

Signature of Subject/Participant or Legal Representative **Date**

SIGNATURE OF INVESTIGATOR

I declare that I explained the information given in this document to _____ [name of the subject/participant] and/or [his/her] representative _____ [name of the representative]. [He/she] was encouraged and given ample time to ask me any questions. This conversation was conducted in [Akan/*English/*Ga/*Other] and [no translator was used/this conversation was translated into _____ by _____].

_____ _____

Signature of Investigator **Date**

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STELLENBOSCH UNIVERSITY

CONSENT TO PARTICIPATE IN RESEARCH

You are kindly asked to participate in a research study conducted by Yaw Owusu-Agyeman, a PhD candidate, from the Department of Curriculum Studies at Stellenbosch University. Please note that the result of this questionnaire will contribute to his thesis. You were selected as a possible participant in this study because of your knowledge and experience in the Telecommunications and Electrical Engineering industry. Your contributions will be very useful in advancing quality education for adult learners in HEIs.

1. **PURPOSE OF THE STUDY**

   This study seeks to assess the relevance of Telecommunications and Electrical Engineering Programmes to the needs of adult learners in Ghana.

2. **PROCEDURES**

   If you volunteer to participate in this study, you will be required to participate in a semi-structured individual interview. This should not require more than 30 minutes of your time.

3. **POTENTIAL RISKS AND DISCOMFORTS**

   Please note that there are no foreseeable risks, discomforts or inconveniences in participating in this interview and we will be grateful if you could inform the researcher of any reservation you may have while participating in the interview.

4. **POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY**

   The result of this study is expected to provide options for HE institutions and other stakeholders in Ghana to design relevant curricula to meet the knowledge needs of adult learners.

5. **PAYMENT FOR PARTICIPATION**

   Please note that you will not receive payment for participating in this study.

6. **CONFIDENTIALITY**

   Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of blind coding procedures and plans to safeguard data, including where data will be kept and who will have access to it, are in place.

7. PARTICIPATION AND WITHDRAWAL

Please note that you can choose whether to participate in this study or not. If you volunteer to participate in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer any questions you don't want to answer and still remain in the study. The investigator may withdraw you from this research if circumstances arise which warrant doing so.

8. IDENTIFICATION OF INVESTIGATORS

If you have any questions or concerns about the research, please feel free to contact Yaw Owusu-Agyeman on 0202698223 or e-mail yoagyeman@yahoo.com or Mr. Kwaku Asamoah on 0547862330/0202698224 or e-mail kwax8612@yahoo.com.

9. RIGHTS OF RESEARCH SUBJECTS

You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research subject, contact Ms Maléne Fouché [mfouche@sun.ac.za; 021 808 4622] at the Division for Research Development, Stellenbosch University.

SIGNATURE OF RESEARCH SUBJECT OR LEGAL REPRESENTATIVE

The information above was described to me by [name of relevant person] in English/other language (specify) and I am in command of this language or it was satisfactorily translated to me. I was given the opportunity to ask questions and these questions were answered to my satisfaction.

I hereby consent voluntarily to participate in this study. I have been given a copy of this form.

_____

Name of Subject/Participant

_____

Name of Legal Representative (if applicable)

_____ _____

Signature of Subject/Participant or Legal Representative Date

SIGNATURE OF INVESTIGATOR

I declare that I explained the information given in this document to _____ [name of the subject/participant] and/or [his/her] representative _____ [name of the representative]. [He/she] was encouraged and given ample time to ask me any questions. This conversation was conducted in [Akan/*English/*Ewe/*Other] and [no translator was used/this conversation was translated into _____ by _____].

_____ _____

Signature of Investigator Date

Addendum C – Questionnaire

QUESTIONNAIRE FOR ADULT LEARNERS

The relevance of Telecommunications and Electrical Engineering Programmes to the needs of adult learners in Ghana**.**

Dear Participant

Please place a cross (x) in the applicable block if you consent to participate in the study as outlined in the consent letter that accompanies this questionnaire.

YES	
NO	

The questionnaire is divided into three sections namely, Section A: Biographical information and Section B: Graduate attributes and learning expectations of adult learners and Section C: Programme component and D: Teaching and learning methods. Please complete each section.

SECTION A: BIOGRAPHICAL INFORMATION

Please answer each item in full, or indicate with an (x) where applicable.

1. PROGRAMME OF STUDY	

2. LEVEL/YEAR OF STUDY	

3. **AGE GROUP**	
21-30 years	
31-40 years	
41-50 years	
51-60 years	

4. **GENDER**	
Male	
Female	

5. HIGHEST QUALIFICATION	
WASSCE	
Certificate	
Diploma	
Other/Please indicate.	

6. WORK EXPERIENCE IN INDUSTRY	
0-2 years	
3-5 years	
6-10 years	
11-15 years	
16-20 years	
21 years and above	

7. TYPE OF FUNDING	
Self-Financing	
Parental/Family support	
Government loan	
Study leave with pay	
Partial funding from employers	
Others (please specify)	

SECTION B: CURRICULUM

In Section B, please answer the CLOSED questions by indicating; strongly agree, disagree, agree or strongly disagree on a scale of 1 – 5. Please place a cross (X) in the applicable column.

Information on specialist knowledge in engineering	Strongly disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly agree 5
1. I understand the technical requirements of my study.					

2. I have obtained a better understanding of the theories and concepts that are related to my work.					
3. I understand the subject-specific skills that are taught and practiced.					
4. I am able to quickly relate the theories taught in class to the job setting.					
5. I consider my training here as important for my progress in my field of work.					
6. I have been able to use the technology in the laboratory and also relate them to my job needs and activities.					
Information on the benefits of the programme to adult learners.	**Strongly disagree 1**	**Disagree 2**	**Neutral 3**	**Agree 4**	**Strongly agree 5**
7. I consider the programme as one that is capable of developing my skills for creativity.					
8. The structure of the programme has exposed me to the appropriate modern technologies needed in my job setting.					
9. I consider the programme as very good with respect to giving me better understanding of work ethics and discipline.					
10. The programme is designed to provide deep thinking to solve complex real life problems					
11. The programme enables me make use of complex mathematical calculations,					

advanced/emerging technologies and to understand quantitative data and analysis.					
12. I consider myself as developing my capacity for reasoning abilities that are relevant in the engineering field.					
13. Overall, I am confident that the programme will challenge me to be creative.					

Information on motivation to advance self-directed learning	**Strongly disagree 1**	**Disagree 2**	**Neutral 3**	**Agree 4**	**Strongly agree 5**
14. I consider my ability to work both independently and as a team as important to my successful completion of the programme.					
15. My enthusiasm for understanding theoretical and practical aspects of modern engineering process is a key consideration in pursing higher education.					
16. I consider self-discipline and hard work as essential in obtaining the requisite knowledge in my field.					
17. My desire to manage affairs within the engineering discipline and be able to exchange ideas on difficult tasks is a major reason for enrolling in this programme.					
18. I consider my passion for work and the exposure to new trends as key to pursuing further education.					
19. My desire to accept social and work responsibilities is a key factor in my education.					

SECTION C: TECHNICAL KNOWLEDGE AND SKILLS

In Section C, please answer the CLOSED questions by indicating; not important, quite important, important or very important on a scale of 1 – 5. Please place a cross (X) in the applicable column.

Information on relevant technical areas for adult learners: Relating course content to specific job demands.	Not important 1	Quite important 2	Neutral 3	Important 4	Very important 5
1. I am able to assess my work in classroom and relate them to my job demands.					
2. I consider the peer review process in the lecture room as essential to developing my critical thinking abilities that are needed on the job.					
3. I am able to develop my own set of learning outcomes based on the course content and my job expectations.					
4. I consider all the topics in the core courses as relevant to the knowledge needs of my job and other related job functions.					
5. The application of technology in the laboratories and field activities has provided me further knowledge on modern trends in my discipline which will enhance my performance on the job.					
6. I consider the course content as very detailed and contain all the relevant information and practical sessions that are relevant for my job needs.					

SECTION D: TEACHING AND LEARNING METHODS

In Section C, please answer the CLOSED questions by indicating; not important, quite important, important or very important on a scale of 1 – 5. Please place a cross (X) in the applicable column.

Information on Teaching and learning methods used by the HEI and the facilitators	Not important 1	Quite important 2	Neutral 3	Important 4	Very important 5
1. I appreciate the teaching methods used during lectures by faculty					
2. I comprehend the opportunities that exist for assessing the teaching and learning processes in all the courses I am offered					
3. I am provided with all the learning resources (books, journals and lecture slides) needed for my programme.					
4. The teaching and learning session that have been designed for my programme are very flexible					
5. Together with my colleagues, we are able to negotiate with our lecturers, the timing of assignments, seating arrangements, learning groups, learning activities and laboratory work.					

Thank you

Addendum D – Interview protocols

STRUCTURED INTERVIEW FOR HEAD OF DEPARTMENT

The relevance of Telecommunications and Electrical Engineering Programmes to the needs of adult learners in Ghana**.**

Dear Participant

Please place a cross (x) in the applicable block if you consent to participate in the study as outlined in the consent letter that accompanies this structured interview.

YES	
NO	

The interview instrument is divided into three sections namely, Section A: Tools for curriculum design B: Incorporating work experience in curriculum and Section C: Programme component. Please complete each section.

Position:	
Department:	
Name of Institution:	

SECTION A: TOOLS FOR CURRICULUM DESIGN

In Sections A and B, please answer the **CLOSED** questions by indicating; strongly agree, disagree, agree or strongly disagree on a scale of 1 – 4. Please place a cross **(X)** in the applicable column

Essentials of Curriculum design for adult learners in Telecommunications and Electrical Engineering disciplines.	**Strongly disagree 1**	**Disagree 2**	**Agree 3**	**Strongly agree 4**
1. Intended learning outcomes are necessary requirement for curriculum design.				
2. The background showing the context for course design should always be included in the curriculum of every course.				

3. Programme structure must necessarily show how teaching and credit/contact hours have been designed to provide results.				
4. Evaluation of programme must be carried out by all relevant stakeholders.				
5. Assessment methods and criteria must show how formative and summative assessments are designed.				
6. Programme content should specify the learning outcomes, assessment criteria and relevant descriptors.				
7. Specific teaching activities should include laboratory and field activities that enable the adult learner to easily understand concepts and connect to the job				
8. General grading standards and credit requirements are essential for evaluating the performance of adult learners.				
9. Adult learning activities must include detailed project activities and practical sessions which allows adult learners to draw their experiences.				
10. Learning resources for adult learners include, technologies, tools, teaching schedule, learning management systems, text books and libraries.				
11. Undertaking adaptation strategies for adult learners in the department is important because it enable adult learners cope with the programme				

demands while they continue to work in their organisations.				
12. Laboratory sessions and the practical learning activities must be validated by experts from the energy and Telecommunications industry before they are introduced to students.				
13. Specific procedures must be followed to ensure that planned learning activities among adult learners produce creativity in them.				
14. There should be an established unit responsible for aligning the telecom/Electrical Engineering learning activities, content and objectives before they are delivered to students.				
15. All lecturers should be trained to adopt the teaching philosophies of the department.				
16. Employers of adult learners must review our curriculum and provide us with detailed feedback on the programme content.				

SECTION B: INCORPORATING WORK EXPERIENCE IN CURRICULUM				
Incorporating work experience in curriculum	**Strongly disagree 1**	**Disagree 2**	**Agree 3**	**Strongly agree 4**
1. It is the responsibility of the department to provide work experience opportunities to adult learners.				

2. Industrial attachment should be a requirement for all adult learners and the performance of students must form part of the award of grades.				
3. Realistic simulations if used will provide adult learners with experience of real work situations using modern technologies and tools.				
4. The curriculum of adult learners should be developed to encourage students to carry out project work in real settings with employers.				
5. Providing assessment feedback to adult learners on specific subject skills and work attitude will help them enrich their knowledge and skills needed for their jobs.				
6. Students should be made to complete a skills matrix periodically so that lecturers can help them identify weak areas for support.				

Section C: ***Kindly provide detailed answers to the following open-questions.***

1. Are there internal consultations and discussions especially among faculty to ensure that the programme content have the required resources and personnel to run?.....
   If yes, can you kindly provide how these consultations are made and how often are they made to ensure that the programme contents are always up to date…….....
   ……
   ……
   ……
   …….....
2. Are there established processes to engage skilled engineers especially those from industry to provide you with specific skills needs for their sector?.....
   If yes, can you kindly provide a brief information on how these suggestions are factored into the design of your curricula…….....
3. To what extent are the teaching strategies and programme objectives for adult learners informed by the input of both faculty and experts in Telecommunications and energy industry? …….....

……

……

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4. How often do you change the content of your programme to suit industry needs and how relevant are these changes to the needs of adult learners? …….....

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5. Do you consider the age range of your students when designing your programme content? If yes how do you ensure that the objectives meet the needs of both regular students and adult learners?.....

……

6. What processes do your department go through to ensure that faculty align their teaching with the broad teaching strategies that aims at providing adult learners with the requisite teaching methods?.....

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7. To what extent do your teaching strategies, especially those involving adult learners derive from the Ghanaian cultural values?.....

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8. What processes does your department go through to ensure that the teaching of courses especially to adult learners is based on philosophical underpinnings that seek to provide adult learners the best of teaching?.....

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9. What established processes exist in your department to ensure that your programmes are aligned to the broad policy directives of the National Council for Tertiary Education?.....

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10. How does your department manage the connection between adult learners' interest and the course content to ensure that they get best of teaching in the discipline?.....

……

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11. How do you ensure that relevant skills needed by industry are marked within the relevant quality assurance benchmarking/standards of the Ghana Institute of Engineers in your curriculum?.....

……

……

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……

STRUCTURED INTERVIEW FOR EMPLOYERS

The relevance of Telecommunications and Electrical Engineering Programmes to the needs of adult learners in Ghana.

Dear Participant

Please place a cross (x) in the applicable block if you consent to participate in the study as outlined in the consent letter that accompanies this structured interview.

YES	
NO	

The interview instrument is divided into three sections namely, Section A: Tools for curriculum design B: Incorporating work experience in curriculum and Section C: Programme component. Please complete each section.

Position:	
Department:	
Name of Institution:	

Questions on Industry – HEI collaboration in promoting quality learning

1. How are the learning activities of your employees who are studying in HEIs monitored to ensure that they obtain relevant knowledge needed to perform their work?

……

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2. Do you consider the benchmarks of the Ghana Institute of Engineers as key to the training engineering students in Ghana?

…….....

3. How often do you interact with HODs in the universities where your staff are enrolled to ensure that they understand the knowledge needs of your staff?
4. Do you have prescribed learning goals/objectives which you discuss with the students as well as The HODs in the Universities.

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5. If your answer to question 4 is yes, from what sources do you derive these goals?

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……

6. What technology and tools do you consider as essential to the training needs of students who are pursing first degree programmes in Telecommunications/Electrical Engineering in universities in Ghana?

……

……

……

……

7. Are you involved in the design of the curriculum of any of the Telecommunications/Electrical Engineering programmes in the universities?

……

……

8. If your answer to question 7 is yes, what specific contribution do you make in the design of Telecommunications/Electrical Engineering curricula in the universities?

……

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9. What opportunities for work experiences / placements are available in your organisation to students studying Telecommunications/Electrical Engineering programmes from universities in Ghana?

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10. What skills in your industry do you consider as necessary for employees to acquire to be able to maintain their jobs?

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……

……

Thank you

Addendum E – Letters of permission

EZi Technologies Ltd
"YOUR TRUSTED ICT ALLY"

P. O. Box GP 17593, Accra
Tel: +233.30.278 2280
Fax: +233.30.278 2280
Email: info@ezitech.net
Website: www.ezitech.net

The Assistant Registrar
Examinations & Records Unit
Ghana Technology University College (GTUC)
PMB 100
Accra-North

June 26, 2013

Attn: Mr. Yaw Owusu-Agyeman

Dear Mr. Owusu-Agyeman

RE: REQUEST FOR INSTITUTIONAL AND ETHICAL CLEARANCE TO CONDUCT INTERVIEW AT EZITECH

Reference is herewith made to your letter on the above-mentioned subject and dated June 24, 2013.

This is to inform you that your request for institutional and ethical clearance to conduct interview at EZiTech is hereby acknowledged and permission is duly granted.

You may contact the appropriate officers for scheduled appointments.

Sincerely

Ezer Yeboah-Boateng
Chief Solutions Officer

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI, GHANA
OFFICE OF THE HEAD
CENTRE FOR DISTANCE AND CONTINUING EDUCATION
Institute of Distance Learning

University Post Office
Kumasi, Ghana
Tel: 233-3220-63389 / 61287

Email: cdce_2005@yahoo.com
Website: http://www.knust.edu.gh

Our Ref: CDCE/HO/VOL 3

Your Ref:

Date: 6th August 2013

TO WHOM IT MAY CONCERN

CONTENT LETTER – YAW OWUSU-AGYEMAN

The above mentioned is an Assistant Registrar at Ghana Technology University College at Tesano, Accra. Mr. Owusu-Agyeman is a PhD student pursuing Curriculum Studies at the University of Stellenbosch, South Africa.

Mr. Owusu-Agyeman applied to our institute for institutional and ethical clearance to conduct interviews with some of our staff and administer questionnaire to our students in Accra.

We write to give him our consent. We have informed our staff and students about the project and can start anytime he is ready.

Thanks.

Rev. Dr. W. Owusu-Boateng

Head, CDCE

For the Dean

NATIONAL COUNCIL FOR TERTIARY EDUCATION
(NCTE)

In case of reply the number and date of this letter be quoted

My Ref. No. NC/C.24/1/V.8

Your Ref.

REPUBLIC OF GHANA

P. O. Box MB 28
Accra - Ghana

19Th June, 2013

The Chair
Research Committee
Department of Curriculum Studies
Stellenbosch University
South Africa

Dear Sir/Madam,

REFERENCES FROM NCTE

This is to confirm that Mr. Yaw Owusu-Agyeman was at the Documentation Centre of the National Council for Tertiary Education for some academic references.

The Centre is well stocked with materials on Higher Education and it is open to researchers who and the general public.

Thank you.

Yours faithfully,

Rose Nandara
Senior Administrative Assistant

Office Location: East Legon—Trinity—IPS Road (Lagos Avenue); Adjacent Chartered Institute of Bankers Ghana, Accra - Ghana
Tel: +233-302-918790 +233-302-918791 +233-302– 918793
E-mail: info@ncte-ghana.org

NATIONAL COUNCIL FOR TERTIARY EDUCATION

In case of reply the number and date of this letter be quoted
My Ref. No. NCTC.60/V.1
Your Ref.

REPUBLIC OF GHANA

P. O. Box MB 28
Accra - Ghana
June 27, 2013

The Assistant Registrar
Examinations and records Unit
Ghana Technology University College
PMB 100 – Accra North

Dear Sir,

RE: REQUEST FOR INSTITIONAL PERMISSION AND ETHICAL CLEARANCE TO CONDUCT INTERVIEWS AND USE DATA FROM NCTE

Your letter dated 17th June, 2013 on the above subject refers.

Permission is hereby granted for you to use data and materials from the library of the National Council for Tertiary Education (NCTE) for your ongoing Doctor of Philosophy Studies.

Yours faithfully,

N. A. Abrahams
Head, Corporate Affairs
For: Executive Secretary

Cc: Head, Documentation, Publications and Public Relations

Office Location: East Legon—Trinity—IPS Road (Lagos Avenue); Adjacent Chartered Institute of Bankers Ghana, Accra - Ghana
Tel: +233-302-918790 +233-20-9989414 +233-20-9989413
E-mail: info@ncte.edu.gh

GHANA TELECOM UNIVERSITY COLLEGE

June 17, 2013

TO WHOM IT MAY CONCERN

Dear Sir,

APPROVAL TO CONDUCT RESEARCH AT GTUC

I write to inform you of our consent to the request by Mr. Yaw Owusu-Agyeman who is a PhD (Curriculum Studies) student at the University of Stellenbosch, South Africa to conduct his research at Ghana Technology University College Accra.

We have perused the documents he attached to his letter for approval and we consider his area of research as relevant to the advancement of knowledge in Ghana.

Thank you.

Yours faithfully,

Abena Offe (Ms)

Head of Academic Partnership

Ghana Technology University College

PMB 100

Accra North

Private Mail Bag 100, Accra North. Tel: 0302-221412/ 221446/ 221456/ 221479/ Fax: 0302-223531
E-mail: info@gtuc.edu.gh Website: Http://www.gtuc.edu.gh

A branch of the World Maritime University Malmo, Sweden

RMU
REGIONAL MARITIME UNIVERSITY
KNOWLEDGE, EXCELLENCE & DISCIPLINE

I.S.O. 9001:2008 Certified

Regional Maritime University
ACCRA, GHANA

Post Office Box GP 1115, Accra, Ghana Tel: (+ 233 302) 712775 / 712343 / 718225. Fax: (+233 302) 712047. Registrar Tel/Fax: (+233 302) 714070

MY REF: RMU/11/26[1088] 2ND JULY, 2013

YOUR REF:

Mr. Yaw Owusu – Agyeman
Assistant Registrar
Examinations and Records Unit
Ghana Technology University College
PMB 100
Accra North

RE: REQUEST FOR INSTITUTIONAL PERMISSION AND ETHICAL CLEARANCE TO CONDUCT INTERVIEWS AND USE DATA FROM RMU

The Regional Maritime University presents its compliments to you.

We write with reference to your letter dated 17th June, 2013 to inform you that approval has been granted for you to administer your questionnaire and also gather other relevant information for your research.

The Regional Maritime University takes this opportunity to renew to you the assurances of its esteem regards.

Yours sincerely,

JONES ADDAI-MARFO
REGISTRAR

Cc: Rector
Deputy Rector
Director of Academic Affairs
Director of Administration
Director of Finance

RE: Request for Institutional Consent from MTN Ghana

George Frimpong [MTN Ghana - Corporate Services] [gfrimpong@mtn.com.gh]
Sent: Wednesday, August 28, 2013 3:58 PM
To: Yaw Owusu-Agyeman

Dear Mr. Owusu-Agyeman,

I have discussed your request with the Managers in charge with engineering and they have all promised to assist you with your interview.

Please do not hesitate to contact me on 0244510679 to facilitate a meeting between you and the managers at your convenience.

My Kind Regards

George

Personal Assistant , Corporate Services Division

NOTE: This email message is subject to MTN Ghana disclaimer.
For further details, please click on the link: http://www.mtn.com.gh/SubPage.aspx?pageid=471

From: Yaw Owusu-Agyeman [mailto:yowusu-agyeman@gtuc.edu.gh]
Sent: Wednesday, August 28, 2013 3:16 PM
To: George Frimpong [MTN Ghana - Corporate Services]
Subject: Request for Institutional Consent from MTN Ghana

Dear Mr. Frimpong,

My name is Yaw Owusu-Agyeman, an Assistant Registrar at the Ghana Technology University College, Tesano-Accra and a PhD (Curriculum Studies) student at the University of Stellenbosch, South Africa.

As part of the institutional and ethical requirement for my research, I have been informed to seek a written consent from your outfit to interview the Head of Telecommunications Engineering Department in your organisation.

I would also be grateful if you could kindly approve my request to conduct an interview between June 2014 and September 2014. The title of my study is, "The relevance of Telecommunication and Electrical Engineering Programmes to the needs of adult learners in Ghana".

I appreciate your kind assistance in this matter.

In case of reply the
number and date of this
letter should be quoted
My Ref. No. **NAB/A/19**
Tel.No.: 0302946014/0307034453
Fax No.:
E-mail: **nabsec@nab.gov.gh**
Website: **www.nab.gov.gh**

Republic of Ghana

National Accreditation Board
P. O. Box CT 3256
Cantonments Accra

June 20, 2013

MR. YAW OWUSU-AGYEMAN
ASSISTANT REGISTRAR
EXAMINATIONS AND RECORDS UNIT
GTUC
PMB 100
ACCRA - NORTH

Dear Sir,

RE: REQUEST FOR INSTITUTIONAL AND ETHICAL CLEARANCE TO CONDUCT INTERVIEW AT NAB

We refer to your letter dated June 17, 2013 on the subject above.

I have been directed to inform you that permission has been granted for you to conduct interviews at the National Accreditation Board in line with your Ph D. studies.

You are, however, advised to book specific dates for the interviews and submit the questionnaires/topics for the engagement well in advance for the purposes of planning.

Yours faithfully,

RICHARD K. ADJEI
DEPUTY EXECUTIVE SECRETARY
FOR: EXECUTIVE SECRETARY