



**THE NATURE OF INFRASTRUCTURE IN TEACHING AND
LEARNING DESIGN AND TECHNOLOGY IN TECHNOLOGY
STUDIES AT KITWE COLLEGE OF EDUCATION**

By

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**A Dissertation Submitted To The University Of Zambia and Zimbabwe Open
University In Partial Fulfillment Of The Requirements For Award Of The
Degree Of Master Of Education In Educational Management And
Administration**

THE UNIVERSITY OF ZAMBIA

LUSAKA

2016

DECLARATION

I, MUBANGWE MUBANGWE J do solemnly declare that this dissertation is my own work which has not been submitted for a degree at this or another university except in the case where acknowledgement has been made in the text.

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APPROVAL

This dissertation of MUBANGWE MUBANGWE J. is approved as partially fulfilling the requirements for the award of the Masters of Education in Educational Management and Administration by the University of Zambia in association with the Zimbabwe Open University.

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DEDICATION

This dissertation is dedicated in loving memory of my late father Mr. John Sanga Mubangwe, and late uncle Mr. Ignacious Mutande Chalilunda men who instilled the love for education and hardwork in me at my tender age and to my remaining mom Mrs. Clementian Chanda Chalilunda Mubangwe whose prayers keep me going each day.

Also dedicated to is my beloved wife Constance Ngosa Mubangwe who indeed is a friend, my children Tuyosika Chanda, Kusekelela Sanga and Mano Mwila for their endurance, support, love and patience through out my period of study. Above all, praise be to the name of Jesus Christ son of the Living God.

ACKNOWLEDGEMENTS

Many people have made this study a success. However, I am particularly indebted to my supervisor Dr. Gift Masaiti for his invaluable advice and scholarly guidance which has greatly contributed in realising the research project. His patience, generous feedback and consistently positive encouragement are invaluable and unforgettable.

My special thanks go to the college principal of Kitwe College of Education for granting me permission to conduct my research. Other thanks go to the head of department Technology Studies, Lecturers and students at this college who contributed to the study. Their willingness and wholehearted participation made this study a reality.

Last, but not the least sincere thanks to my friends Paul Silungwe Musonda and Spyros Spider Kafunda and all those who supported and helped me in various ways to make this work successful.

ABSTRACT

The research was carried out at Kitwe College of Education of Copperbelt province. Its major objective was to examine the nature of infrastructure in teaching and learning Design and Technology in Technology Studies in Teacher Education Institution. The study is grounded in the constructivist theory and it used a mixed method design. Respondents consist of the principal and the head of department, 4 lecturers and 100 students that were randomly selected using the multi-stage sampling technique from a pool of full time and distance students. The data collection instruments were questionnaire, interview and observation. A statistical package of SPSS and Microsoft Office Excel 2010 was used in analysing responses from the respondents. The data analysis was done using statistical tools such as percentages, frequencies, means and grand means. Quantitative data from students were collected using questionnaire and from the principal and lecturers the researcher obtained qualitative data through interview guide.

This study is similar to studies done by Mulinda on Factors Affecting Utilisation of Industrial Arts Department in Secondary Schools in Lusaka district, although the focus is different. This research works focus on reducing the knowledge gaps in colleges of education in Zambia on the nature of infrastructure for teaching and learning Design and Technology. The result of the study reveals that the four (4) built Industrial Arts workshops infrastructure with machinery and equipment are no longer used as were intended. Kitwe College of education has turned its workshops infrastructure for teaching Design and Technology into ordinary classrooms. This implies that the quality assurance practice of training teachers equip to handle or teacher Design and Technology after training remains questionable. Result also reveals that there is a significant relationship between the infrastructure for teaching and learning Design and Technology with the trainee teacher's academic and professional performance.

The study concludes that education is an important tool for national development and preparation of an individual for a better life in adulthood. To achieve this, Teacher Education plays an important role to produce a well-balanced individual who will fit in classroom, school, and society and contribute positively for his or her own good and society at large. Hence, good, modern and quality infrastructure is important in training teachers more especially in practical subjects.

ABBREVIATIONS AND ACRONYMS

PTD:	Primary Teacher Diploma
ECZ:	Examinations Council of Zambia
ICT:	Information and Communication Technology
GMD:	Geometrical and Mechanical Drawing
MoHE:	Ministry of Higher Education
MESVTEE:	Ministry of Education, Science, Vocational Training and Early Education
DT:	Design and Technology
TD:	Technical Drawing
KCE:	Kitwe College of Education

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CHAPTER 1: INTRODUCTION

This chapter presents the background to the study, statement of the problem, purpose of the study, objectives of the study, research questions, and significance of the study, theoretical framework, and operational definition.

1.1. Background

Kitwe College of Education is situated in Mindolo township of Kitwe district which is on the Copperbelt province of Zambia. The college was established in 1953. It is the biggest primary teachers' college in the country, with a motto "Uwileka mbe wafye" meaning "do not let me be a useless person in life". Its capacity is twice that of the other nine teachers' colleges in Zambia in terms of infrastructure, number of teacher educators, non-teaching staff and students (Chikonde, 2008). Currently, Kitwe College of Education offers Zambia Primary Diploma Course for primary school teachers who teach from grade 1 to 9 in all subjects among others.

This piece of study is focused on nature of infrastructure for the teaching and learning of Design and Technology in Technology Studies at Kitwe College of Education and other institutions of learning. It means that infrastructure has a strong influence in teaching and learning processes, because effective teaching can only take place in an environment that is organized, motivating and peaceful. The environment where teaching and learning of Design and Technology takes place is an important educational factor that needs to be considered by everyone concerned, the environment needs adequate attention in the area of infrastructural facilities, and made conducive for learning purposes in order to achieve the set goals and objectives. Phiri (2011), described teaching in this modern era as a complex and challenging profession that involves a lot of professional skills, personal characteristics and specialised based knowledge. Teaching is a process of human interaction and an important aspect of quality education. The role played by teachers in the education system is significant because teachers are the custodians of knowledge and skills. They are the key personnel in the educational system as they are in the forefront of education, seriously engaged in various teaching and learning processes, and the final personnel in the implementation of educational principles and theories. Training students into teachers is the core business of Kitwe College of Education. The importance of

teaching is not only appreciated by educators and practitioners, but by the public at large (Phiri, 2011).

Zambian Primary Teacher Education Diploma program which is currently three (3) years prepares the trainee teachers with a variety of pedagogical knowledge; skills, attitudes and values that will enable them implement the school curriculum effectively. It is therefore designed to enable trainee teachers acquire these competences in the course of training (Primary Teachers' Diploma Curriculum for Colleges of Education, 2015). Therefore, Design and Technology (DT) is a new course in place of Industrial Arts which was a composition of Technical Drawing (TD), Geometrical and Mechanical Drawing (GMD), Metal and Wood work.

Design and Technology (D&T) is tailored towards providing trainee teachers with opportunities and experiences necessary in the development of children's mental, physical, emotional, social, spiritual and moral ability and potential. Further, it provides for appropriate and practical teaching pedagogies which are strengthened by hands-on experiences through interactive, practical and observational strategies. Emerging needs of society (i.e. cross cutting issues) have also been incorporated in order to ensure trainee teachers are abreast with the immediate needs of society and are able to offer direction and equip the children with basic skills to enable them adapt to their environment.

As such Technology Studies provides an essential and unique component for the education of all young people whatever their eventual employment. Technology Studies supports the economy by helping to prime young people (especially school leavers) and develop skills of creativity, innovation and engineering. It is one of the few subjects in school from where young people can have a truly authentic experience of a practical work environment and it is therefore a subject through which the country can grow its future designers and engineers. Technology Studies is an important subject for learners who are considering pursuing careers in the design and engineering sectors and who could contribute to a rebalanced economy at the heart of the Government's growth strategy (Primary Teachers' Diploma Curriculum for Colleges of Education, 2015).

The infrastructure of Kitwe College of Education plays a role in teaching and learning Technology Studies. The nature and role of infrastructure determines the levels of quality in training teachers for better skills and knowledge. In 2012 the Ministry of Higher

Education (MoHE) then Ministry Of Education, Science, Vocational Training and Early Education MESVTEE through Zambia Education Curriculum Framework endeavoured to integrate Design and Technology, and Information and Communication Technology and Home Economics (HE) into a single course called Technology Studies (TS) so as to meet the goals for social and economic development.

In line with the National Policy, 'Educating Our Future' goal, the new curriculum links all the levels of education from Early Childhood Care, Development and Education (ECCDE) to tertiary education and adult literacy. The current curriculum is a two way path career. It is envisaged that the curriculum will equip learners at all levels of education with vital knowledge, skills, positive attitudes and values that are necessary for contributing to the achievement of the Vision 2030 (MESVTEE, 2012).

Under Vocational and Technical Subjects, Practical Subjects constitute a form of knowledge, skills, positive attitudes and values that every person should possess to help him or her deal with the physical world. Vocational and Technical Subjects possess a potential relationship to the world of work. Hence, these help to prepare learners for post-school employment or vocational training (MESVTEE, 2012).

In recognition of the importance of practical subjects, every institution of learning in Zambia today is required to offer practical subjects as part of their curriculum. At Lower and Upper Primary Education all learners will learn all practical subjects as compulsory since these are integrated. And the following are considered as practical subjects: Agricultural Science, Art and Design, Computer Studies, Design and Technology, Home Economics (Home Management, Fashion and Fabrics, and FN), Information and Communication Technology, Physical Education, and Musical Arts Education

When moderating the Primary Teachers' Diploma for 2015 Examination Council Zambia, the researcher, then ICT and Technology Studies Moderator developed interest in how candidates fared in that examination. It was noticed that the candidates' performances was questionable. The researcher wanted to find out why most of the candidates did not respond well in that exam particularly in practical of Design and Technology. Thus, it was decided that the researcher investigate the nature of infrastructure in teaching and learning Design and Technology in Technology Studies in colleges of education particularly at Kitwe College of Education.

One of the objectives of education is to promote the full and well-rounded development of the physical, intellectual, social, affective, moral and spiritual qualities of all learners so that they can develop into a complete person for his or her own fulfilment and for the good of society thus according to the policy on education. It is in view of this understanding that the Ministry of Higher Education is trying to have a pool of intellectuals who could educate a primary school child into a useful and beneficial to the nation and world at large. Under this objective, the government through the Ministry of Higher Education in Teacher Education is hoped to train a well-rounded skilled teacher to teach practical subjects regardless of gender. In fact, in primary schools only one teacher is responsible of a class or grade. This even makes life of a primary teacher to be a complete master piece source of knowledge, skills and attitude in practical subjects. This is noted in the Ministry of Education (2012), policy document that states the levels of education in Zambia and the classes a Primary Teacher with Diploma will teach.

In regard to infrastructure in colleges of education in relation to Design and Technology or Technology Studies no much clear empirical study has been done to the knowledge of the researcher. There is need for attention at colleges of education, especially on infrastructure in Technology Studies department. Previously, the Danish had the desire to develop modern workshop in colleges of education but today the picture is far different. Noteworthy is the fact that Design and Technology is now offered in all colleges of education in Zambia and its contributions can never be under estimated. The bottom is that Design and Technology is important for engineering. Now the question is, do society understand the value this has in the development of our youth and country. However, the good part is the National Policy on Education of 1996 acknowledges the importance of practical subjects for economic growth, national prosperity and social cohesiveness (MOE, 1996).

On the sad part, there are high poor results in Technology Studies examination as noticed by ECZ particularly in practical subjects in Colleges of Education in Zambia. And, the challenges faced by colleges of education, lecturers and learners still remain unexplored (Examinations Council of Zambia, 2015).

1.2.Statement of the problem

Although the nation has development of the new curricular has been done with the major focus on practical subjects having its own stream, the state of colleges of education infrastructure has remained lacking. This study highlights the nature of infrastructure in teaching and learning Design and Technology in Technology Studies at Kitwe College of Education. Some of the scholars who have discussed Design and Technology (DT) in Zambia under Industrial Arts in there dissertation are Mulinda A. Mulenga (2001) and Ndopu Robert (1994). Then Japheth Chanda and Edward Songa (2014) under the Examination Factors That Influence Performance in Industrial Arts. Much of what has been undertaken by these scholars, public and private institutions, research institutions and cooperating partners have a bearing to practical subjects and youth empowerment or employment. The debate is whether the dream of vocational and technical career path will be tapped at an early stage in primary school going children under the works of trained primary teachers with the state of infrastructure around.

1.3. Purpose of the Study

The purpose of this study is to investigate the nature of infrastructure in teaching and learning Design and Technology in Technology Studies at Kitwe College of Education.

1.4. Study Objectives

In order to deal with and examine the research problem adequately, the research aimed to:

Main Objective:

- i. Establish the nature of infrastructure in teaching and learning of Design and Technology at Kitwe College of Education?

Supporting Objective:

- ii. Determine the usage of infrastructures for the teaching/learning of practical skills at Kitwe College of Education.
- iii. Identify specific factors affecting the utilization of Design and Technology infrastructure at Kitwe College of Education?

- iv. Establish which aspect of infrastructure in teaching and learning of Design and Technology at Kitwe College of education are mostly developed?

1.5. Research Questions

In order to deal with and examine the research problem adequately, the researcher formulated questions to be answered:

Main Question:

- i. How is the nature of infrastructure in teaching and learning of Design and Technology at Kitwe College of education?

Supporting Questions:

- ii. How is the infrastructures usage for the teaching and learning of practical skill at Kitwe College of Education?
- iii. Which aspect of infrastructure in teaching and learning of Design and Technology at Kitwe College of education are mostly developed?
- iv. What are the factors affecting the utilization of Design and Technology infrastructure at Kitwe College of Education?

1.6. Significance of the Study

It is hoped that the findings, conclusions and recommendations of the study might help curriculum developers, policy makers in the Ministry of Education and lecturers to address challenges arising from the teaching and learning Design and Technology in Technology Studies in Zambian Colleges of Education. It is further expected that the results has highlight areas of challenges that cause learner not do well in examinations.

1.7. Theoretical Framework

This study was be guided by constructivism theory that provides a theoretical framework for teaching and learning Design and Technology. Constructivism theory of learning is based on the idea that learners construct and build their own knowledge of the world around them through experience (Piaget, 1970; Vygosky, 1978; Driver, 1988).

Constructivists believe that the construction of new understanding is a combination of prior knowledge and new information. Active learners construct their knowledge with teachers acting as facilitators (Ratanaroutal and Yutakom, 2006). Design and Technology or Technology Studies qualify to use this theory because of its practical in nature.

Kombo and Tromp (2006), state that a theoretical framework is a collection of interrelated ideas based on theories. The domain under interest is the nature of infrastructure in teaching and learning Design and Technology in Technology Studies at Kitwe College of Education.

The core of this theory is discovery learning. Students learn by doing. John Dewey (1859-1952), a well-known educational psychologist, believed that practicing is a foundation of learning, and without learning practice, students would get lost. Therefore, Design and Technology or Technology Studies been a practical subject, gained its strengths in connection to the constructivist theories.

Lecturers who are constructivists are aware of the role of prior knowledge in students learning, recognising that students are not blank slates or empty vessels waiting to be filled with knowledge. Instead, they believe that students bring with them a lot of prior experiences, knowledge, and beliefs that they use in constructing new understandings (Jones, 2002). It's for this reason lecturers choose which pedagogical skills they would employ to teach practical subject. These skills include practical work. These strategies engage the learners to construct knowledge by themselves. Student preconceptions have been shown to be very resistant to change. Preconceptions are based on a child's early experiences, intuitions and form a filter for later learning. In order for understanding to take place, lecturers must elicit students' prior concepts and build on these concepts during instruction. The lecturers must provide educational experiences that will confront prior conceptions or provide a cognitive conflict in order to promote conceptual development.

1.8.Application Of Constructivism Theory

Constructivism offers lecturers instructional approaches that are in line with this research on the nature of infrastructure in teaching and learning Design and Technology at Kitwe College of Education. Treagust et al (1996) pointed that in the constructivists view, knowledge is a dynamic conceptual means of making sense of experience rather than a passive representation of an extant world. They stress that each person must individually construct meanings of words and ideas if they are to be truly useful.

The key features in the constructivists' view of learning are:

- a. The student's head is not empty
- b. There are interactions between pre-existing ideas and new experiences and phenomena
- c. Learners attempt to make sense of new experiences and phenomena by constructing meanings
- d. This is a continuous and active process

Learners do not therefore, have to only assimilate new concepts but also develop, modify and change existing ones. The constructivists' view of learning can therefore be summarized as follows:

- a. Learning outcomes depend not only on the learning environment but also on the knowledge that the learners possess.
- b. Learning involves the construction of meanings. Meanings constructed by learners from what they see or hear may not be those intended. Construction of meaning is influenced to a large extent by the existing knowledge.
- c. Construction of meaning is a continuous and active process.
- d. Meaning, once constructed, is evaluated and can be accepted or rejected.
- e. Learners have the final responsibility for their learning
- f. There are patterns in the types of meanings learners construct due to shared experiences with the physical world and through natural language.
- g. The essence of one person's knowledge is the result of a personal interpretation of experience that is influenced by such factors as the learners' age, gender, race, ethnic background and knowledge (Treagust et al 1996).

The degree to which a learner will be prepared to consider and modify an existing concept will depend solely on how plausible the new concept is and how the learner is dissatisfied with the existing concept. This state of affairs is commensurate with the notion held by constructivist that all learning is a process of personal construction so that learners can construct scientific concepts if they are given the opportunity and also if they find out that the scientific concept is superior to the previously held concepts (Lumps and Staver, 1995)

Children develop intuitive or informal conceptions about the world through experience and interaction with the natural and social environment. Often these conceptions, (also referred to as misconceptions, alternative concepts and alternative frameworks) are in contrast to prevailing scientific views (Johnstone and Qualter, 1996).

It can therefore be concluded that through formal and informal experiences practical lessons learners develop ideas about events, objects and skills. This implies that:

- a. Learners have explanations about their world.
- b. Learners' current concept of their natural skills influences what and how they learn Design and Technology.
- c. The concepts that the learners hold may be inadequate when compared to what they can learn.

From the above implications, it is important to note that the most important single factor that influences the learning of Design and Technology is what the infrastructure in place. It was therefore very important for the researcher to investigate the nature of infrastructure in teaching and learning Design and Technology in Technology Studies in the teacher trainees.

1.9. Conceptual Framework

A conceptual framework is an analytical tool with several variation and context. It is used to make conceptual distinctions and organized ideas. It gives a real picture of the relationship of variables. The framework formulated by the researcher here helps to explain the logic link of the four variables thus workshop tool, workshop status, workshop equipment and ICTs facilities in teaching and learning Design and Technology. These variables are interrelated infrastructure component that points to better student

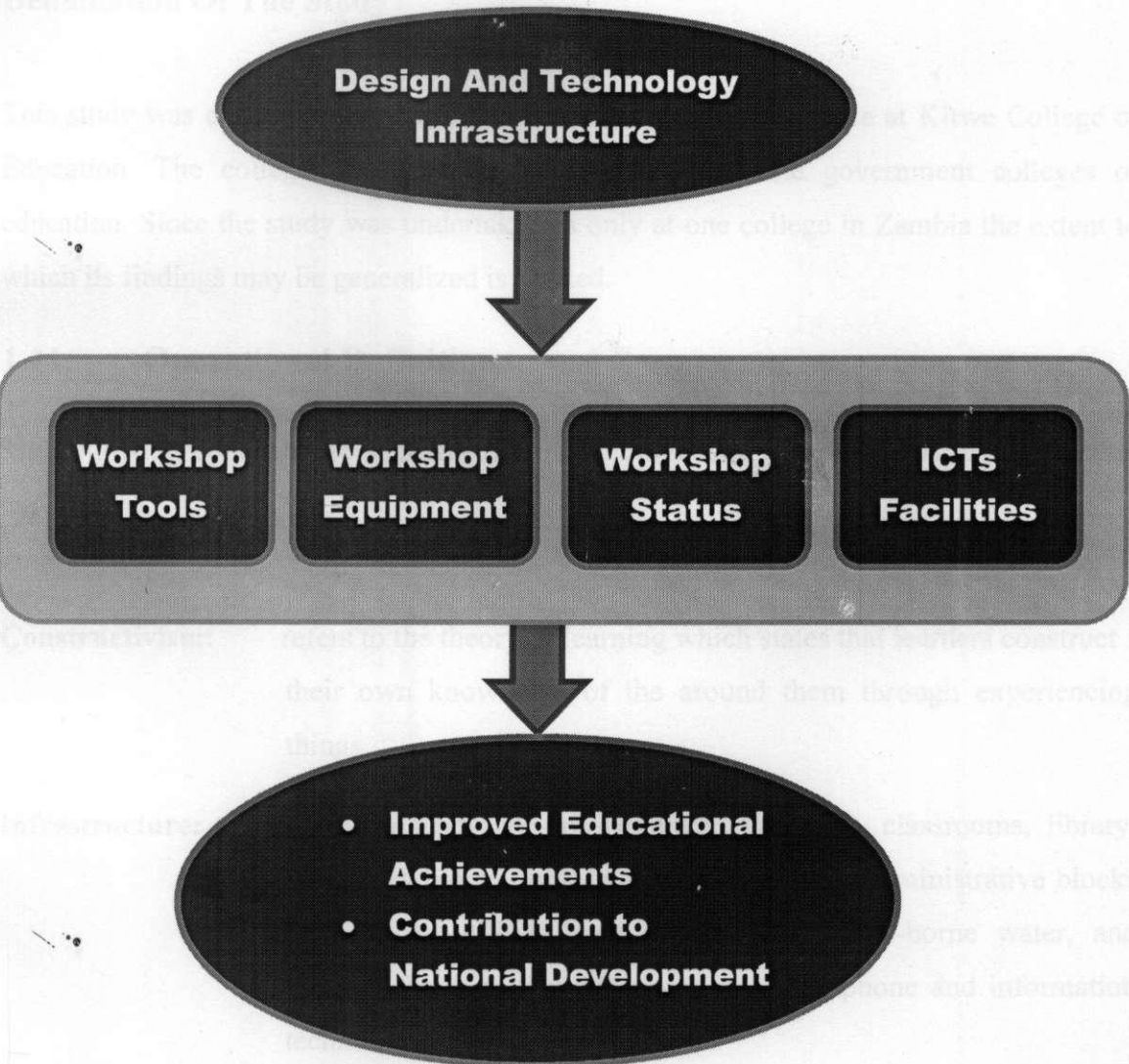
performance and contribution to national development. The framework reviews the relationship between and among the variables in this study.

Introduction Of The Study

Below is a multi-level conceptual framework as a tool for addressing nature of infrastructure in teaching and learning Design and Technology in colleges of education.

Conceptual Framework of infrastructure in teaching and learning Design and Technology in Technology Studies

Figure 1



Source: Formulated by the author

1.10. Delimitation And Limitation Of The Study

Limitation Of The Study

Limitations related to this study were many. Firstly, while collecting data, the researcher encountered a number of problems in that the collection of data was conducted during school experience preparation period. This meant that some of the respondents spent very little time in college and it was difficult to find them. Secondly, in order to have a wider analysis, the study should have covered two third of the government colleges of education.

Delimitation Of The Study

This study was conducted in Kitwe District of Copperbelt Province at Kitwe College of Education. The college was purposively selected from the government colleges of education. Since the study was undertaken in only at one college in Zambia the extent to which its findings may be generalized is limited.

1.11. Operational Definition

The following concepts are fundamental in the context of the study and require further explanation.

Constructivism: refers to the theory of learning which states that learners construct their own knowledge of the around them through experiencing things.

Infrastructure: refers to landscape, playgrounds, buildings, classrooms, library, laboratory blocks, sick bays, toilets, hostels, administrative blocks and so on, utilities such as electricity, pipe-borne water, and security facilities walls (fences) gates, telephone and information technology system

Equipment: refers to the machines and other utilities used in doing a job.

Industrial Arts: refer to technical or technology subjects (metal work, wood work and drawing and design) with a bias towards understanding technology, industry and generally require to a large extent coordinated use of hands and tools.

Design and Technology: is a practical study with the composition of Technical Drawing, Wood work, Metal work, Building and Electrical, and ICTs.

CHAPTER 2: LITERATURE REVIEW

This chapter presents a review of the literature on the nature of infrastructure in teaching and learning Design and Technology in Technology Studies Colleges of Education in particular Kitwe College of Education. It is structured as follows: Nature of Design and Technology and Studies on Infrastructure. The purpose of this review is identification of the missing gaps.

Some of the scholars who have discussed Design and Technology (DT) in Zambia under Industrial Arts in their dissertation are Mulinda A. Mulenga (2001) and Ndopu Robert (1994). Then Japheth Chanda and Edward Songa (2014) under the Examination Factors That Influence Performance in Industrial Arts. Much of what has been undertaken by these scholars, public and private institutions, research institutions and cooperating partners have a bearing to practical subjects and youth empowerment or employment. This study has a focus on the nature of infrastructure in teaching of learning Design and Technology (DT) in Zambian Colleges

Snelson (1974) reveals that practical and technical subjects (Home economics and Industrial Arts) were first introduced in Zambia by the London Missionary Society (LMS) at Mbereshi in Luapula Province in 1903. The growth of Practical Education has been steady over the years. Snelson (1974) adds that despite the idea of white collar jobs, Practical Education was part of the school curriculum and had been strengthened upon the recommendation of Phelps Stokes Commission which visited the territory in the early 1920s. However, the development of Practical Education slowed down due to the fact that it was/has been received with mixed feelings by some people owing to various factors.

In a bid to promote practical subjects in industrial arts, the Zambian government through the Ministry of Higher Education has come up with a 2-tier curriculum which provides an opportunity for learners to pursue either a vocational path or an academic path. This is supported by the national policy on education which advocates for assessment of learners' technical competencies in use of tools and machines, problem solving, development of pre-vocational experience as well as development of valuable leisure time interests. Hence, assessment in Industrial Arts is done through theory papers which test learners' cognitive abilities as well as through a portfolio of practical assessments and projects which measure the learners' ability in psychomotor skills (Chanda and Songa, 2014).

In Zimbabwe, President Robert Mugabe in 2013 was of the view that “PRACTICAL subjects be made compulsory for all pupils so that they attain skills that will not make them seek employment”, “Let us go back to that old system of education where children were taught hands on skills. “All practical subjects like building, carpentry, home economics and agriculture must be made compulsory so that when children grow up and cannot find jobs they can use their skills to survive.” (The Herald, 2013). Further the President appointed a Minister of State for Liaising on Psychomotor Activities in Education, Cde Josiah Hungwe, to ensure that apart from teaching academic subjects, the education system imparts life skills (The Herald, 2013). This was said at a briefing at the Roman Catholic Church-run Sacred Heart Girls High School in Umzingwane district; President Mugabe said training in manual work was essential in developing self-sufficient citizens who would manage to survive even economic hardships. This is a clear indication of how the governments world over recognise the positive contributions of practical subject such as Technology Studies.

In view of that Zambia is not left behind. The Ministry of Higher Education through Teacher Education has embarked on the three year training program in teacher education under which trainee teachers are expected to gain competences and skills in handling pupils in primary school in practical subjects. It's now realised to be a global call for youth empowerment. Nations worldwide have benefited from skills in practical subjects children get from primary schools. In an event that they fail to finish school or get employment they turn to skills they have and use them to get a living. Hence, the governments worldwide are showing interest.

2.1. Nature of Design and Technology

Design and Technology in Zambian Colleges of Education is taught under Technology Studies. Technology Studies is not just a vocational subject. It is a general academic subject, and has its own fundamental body of knowledge, principles and concepts which are not provided elsewhere in the curriculum. Technology Studies enables higher level of cognitive skills to be developed in the learner –developing hypotheses, synthesis of ideas and reflection. Thus it offers the opportunity for learners to investigate and evaluate the use of materials in products and designs and the consequent depletion of the earth's natural resources, (Primary Teachers' Diploma Curriculum for Colleges of Education, 2015)

Design and Technology, is an integrated subject of Geometrical Mechanical and Drawing (GMD), Woodwork (WW), Metalwork (MW), Entrepreneurship Education, and Information and Communications Technology. Practical and technical subjects are very popular in the Zambian school curriculum today. The Ministry of Education (1996) justifies the inclusion of practical and technical education in the school curriculum among other claims by saying "they possess a potential relationship to the world of work, and hence may help to prepare pupils for post-school employment or vocational training". Industrial Arts, Home Economics, Art and Design have the educational objectives in developing certain qualities in learners and the content of the syllabus relate to domestic life, commercial activities and self-employment attitude. The Ministry of Education has been trying to improve the quality and relevance of the high school curriculum in terms of knowledge and skills development.

Mohan (2010) defines teaching as a process of assisting learners acquires new knowledge and skills. It consists of showing and guiding the learners in performance of tasks and then measuring their results. And, learning is the process of knowledge and skills acquiring by the learner. Therefore teaching and learning are interrelated. Design and Technology is a practical subject and is mostly taught under discovery learning. Its learning by doing. At Technical Vocational Teacher College, the motto is learning by doing, the core of this theory or motto is discovery learning. Students learn by doing. John Dewey (1859-1952), a well-known educational psychologist, believed that practicing is a foundation of learning, and without learning practice, students would get lost. Therefore, Design and Technology or Technology Studies been a practical subject, gained its strengths in connection to the constructivist theories. Students and lecturers should have hand-on teaching and learning experiences. As Phiri (2011), pointed out students should be making there on artworks and not buying.

2.2. Studies on Infrastructure

Hage and Aiken (2000) defines attitude of a person as positive or negative emotional dispositions. From this view point, an individual's attitude towards Design and Technology or Technology Studies is defined in a more articulated way by the emotions that the individual associates with Design and Technology infrastructure, by the beliefs the individual has regarding Design and Technology infrastructure and by how the individual behaves in

relation to Design and Technology infrastructure. Similarly, a negative attitude is characterized by a negative emotional disposition towards Design and Technology infrastructure.

The quality and effectiveness of an education system in colleges of education depend heavily on the attitude of its lecturers. They are the key persons in determining success in meeting the system's goals. The educational and personal well-being of learners in colleges hinges crucially on the attitude of their lecturers. Phiri (2011) observed in his studies that the attitude of the lecturers toward Design and Technology or practical subject has led to students equally having negative attitude. He further lamented that, the lecturers' gives assignments to students to make dusters and rulers etc., but instead of students using the industrial arts workshop to produce the things instead they go to buy finished items from shops. This is not training at all. The products are not made by the students and so no skills have been learnt at all.

Taking a look at Ndola Girls Technical School, because of the infrastructure for Design and Technology the attitude of teachers toward the facility is superb. One cannot imagine that a girl's school would beat performance of boy's school in Design and Technology. Further investigations revealed that the same teachers in other schools could change attitude and make learners perform better (Examinations Council of Zambia, 2015).

As observed by Lubeya (2012), the attitude of learner involves many factors which include: unpreparedness, laziness, truancy, lack of interest, inferiority complex, negative attitude and, incompetence of lecturer. Under unpreparedness, laziness and lack of interest in the subject, students have been completing there studies in Teacher Education without even passing through any preparedness of workshop life. Most students as observed by Phiri, they just buy projects done by others in shops. This can also be attributed to lack of interest by the authority.

On misconception, for instance, Chanda and Songa (2014) observed that societal misconception is to label Industrial Arts as subjects for men. The belief is that practical oriented subjects such as Woodwork and Metalwork be relegated to male learners because they demand more of physical power than the others is flawed. On the other hand, opportunities for girls in what is traditionally a male dominated field are more promising at

the moment than before. Nevertheless, today the program for colleges of education does not see who is a man or woman when it comes to enrolment.

Studies done in Zimbabwe by Misozi et al (2013) indicate that parents find it difficult to perceive practical subjects as a route to success in the same way as the academic subject route. The assumption is that practical subjects can be passed even by low performers. Students in turn develop a negative attitude towards practical subjects as they are afraid of being branded failures. Kehoe (2007) concurs that the practical subject route is encouraged to those who show that they are unlikely to succeed in the academic route. This is not the case though, as students can still fail practical examinations if they do not take them seriously. The practice of giving practical subjects to low performers has also impacted on the pass rate for practical subjects. Experience has shown that practical subjects are on record for posting a poor pass rate at 'O' level in Zimbabwe.

This study therefore, is interested in the very students with bad attitude toward the subject who in turn will seek to enter colleges of education to become teachers. If this is left unchecked it could result in student teacher having negative attitude towards the subject. Afterwards this will affect their pupils having no interest in the subject as well, hence also affecting the contribution to national economic development. Spencer and Spencer (1993) provide that the definition of competency is: "... an underlying characteristic of an individual that is casually related to criterion-referenced effective and superior performance in a job or situation". According to these definitions of competence are the basic characteristics that influence the effectiveness of the way individuals think and act, and form a high performance in carrying out the work or in a situation.

Johnson (in Ma'mun, 1996), elaborated components of competence that must be possessed by educators as: First, the performance component. This component consists of several behaviors that are displayed in work activities (learning process), which is the totality of knowledge, skills, processes and values to make decisions for personal appearances in achieving learning goals. Second, teaching subject component. This component is combined with science learning objectives. This component consists of facts, ideas, values, processes and / or skills in which the lecturer seeks to help students acquire it. Third, teaching process component which contains a thought process (learning process) that enables these components used as a reference for a number of techniques to produce human ideas, designs,

strategies, decision making, and evaluating the progress of learning outcomes. Fourth, is a *personal adjustment component*? This component contains the basic elements of adjustment between the individual characteristics of educators with job performance in accordance with the demands of its competence. Adjustment process involves the practice of skills, attitudes, creativity, and efforts to improve themselves and reduce the weaknesses that do not fit to the look of competence. Fifth, is the professional teaching component? A basic source of information in the form of set theory and practical in education as a professional reference which include educational philosophy, educational sociology, educational psychology, curriculum, test and measurement, learning management, media, education and so on. Sixth, the attitude component which contains the quintessence of the elements of attitudes, values and roles that are important to base all the competencies of educators

Against this wish of competence, Lubeya (2012) revealed in her study that, in industrial arts/technical subjects, the highest qualification teachers and lecturers have is a Secondary Teachers' Diploma. Therefore, this study stands to question the abilities, skills and qualifications in relation to the expected competences and standards in *Zambian Colleges of Education*. When observing Johnson (in Ma'mun, 1996), elaborates on components of competence it is clear that a lot is to be done. Research works done by Ball (1990), shows that teachers tend to teach the way that they were taught. Therefore, if we expect teachers to teach in a constructivist way using technology, we need to teach and train them in constructivist ways using technology. Lubeya's revelation requires attention if *Zambian Colleges of Education* are to meet what Johnson sees as competences of lecturers.

Data collected by Phiri (2011) for the study 'A Perspective of the Challenges Facing (Basic School) Teacher Training, Recruitment and Quality in Zambia' showed that *Colleges of Education* do not have enough tools and other training and learning resources necessary for the moulding of teachers. The workshops in *Colleges of Education* are ill equipped. In most cases, the few tools available are too shallow to mould a teacher's skills. Tools and machines that are found are those finished given by the Ministry of Education. And books that talk about theories and approaches of teaching Design and Technology cannot be found in the colleges. In addition, colleges no longer produce things such as rulers, axes, hoes and other tools during training. The Industrial Arts (Design and Technology) section for instance is almost dead. The Industrial Section lacks tools for students to use to develop skills that they can in turn impart onto their learners when they become teacher. The section gives

assignments to students to make dusters and rulers etc., but instead of students using the industrial workshop to produce the things, instead they go to buy finished items from shops. This is not training at all. The products are not made by the students and so no skills have been learnt at all. In Expressive Arts, the same scenario occurs. Students have to buy their own materials to produce what is demanded of them in the form of assignments. This makes lecturers omit certain activities that they know students cannot access. Similarly, in his study, entitled 'Integration of Information and Communication Technologies (ICTs) in the Teaching Process in selected Colleges of Education in Zambia,' Kangwa (2011) investigated the extent to which ICTs equipment is inadequate in most colleges of education.

However, this study focuses on infrastructure use in teaching Design and Technology. The question at hand is whether Design and Technology as a component of Technology Studies and the infrastructure in place in colleges of education are adequate for the training of teachers. This review will be of some help in gauging the challenge posed by infrastructure use in relation to performance. Technology studies have both theory and practical examinations paper, thus two for Home Economics and two for Design and Technology. It's observed that the structure of the examinations can have a bearing on the performance of students. A student is expected to sit and pass these four (4) paper Technology Studies. Looking at the load and the demand on practical, the poor performance in Design and Technology will be the song of the day. Already, there poor performance is attributed to lack of teaching materials, lack of experience and knowledge, inadequate funding, lack of adequate support by the administrators, poor infrastructure, and inadequate funding as observed by Lubeya (2012).

The examinations are aimed at testing what students have learnt and known. In this context as Phiri pointed out students buy items and things already made, and the examination results do not clearly reflect knowledge and skills learnt. It's from this angle that measures should be put in place for the benefit of the education system in Zambian Colleges of Education. Design and Technology being a practical subject should have student involvement in skills and knowledge acquiring. Not having an involvement is depriving the learners of opportunities to develop skills to help them understand concepts involved in Design and Technology.

2.3. Summary Review

The major aim of this chapter was to review relevant literature dealing with nature of infrastructure in teaching and learning Design and Technology in Technology Studies in Zambian Colleges of Education. The chapter review of literature on Nature of Design and Technology, Lecturers Attitude Toward Infrastructure, Society and Learners' Attitude toward Design and Technology, „Lecturers' Competences and Skills in Design and Technology, Infrastructure Usage of Design and Technology, And Examination Structure of Design and Technology. The next chapter outlines the methodologies that were used in this study.

CHAPTER 3: METHODOLOGY

This chapter describes the research designs which were employed: the population, methods and procedures which were used in data collection and how the data was analysed. It further describes the study population, sample size and the sampling techniques. In addition, analysis as well as the data collection instruments used in the investigation are discussed.

3.1. Research Design

A research design is the plan, which specifies how the research participants (samples) are going to be obtained and what is going to be done with them with the view to reaching conclusions about the research problem (Huysamen 1994). The research design therefore specifies the number of groups that were used, whether these groups were drawn randomly from the populations involved or whether they were drawn randomly and also assigned randomly; and exactly what was done to the sample chosen?

This study employed a mixed method research design in which qualitative method was used and was supplemented by quantitative ones in order to obtain in-depth understanding of the research problem. According to Johnson, Onwuegbuzie and Turner (2007), Angell and Townsend (2011) and Creswell J (in press) cited by Johnson et al. (2007), mixed methods research is a research design in which both qualitative and quantitative approaches of research are combined for the purpose of obtaining in-depth understanding of the research problem.

A mixed method research design is preferred in this study because the researcher believes that it was capable of yielding new insights and illuminating meanings into the problem under investigation. The researcher also believes that a mixed method research is the best design for breaking new ground for a better understanding of the nature of infrastructure in teaching and learning Design and Technology in Technology Studies at Kitwe College of Education. Further the mixed methods design was selected because of the strengths to obtain a more insightful understanding of the research problem. Again the reason of having qualitative method leading was that findings were coming from the leadership of the institution using interview guide. It was used because of the numbers of responders involved and the type of data the researcher was interested to find.

Quantitative approach is a formal, objective, systematic process in which numerical data are used to obtain information about the phenomenon under investigation (Babbie, 2004). Creswell (2003) concurs when he asserts that a quantitative approach is one in which the researcher primarily uses post positivist claims for developing knowledge and collects data on predetermined instruments that yield statistical data. Creswell (2003) adds that , quantitative methods are used chiefly to test or verify theories or explanations, identify variables to study, relate variables in questions or hypotheses, use statistical standards of validity and reliability, and employ statistical procedures for analysis. Babbie (2004) laments that, quantitative approach makes our observations more explicit, make easier to aggregate, compare and summarize data and it opens up the use of statistical analyses ranging from simple averages to complex formulas and mathematical models.

3.2. Study Area or Site

Decisions on site selection are made for the purpose of obtaining the richest possible source of information to answer the research question. In this study, Kitwe College of Education is purposively selected from the list of colleges of education in Zambia. Kitwe College of Education is located in Kitwe district on the Copperbelt; it's in Mindolo North, about 4km North from Central Business Town.

3.3. Study Population

The population is 'the study object, which may be individuals, groups, organizations, human products, and events, or the conditions to which they are exposed' (Welman and Kruger, 1999).

3.4. Study Sample

The study sample targeted 106 people in total thus the college Principal, Design and Technology Head of Department and lecturers, and 100 students both males and female, full time and distance students of Kitwe College of Education. Cooper and Schindler (2001), defines a sample as 'a group of cases, respondents, or records comprised of part of the target population, carefully selected to represent that population'. The researcher had to study small subsets of the population of Kitwe College of Education, called 'samples'. The researcher draws conclusions about the population from the samples which were taken.

3.5. Sampling Techniques

The respondents were chosen on the basis of accessibility and their being informed about the subject matter in the purposive method of sampling. The sample population should be within reach and accessible (Dellinger, 2005).

3.6. Instruments for Data Collection

To collect data both qualitative and quantitative methods were used. Thus, questionnaires, Semi-structured interview guide and observation were employed.

Questionnaire

The questionnaires were administered to the College Students. It was felt that the questionnaire was the most ideal method of collecting data because first, the instrument could be administered to a considerably large number of respondents at the same time and enabled the survey to be done within the limited time given. Secondly, data collected through questionnaires will be easily analysed as all respondents are asked the same questions and the themes were easily developed. Thirdly, it was cheaper to print the questionnaires and administer them at once. The questionnaire used a Likert response format and an open ended response format. The respondents were free to give their views since questionnaires were mainly completed in the absence of the researcher. Confidentiality was assured as there was less interaction between the researcher and the respondents after administering questionnaires and no identity/personal information was sought. The researcher assured the participants that information collected was for the purpose of the research only. The target groups for the questionnaires were pupils and teachers.

Sem-Structured Interview guide

The interview was targeted at the College Principal, Head of Department, and Lecturers. The researcher engaged in a face-to-face interaction with the respondents. The advantages in using interviews are that, firstly, the researcher

will get prompt feedback from administrators. Secondly, there is room for the researcher to alter or clarify the interview question(s) or item(s) through in-depth interviews. Thirdly, the researcher can obtain more and clearer data from the respondents' non-verbal expressions and by making follow-up leads.

• Observation

Observation was employed as one of the methods so that the information given in other instruments could be confirmed.

3.7. Validity and Reliability of the Instruments

Cohen et al (2007), point out that validity is important for effective research. If a piece of research is invalid then it is worthless. Apart from ensuring that the instruments used in this study measured what they purported to measure, validity was addressed through member checking, the honesty, depth, richness and scope of the data. This was achieved by ensuring that, as much as possible, the researcher presented data as it was given and focused on the issues at hand. The researcher was as objective as possible and was supervised by an expert, who provided substantive guidance during the entire research. Bearing in mind that this was largely a qualitative study, the subjectivity of the researcher, his opinions, attitudes and perspectives as well as those of the respondents together contribute to a degree of bias. Therefore, validity then should be seen as a matter of degree rather than as an absolute state (Cohen et al, 2007).

Reliability as defined by Cohen et al, (2000), is the consistency of the results obtained from a measuring instrument in a piece of research while validity refers to whether a measuring instrument measures what it is supposed to measure, or the degree to which the finding is interpreted in a correct way. To ensure that this study produced realistic, valid and reliable results, triangulation method was used. This study used various data collection techniques such as questionnaires, observation and interview. The data collected from different methods was checked for credibility. Furthermore, instruments (i.e. questionnaires, observation schedule and interview) used for data collecting were piloted. The researcher also avoided asking leading questions to the respondents during interview and in the questionnaire.

3.8. Procedure for Data Collection

A letter obtained from The University of Zambia to introduce the researcher and the letter was given to the College principal who later gave permission to do the research. The researcher then made appointments with the respondents for the time to administer questionnaires, conduct interviews and observations.

Accurate data collection is important in research as it allows for dissemination of accurate information and development of meaningful programs. Data collection is a process of gathering information from respondents aimed at proving or refuting some facts. This is achieved using appropriate data collection techniques which are essentially tools and means for collecting data.

This study used semi-structured questionnaires to collect data from the principal and lecturers. This was because a semi-structured questionnaire, apart from producing quantitative data, also produces qualitative data. The researcher distributed questionnaires to principal and lecturers who completed the questionnaires on their own since they were literate as anticipated. Four Interviews were conducted. The researcher conducted the unstructured key informant interviews. During the interviews, note taking was coupled with a voice recorder which was used only with the consent of the respondents.

3.9. Data Analysis

A total of 104 questionnaires were distributed to college students and lecturers. The data, which was obtained from questionnaire, interview and observation, were analyzed quantitatively and qualitatively. In this study, the data collected was analysed both manually and electronically. Basic descriptive statistics such as frequencies and percentages were used in the analysis of quantitative data. Frequencies, percentages and some tables were generated electronically using the Microsoft Excel 2010 and Statistical Package of Social Sciences (SPSS).

Qualitative data was thematically analysed using the themes and sub-themes that emerged from the data. Each item in the questionnaire constituted a theme under which all responses were recorded and consolidated. Similarly, views from interviewees were recorded under specific themes.

3.10. Ethical Considerations

Rule and John (2011) note that the key aspects of the quality of research are the ethical relationships and its practices. Therefore, conducting research in an ethical sound manner enhances the quality and trustworthiness of the research. That is the reason the researcher had applied for ethical clearance before the research began. Therefore it was the responsibility of the researcher to inform the participants about their rights. The participants have the right to privacy and confidentiality, as a result the researcher assure the respondents that the information they provided to the researcher would be treated with confidentiality and make assurance on privacy (Babbie, 2001).

Referring to the aforementioned ethical requirements, all respondents were assured of confidentiality on the information they gave during and after research. Questionnaires were issued to respondents by researcher and collected. Interviews were done in closed rooms without any third party.

3.11. Summary Review

The chapter looked at Research Design and Study Area, Study Population, Study Sample, Sampling Technique, Instruments for Data Collection, Validity and Reliability of the Instruments, Procedure for Data Collection, Data Analysis, and Ethical Consideration.

CHAPTER 4: PRESENTATION AND ANALYSIS OF THE FINDINGS

This chapter presents the findings of the study. It is divided into sections. These sections include themes that mainly focused on research objectives or research questions of the study. The main objective of the study was to establish the nature of infrastructure in teaching and learning of Design and Technology at Kitwe College of education in Copperbelt Province of Zambia. The study solicited information from student teacher, lecturers and college administrators such as Head of Department Technology Studies and the Principal of the college. The views were obtained from in-depth interviews and questionnaire conducted during the research. Respondents were requested to indicate whether they strongly agreed, agreed, disagreed or strongly disagreed with the statement posed in the questionnaire. Using this format the results were interpreted.

The Nature of Infrastructure in Teaching and Learning of Design and Technology

To answer this question data was collected on the status on infrastructure (under a review of workshop status, workshop tools, workshop equipment and ICTs facilities), administration funding, practical lessons, professional qualification and teaching experience of lecturers of Design and Technology. These are presented below.

4.1. Status of Infrastructure

Picture1 below show the structure that house Technology Studies Department. The department consist five (5) roomed building, thus Woodwork workshop, Metalwork workshop, Technical Drawing room, Information and Communication Technology and General Room for Building Science and Electric al.



Picture 1

Picture 2



Picture 2 above, shows the entrance to workshops. On its right side is the Woodwork shop and Metal workshop while the left side is the General Room and Computer Lab for the department.

Table 1

Status Of Infrastructure					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Workshop Status	10	9.6	9.6	9.6
	Workshop Equipment	23	22.1	22.1	31.7
	Workshop Tools	4	3.8	3.8	35.6
	ICTs Facilities	67	64.4	64.4	100.0
	Total	104	100.0	100.0	

Table 1 shows the distribution of respondent’s response of 100 student teachers and 4 lectures on the status of infrastructure. It reveals that 64.4% of the respondents were in strongly satisfied with the ICTs Facilities for Design and Technology at Kitwe College of Education. This result is of the majority of respondents who were strongly satisfied with the

status of the ICTs Facilities. The lowest satisfaction response was recorded on workshop tools with a frequency of 4 and a percent of 3.8%.

4.2. Comparison of Design and Technology Facilities at KCE

Figure 2

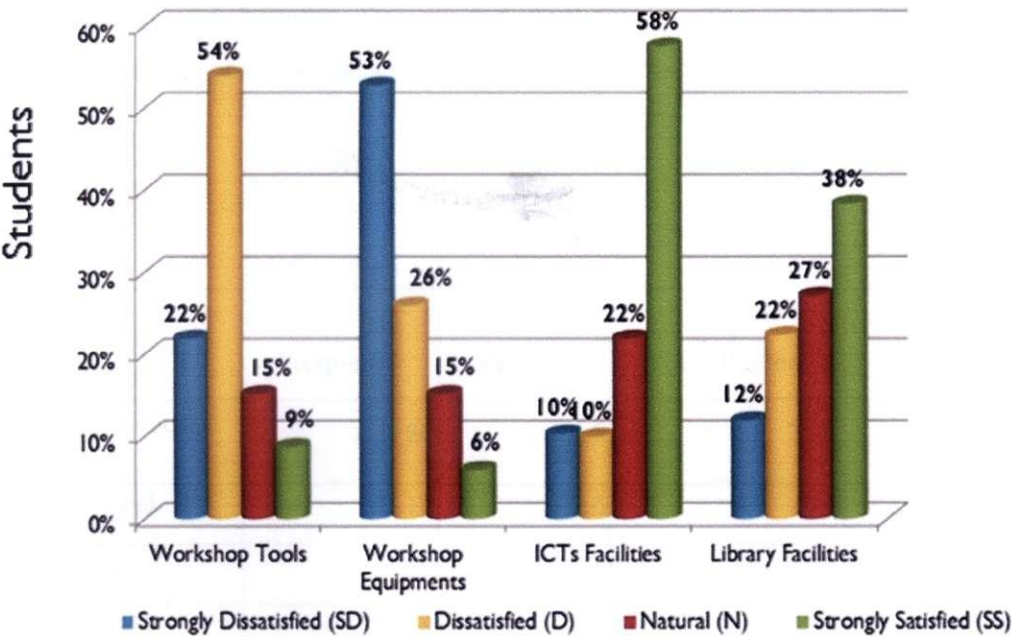


Figure 2, gives a picture of the responses of 100 student teachers and 4 lecturers. The revelation is that deficiencies in learning infrastructure and environment. The figure shows the distribution of respondent's response of Students and lecturers on the infrastructure and other facilities related. It reveals that 54% of the respondents were in strongly dissatisfied with the Workshop tools for Design and Technology at Kitwe College of Education. The majority of respondents were Strongly Satisfied with ICTs facilities with a representation of 58%.

4.3. ICTs Facilities

The researcher presents details as observed and as availed from the principal of the college, lecturers and student teacher pertaining to ICTs facilities in the teaching and learning of Design and Technology.

In order to understand ICTs facilities in the teaching and learning of Design and Technology, the principal who is the lecturers’ supervisor was interviewed. In response to the question on what ICTs were available in the college? The principal said that

The college had general ICTs which were used to teach all students both internal and distance. She further said that the college had no special program for ICTs alone. However, the facilities for ICTs are also used in teaching and learning Design and Technology. The college has no independent computer labs for Design and Technology.

Table 2

Computers					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	V. Good	80	76.9	76.9	76.9
	Good	10	9.6	9.6	86.5
	Fair	10	9.6	9.6	96.2
	Bad	4	3.8	3.8	100.0
	Total	104	100.0	100.0	

Picture 3 shows computers in the General Lab for all programs.



Table 3

The table below shows software for computers used in teaching and learning Design and Technology at Kitwe College of Education. The table shows a frequency of 80 which a very good response is giving 76.9% of the distribution. Further, it shows that only 2 responses of 1.9% indicated badly.

Table 3

Computer Software(S)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	V. Good	80	76.9	76.9	76.9
	Good	14	13.5	13.5	90.4
	Fair	8	7.7	7.7	98.1
	Bad	2	1.9	1.9	100.0
	Total	104	100.0	100.0	

Table 4

The table below shows 86.5% very good responses of internet facilities in teaching and learning Design and Technology at Kitwe College of Education. The table further, shows only 2 responses of 1.9% indicated badly.

Table 4

Internet Facilities					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	V. Good	90	86.5	86.5	86.5
	Good	8	7.7	7.7	94.2
	Fair	4	3.8	3.8	98.1
	Bad	2	1.9	1.9	100.0
	Total	104	100.0	100.0	

Table 5

Computer Labs					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	V. Good	95	91.3	91.3	91.3
	Good	5	4.8	4.8	96.2
	Bad	4	3.8	3.8	100.0
	Total	104	100.0	100.0	

Table 5, above shows the state of computer labs at Kitwe College of Education. 91.3% of 104 respondents indicating very well. The state of the computer lab is great.

Table 6

Computer Labs Furniture					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	V. Good	70	67.3	67.3	67.3
	Good	30	28.8	28.8	96.2
	Fair	4	3.8	3.8	100.0
	Total	104	100.0	100.0	

Table 6 above shows the 70 responses from the questionnaire giving a 67.3% of very good computer lab furniture. The state of furniture in the lab stands above average if the 70 and 30 are used.

Table 7

Computers Peripherals Devices					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	V. Good	90	86.5	86.5	86.5
	Good	6	5.8	5.8	92.3
	Fair	1	1.0	1.0	93.3
	Bad	7	6.7	6.7	100.0
	Total	104	100.0	100.0	

A frequency of 97 (from 90, 6 and 1) out of 104 shows satisfaction in the computer peripheral devices. The computers in the lab had good peripheral devices. Only 6.7% were bad.

4.4. Practical Lessons in Design and Technology at KCE



Picture 4

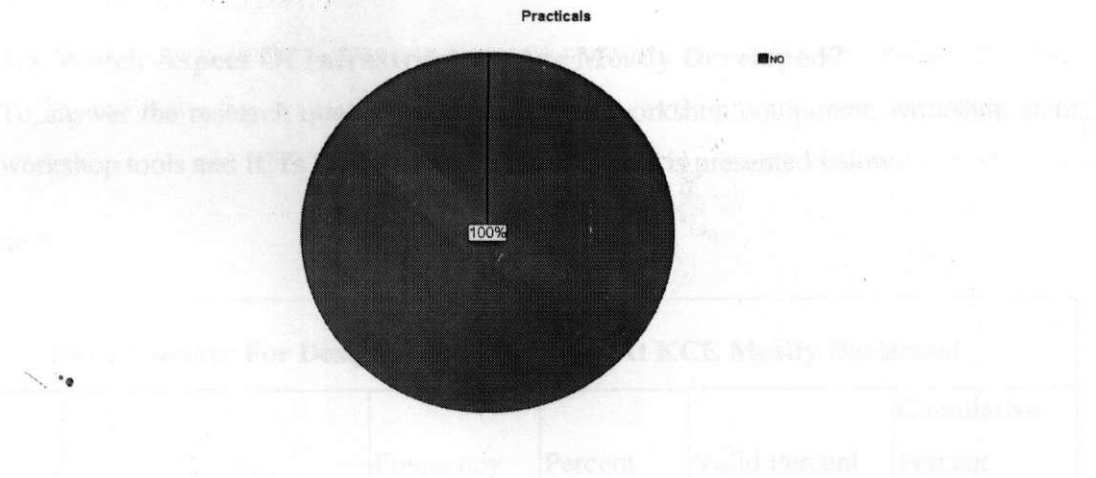
The picture above shows students having normal classes from the wood workshop. The class has displaced the workshop benches. The very workshop is just a picture of how the other four (4) are used. This has force the college students only learning theories.

Table 8 *How the kind of work being done will help build Technology*

Practical lessons					
		Frequency	Percent	Valid Percent	Cumuiative Percent
Valid	NO	104	100.0	100.0	100.0

The table above shows responses of the student teachers and lecturers that indicated they do not do practical lesson. As shown in Table 9.

Figure 3



In an interview with the Head of Section Design and Technology Mr. Reuben H. Mulenga the researcher recorded this statement

The college is back on track in terms of securing the future for Design and Technology, the college has embarked on building the new structure replace the out lived Technology workshop. The college is using school fees paid by the student as resource for the project. The new building had blocks made by the students in Building and Electrical classes under Design and Technology.

The picture below show the kind of modern building being built that will house Technology Studies.



4.5. Which Aspect Of Infrastructure Are Mostly Developed?

To answer the research question above, data on workshop equipment, workshop status, workshop tools and ICTs facilities was collected. This is presented below.

Table 9

Infrastructure For Design And Technology At KCE Mostly Developed					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Workshop Equipment	10	9.6	9.6	9.6
	Workshop Status	23	22.1	22.1	31.7
	Workshop Tools	4	3.8	3.8	35.6
	ICTs Facilities	67	64.4	64.4	100.0
	Total	104	100.0	100.0	

Table 11 present the responses of student teachers on which information and communication technology component with 64.4% at Kitwe College of education is shown to be mostly developed for teaching and learning Design and Technology.

4.6. Factors Affecting the Utilization of DT Infrastructure at KCE

To answer the research question above, data on Education Resources, Lecturers Competence State of Infrastructure, Motivation, Students Back Ground Knowledge was collected. This is presented below.

Table 11 shows that a number of factors affecting the utilization of Design and Technology infrastructure. The table shows that the state of infrastructure had 58 respondents representing 55.8 %. From the interview with the principal and lecturers an acknowledgement was recorded about students back ground knowledge as another source of lack of utilization of the infrastructure around such as ICTs facilities. This came as a third source of factors affecting the utilization of Design and Technology at Kitwe College of education.

Table 10

Factors Affecting The Utilization Of DT Infrastructure At KCE					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Education Resources	21	20.2	20.2	20.2
	Lecturers Competence	15	14.4	14.4	34.6
	State of Infrastructure	58	55.8	55.8	90.4
	Motivation	3	2.9	2.9	93.3
	Student Back Ground Knowledge	7	6.7	6.7	100.0
	Total	104	100.0	100.0	

Picture 5



4.7. Challenges Lecturers face as they teach Design and Technology at KCE

Table 12 below shows the frequency of 40 and the percent of 38.5% on infrastructure as the major challenges lecturers face as they teach Design and Technology at Kitwe College of Education. This was despite a greater number of students back ground knowledge posing 28.8%.

Table 11

Challenges Lecturers Face As They Teach Design And Technology At KCE					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Education Resources	14	13.5	13.5	13.5
	Lecturers Competence	5	4.8	4.8	18.3
	Infrastructure	40	38.5	38.5	56.7
	Motivation	15	14.4	14.4	71.2
	Student Back Ground Knowledge	30	28.8	28.8	100.0
	Total	104	100.0	100.0	

4.8. Challenges Students face as they learn Design and Technology at KCE

Table 12

Challenges Students Face					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Education Resources	3	2.9	2.9	2.9
	Lecturers Competence	14	13.5	13.5	16.3
	Infrastructure	80	76.9	76.9	93.3
	Motivation	7	6.7	6.7	100.0
	Total	104	100.0	100.0	

The largest portion of the challenges students face in learning Design and Technology were from infrastructure frequency of 80 out of 104 giving a percentage of 76.9%, followed by lecturer’s competence 13% a representation of 14.

This large portion of student teachers 80 (76.9%) strongly affirmed that the infrastructure showed inadequacy.

Picture 6



4.9. **Qualifications Lecturers have at KCE**

The table shows the qualifications of lecturers for Design and Technology at Kitwe College of Education.

Table 13

QUALIFICATIONS OF LECTURERS AT KCE					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bachelors	1	25.0	25.0	25.0
	Diploma	3	75.0	75.0	100.0
	Total	4	100.0	100.0	

The table above shows that Kitwe College of Education had professionally trained lecturers. Three lecturers representing (75%) possessed the qualification of Diploma in Education (Design and Technology or Industrial Arts) while only 1 (25%), had degrees in education.

Figure 4 shows responses from the Principal and Head of Section Technology Studies at Kitwe College of Education on the general state and nature of infrastructure for Design and Technology.

Figure 4.

S. No	Factors	Remark
1	Standard workshops to support practical skill acquisition in colleges.	Not Available
2	Workshops for various trades available for practical lessons	Not Available
3	College has standby power generating plant for practical lessons	Not Available
4	Workshops are usually opened for students' use every day.	Not Available
5	The classrooms/workshops are conducive for instruction	Unsatisfactory
6	Tools and equipment for practical lessons are adequate.	Inadequate
7	Students engaged in independent practical projects	Inadequate



Picture 6 shows the only machine left and not working.

4.10. Summary Review

The chapter has presented findings from: Status of Infrastructure, Comparison of Design and Technology Facilities at KCE, ICTs Facilities, Practical Lessons in Design and Technology at KCE, Which Aspect of Infrastructure Are Mostly Developed? Factors Affecting the Utilization of DT Infrastructure at KCE, Challenges Lecturers face as they teach Design and Technology at KCE, Challenges Students face as they learn Design and Technology at KCE, Qualifications Lecturers have at KCE. The findings point that lack of practical work was a challenge mentioned by lecturers and learners. This implied that the learners did not get the opportunity to do hands on activities, to develop critical thinking skills and accurate observation skills. Furthermore, the lack of practical work deprived the learners of opportunities to develop skills to help them understand concepts involved in genetics. The findings review that the institution lacked modern infrastructure and other good learning and teaching facilities for Design and Technology.

CHAPTER 5: DISCUSSION OF THE FINDINGS

This chapter presents discussions of the findings of the three research objectives. The findings were interpreted with the help of the objectives of the study in relation to both the literature review and the tables. The first objective of the study was to establish the nature and of infrastructure in teaching and learning of Design and Technology at Kitwe College of education.

The discussions of the findings were guided by constructivism theory of learning based on the idea that learners construct and build their own knowledge of the world around them through experience (Piaget, 1970; Vygotsky, 1978; Driver, 1988). The core of this theory is discovery learning. Students learn by doing. John Dewey (1859-1952), a well-known educational psychologist, believed that practicing of discovery is a foundation of learning, and without learning practice, students would get lost. Therefore, Design and Technology or Technology Studies been a practical subject, gained its strengths in connection to the constructivist theories.

5.1. Inadequate almost to non-existence of DT Infrastructure at KCE

The results presented in table 1 show the statistical analysis of the responses of 100 students and 4 lecturers. The table records standard deviation of 1.099 from a mean of 3.23 and mode of 4.00. The percentage scores (64.4%) of the students' responses on the status of infrastructure in ICTs facilities as the highest in table 1, at Kitwe College of Education. The highest score of 64.4% were Strongly Satisfied (SS) in ICTs facilities followed by 22.1% satisfaction in workshop equipment. This implied that only the status of infrastructure in ICTs for teaching and learning Design and Technology were adequate in college. However, student's indication was evident enough to show that the college needs to work on the status of the Design and Technology infrastructure on workshop status and tools. Design and technology is a practical subject hence, the demand that students and lecturers have hands on lessons. Also, the results revealed inadequacy of workshop equipment, the college has no standard rooms or workshops for Design and Technology. In an interview with the lecturer, the study further revealed that Design and Technology is taught theoretically. This indication showed that the college was still striving to achieve quality assurance standard in Design and Technology.

The nature of infrastructure in teaching and learning Design and Technology in colleges of education is of greater importance in the development and making of a teacher. College/school learning infrastructure refers to the site, building, furniture and equipment and tools that contribute to a positive learning environment and quality education for all students (Ayeni, 2012). The quality of learning facilities available within an educational institution has positive relationship with the quality of teaching and learning activities which in turn leads to the attainment of goals set. The quality of the school buildings and furniture will determine how long such will last while comfortable classrooms and adequate provision of instructional resources facilitate teachers' instructional task performance and students' learning outcomes (Ayeni, 2012).

Ayeni (2012) revealed that there is actually a general belief that the condition of school's learning environment including infrastructure has an important impact on teachers' effectiveness and students' academic performance. The facilities that are needed to facilitate effective teaching and learning in an educational institution include the classrooms, offices, libraries, laboratories, conveniences and other buildings as well as furniture items and sporting equipment. The quality of infrastructure and learning environment has strong influence on the academic standard which is an index of quality assurance in the school. For instance, Earthman (2002), reporting on California, revealed that comfortable classroom temperature and smaller classes enhance teachers' effectiveness and provide opportunities for students to receive more individual attention, ask more questions, participate more fully in discussions, reduce discipline problems and perform better than students in schools with substandard buildings by several percentage points.

The nature of Design and Technology is purely a hand on subject. It's imperative that the college works on the status of the infrastructure that exist and the buying of workshop tool and equipment. Honestly, how would one expect the training institution not to have a workshop? Yet the same college is training teachers who should be teaching practical subjects. Under constructivism theory, the idea of not having hands-on the subject tools and equipment brings a lot questions that cannot be answered. Student teachers need to benefit from what the good infrastructure can offer to teaching and learning Design and Technology. There is no doubt that student teachers being trained now at Kitwe College of Education will have challenges when it comes to teaching Design and Technology after they have completed their study. The probability is high on the challenges because these students are being deny the opportunity to improve on their skills.

The in-depth interviews conducted with the principals revealed that infrastructural facilities for Design and Technology were inadequate; the entire workshop buildings were old and of smaller class. The college lack well equipped workshops and libraries. The college libraries were choky and lacked adequate relevant textbooks. There is no doubt that inadequate learning infrastructure in Design and Technology adversely affects the quality of teaching and learning Design and Technology at Kitwe College of Education. This was evident with the findings of Phiri. Phiri (2011) observed in his studies that the attitude of the lecturers toward Design and Technology or practical subject has led to students equally having negative attitude. He further lamented that, the lecturers' gives assignments to students to make dusters and rulers etc., but instead of students using the industrial arts workshop to produce the things, they opt to buy finished items from shops. The case is that the workshops are not enough for everyone to carry activities because of the larger population in college and the tools are also limited.

Figure 2, gives a picture of a composition of the state of four infrastructures for teaching and learning Design and Technology at Kitwe College of Education. From the total of 100%, again responses were not far different from what was obtaining earlier. ICTs facilities seem to be doing well at Kitwe College of Education. However, the figure reveals that from a comparison of these four facilities there was a strong dissatisfaction in workshop equipment. This result brings the discussion whether lecturers get to use the same workshop equipment that is now in classes or there is some arrangement made somewhere? In the same line, workshop tools recorded the highest score of dissatisfaction which again confirm that both tools and equipment are not something seen by students at this college.

Further findings reveal that the ratio of equipment/machines with students is abnormal. The college has limited tools and equipment/machines. The situation coursed students not to have a chance of using tools and equipment through out there course of study. Now the question is how possible is it that these teachers will have the skills that he/she will eventually impact in the pupils he/she will be teaching. The population of college is about 2000 students against make shift workshops. The college has turned its four (4) workshops into classroom for ordinary learning leaving the entirely college without Design and Technology workshop. It's further revealed that the make shift facilities is inadequate in many ways, including being over-crowded or dangerous, lacking in adequate sanitary facilities and lacking first aid

facilities. The health implications of first aid facilities are very serious. In short, there is no-existence of Design and Technology infrastructure at Kitwe College of education.

In an exclusive interview with the lecturers of Design and Technology it was revealed that the classes for Design and Technology are overclouded. A class of 55 students in a practical subject is not logical. The same dilapidated classrooms also need refurbishing or upgrading to acceptable minimum standards for learning.

This was further supported by Okebukola (1996) as he identified lack of adequate infrastructure and large classes, as part of the major challenges to effective teaching and learning. The results are more weighing on the negative side. There is need to lift the standards at Kitwe College of education in Design and Technology.

In a nutshell, the nature of infrastructure in teaching and learning of Design and Technology at Kitwe College of education is highly questionable. Infrastructure plays a crucial role in teaching and learning Design and Technology. Design and Technology is a practical course or subject that requires use of equipment and tools. Beyond that Kitwe College of education has turned its workshop infrastructure into ordinary classrooms making it more difficult for the subject to be offered in practical. As pointed out by Ayeni (2012), College/school learning infrastructure refers to the site, building, furniture and equipment and tools that contribute to a positive learning environment and quality education for all students. In this regard, quality education is not even on the rips of Kitwe College of education in terms of Design and Technology. How do you talk of practical lessons without tools and workshops? This has contributed to student being under developed in skills and Design and Technology competences.

Ideally, the nature of infrastructure in teaching and learning Design and Technology is to accelerate skills acquisition, safety on working, and performance enhancement. Infrastructure boost moral for working hard and skills development and this is not a case at Kitwe College of education. To the worse, the findings are contrary to MOE policy which state that the school must have all the necessary educational requirement, classroom, desks, chairs text books (MOE, 2007).

5.2. Adequate and in place ICTs Facilities

The researcher presents details as observed and as availed from the principal of the college, lecturers and student teacher pertaining to ICTs facilities in the teaching and learning of Design and Technology.

In order to understand ICTs facilities in the teaching and learning of Design and Technology, the principal who is the lecturers' supervisor was interviewed. In response to the question on what ICTs were available in the college? The principal said that,

The college had general ICTs infrastructure which are used to teach all students both internal and distance. She further said that the college had a special program specifically for ICTs only. However, the same facilities of ICTs are used in teaching and learning Design and Technology. The college has no independent computer labs for Design and Technology.

Table 2 indicates that 76.9% of respondents marked that the college had very good computers as compared to 9.6% which were indicated to be bad. Not surprising is the fact that the same percentages of those who had indicated very good computers reflected in table 3 on the status of computer software. However the difference was recorded in the bad computers having good software and this gave a less in frequency of 2.

What this means, the college has very good working computers with very good software ideal for the teaching and learning Design and Technology. Even though, this are shared computers between programs in college at least the state of ICTs facilities items of computers is good.

On internet facilities the study revealed the highest record of 91.3% with the frequency of 95 of 104 respondents of lectures and student teachers. This result is indicated in table 4 in the findings. The state of internet is similar to the computer peripheral devices in table 8. Generally speaking, it seems that on the state of computers and its surrounding the college has acquired very good state of art for teaching and learning Design and Technology.

The foregoing partly explains the greater number of computer and its peripheral devices than the state of the computer labs and it furniture. Table 5 and 6 showed very good of satisfaction of the computer labs and the furniture. Only a smaller margin of 1.0% is in the state of furniture and labs general outlook. It is therefore not a surprise that Table 6 further reveals

that the state of computer labs were good because they just received a new face lift in the recent funding's in ICTs sector in colleges of education. In light of the above findings in figure 2, the researcher sees that ICTs facilities were highly developed and in good order compared to other Design and Technology infrastructure. Students showed a satisfaction higher of the ICTs facilities than any others. The researcher observed that the college has bought some ICTs gadgets and the computer laboratory looked modern. This in itself is a booster to teaching and learning Design and Technology in teacher education. There is a coloration of nature of infrastructure and performance of students in practical subjects. Studies done by Hemmingson and Borell (2002) reveals that an absence of desks, chairs, and other objects that are suitable for students will restrict their ability to participate in class activities. Therefore, it's certain that in most cases Design and Technology can never be taught nicely without better infrastructure. The interview with the lecturers reviewed that student's performance in Information and Communication Technology in Design and Technology is good. And this could be attributed to good ICTs infrastructure.

Schneider (2002) pointed out that school facilities had a direct effect on teaching and learning. He also found that the poor conditions of school facilities made it difficult for teachers to teach their students or provided an adequate education to their students, which affected teachers' health and safety. These poor conditions caused teachers to leave their schools and leave the teaching profession. "Our country's school facilities are a serious part of the educational system. Their condition and upkeep must be talked in the continuing discourse about student success, teacher efficiency, and responsibility". One can imagine a trainee teacher not having hands on experiences in the fields where they will be expected to showcase their expertise. The case for ICTs facilities at Kitwe College of education is encouraging though much needs to be done. The population of the college is about 3000 both full time and distance students against 2 computer labs of 50 computers each. There is need to increase the labs and computers so as to increase chances of students having access to computer hands on training. Most lessons for ICTs at Kitwe College are taught theoretically. In regard of facilities satisfaction to students, ICTs infrastructure facilities emerge higher compared to others. The college principal discloses that the college and the Ministry of education have worked tirelessly to make the labs what they are today. The nature and role of ICTs infrastructure in teaching and learning Design and Technology is basically the enhancement of the knowledge acquisition and attainment of quality assurance. Teacher

education demands quality assurance hence it's imperative the college works at having good and quality infrastructure for teaching and learning Design and Technology.

Table 11 gives the researcher picture that the state of infrastructure in general is the worse followed by motivation and educational resources. The three had a respective of 55.8, 2.9 and 20.2 percent. There was little from students back ground knowledge and lecturers competences. Most of what had caused failure in utilization is the state of infrastructure which has been turned into classes. Olagboye (2004), viewed utilization of school infrastructure and learning environment as the extent of usage of school buildings, laboratories, library, assembly-ground, flower garden, school garden, volleyball field, chairs, desks, chalkboard, and so on. However, under observation the researcher learnt that some infrastructure in college did not exist or they were damaged. Too much pressure on their use could result in over utilization, a situation that has led to rapid deterioration and breakdown. For instance, when a classroom built to accommodate 30 students is constantly being used for 80 students then the returns from these facilities may not be maximized in terms of teaching and learning. The true picture is that Kitwe College was built about 50 plus years ago to house a sizable number of students. Today the situation has tripled forcing the college to turn the Technology Studies workshop into classrooms. Comfortable learning facilities will not only boost the morale of teachers and students but will also ensure the realization of the set educational objectives is achieved.

In an interview with the lecturers, it was revealed that the college lacked classroom for ordinary classes and turned the workshops into classes was a major blow to teaching and learning Design and Technology at Kitwe College of education. The decision was for the view to increase the enrolment for the college and not the standard and quality assurance for education. It's difficult to talk about utilization when the workshops are no longer changed into classrooms at the college. The workshops are now turned into full classroom in operation and students learning just like any other classroom. They sit next to machines in a normal way. The case for workshops is no more. The situation at Kitwe College of education in terms of teaching and learning Design and Technology is full of sorry site story.

In addition, is maintaining existing college buildings, there is a continual need for modernization. This is a far broader need than the typical concern over creating an infrastructure for technology studies. The college was built in the past and do not provide

adequate space resources in a way the college educate student teachers in the early twenty-first century. Efforts to reduce class size across the college along with growth in the number of students have placed a burden on college facilities and increased the demand for more classroom space. This is the more reason the college has turned Technology Studies workshops into traditional classrooms. Moreover, college's efforts to use classrooms in different ways to maximize learning often require additional square footage in each classroom. For example, in Technology Studies at Kitwe College of Education, the traditional workshop full of machines has often been used as room with desks on one side where students sit for classroom activities. All of this requires additional space and reorganization of the classroom space.

Infrastructure is an integral component of the learning and teaching context. This is because a school's infrastructure enables students and teachers to access a wide range of tools, services and resources to support learning and teaching. For instance information technology through the use of computers could be useful for teaching, learning and administrative purposes. However, lack of electricity for instance renders the virtues of information technology useless in such a context. The lack of resources is a critical factor in education because it may negatively affect the learning and teaching processes within the classroom. It is reported on the one hand, that lack of facilities and under resourced schools are directly associated with the academic failure of learners (Lolwana 2004)

The conclusion is that the college has done tremendous work in the ICTs facilities compared to other sectors of infrastructure in the teaching and learning Design and Technology in Technology Studies. The tables have revealed that computer and their peripheral devices are in good state and ideal for the teacher training institution.

5.3. No Practical Lessons

Papernek (1972) (as cited in Chanda and Songa, 2014) believes that the best way of teaching Industrial Arts is through exposure to any fields of human activities and the respective equipment used thereof. The learners must also acquaint themselves with the mechanical systems involved. Furthermore, fieldwork exposures must be accompanied by well-planned discussions, questions and possibly practical application exercises.

Table 9 revealed that all the 104 respondents indicated that there is nothing items of teaching and learning Design and Technology in practical. The table shows the frequency of 104 and percentage of 100.

This finding was at variance with, and thus proved wrong the contention of the Ministry of Higher Education in its dream of an industrious nation. The college does not offer any form of practical lesson and this is in line with Phiri's observation that students just buy articles from outside college. The question that rises is where will these teachers to be, will learning the practical aspect of Design and Technology.

At Kitwe College of Education students' lack of interest in practical lessons as revealed by this study, may be attributed to the lack of workshops for practical lessons. The basic idea behind colleges of education training is to 'develop in students' manipulative skills, creativity; the finding revealed this objective could not be attained due to lack of basic adequate facilities for training. This finding is also in line with Ibeneme and Eze (2010), who reported that the major factors hindering the growth of technical and vocational education in Nigeria are: lack of adequate qualified personnel, inadequate facilities, more theoretical training given to students, among others. Thus, the placement of technical vocational education as a program which will lead to the acquisition of practical skill as well as the realization of the vision 2030 through technical vocational education will continue to be a mirage (Ibeneme and Eze, 2010) except the status quo is corrected and improved. The responses of the lecturers in this study indicated that they have the training required to impart practical skill to their students, but they also agreed that the qualities of their practical instructions are unsatisfactory. This could be as a result of many factors as found out by this study. The extent to which facilities are provided will determine, to a large extent, the attainable quality of education, training and graduates to be produced. The inability to provide facilities can *force the introduction of undesirable alternative measures that will undermine the standard of the overall set goals*. This implies the need for provision of relevant and adequate training facilities, personnel and infrastructures to achieve the objectives of technical and vocational education cannot be over emphasized (Kumazhege and Egunsola, 2010)

Up next, is the second objective of the study which was to determine which infrastructure is mostly developed?

5.4. Other Factors Related to Infrastructure Usage.

Table 14 shows qualifications of lecturers at Kitwe College of Education. The table indicates that the college had 3 diploma holders lecturer who are upgrading their studies and 1 with a bachelor s degree.

Getting a qualification is one thing, but geating the qualification which is directly relevant to the teaching profession is another. The Teaching Service Commission had been grappling with the issue of relevance of the qualifications teachers acquired vis-à-vis the current vocation as a prerequisite to their promotion. This was evidenced by the Teaching Service Commission’s realization that teachers needed sensitization on their terms and conditions of service under which they operated. This included some administrative procedures and vacancies that should be available after they have acquired higher academic and professional qualifications. The Commission noted that many teachers countrywide had shown keen interest in upgrading their academic qualifications in order to gain promotions and better salaries.

Unfortunately, some teachers used the chance to go to school without considering the contribution that the qualification to be acquired would bring to the performance of their current jobs. This had a ripple effect on their stay in the education sector.

The most frequent reason given over the lecturers competences was that lecturers in colleges of education like Kitwe College of Education are not fully practical skills based. Most lecturers in colleges of education had not received specialist training in teacher development as observed by researcher. The lack of training in practical skills by lecturers affects the consistency in the teaching of skills. Avalos (2000) adds that poorly trained lecturers are likely to teach the way they themselves were taught, and are slow to incorporate new teaching skills into their teaching. This reason has been noted also by Kunje and Lewin (1999) who concluded that the majority of teachers in primary teachers training colleges were either secondary school teachers or primary school teachers who have been transferred to the college to train primary school teachers without any further training themselves. These teachers join the colleges of education without thorough understanding the basics of Design and Technology skills and pedagogical content. This is the situation that prevails even in the Zambian primary education system as noted by Mulkeen (2010). It is important to appoint

teachers who are teaching at primary school sector who have upgraded in studies to be lecturers at colleges of education as these can draw from their own experiences. Lecturers in colleges of education need to be trained in Design and Technology skills and pedagogical content than letting them to do trial and error method. The teaching processes used by college lecturers influences the learning process of the student teachers which in turn affects the pupils in practical skills. In short the quality of teacher training is dependent on the quality of college lecturers.

What is certain is that educator qualifications are critical because it is their knowledge and expertise that is required in helping learners understands different subjects. About this matter it is argued that educators should possess adequate "...knowledge and skills to assist learners in solving problems, communicating clearly, making informed decisions, and in constructing new knowledge, products, or systems in diverse, engaged learning environments" (Jusuf, 2005).

5.5. Summary Review

The chapter looked at the nature of infrastructure in teaching and learning Design and Technology at Kitwe College of Education, ICTs facilities, Practical Lessons, the most developed infrastructure, Utilization of the infrastructure, challenge lecturers face when teaching Design and Technology, challenges students face when learning Design and Technology and of course the qualification lecturers have for teaching Design and Technology.

According to the findings, it can therefore be concluded that the true answer to the question is that there is no infrastructure for Technology Studies apart from what was set for Information and Communication Technologies. The picture the college gives about Technology Studies infrastructure is of make shifts arrangements.

CHAPTER 6: CONCLUSION AND RECOMMENDATION

6.1. Conclusion

This chapter is designed to give a summary drawn from the findings of the study under the topic “the nature of infrastructure in teaching and learning Design and Technology in Technology Studies at Kitwe College of Education”. The main aim of this study, therefore, was to fill the knowledge gap by finding the nature of infrastructure in teaching and learning Design and Technology in colleges of education.

Lack of / Deteriorating Infrastructure as described by Ehiametalor (2001) are the operational inputs of every instructional program and they constitute elements that are necessary for teaching and learning e.g buildings, laboratories, machinery, furniture and electrical fixtures. Infrastructure represents the empirical relevance of the totality of school environment for the realization of school business. He identifies the following as components of infrastructure: landscape, playgrounds, buildings, classrooms, library, laboratory blocks, sick bays, toilets, hostels, administrative blocks and so on, utilities such as electricity, pipe-borne water, and security facilities walls (fences) gates, telephone and information technology system. It also includes the basic systems and services that are necessary for smooth organization of buildings, transport, water, power supplies and administrative systems. To a large extent the issues discussed above are lacking in our educational institutions, classes are overcrowded, libraries, offices, estates, hostels, etc. the shortage of equipment and facilities can hinder quality of teaching and learning, quality reduces when the facilities required for imparting and learning are not provided. Olaitan (1996) remarked that the condition under which vocational and technical education is imparted is poor, most secondary and tertiary institutions lack equipment for training, lack workshops and workshop facilities, have ill-equipped laboratories and libraries. Students in this program are supposed to be exposed to a work environment while in school to enable them fit in and outside the school environment. The acute shortage/lack of infrastructure and equipment e.g machinery, laboratories, tools, is a result of over enrolment of students, workshops. This situation, has affected the production of skilled manpower, useful for employment and nation building from the foregoing, the lack/deterioration of infrastructure in colleges of education cannot in any way guarantee

role for infrastructure at Kitwe College of Education for teaching and learning Design and Technology.

The nature of infrastructure in teaching and learning Design and Technology is to accelerate skills acquisition, safety on working, and performance enhancement. Infrastructure boost moral for working hard and skills development and this is not a case at Kitwe College of education.

The value for producing quality teachers through the present state of infrastructure is questionable. This picture poses greater challenge on quality assurance in training of teachers to handle pupils who the nation of Zambia is one day expecting to be engineers. Further, questions are posed on how these teachers will teach what themselves have not done at college level. Therefore, the college and other stakeholders in education should effectively collaborate and contribute significantly towards the development of infrastructure for teaching and learning Design and Technology in Technology Studies, so as to create a more conducive teaching and learning environment for a sustainable high-quality education assurance practices in colleges of education.

6.2.Recommendations

Based on the findings of the study, the following recommendations were made:

- i. Kitwe College of Education should take a decisive measure towards the restoration of functional workshops for all the courses in Technology Studies so as to enable the student teachers and lecturers have a better practical experience.
- ii. The Ministry of Higher Education should check the Technology Studies infrastructure existing in colleges of education in Zambia in order to have standard and quality assurance training of teachers in colleges of education.
- iii. The Ministry of Higher Education should examining challenges of utilisation of the exciting infrastructure and considers establishing ways of bringing life back to practical subjects so as to foster hand-on experience and training in teacher education.

6.3.Suggestions for Further Research

- i. A comparative study on the infrastructure for Design and Technology in all colleges of education in Zambia. This would give insights into whether the infrastructure for Design and Technology can have influence in training teachers.
- ii. A study on lecturing and training of student teachers in Design and Technology in colleges of education without impacting practical skills should be conducted.

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APPENDICES

Appendix A

THE UNIVERSITY OF ZAMBIA
DIRECTORATE OF RESEARCH AND GRADUATE STUDIES
SCHOOL OF EDUCATION
INSTITUTE OF DISTANCE EDUCATION

QUESTIONNAIRE FOR THE PRINCIPAL

Dear Respondent,

The researcher is a post graduate student at the University of Zambia, undertaking a Study at Kitwe College Of Education. You are requested to take part in this exercise by completing this questionnaire which will take about 10 minutes of your valuable time. The information you will provide shall be strictly used for academic purposes and will be kept confidential at all times.

Confidentiality: The degree of confidentiality encompasses academicians who may be interested to improve the quality of this study. Fellow researchers and research supervisors may review or have access to the research records but anonymity and confidentiality will be upheld at all times.

Beneficence: The participants are expected to benefit from the research by way of government and other stakeholders in the private sector strengthening existing programs while developing new and more appropriate policies and programs for the course using the results of this study.

Guide:

1. Please answer questions below as honestly as possible.
2. You do not need to write your name on the questionnaire.
3. Tick where necessary and write in the spaces provided for the questions which require brief explanations.

Appendix B

Questionnaire for the Principal of Kitwe College of Education

The Study Meant To Establish The Nature Of Infrastructure Teaching And Learning Design And Technology In Technology Studies At Kitwe College Of Education.

Dear Respondent,

Note that the information you give shall be treated in strictest confidence. So, please respond to all the questions freely and honestly. The researcher will collect and analyse the information (data) personally.

SECTION A: BIOGRAPHICAL INFORMATION

Indicate your response by marking an “X” in the appropriate box or writing in the provided spaces.

Gender: Male ☐ Female ☐

SECTION B: RESEARCH QUESTIONS

- How long have you been in the teaching profession?
1 – 5 years ☐ 6 – 10 years ☐ 11 – 15 ycars ☐
16 – 20 years ☐ 21 – 25 years ☐ 26 – 30 years ☐
- What are your qualifications? (tick)
Postgraduate ☐ Advanced diploma ☐
Bachelor degree ☐ Diploma ☐
- What is your professional area of specialization? (Fill in the blanks spaces)
Postgraduate qualification
Bachelor degree in Major
- Suggest how best Design and Technology can be improved in Teacher College of Education.
.....
.....
- Comment on the integration of Design and Technology in Technology Studies in relation to student performance.

.....
.....

6. How is the situation of Design and Technology teaching resources at KCE?

.....

7. What challenges, if any, do lecturers face as they teach Design and Technology at Kitwe College of Education in relation to infrastructure?

.....

.....

8. What challenges, if any, do students face as they learn Design and Technology at Kitwe College of Education?

.....

.....

9. What are the factors affecting the utilization of Design and Technology infrastructure at Kitwe College of Education?

.....

.....

The End

Thank you for your participation

.....

**Questionnaire guide for the Head of Department / Section Technology Studies -Kitwe
College of Education**

Dear Respondent

Note that the information you will give shall be treated in strictest confidence. So, please respond to all the questions freely and honestly. The researcher will collect and analyse the information (data) personally.

Indicate your response by marking an “X” in the appropriate box or writing in the provided spaces.

Gender: Male ☐ Female ☐

SECTION B: RESEARCH QUESTIONS

SECTION B: RESEARCH QUESTIONS

2. How long have you been in the teaching profession?

1 – 5 years 6 – 10 years 11 – 15 years
16 – 20 years 21 – 25 years 26 – 30 years
31 – 35 years 36 – 40 years 41 – 45 years
46 – 50 years 51 – 55 years 56 – 60 years
61 – 65 years 66 – 70 years 71 – 75 years
76 – 80 years 81 – 85 years 86 – 90 years
91 – 95 years 96 – 100 years

3. What are your qualifications? (tick)

Postgraduate	<input type="checkbox"/>	Advanced diploma	<input type="checkbox"/>
Bachelor degree	<input type="checkbox"/>	Diploma	<input type="checkbox"/>

4. Suggest how best staffing of Design and Technology can be done effectively in Teacher Colleges of Education

5. Suggest how best Design and Technology can be improved in Teacher College of Education.

6. Comment on the integration of Design and Technology in Technology Studies in relation to student performance.

.....

.....

.....

7. How is the situation of Design and Technology teaching resources at KCE?

.....

8. What challenges, if any, do lecturers face as they teach Design and Technology at Kitwe College of Education in relation to infrastructure?

.....

.....

.....

9. What challenges, if any, do students face as they learn Design and Technology at Kitwe College of Education?

.....

.....

.....

10. What are the factors affecting the utilization of Design and Technology infrastructure at Kitwe College of Education?

.....

.....

.....

11. Do lectures have access to the tools and equipment?

i. YES ☐ ii. NO ☐

12. If the answer is No to the question 11, give reasons.

i.

ii.

13. Does your college administration support Design and Technology?

i. YES ☐ ii. NO ☐

14. If the answer is YES to question 13, what support do you receive?

i.

ii.

15. If the answer is NO to question 13, why not supporting Design and Technology?
- i.
 - ii.
16. Does the department discuss matters concerning Design and Technology with the principal?
17. If the answer is YES to the question how often in a term?
- i. 4 ii. 3 iii. 2 iv. 1 v. 0
18. Suggestion for improvement of infrastructure.
- i. Increase funding from government
 - ii. More equipment should be sourced
 - iii. Lecturers should change their negative attitude towards work
 - iv. Administration should repair and maintain new and old equipment
 - v. Motivate lecturers

The End

Thank you for your participation

Appendix D

Questionnaire for the Lecturers and Students of Technology Studies of Kitwe College of Education

The Study Meant To Establish The Nature Of Infrastructure Teaching And Learning Design And Technology In Technology Studies At Kitwe College Of Education.

Dear Respondent,

Note that the information you give shall be treated in strictest confidence. So, please respond to all the questions freely and honestly. The researcher will collect and analyse the information (data) personally.

SECTION A: BIOGRAPHICAL INFORMATION

Indicate your response by marking an “X” in the appropriate box or writing in the provided spaces.

Gender:	Male		Female				
What is your age range?							
21 – 25 yrs		26 – 30yrs		31 – 35yrs		36 – 40yrs	
41 – 45yrs		46 – 50yrs		51 – 55yrs			

SECTION B: RESEARCH QUESTIONS

- Do you have practical lessons in Design and Technology?
1.i. YES ☐ ii. NO ☐
- If so, are they adequate? YES ☐ NO ☐
- Which aspect of infrastructure in teaching and learning of Design and Technology at Kitwe College of education are mostly developed?
Workshop Tool ☐ Workshop Equipment ☐
Workshop Status ☐ ICTs Facilities ☐
- What challenges, if any, do lecturers face as they teach Design and Technology at Kitwe College of Education?
 - Education resources
 - Competences

- Infrastructures
- Motivation

5. What challenges, if any, do students face as they learn Design and Technology at Kitwe College of Education?

- Education resources
- Back ground knowledge
- Infrastructures
- Motivation
- Lecturers

6.

Information and Communication Technology (ICT)

Items	V. Good	Good	Fair	Bad	V. Bad
Computes					
Computer Software					
Internet					
Computer Peripherals					
Furniture					
Computer Labs					

Technical Drawing

Items	V. Good	Good	Fair	Poor	V. Poor
Drawing Tables					
Drawing Instruments					
Drawing Room					

<div>Observation Check list</div> <div>WOOD AND METAL WORK TOOLS AND EQUIPMENT</div>				
No	Equipment/Tool	Number	Condition	
			Good	Bad
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
29				

Appendix E:

Time Line for Carrying Out the Research:

ACTIVITIES	JAN 2016	FEB 2016	MAR 2016	APR 2016	MAY 2016	JUNE 2016
Problem formulation						
Writing the proposal						
Preparation & procurement of research instruments						
Research trial of instruments						
Field work (data collection)						
Data processing and analysis						
Writing of the research paper						
Binding, presentation & submission of the paper.						

Appendix F:

Research Budget

<u>Stationary</u>	ZMK
3 Reams of white paper	180.00
6 Pens	20.00
1 Stapler	50.00
1 Staples	50.00
1 Perforator	50.00
3 Writing pads	120.00
Secretarial Service	600.00
Binding of three copies	900.00
<u>Field Work</u>	
Trial of instruments	400.00
Transport- To and from the college (100 x 3)	300.00
Lunch allowance	400.00
<u>Monitoring Instruments</u>	
Video Recorder	500.00
Grand Total	K 3,570.00