REVIEWING THE LEARNER - CENTRED APPROACH IN THE TEACHING OF MATHEMATICS AT NKRUMAH AND COPPERBELT SECONDARY TEACHERS COLLEGES

by

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A thesis submitted to the University of Zambia in Fulfilment of the Requirements for the Degree of Master of Education in Mathematics Education

The University of Zambia

Lusaka

2009.

DECLARATION

I declare that with the exception of the assistance acknowledged, this thesis is the result of my own studies. This work has not been accepted for any degree, and is not being currently submitted in candidature for any other degree. Any ideas presented earlier by other authors have been acknowledged.

Candidate's Signature A. Musonda

Musonda Allan

Date 23/07/2009

DEDICATION

To my late mother, Nelly Muleba, who taught me patience and perseverance.

CERTIFICATE OF APPROVAL

This dissertation of Musonda Allan (Reviewing the Learner - Centred Approach in the Teaching of Mathematics at Nkrumah and Copperbelt Secondary Teachers Colleges) is approved as fulfilling the full requirements for the award of the Degree of Master of Education in Mathematics Education of the University of Zambia.

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ACKNOWLEDGEMENTS

I wish to express my gratitude to Dr, G.P.A. Banda for his kindness and patience with me in providing guidance during my study. His encouragement and understanding made it possible for me to accomplish my dream. My heart of gratitude also goes to the following for their words of encouragement and advice at various stages of my work: Mr C. Haambokoma, Mr B. Nkhata, Mr M. Tabakamulamu and the rest of the lecturers in the Department of Mathematics and Science Education in the School of Education of the University of Zambia. I am thankful to the Assistant Dean – Postgraduate of the School of Education at the University of Zambia, Dr P. Manchishi for his advice and direction regarding my studies.

I am grateful to the Flemish Office for International Cooperation and Technical Assistance (VVOB) for their sponsorship. Of special mention are Mr Hans Casier and Mrs Judith Kerhkof. I am also indebted to the administration at the two colleges for making it easy for me to do my studies. I wish to thank the mathematics departmental administrators, Mrs Mvula and Mr Kangwa and departmental colleagues for their help in many ways. I am indebted to my fellow graduate students: P. Mulendema, V. Mudenda, W. Mwape and S. Nkoya for their cooperation. My thanks go to: Mr M.M. Aikayo for making it easy for me to access the VVOB library and Mr K. M. Likando of COSETCO for being 'handy' whenever I was at COSETCO. I thank Mr.W. Mwandu, Mr D. Shibeleka, Ms R. Mapoma, Ms R. Mulenga, Ms J. Nkhoma and Mr G. Kaira for their support. I am grateful to all friends and colleagues who assisted me in one way or the other.

My great appreciation and thanks go to my wife, Brenda and the children: Allan (Jnr), Nchima, Sinjala and Mwitwa for being there for me when it mattered most. Thanks for your endless support and your positive words.

I would also like to thank all students and lecturers who participated in the study by way of completing the questionnaires. Above all, to God be the Glory.

ACRONYMS

BeSSTT	Better Secondary School Trained Teachers
CDC	Curriculum Development Centre
COSETCO	Copperbelt Secondary Teachers College
CPD	Continuous Professional Development
EOF	Educating Our Future
FG	Focus Group
FOL	Focus On Learning
HoD	Head of Department
HoS	Head of Section
LCT	Learner Centred Teaching
MoE	Ministry of Education
NTC	Nkrumah Teachers College
OHPs	Overhead Projectors
SPSS	Statistical Package for Social Sciences
UNZA	University of Zambia
VVOB	Flemish Office for International Cooperation and Technical Assistance
ZPD	Zone of Proximal Development

ABSTRACT

This study is a review of the implementation of the Learner Centred Teaching (LCT) approach at Copperbelt Secondary Teachers College (COSETCO) and Nkrumah Teachers College (NTC). In 2003, the Flemish Office for International Cooperation and Technical Assistance (VVOB) launched the Better Secondary School Trained Teachers (BeSSTT) project at the two colleges. One area the project wanted to address was the issue of teaching/learning methodologies that teachers and teacher educators used in their classrooms. It was one of the objectives of the project to promote the use of methodologies that brought about improved class interaction among the learners. As such the LCT approach was seen to be a way of bringing about this improved interaction. Therefore, VVOB trained mathematics and science lecturers at the two colleges in the LCT approach. The underlying principle of the LCT approach is that if learners are to learn then they should be involved in the learning process as opposed to being passive recipients of information from their teachers (lecturers). The purpose of this study was to review and investigate the implementation of the LCT approach at Nkrumah and COSETCO. As such the questions addressed are among others: Were the mathematics lecturers using the LCT approach? If so how were they doing it and what were the lecturers and students' opinions about the approach? This study is largely qualitative in nature. The data collection instruments employed were observation schedules, structured questionnaires and un-structured questionnaires. The study sample of eight mathematics lecturers (five from COSETCO and three from Nkrumah) was selected using purposive sampling from the population of mathematics lecturers at the two colleges. This meant deliberately selecting the mathematics lecturers for the specific purpose of investigating how they were implementing the LCT approach to which they were introduced. Another target population for the study comprised 251 students of mathematics at the two colleges. A study sample was selected from this population using proportionate sampling. By means of proportionate sampling, the researcher found that for every sample of students selected, 63.7% were to come from COSETCO and 36.3% from Nkrumah. This study showed that lecturers were implementing or using the LCT approach in their teaching. This was reflected in the activities, which they engaged the students and themselves in. Apart from class activities another pointer to the implementation of the learner centred approach was the methods of teaching that were used in class. Both lecturers and students were in agreement that the LCT approach was in use at the two colleges and that it was much more used in methodology lectures since there students had more opportunities to express themselves in their own way. This study has established that student performance in mathematics can be affected either positively or negatively by the lecturers' method of teaching. As such lecturers should use methods of teaching that involve the students. Additionally, this study has revealed that the mathematics lecturers needed more training in the LCT approach. This is especially true for those lecturers who might have missed the earlier training. Even those who were trained would benefit by consolidating their knowledge in the use of the LCT approach. Apart from training the mathematics lecturers, there was need to include lecturers from other departments in the training especially those whose subjects combine with mathematics.

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CHAPTER ONE

INTRODUCTION

1.1: Background

In recent years societies world over have undergone changes in the way they are organising themselves. One of the areas of change in most, if not all societies is member participation and contribution in the running of the affairs of the society (Brandes and Ginnis, 2001). In the Zambian context, the country has, since 1991, adopted multiparty politics, abandoning the one party participatory democracy.

The political developments in Zambia in the early 1990s cannot be looked at in isolation, but in connection with other world events. Mwanakatwe (2003), asserts that one of the reasons for this political development was the events in Eastern Europe. Eastern Europe was experiencing the collapse of communism in the late 1980s and early 1990s and this had an effect on Zambia's political direction. Zambia had strong links with the communist countries as was reflected in the national philosophy of 'humanism' whose principles were on similar lines with the socialism of Eastern European countries (Chiluba, 1995). With such a background we see that "new movements were started by men and women in various countries in Africa who pledged to promote democracy on the basis of political pluralism and respect for fundamental human rights" (Mwanakatwe, 2003:422). These movements, which were seen to be pressure groups, challenged the established order of autocratic rule under single-party politics. One of these pressure groups in Zambia was the Movement for Multiparty Democracy (MMD), which later became a political party and in 1991 formed the new

government under plural politics. The plural politics aimed at getting citizens participate in the affairs of their country without fear of victimization.

The changes taking place in the political arena brought about changes in other sectors. Education was such one sector affected. In 1991, a team was appointed to review strategies in education. This resulted in the Ministry of Education document of 1992 (Focus on Learning [FOL]) which emphasised, among other things, that learning was to be centred on learners. It was argued that "the curriculum should be centred on the student rather than on the material to be covered" (MoE, 1992:7). By so doing it was hoped that students would be active participants in their own learning as opposed to passive recipients of knowledge.

Educators, therefore, have been making efforts to bring about change in the way they teach and also in the way their learners learn. Educators have seen, among other reasons, the need to allow learners to take a prominent role in their own learning processes. The learners must be involved more in their own learning so that their learning is meaningful to them. This has brought about the Learner Centred Teaching (LCT) approach. LCT comes under a variety of names such as outcomes-based education (Horst and McDonald, 2003), active learning, participatory learning, student centred learning, and the alternative approach (Bruce, 2002; Vakalisa, 2004).

LCT is the kind of teaching in which the learner is placed in or at the centre of the learning process. Castle (1965), supports this view and adds that learner centred

teaching places learners in the forefront of the teacher's mind, not books or subjects or the teacher's convenience. Learners are given the opportunity to participate in their own learning and by so doing they assume responsibility for their learning. In LCT the learners are encouraged to think for themselves and they do most of the class activities either in groups or individually.

LCT approaches "have been around for at least 2000 years, though they are being introduced as if they were something new" (Brandes & Ginnis, 2001:9). Vakalisa (2004), echoes Brandes and Ginnis' observation and further points out that the concept of learner centred teaching is not totally new but it has been selected to express a deeper meaning of what is usually referred to as active participation of learners in the teaching-learning situations. However, there seems to be a re-introduction of the approach since teachers (lecturers) seem to continue using the traditional methods in their teaching (Hambokoma et al., 2002).

A number of countries in Southern Africa have embraced the LCT approach in their institutions of learning. In Botswana, for instance the education system has undergone a number of changes. The country has, since 1980, made headways in implementing the LCT approach (Tabulawa, 1998). It is now official policy of the Ministry of Education of that country that teaching and learning should emphasize learner-centred education. In implementing a learner-centred approach in Botswana the teachers (lecturers) have specially been targeted.

In Namibia, similar changes have taken place in the education system of that country. Among the changes was the endorsement of the learner-centred approach to teaching school subjects rather than the teacher-centred approach in 1993 by the Ministry of Education and Culture (Kasanda, 2003). It is further stated by Kasanda (2003), that LCT as the mandated teaching method in that country is supposed to be used by every teacher from Grades 1 to 12. Student teachers in training colleges were supposed to be skilled in the use of LCT methods and later use them when they graduated.

A similar situation occurred for South Africa where soon after abolishing apartheid, there was need for educational reform. Educational reforms were now required to provide equity in terms of educational provision. LCT approaches were seen to be the means by which learners' critical thinking powers and their problem-solving abilities would be developed (Horst and McDonald, 2003). Brodie (2000), is in agreement with Horst and McDonald adds that "learner-centred teaching classroom practices, underpinned by social-constructivist theories of learning, will lead to improved mathematics learning in the South African contexts" (Brodie, 2000:131).

Zambia has also embraced the LCT approach. The Ministry of Education (MoE) policy document on education (Educating Our Future [EOF]) puts emphasis on this approach. One of the aims of High School education, for instance, is to "provide educational experiences that will nurture skills that will enable pupils to take charge of their own learning" (MoE, 1996:51).

Although the Zambian educational document policy EOF (MoE, 1996) puts emphasis on learner-centred classroom practices, it seems very little has been done in implementing learner-centred classroom practices. However, in 2003 the Flemish Office for International Cooperation and Technical Assistance (VVOB) in collaboration with the Ministry of Education (MoE) launched the Better Secondary School Trained Teachers (BeSSTT) project 2003-2007. The general objective of this project was to improve the quality of Upper Basic and High school education in Zambia. The project chose the Copperbelt Secondary Teachers College (COSETCO) and Nkrumah Teachers College (NTC) as partners in the project since they are among government colleges in the country responsible for training teachers for Grades 8 to 12. In line with the policies and strategic plan of the MoE the project was determined to see to it that the initial teacher training programme was improved in terms of quality and relevance of knowledge and skills development. The project aimed to empower the lecturers and teacher trainees with "the necessary *pedagogical skills* that will allow them to use more learner-centred teaching strategies" (BeSSTT project Team, 2003:15).

1.2: Statement of the problem

Since the launch of the BeSSTT project in 2003 the Flemish Office for International Cooperation and Technical Assistance (VVOB) has put a number of measures in place at COSETCO and NTC to encourage lecturers use methods of teaching that promote active student participation in the classroom. One such measure is the adoption of the LCT approach as a means of improving the interaction taking place in the classroom. The VVOB/BeSSTT project has emphasized the use of the learner centred approach and

has therefore introduced mathematics and science lecturers at the two colleges to the approach. The lecturers from the two departments (mathematics and science) have undergone training in the use of the LCT approach. From the time when the lecturers were trained in the use of the LCT in the two colleges they (lecturers) have been encouraged to employ learner centred approaches in their teaching. However, no research has been conducted to find out how the approach is being implemented and the extent to which it is being implemented in these colleges. The implementation of LCT has to date not been evaluated by anybody.

1.3: Purpose of the Study

The purpose of this study was to review and investigate the implementation of the LCT approach at Nkrumah and COSETCO.

1.4: Specific Objectives

Arising from the purpose of the study the following were the specific objectives of the study:

(i) assess the mathematics lecturers' understanding of the learner-centred teaching approach;

(ii) determine whether the mathematics lecturers were implementing the learner centred teaching approach;

(iii) find out how lecturers were implementing the learner centred teaching approach in mathematics;

(iv) determine the extent to which the learner centred teaching approach was being implemented by the lecturers of mathematics in their teaching;

(v) assess the students' understanding of the learner-centred teaching approach and

(vi) ascertain the extent to which students benefited from the learner-centred approach in the teaching of mathematics.

1.5: Research Questions

The following questions were used to guide the researcher in attaining the above objectives:

(i) What was the mathematics lecturers' understanding of the learner centred teaching approach?

(ii) Were the mathematics lecturers implementing the learner centred teaching approach?

(iii) How were lecturers implementing the learner centred teaching approach in mathematics?

(iv) To what extent was the learner-centred approach being implemented by the mathematics lecturers?

(v) What was the students' understanding of the learner-centred teaching approach?

(vi) To what extent did students benefit from the learner-centred approach in the teaching of mathematics?

1.6: Significance of the Study

The study might be useful to the donors who might wish to know how the learner-centred approach in teaching has been received by both the students and lecturers in the two colleges. In particular VVOB, who are behind the initiative in the two colleges, might wish to know the successes and failures of the approach. Such knowledge might help the colleges and the donors to find a most suitable way of implementing LCT rather than abandon the project should the study reveal what might not be acceptable to VVOB and the colleges. Conversely, the colleges and VVOB might want to better the project should the findings reveal positive results so far.

The study might be useful to the MoE who might wish to know the successes of implementing the approach. In doing so, it might make use of the approach in other learning situations. The study may be helpful to the Curriculum Development Centre (CDC) in that should the study reveal successful implementation of the LCT approach, the CDC may design learner centred materials for use in institutions of learning.

The study might be useful to other teacher educators other than those at Nkrumah and COSETCO. Other teacher educators, might wish to implement the LCT approach in their own institutions should it be seen from the findings of this study that it had succeeded at the two colleges.

Students at Nkrumah, COSETCO and other teachers' colleges might benefit from this research in that they might be motivated to implement LCT approach in their own

teaching when they graduate. The research might be useful in providing the students with direction in implementing LCT approach in their own situations.

Other researchers and scholars might benefit from this study in that they might wish to explore other areas in relation to the LCT approach. Researchers might wish to consider certain areas of this study for their own future studies. As such this study might provide a useful background to such future research.

1.7: Limitations of the study

The main limitations were two. The first was fear by some students to be open and free when giving responses to the oral questions posed by the researcher who happened to be their lecturer at the same time. It was likely that some might have thought that telling the truth would offend their lecturer (researcher). Similarly, fellow lecturers might have not felt free and open to respond to oral questions. However, the effects of these limitations were mitigated by the use of questionnaires for both lecturers and students, checking of the lecturers' schemes of work paying attention to the methodologies used.

A number of the problems encountered by the researcher were as a result of the routine and programmes within the two colleges. To start with the colleges conduct the Teaching Practice during the second year. This meant that for the whole of the second term (May to August) the second years were not in college but out in schools. They only reported back to college in the month of September. This posed a problem to the research in that whereas the data was collected from the first year students,

comprehensive data analysis would not start without the second year's data. Of course it was possible to analyse the data on its own but the researcher waited for the other data.

There was also the problem of absent students when the questionnaires were distributed. Such students were left out as some were absent for extended periods of time due to some personal problems in certain instances. The researcher had to do without such potential respondents. However, the absent students were so few that they did not affect the results of the study.

The third term is usually a busy time in both colleges because of examinations and it was during this time that the researcher had to collect the data from the second year students who had been on teaching practice during the second term. It was difficult for the researcher to commute and collect data within a short space of time and within the busy examination period. Apart from this the researcher had to carry out his normal duties of teaching and preparing examinations for his students also.

Another problem encountered was that of unanswered questions in the questionnaire. It was difficult for the researcher to follow up such respondents, as there was an element of anonymity as research ethics required. Even if this was the case, the responses provided by the rest were adequate for making generalisations.

It was difficult to deal with new mathematics lecturers considering that they had not undergone the training under the BeSSTT project. Some seemed hesitant to be interviewed and also to respond to the questionnaire, as there was a feeling of not being sure what was really expected of them. Others felt they were indirectly being subjected to some kind of testing. There were some lecturers who were not willing to be interviewed indicating that they were busy. However, the same lecturers were willing to complete the questionnaire to the satisfaction of the researcher.

1.8: Operational Definition of Terms

The terms used in this study have the following meanings:

Mathematics teaching method: the way in which mathematics is taught in class

Lecturer : a person in charge of teaching in a subject area at college

Student : student teacher

Teacher : used to convey the same meaning as lecturer

Lecturer performance : the way in which the lecturer conducts his activities in class and the extent to which learning for students takes place.

Student performance : the way in which students are involved in the activities of the class.

CHAPTER TWO

LITERATURE REVIEW

2.1: Overview

This chapter looks at literature related to the LCT approach and its implementation.

2.2: Background

Traditionally, teachers occupied a central position while learners assumed a receptive role in the learning process. With research into how people learn, the traditional approach of teaching where teachers were at the centre gave way to new ways of teaching and learning. The new ways shifted the emphasis from the teacher being at the centre of the teaching and learning process to the learner. This resulted in the LCT approach.

A lot of literature exists on the learner-centred approach in teaching and most of it gives detailed accounts of what is meant by LCT and also the benefits associated with the approach. Tabulawa (1998:264), notes that LCT "demands that the teacher acts as a facilitator in the learning process and the learners be active participants in their own learning process." Teachers (or lecturers) are therefore supposed to design their teaching in such a way that participation of the learners in the teaching/learning process is maximized. The learners are at the centre of the teaching/learning process. They are encouraged to critically analyse the information that is presented to them. The learners are expected to be mindful of the fact that whatever contributions they make to classroom activities in their individual or group capacities counts towards the success of

the lessons. In this way learners are responsible for their own learning. Every effort is made to help them feel that they are capable and that each is responsible for the learning of all (Bruce, 2002). Additionally LCT is associated with methods such as group work, discussion, and fieldwork among others since these are some of the methods, which engage the learners actively (Bruce, 2002).

2.3: Theories of learning and the LCT approach

Dean (1982), defines a theory of learning as a suggestion of how learners learn. Mathematics teachers, therefore do not just need to possess knowledge of teaching methods in order to be effective in their teaching. They also need knowledge of the way learners learn mathematics and be aware of factors thought to affect learning.

The LCT approach is seen in the light of the theories of the following psychologists, among others: Piaget (1972), Vygotsky (1978) and Bruner (1973).

2.4: Piaget's theory of learning and the LCT approach

Ginn (2005), notes that Piaget, through his theories of intellectual development and how learning takes place, advanced the idea that knowledge should not just be transmitted verbally but it should be constructed and reconstructed by the learner. Further, Ginn (2005), asserted that learners must be active in their own learning. Learners should not be treated like vessels to be filled with facts. This is the central theme of LCT. Piaget (1972), advocated for "*active* discovery learning environments in our schools" (Ginn, 2005:2). Learners need to explore, to manipulate, to experiment, to question, and to

search out answers for themselves and activity is seen to be essential in order to achieve this.

Piaget has been seen to be an influential theorist whose work continues to contribute significantly to discussions about cognitive development. Piaget (1972), propounded two important concepts, which help us understand the learning and teaching process. The two concepts are assimilation and accommodation. He looked at assimilation as "the process by which the learner incorporates, as it were, elements of the physical world into the logic of his /her own developing and existing understandings"(Moore, 2000:7). Accommodation was defined by Piaget (1972) as the "process by which human beings adapt their developing understandings and expectations to the realities and constraints of the social and physical world in order to arrive at better understandings or explanations" (Moore, 2000:7). From this we see that accommodation is some kind of counterbalance or complement to assimilation. Piaget who has been labeled as an interactionist as well as constructivist took great interest in knowledge and how children come to know their world (Moore, 2000).

Through his observation of children, Piaget (1972), concluded that as the child develops and constantly interacts with the world around him or her, knowledge is invented and reinvented. Piaget's suggestion is that learning is an active process of assimilation and accommodation that does not depend on another person such as a teacher or lecturer to 'kick-start it' (Moore, 2000). This in itself suggests activities that are associated with student or learner centred teaching, that is teaching which begins with the learners existing understandings and experiences. It is from these existing

understandings and experiences that the teacher or lecturer will build on in his/her teaching.

A very important aspect of Piaget's development theory of learning and thinking was that both involved the participation of the learner. The learner should be involved in the learning process and should think seriously on what he/she is learning. Concerning this process Piaget (1972), argued that knowledge should not merely be transmitted verbally to the students or learners but must be constructed and reconstructed by the learner or student. This means the learner should be involved in the activities of the class if he/she is to learn. His/Her participation is of great benefit to himself/herself as a learner, the teacher (lecturer) and the learning process. It is through this participation that the learner will make sense of the learning situation.

Piaget's argument on how the learner constructs knowledge of the learner's world gave birth to the theory of constructivism. The theory of constructivism holds the view that learners construct their own meanings from what they experience rather than experiencing knowledge from other sources (Bennett, 2003). Piaget (1972), suggested that through processes of assimilation and accommodation, individuals construct new knowledge from their experiences. He further argued that when individuals assimilate new knowledge they incorporate the new experience into an already existing framework without changing that framework. Although constructivism does not suggest any one particular way of teaching, it is consistent with the LCT approach. Both the theory of constructivism and the LCT approach advocate the idea that learning should build upon

knowledge that a student or learner already has. They both further advocate that learning is more effective when a student is actively involved in the construction of knowledge, rather than when he/she is passively listening to a lecture.

2.5: Vygotsky's theory of learning and the LCT approach

Another name associated with teaching and learning theories is that of the influential Russian psychologist Lev Vygotsky. Lev Vygotsky (1896 -1934), who lived and worked in a Marxist environment, became famous for his views on mediation as an important part of human psychology. However, Vygotsky's work only became known during the 1960s. He outlined a theory of learning and development that has much in common with Piaget's theory, though the two differ in certain aspects. Vygotsky (1978), argues that LCT promotes social interaction. He further states that social interaction plays a fundamental role in the development of cognition.

"At the centre of Vygotsky's theory is the notion that development takes place through social relationships" (Donald et al., 1997: 48). This implies that learners "progressively develop new or adapted meanings and knowledge through building up the space between what they currently understand and what confronts them in social interactions" (Donald et al., 1997:48). The social interactions have important implications for understanding the crucial role of peers, teachers (lecturers), and others as mediators in the learners' cognitive development and therefore education. The social interactions, as advanced by Vygotsky (1978), have a bearing in understanding the nature of knowledge. Donald et al., (1997), argue that meanings cannot be separated from their

social context since they are social constructions which are built up and passed on in the interactions between people.

Vygotsky (1978), advanced the theory of the Zone of Proximal Development (ZPD) as a framework for analyzing learning (Goos, 2004). It is argued that the concept of the ZPD is a key to understanding the process of mediation (Donald et al., 1997). The ZPD may be defined as that space that lies just beyond a learner's present understanding. It is that space where a learner cannot quite understand something on his own, but has the potential to do so through interaction with a more advanced partner, such as a teacher or peer. The teacher or peer who engages the learner in thinking forward into that space acts as a mediator in shifting the learner's present understanding to a new level (Donald et al., 1997; Goos, 2004). The ZPD can also be looked at as the gap between what a learner can do unassisted and what that same learner can achieve with the benefit of a teacher or lecturer.

Vygotsky (1978), analyzed the ZPD as collaboration when there is learner-to-learner interaction. "Working in collaborative peer groups, students have an opportunity to own the ideas they are constructing and to experience themselves and their partners as active participants in creating personal mathematical insights" (Goos, 2004:263). This is at the heart of LCT; a situation where learners are given opportunities to interact in various classroom activities on their own and to learn from one another. "The opportunities to interact can be achieved when the classroom atmosphere is one of relative freedom, where they are respected and respect each other as individuals, where

they become increasingly independent of the teacher in their learning" (Ernest, 1989: 199).

In the classroom such as the one described above, where the atmosphere is one of relative freedom, the learners' experiences are termed democratic. LCT is closely associated with democratic education. Grambs et al., (1970: 40), give us a view of democratic education as:

> ...a social system devoted to developing better human relations. If the needs of students are being met, if they are progressively better able to cope with their world, if they are developing increasing self-direction in the conduct of their own affairs, if they are able to seek more learning as a result of present learning experiences, then probably the classroom is a democratic one.

LCT seeks to fulfill all the conditions mentioned under democratic education.

Whereas Vygotsky built on the work of Piaget, another psychologist Jerome Bruner built on the work of both Vygotsky and Piaget and suggested a cultural context for teaching and learning (Moore, 2000).

2.6: Bruner's learning theory and the LCT approach

Bruner (1973), is in agreement with Piaget's and Vygotsky's theories that promote the learner-centred approach to teaching. Bruner advanced the idea that for learning to be meaningful to a learner, the learner should construct his/her own knowledge. This is what is referred to as constructivism. Social constructivism is today generally accepted to be the theoretical framework that underpins LCT (Brodie, 2000). Social constructivism is a major theme in Bruner's theoretical framework. Bruner (1973), asserts that, learning is an active process in which learners construct new ideas or

concepts based upon their current/past knowledge. The learner is given the opportunity to select and transform information, construct hypotheses, and make decisions, relying on a cognitive structure to do so. Cognitive structure (i.e. schema, mental models) provides meaning and organization to experiences and allows the individual to learn by discovery (Dean, 1982). The learning environment should provide opportunities for the learner to explore on his/her own and actively participate in his/her own learning. This, the learner does by making meaning out of the learning situation. In this way learning becomes interesting and understanding is enhanced. The learners exercise ownership of content and concepts learned. This results in effective content retention and transfer.

2.7: The theory of constructivism and the LCT approach

All the three theories of learning are united on the constructivist position and are at work in the learner-centred approach to teaching: In a Piagetian sense there should be active exploration and equilibration (balance between assimilation and accommodation) on the part of each learner. The teacher (lecturer) on his/her part should encourage students to constantly assess how the activities of the class are helping them gain understanding. Students in the constructivist classroom are empowered with tools to keep learning. With a well planned classroom environment, the students learn how to acquire knowledge by building on the already existing one. In the Vygotskian sense there should be social interaction between learners. "A learner with a grasp of one aspect of the problem may mediate another's shift to a higher level of understanding by connecting in her ZPD" (Donald et al., 1997:51). In the Brunerian sense instruction should be designed in such a way that there is filling in the gaps – that is the learner

should be able to go on his or her own beyond the information given (Donald et al., 1997).

During LCT lessons skills are acquired that make learners become useful to their classmates and the larger society. As Bruce (2002:108), puts it "the central teaching moves build the cooperative social environment and teach students the skills of negotiation and conflict resolution necessary for democratic problem solving." The students learning under LCT are able to choose the direction of their own learning and this is highly motivating as it "gives the student the opportunity to learn how to learn" (Dembo, 1988:207). Learning how to learn will result in self initiated learning on the part of the learners. This will enable them have an opportunity to make their own judgements, choices and evaluations as they "depend more on themselves and less on the evaluations of others" (Dembo, 1988: 208).

2.8: Methods of teaching associated with the LCT approach

Learning within learner centred teaching is mostly by discussion, discovery methods and the question and answer methods among others (Ginn, 2005). In this section it is necessary to look at each of the three methods falling within the LCT approach.

2.8.1: The Discussion method

The value of discussion in the classroom situation can not be overemphasized. As Clement (2004:1), notes "students build better knowledge and understanding through discussion. Classroom discussion can help students clarify issues and relate new knowledge to prior knowledge." The exchange of information among students through

discussion brings about involvement and participation in the activities of the class. This involvement and participation of the learner is necessary for learning to take place. The learner or student is afforded the opportunity to construct knowledge rather than passively receive it. However, in successfully carrying out a discussion the teacher should ensure that a number of things are in place.

The teacher (lecturer) needs to plan in advance for the discussion. He/She should also state the lesson outcomes of the discussion. This will help the teacher "to steer the discussion towards the desired end" (Mahaye, 2004:212). However, the teacher should not prevent learners from expressing their opinions just because he/she is concerned about achieving a specific outcome from the discussion.

2.8.2: The Discovery methods

Within the discovery methods of teaching there are several other individual methods that can all be classified under the LCT approach. The methods are: directed discovery, guided discovery, exploratory discovery and free discovery. Of these methods, it appears the guided discovery is much used in institutions of learning (Dean, 1982). In the teaching and learning situation the guided discovery is carried out using the following three stages: the (lecturer) sets a problem; the students explore the problem and the lecturer and students discuss the problem and formulate conclusions (Barry and King, 1997).

As the name implies in guided discovery students proceed in their discovery journey with guidance from the teacher at every stage of their learning. Dean (1982:73), describes what goes on in class under the guided discovery method by saying:

> In *guided discovery* the teacher starts the lesson with a statement or question which suggests the right way of thinking about, and investigating, a situation. The pupils then start work and may come to the teacher for more guidance during the lesson.

The main purpose for the guided discovery method in a classroom situation is to have students actively involved in their own learning and problem solving. The guided discovery is an effective method in helping students to develop a better understanding of ideas and concepts.

The guided discovery method, however, has the following disadvantages: it is not suitable for teaching many facts; students may learn wrong things if teacher guidance is lacking, and it may not be suitable for certain students (Skemp, 1989).

Dean (1982), acknowledges the disadvantages of the guided discovery method and asserts that while the method allows some learners to make significant mathematical discoveries others just discover that they have failed to discover anything worth recording.

2.9: LCT classrooms

The underlying fact behind LCT is that learners take full responsibility of their learning while the teacher becomes a partner in the learning process. Apart from taking full responsibility of their learning, the learners should have the opportunity to choose

the direction their learning will take. The learner and the teacher (lecturer) should work in partnership in order to choose which direction the learning should take. Also there should be opportunities given to each learner to achieve learning in their own way. Learners should feel valued as people and the teacher (lecturer) should provide a conducive atmosphere for such.

Providing a conducive atmosphere may entail the teacher (lecturer) to help learners get involved and participate in their own learning. In such an atmosphere learners do not have to wait on the teacher to give out correct answers. The learners take it upon themselves to find out answers to the work given. There is a lot of consultations between the learners themselves and with the teacher. However, the teacher is not looked at, by the learners or himself or herself, as the only source of knowledge but as a valuable resource in the learning journey. In other words, the learners are the owners of their learning and the teacher should help the learners understand the meaning and implication of this ownership.

2.9.1: Mathematics classroom

In a mathematics classroom situation "students need to construct their own understanding of mathematical concepts, so that the primary role of teaching is not to lecture, explain or otherwise attempt to 'transfer' mathematical knowledge, but to create situations for students that will foster their making the necessary mental constructions"(/maths forum.org/,2007:1). One way of achieving this is through a well planned discussion activity for the class as outlined above. The teacher (lecturer) brings

about such discussions among students through questioning. Through this approach the teacher or lecturer will not only challenge the learners to answer but also to clarify and justify their thinking.

The lecturer has the important task of monitoring students' participation in discussions and deciding when and how to encourage each learner to participate (Thekwane, 2001). Mathematics lecturers should ensure that their classrooms are places where students learn. As such students should be provided with opportunities through which they can learn by: listening to the lecturer and each other, responding to the lecturer, each other, and also question the lecturer and each other as students.

The classroom environment plays a major role concerning what and how the learners or students learn. As such a conducive learning environment should be created in which the lecturer: encourages students to explore mathematical ideas and problems; helps learners to verbalise their mathematical ideas; shows students that many mathematical questions have more than one right answer; builds confidence in all the students that they can learn mathematics; uses the physical space and materials in ways that facilitate learners' learning of mathematics, and respects and values students' ideas and ways of thinking (Thekwane, 2001).

Furthermore, the lecturer must teach students to respect and be interested in other students' ideas. Thekwane (2001), adds that lecturers must consistently expect students to explain their ideas, to justify their solutions and not give up when they are stuck.

Lecturers must also help learners learn to expect and ask for justifications and explanations from one another. Students should also learn how to justify their own claims without becoming hostile or defensive as may be the case at times for students.

2.10: Teachers and students in LCT classrooms

While agreeing with other scholars about the LCT approach's emphasis on the learner being at the centre of the activities in class, Skemp (1989), points out that the LCT approach can only produce positive results if a teacher/lecturer gives guidance to learners rather than leave them alone. The learners should be directed in their learning so that the desired results are achieved. Skemp (1989:179), further adds that "an orderly classroom environment is necessary for intelligent learning, and it is part of a teacher's job to create and maintain this." Learners should not be left alone to do what they wish to do under the pretext of LCT. There should be order in the learning environment so as to promote maximum learning. This is true of most if not all the learning environments.

Skemp's views are echoed by Brodie (2000), who says that the teacher has the task of ensuring that order exists in the learning environment by giving direction to the learning process. Learners should not be left to learn on their own in the way they feel comfortable with. Even in learner-centred teaching the teacher (lecturer) gives direction to the learning process.

It should be noted that whether a lecturer is using the LCT approach or not is determined by certain activities which the lecturer and the students involve themselves in. This is consistent with Wermer (2002), who notes that the LCT approach focuses attention on what the learner is learning, how he/she is learning and the conditions under which he/she is learning. This spells out the content of what the learners are learning, the activities, which the learners and lecturer engage in, and the availability of teaching/learning materials (aids) in a non-threatening environment.

The lecturer and student should both engage themselves in the activities of the classroom. The lecturer has the task of translating information to be learned into a format that is appropriate to the student's current state of understanding. He/She organises class activities in such a way that the student continually builds upon what they have already learned (Brandes and Ginnis, 2001).

The teacher (lecturer) also takes the role of assessing the learner's present cognitive level: their strengths and weaknesses. "The skilful teacher can design inquiries appropriate to the students' abilities and to his or her own ability to manage the investigation" (Bruce, 2002:108). The teacher will play the role of a facilitator of knowledge who should be there for the learners to guide and stimulate them. The teacher should be there to provide opportunities for learners to communicate with one another, to argue and debate issues. The teacher has the task of presenting learners with suitable materials and occasions that allow them to discover new learning (Ginn, 2005).

While the teacher carries out the tasks outlined above he/she should have confidence in the learner's ability to learn on his/her own. As such the teacher should avoid interrupting the learner unnecessarily as this robs the learner the opportunity to concentrate on his/her learning. The teacher also has the important role of ensuring that all the learners are involved in the class activities. Some learners may show less interest in the learning activities due to some reasons better known to themselves. However, the teacher should be on the look out so that every learner is actively involved in the learning experience. This is not easy for the teacher whose background is one where the learner takes a passive role, "a teacher who has been nurtured in a culture of teacher-dominated classrooms, as is the case with most contemporary teachers" (Jacobs, 2004:6).

2.11: Assessment in LCT classrooms

The lecturer using the LCT approach has another important task apart from being a facilitator. He/She should assess the students on the learning that has taken place. There is a difference in the area of assessment between LCT and the teacher centred teaching (TCT). In LCT students participate in the evaluation of their learning. This means that students are involved in deciding how to show that learning. In the LCT approach more formative assessment is developed and encouraged so that the students learning gaps and areas are highlighted. In general terms formative assessments include feedback on written work, written comments on assignments and grades obtained during the course of the year. Grades obtained during the course of the year are not added to the end of year mark. The addition of more formative assessment encourages

a more LCT approach. In particular LCT assessments include projects, group work, peer or self assessment and field trips.

Assessment in LCT classrooms is not looked at as a process initiated and carried out by the lecturer only but is seen as a two way process involving interaction between the lecturer and the student. As such the role of the lecturer is to enter into dialogue with the students to be assessed to find out their current level of performance and also sharing with them possible ways in which that performance might be improved on a subsequent occasion. Therefore lecturers should see assessment under LCT as a continuous interactive process that measures the achievement of their students and the quality of the learning experience. According to Thekwane (2001), assessment in LCT mathematics class should aim to fulfill the following: be an integral part of teaching and learning; focus on a broad range of mathematical tasks and take a holistic view of mathematics and develop problem situations that require applications of a number of mathematical ideas.

The above points to the fact that assessment in mathematics teaching under LCT should be broad based. As such assessment should not be based on tests only, but also on observation of the student, the student's work and the student's points of view. The interactive nature of learning is extended to the process of assessment.

2.12: Different understandings of LCT

Learner-centred teaching has been understood to mean different things to different people-including practitioners. Kasanda (2003:3), argues that, "since not all teachers had been exposed to LCT, their understanding and practice of LCT varied. For some LCT is the use of group work, worksheets or teacher talk with group work ending every lesson." Additionally teachers' varied understanding of LCT is as a result of not all of them being exposed to the method (Kasanda, 2003).

There are some criticisms of the LCT approach from some quarters. One of the criticisms is that some learners, if not the majority of them, may not cope with the demands of LCT (Brodie, 2000). As such the teacher has to make a choice as to whether to ignore those who cannot cope with the LCT approaches and concentrate on the few who are able to follow or concentrate on the whole class. The teacher is in a dilemma since he/she does not have all the time he/she needs to prepare learners for the demands of examinations at the end of the course. The critics of LCT therefore see it as time consuming and not in conformity with the deep beliefs about teaching and learning (Tabulawa, 1998).

Tabulawa (1998), advances the view that the teachers' beliefs about the goal of schooling could explain why the learner centred approach has not been adopted or implemented in Botswana's schools as suggested in many official documents of that country. However, the situation in that country could be due to a number of reasons other than "teachers' deep seated assumptions about the goal of schooling" (Tabulawa,

1998:265). There is need for follow up of some kind even if the teachers might have received adequate training in LCT approaches. As Walczyk and Ramsey (2003:579), argue "even after attaining initial expertise in teaching in a learner-centred way, faculty must continually update their knowledge by participating in workshops on pedagogy, by reading articles on instructional advances in their disciplines, and so forth."

In the case of Namibia, Kasanda (2003), states that "although LCT is the mandated teaching strategy in Namibia, it seems that many teachers in Namibian schools do not seem to be using this method" (Kasanda, 2003:3). A number of factors are said to be responsible for this state of affairs. These factors need to be addressed before LCT could be in use in a more effective way. However, Kasanda (2003), admits that there are institutions in Namibia, though few and far apart, where LCT is practiced. Generally the approach suffers, as Horst and Mc Donald (2003) put it, in many cases from not being well received by society.

Horst and Mc Donald (2003), further argue that there is criticism from society regarding the use of the LCT approach. This criticism, probably stems from the fact that society generally has taken the teacher-centred approaches such as the lecture method to be the acceptable and standard way of delivering the material to the learners. Society seems to have the feeling that learning can only take place if the teacher is in charge of the learning situation. This belief by society trickles down to the teachers themselves who seem to resist other forms of teaching as Haambokoma et al., (2002:v) observed by stressing that: "With regard to prevailing teaching trends most

teachers of mathematics and science used the lecture method, question and answer, as well as demonstration in their teaching. Teachers were more active than pupils who took the passive roles of listening and observation."

The responsibility then is on the education system, which has the task of orienting society in general, and the teachers in particular to the use of the LCT approach and the benefits attached to it. This agrees with the Zambian education policy document Educating Our Future (MoE, 1996:5) which outlines that the education system should "produce a learner capable of developing an analytical, innovative, creative and constructive mind." This can be achieved by involving the learner in the learning process through approaches that place him/her at the centre of the learning process.

Educators should therefore be provided with user friendly and accessible guidelines in their learning programmes if the learner centred approach is to be implemented with fewer difficulties. These guidelines could include clear instructions on how to effectively handle the teaching and learning situation under the LCT approach. This is because the teaching and learning situation is in most, if not all cases, looked upon in terms of the teacher/lecturer being in control and nothing short of that is expected. The teacher/lecturer will make decisions concerning what is to be done, when, where and how things have to be done. This is looked at as the normal way of doing things and no diversion is expected. The teacher is not supposed to give away his/her authority of deciding what should take place in the classroom situation. "Any move to transfer ownership from teacher to students is likely to be met with fierce resistance because

it may be perceived as a threat to the profession as a whole" (Brandes and Ginnis, 2001:26).

In the implementation of LCT it is important to take into consideration certain factors in order for the innovation to be successful. Farrant (1991), outlines some of these factors, which may apply to any other innovation, as: participation by all involved, official support, adequate preparation of teachers (lecturers) and realistic objectives.

It is important to note that in an implementation study certain questions should be addressed. Wagg (1994), looks at the questions from two angles: policy makers and implementers (teachers or lecturers). The purpose of looking at implementation is to see whether there is a match between what policy makers expect from the teachers (lecturers) and what the teachers (lecturers) are actually doing in classrooms.

Although Zambia has shown willingness to implement the LCT in its institutions of learning as documented in the educational policy document EOF there has not been any study conducted to investigate the implementation of the LCT approach.

CHAPTER THREE

METHODOLOGY

3.1: Research Design

This thesis is largely qualitative in nature. In qualitative research the data are the product of a process of interpretation. The researcher here believes that "data do not exist 'out there' waiting to be discovered, but are produced by the way they are interpreted and used by researchers" (Denscombe, 2003: 268). Qualitative data can be obtained using different research methods and often come in a number of formats among which are fieldwork and interview transcripts. Apart from being qualitative in design, this research is also quantitative. In quantitative research numbers are used and findings are presented in the form of graphs, charts, tables and statistics. This research, however, employed the descriptive research method.

Descriptive research is "research which describes phenomena as they exist. It is used to identify and obtain information on the characteristics of a particular problem or issue" (Collis and Hussey, 2003:11). The information obtained usually has the purpose of satisfying a need to know, but also may be used for decision making (Giddens, 2002). Further, Giddens (2002) states that topics of descriptive research in education can include any people, places, situations, conditions, procedures, interactions, and undertakings about which we wish to know more. In this study the researcher chose descriptive research among the many research designs because of its easy application to many situations as outlined above.

Descriptive research is primarily concerned with data collection and the interpretation of the same data. The data collected is usually quantitative and statistical techniques may be used to summarise the information (Collis and Hussey, 2003).

3.2: Target Population

The study population consisted of all (8) mathematics lecturers at COSETCO and NTC. These colleges were selected because the mathematics lecturers in the two colleges had been introduced to the LCT approach by way of training and were encouraged to implement it in their teaching as much as it was possible. Therefore, data were collected to determine how the lecturers were implementing the LCT approach.

Apart from the mathematics lecturers, another target population for the study comprised all (251) students of mathematics at the two colleges. It was necessary to learn from the students as to whether their mathematics lecturers were implementing the LCT approach or not. Further, it was important to find out from the students their learning experiences under the approach.

3.3: Study Sample

The study sample consisted of eight (8) mathematics lecturers: five (5) from COSETCO and three (3) from NTC. The sample of this study was also the population for the study. This was because the population was small and all the lecturers of mathematics were introduced to the LCT approach. In arriving at the sample the researcher used **purposive sampling.** This means "sampling in a deliberate way, with some purpose or

focus in mind" (Punch, 2004:193). In other words, the sample was 'hand picked' for the research. The researcher 'hand picked' the sample because he knew something about the specific people or events and deliberately selected particular ones because they were seen as instances that were likely to produce the most valuable data (Denscombe, 2003). In this case the researcher deliberately selected the mathematics lecturers since they had been introduced to the LCT and the lecturers were encouraged to employ it in their teaching. Thus, the sample was chosen for the specific purpose of investigating how the lecturers were implementing the approach (LCT) to which they were introduced.

Apart from the sample of mathematics lecturers a sample of students was selected using proportionate sampling. Ghosh (1992), states that in proportionate sampling the number of respondents is drawn from each group in the same proportion as they are in the population. In this study the population consisted of 251 mathematics students (91 from Nkrumah and 160 from COSETCO). Proportionately, this gave $\frac{91}{251} \times 100\% =$ 36.3% for Nkrumah and $\frac{160}{251} \times 100\% = 63.7\%$ for COSETCO. In this way the researcher ensured that for every sample chosen 36.3% were to come from Nkrumah whereas 63.7% were to be from COSETCO. In choosing a sample size to which questionnaires were to be administered, out of a total of 251 students 91 were from Nkrumah and 160 were from COSETCO.

The researcher targeted the mathematics students in both colleges as the population of the research. This population was also the research sample. This was done in this way

because the mathematics students were the recipients of the LCT approach. Therefore, a sample of 91 mathematics students from Nkrumah and 160 mathematics students from COSETCO were studied as already indicated. The researcher was convinced that this sample of 251 mathematics students (35 first years and 56 second years at Nkrumah and 70 first years and 88 second years at COSETCO) would provide the views and feelings on the LCT approach of every mathematics student from the two colleges. The researcher should be able, with this sample, to make generalizations concerning the implementation of the LCT in the two colleges.

3.4: Research Instruments

The data collection instruments employed in the study were observation schedules, structured questionnaires and un-structured questionnaires.

3.4.1: Observation schedules

The researcher designed observation schedules, which were used for recording the interaction taking place in mathematics class/lecture rooms. This interaction was recorded over a one-hour period divided into twenty segments of three minutes each. The researcher focused on observing the activities which lecturers and students engaged in while in class. When the activity was observed the researcher indicated so by ticking on the observed activity on the observation schedules. The activity was whether lecturer was asking a question, listening while the student talked or any other lecturer or student action. As already mentioned, these activities were recorded on an observation schedule designed for the purpose. The purpose of the observation schedule was to

produce a record of what happened in the classroom (Hopkins, 2002). In order to have a normal classroom environment during observation, it was necessary for the researcher 'to establish at the outset a climate of trust between observer and observed' (Hopkins, 2003:70). The researcher established this climate of trust with lecturers to be observed by agreeing on such issues as how long the observation would take, where the researcher (observer) was to sit and how to relate with the students so as not to interrupt the normal processes of the lessons. In order not to disturb the students by the presence of the observer in their classes, the observer assured the students that he was there to learn with them about the topic being taught. This helped the students to concentrate on the lesson as they always did.

3.4.2: Structured Questionnaires

Structured questionnaires were distributed to students and lecturers under the study in both colleges. This approach was taken because the students and lecturers were literate. As such both students and lecturers were able to read and complete the questionnaires on their own. Had the case been different, the researcher would have sat with each respondent and would have completed the questionnaire with them.

3.4.3 Un-structured questionnaires

Un-structured questionnaires were used on students and Heads of Section as a follow up to the structured questionnaires.

3.5: Validity of Instruments

With regard to the instruments used, validity is defined as the extent to which the instruments measure what they claim to measure (Denscombe, 2003). Additionally, Collis and Hussey (2003:59) define validity as 'the extent to which the research findings accurately represent what is really happening in the situation.' Research findings can accurately represent reality if the instruments used measure up to their expectation of accurately measuring what they are supposed to measure. The researcher ensured validity of instruments by piloting the instruments. Piloting the instruments helped the researcher to know, on average, how long it would take respondents to complete the instrument, for instance a questionnaire. Piloting the instruments helped to check on the clarity of instructions and questions in the instrument.

Descriptive research was used in this study to collect data from respondents. As such the selected instruments to be used in this research were: questionnaires, interview schedules and observation schedules.

3.6: Data Collection

Data were collected over a period of six (6) months from May to November 2006. The techniques used to obtain data were lesson observations, structured questionnaires, un-structured questionnaires and documentary analysis.

The researcher used triangulation as a data collection technique. Triangulation is the system of using different methods to collect data on the same thing (Denscombe, 2003).

Each source of data looked at the topic from a different angle and then results obtained were compared and contrasted. Using different methods on the same thing allowed the researcher to have more different kinds of data and hence improving the quality of the research.

3.6.1: Lesson observations

The study involved lesson observations of the mathematics lecturers. The purpose of lesson observations was to "afford the researcher the opportunity to gather 'live' data from 'live' situations" (Cohen et al., 2004:305). In addition, "direct observation may be more reliable than what people say in many instances. It can be particularly useful to discover whether people do what they say they do, or behave in the way they claim to behave" (Bell, 1999:156). The researcher adopted a participant observer approach. As indicated earlier, this entailed the researcher to participate or join in the activities of the people under study, either openly in the role of researcher or covertly in some disguised role as proposed by Cohen et al. (2004). The observations focused on the classroom interaction, in relation to LCT, that took place in the classroom between lecturer and students and among students themselves. The frequency or how often the interactions took place in the given one hour period was observed and recorded on an observation checklist designed for the purpose.

Detailed notes of the lessons were taken. Note-taking was of great importance as its role was to allow the researcher to follow the lecturers' lessons (lectures) and document as many of their actions and words as possible (Hopkins, 2002). The researcher made

notes of the activities in each segment of the lecture, important lecturer and student conversations, questions and statements, instructional practices worth taking note and the general classroom social climate, for instance the number of students who raised their hands to respond to the lecturer or a fellow student. The researcher used the notes to identify significant changes that took place within the lecture rooms (Denscombe, 2003).

3.6.2: Un-structured questionnaires (Interviews)

Following the lesson observations and note taking of the lessons, interviews were conducted individually with the lecturers. The post observation interviews with the lecturers concentrated on finding out the lecturers' understanding and use of the LCT approach in their lessons. The interviews provided the most direct evidence, apart from the observations, of the lecturers' implementation of the LCT approach.

The interviews were un-structured to allow the researcher to probe initial lecturers' responses. The lecturers were interviewed on a one to one basis so that there was no interference from others. Each respondent was given time in which to articulate his/her experiences with the LCT approach. Issues to do with the approach were addressed at length during the interviews and the respondents (lecturers) were allowed to speak widely on their experiences with the LCT approach. The lecturers' responses provided in depth understanding of the way the LCT approach was being implemented and the importance that the individual lecturers attached to the approach.

During the interviews the researcher made notes so as to have a record of the lecturers' experiences as described by themselves in their own words. The researcher, through questions, found out how the lecturers were applying or using the approach in different learning situations. This was in order for the researcher to establish the contexts under which the approach could be effectively used to yield desired results in the learning process.

Apart from the lecturers, discussions were conducted with students using Focus Groups (FG). The discussions with the students concentrated on finding out the students' understanding of the LCT approach and whether their lecturers were implementing it. Discussions with the students were audio-taped so that the researcher could have a permanent and complete record of the students' experiences of the LCT approach, as described by themselves. Written notes backed up the audio tape-recording. The notes were mostly taken during the interviews. These notes, which are often referred to as field notes, had an important role to play during and after the interviews (Bell, 1999). The importance of taking field notes is echoed by Denscombe who argues that:

> A crucial advantage of taking field notes at an interview, however, is that they can fill in some of the relevant information that the audio - tape - recording alone might miss. Field notes can cover information relating to the context of the location, the climate and atmosphere under which the interview was conducted, clues about the intent behind the statements and the comments on aspects of non-verbal communication as they were deemed relevant to the interview (Denscombe, 2003:175).

The notes were used later to refresh the researcher's memory of what was said during the interviews and the prevailing conditions, which the audio tape recorder could not capture.

3.6.3: Structured Questionnaires

Two sets of structured questionnaires were administered: one set to all mathematics students at the two colleges and the other set to all mathematics lecturers at the two colleges. Both sets of structured questionnaires were closed ended. As such there was need to pilot both sets of questionnaires, refine them and set them out in a format that would enable data to be processed and statistics to be calculated as suggested by Cohen et al.(2004). Furthermore, the questionnaires were piloted, as earlier indicated, in order to check the clarity of the questionnaire items, eliminate ambiguities or difficulties in wording and check on the time taken to complete each set of the two questionnaires. After making the necessary corrections, which were as a result of piloting the questionnaires, the researcher then administered the structured questionnaires to the sample of the study.

The two sets of questionnaires comprised 24 questions each. The questions in each set were based on personal profile, student and lecturer preferences of mathematics teaching methods, students' and lecturers' views on the effectiveness of certain mathematics strategies or methods of teaching and students' and lecturers' views as to whether the LCT approach was being used in the teaching of mathematics in the two colleges and if so to what extent and how frequent. The questionnaires were also a way

of finding out the students' and lecturers' understanding of the LCT approach and its benefits for the learner if any. As such items in the questionnaire focused on the LCT approach and the assumption was that the respondents (students and lecturers) had some information, knowledge, experience or opinions about LCT (Cohen, 2004).

3.6.4: Documentary Analysis

Different documents such as journals, books and National Education Policy documents and college records were reviewed so as to have a wide understanding of the topic under study.

3.7: Analysis of Data

After all the interviews were conducted, the researcher embarked on the process of transcribing the interviews on the audiotapes into transcripts. In the transcript, the researcher put informal notes and comments alongside the interviewee's words (Bell, 1999). These informal notes and comments were based on the memories of the interviews and notes taken during the interviews or made soon afterwards about the interview. The informal notes included observations about the conditions surrounding the interviews and things like gestures, outside interferences, uncomfortable silences or other feelings that would add more meaning or emphasis to the words that were spoken during the interviews (Denscombe, 2003).

Each line in the transcript was given a unique line number, so that parts of the data could be identified and located precisely and quickly. The material was coded in order

to identify key concepts that helped explain the LCT approach. It was these concepts that helped provide an explanation or understanding of the LCT and its implementation.

From the observations of the lecturers the researcher was afforded the opportunity to observe what the lecturers did and not only what they said they did through the interviews. Data collected by use of observation checklists were organized manually and arranged according to themes.

Data collected through the questionnaires were analysed using the computer software called Statistical Package for Social Sciences (SPSS) to generate tables of frequencies and percentages. Bar graphs and pie charts were used also to present information graphically.

3.8: Data Interpretation

Ghosh (1992), points that there is no clear-cut dividing line between analysis and interpretation. The two are said to overlap. Additionally, both interpretation and analysis are said to be interdependent since "analysis is not complete without interpretation; and interpretation cannot proceed without analysis" (Ghosh, 1992:269). However, interpretation is defined as the analysis of generalisations and results. It is through interpretation that the findings of the study are connected with the established theories (Ghosh, 1992).

In this study the interpretation of data depended on whether the data were quantitative or qualitative. Quantitative data from questionnaires were interpreted by use of tables of frequencies, percentages and bar charts while qualitative data from semi-structured interviews were interpreted by considering themes or interconnections that recurred between the emerging categories. The emerging categories or themes were as a result of the responses and these were arranged according to the common themes that emerged. Qualitative data from observations were manually organised from the observation schedules and arranged according to common themes (Bell, 1999).

CHAPTER FOUR

PRESENTATION OF RESEARCH FINDINGS

4. 1: Introduction

This chapter presents the findings of the research on reviewing the learner centred teaching approach at COSETCO and Nkrumah. The presentation of the findings is done under headings drawn from the objectives of the research. The headings are classified under the following: age, sex, year of study for students, students' views of the teaching methods used by mathematics lecturers, mathematics teaching methods students enjoy most, mathematics teaching methods students enjoy least and mathematics teaching methods under which students understand mathematics better. Then mathematics teaching methods classified by students as being under the LCT approach, students' performance and the lecturers' teaching method(s), students' views on whether their lecturers do all the explaining (talking) while in class, students' views on whether their lecturers encourage group work and student participation in learning activities, students' views on mathematics lecturers and use of teaching/learning aids, teaching aids usually used by mathematics lecturers in their teaching.

Other headings include: activities mathematics lecturers usually engage in while in class, activities students engage in during mathematics lectures, students' classification of the organization of class activities by their mathematics lecturers, students' views as to whether they (students) experience difficulties in their learning of mathematics, how mathematics lecturers respond to student learning difficulties, students' views as to

whether their lecturers use the LCT approach, lecturers' performance versus the use of the LCT approach and students' performance versus the use of the LCT approach.

Sub headings are in the area of LCT training of the lecturers and whether the training they received was adequate or not. Teaching methods frequently used by lecturers, preference of teaching methods by the lecturers, teaching method effect on student performance and teaching method effect on lecturer performance are covered.

4. 2: Age of respondents

In this study the ages of the respondents were sub-divided into two: age for the student respondents and that of lecturer respondents. For the students the age range was from 18 to 43 years. Most of the respondents were aged 22, 23 and 24 years with percentages of 18.5%, 15.5% and 10.1% respectively. The ages for the respondents are shown in Table 1.

Table 1: Age of students (N = 233).

Age in years	Frequency (Number of students)	Percent
14 – 19	10	4.3
20 – 24	138	59.2
25 – 29	54	23.2
30 – 34	20	8.6
35 – 39	6	2.6
40 - 44	5	2.1
Total responses	233	100
No response / absent	18	
Total	251	

For the lecturers the age distribution ranged from 30 to 52 years. Seven of the lecturers were aged 40 years or less while one was above 40 years.

4. 3: Sex of students

For the student respondents 172 (72%) were male while 66 (28 %) were female. This reflects the small number of females in science related courses. The sex of the students under study from the two colleges is presented in Table 2.

Table 2: Sex of students

Gender	College		Total	Percentage
	COSETCO	Nkrumah		
Male	104	68	172	72%
Female	46	20	66	28%
Total	150	88	238	100%

4. 4: Year of study

One hundred first year students and 138 second year students representing 42% and 58% respectively participated in the research.

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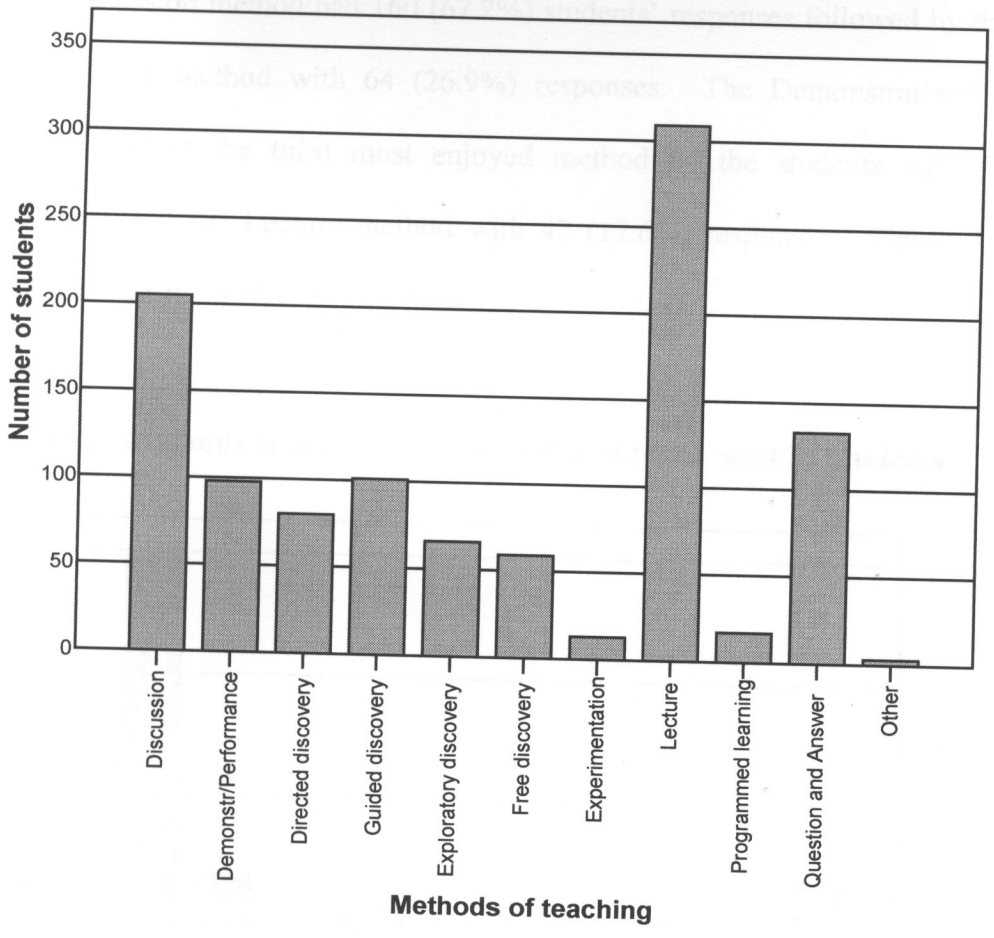
4. 5: Methods of teaching used by mathematics lecturers

Quantitative data from students' questionnaires indicated that the method of teaching used most of the time by mathematics lecturers was the lecture method. The data revealed that the lecture method had 309 (87.8%) of the student respondents choosing it as a teaching method usually used by the lecturers. The discussion method was chosen

as another method of mathematics teaching usually used by the lecturers with 205 (86.1%) of the students indicating so. Following the two methods the question and answer method and the guided discovery were chosen by 133 (55.9%) and 101 (42.4%) students respectively. It is also important to note that the experimentation method had the least number 13 (5.5%) of students choosing it as a method usually used by the lecturers.

From the choices highlighted above one may have the impression that there were more students who responded to this question than the total number of students indicated. This is because in this question and a few others in the questionnaire the respondents were free to supply one or more than one response if it was necessary. In this particular question, the question read, "Which method(s) of teaching do your lecturers usually use in their teaching of mathematics?" It may be that the lecturer usually used three methods according to a particular student respondent. In such an event, the student would indicate these three methods, for instance discussion, demonstration and lecture. From this one respondent it would seem as if three student respondents indicated a method each yet it was just one respondent indicating three different methods. This gave more numbers of respondents as already mentioned. Figure 1 would be helpful in presenting the other methods of teaching used by the mathematics lecturers according to the students.

Figure 1: Methods of teaching usually used by mathematics lecturers

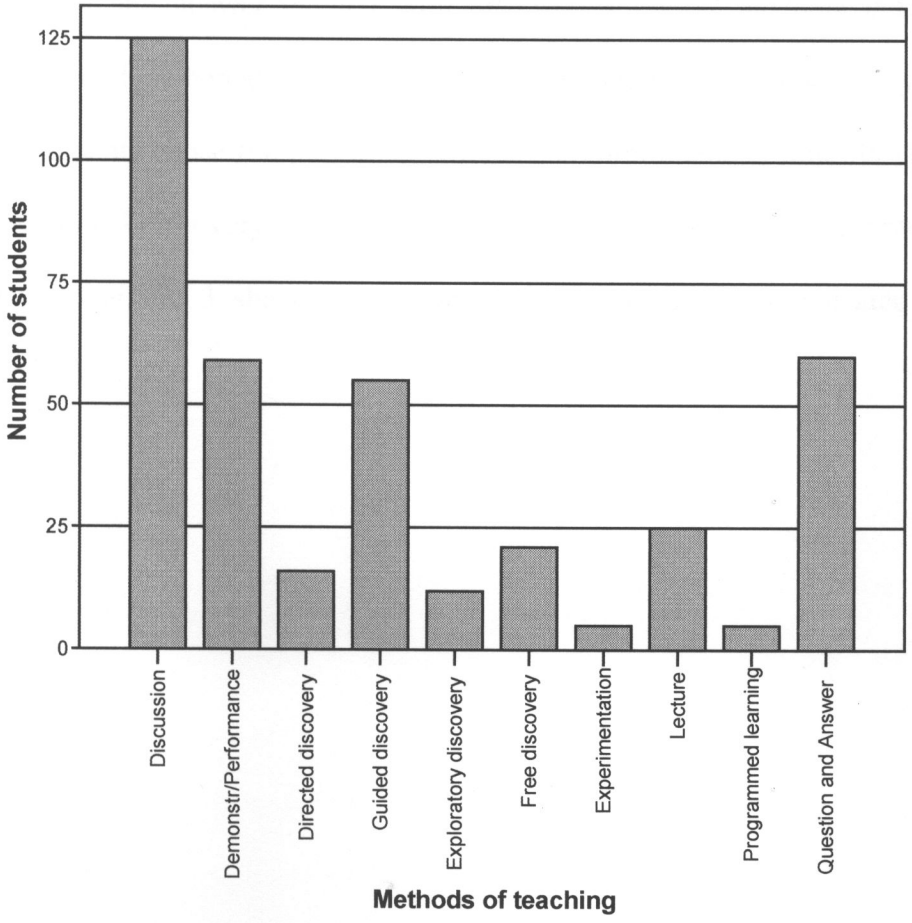


The lecturers seem to have the same opinion as that of the students. All eight lecturers chose the lecturer respondents chose the Lecture and Discussion methods as the two methods that they usually used in their teaching. The Question and Answer method had seven lecturers choosing it as a method usually used by the lecturers. Following the Question and Answer method was the Demonstration/Performance and the Guided discovery method with four of the lecturers indicating them as methods of teaching used by the lecturers themselves.

4. 5.1: Methods of mathematics teaching enjoyed most by mathematics students

The Discussion method had 160 (67.2%) students' responses followed by the Question and Answer method with 64 (26.9%) responses. The Demonstration/Performance method ranked the third most enjoyed method by the students with 51 (21.4%) responses and the Lecture method with 42 (17.6%) responses. Figure 2 shows the responses for the rest of the methods.

Figure 2: Methods of mathematics teaching enjoyed most by students



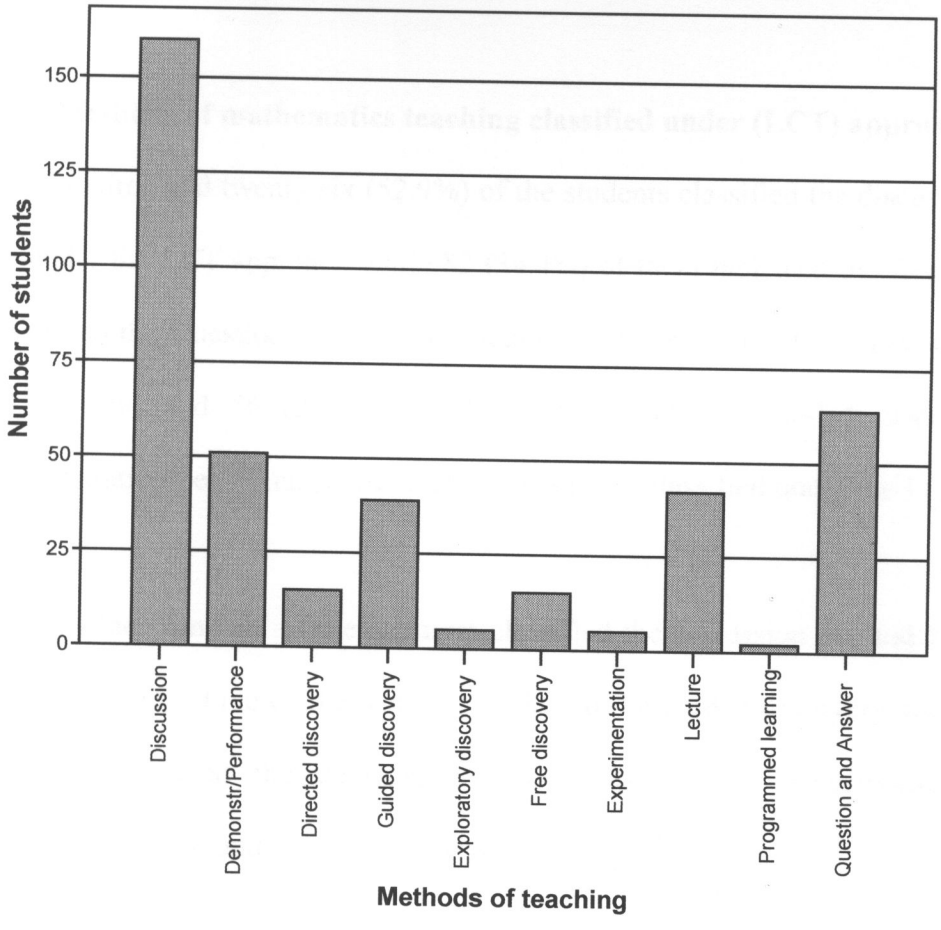
4. 5.2: Methods of mathematics teaching enjoyed least by mathematics students

Fifty four percent of the students indicated that they enjoyed learning mathematics least under the lecture method while 8.8% and 8.5% respectively indicated that they least enjoyed learning mathematics under the directed discovery and free discovery methods.

4. 5.3: Methods of teaching under which students understood mathematics better

One hundred and twenty five students (32.6%) indicated that the discussion method was the method under which they understood mathematics better. This was followed by the question and answer method with 60 (15.6%) of the students indicating that they understood mathematics better if it was taught under this method. Fifty nine (15.4%) of the students chose the performance/demonstration method while 55 (14.4%) indicated the guided discovery method as the method under which they understood mathematics better. Figure 3 shows the number of respondents who indicated the rest of the methods.

Figure 3: Mathematics teaching method(s) under which students understood mathematics better



4. 5.4: Methods of mathematics teaching enjoyed most by mathematics lecturers

From the data collected through questionnaires, six of the mathematics lecturers indicated that the Question and Answer method was the method they enjoyed most. The discussion method was chosen as the second most enjoyed method with four of lecturers indicating so. The lecture and the guided discovery methods were the third most enjoyed methods with two of lecturers for each indicating them. The demonstration/performance and free discovery methods were the fourth with one lecturer each indicating them..

It follows from the above findings in Figure 3 that the rest of the methods were among the least enjoyed methods of teaching.

4. 6: Methods of mathematics teaching classified under (LCT) approach

One hundred and twenty six (52.9%) of the students classified the discussion method to be under the LCT approach while 82 (34.4%) of them indicated the free discovery and 74 (31%) the Question and Answer methods to be under the LCT approach. A further 60 (25.2%) and 56 (23.5%) of the students felt the guided discovery and the demonstration/performance methods could also be classified under the LCT approach.

On the other hand six of the lecturers classified the discussion method to be under the LCT approach. Five of the lecturers indicated the guided discovery while four of the lecturers indicated the demonstration/performance and the exploratory discovery respectively to be under the LCT approach.

4.7: Lecturers' teaching method(s) effect on student performance

One hundred and twenty six (52.9%) of the students strongly agreed, 84 (35.3 %) of the students agreed, two (0.8 %) were undecided, 16 (6.7%) disagreed and seven (2.9%) strongly disagreed that lecturers' teaching method(s) influenced student performance. Information generated by the student questionnaires indicated that 210 students felt that the teaching method used by lecturers did affect students' performance. Table 3 indicates the frequency and percentage of the responses.

Table 3: Students' views on whether their performance is affected by lecturers' teaching method(s)

	Frequency	Percent
Strongly Agree	126	52.9
Agree	84	35.3
Undecided	2	.8
Disagree	16	6.7
Strongly Disagree	7	2.9
Total	235	98.7
No response	3	1.3
Total	238	100.0

Six of the lecturers strongly agreed and two agreed that the teaching method used had an effect on how students performed. In other words all the lecturers under study agreed that the lecturers teaching method did have an effect on how students performed.

4.8: Organisation of class activities by mathematics lecturers

The organization of class activities by mathematics lecturers can be divided into two: mathematics lecturers' activities and students' activities.

4.8.1: Mathematics lecturers' activities during class

According to the students, the lecturers were involved in various activities during class. One hundred and sixty nine (71%) of the students indicated that lecturers were involved in explaining facts or simply 'talking,' while 167 (70%) of the students indicated that lecturers engaged themselves in asking questions. One hundred and fifty five students (63%) indicated that lecturers engaged in listening to students' explanations and 137(58%) indicated that lecturers engaged in working out questions on the board. One

hundred and thirty six students (57%) indicated that lecturers were involved in answering questions from students.

The lecturers also believed that they engaged themselves in more or less the same activities as suggested by the students. Eight of the lecturers felt they engaged themselves in asking questions and listening to students' explanations, while seven of the lecturers said they engaged themselves in commenting on students' questions and working out questions on the board. Six of the lecturers believed that they engaged themselves in explaining facts (talking) and answering questions from students and four lecturers felt they engaged themselves in giving instructions to students.

4.8.2: Mathematics lecturers' talking in class

Since both students and lecturers agreed that lecturers spent a large part of the class activities explaining facts (talking) while in class, it was important to document how often the lecturers talked. One hundred and fifty three (64.3%) of the students believed that mathematics lecturers sometimes did all the explaining (taking) in class. Thirty eight (16%) of the students felt the lecturers always did all the explaining (talking) in class while 47 (19.7%) of the students disagreed that mathematics lecturers did not do all the talking in class.

Four of the lecturers felt that they sometimes did all the explaining (talking) while the other four believed that they did not do all the explaining (talking) while in class. However, data obtained from lesson observations indicated that whatever method of

teaching lecturers used there was need to explain the main ideas behind a topic to the students. A particular example was a lesson on the topic 'Equations' which was observed in a first year class. The students were given a question to discuss and come up with necessary steps and then answer it. Before giving the question to the students the lecturer explained that many word problems in mathematics led to equations. The task was to translate words into appropriate algebraic forms. The question below was then given to the class:

Question

Two trains leave Mpika for Kapiri Mposhi. The first train travels at an average speed of 60km/h. the second train, which departs an hour later, travels at an average speed of 80 km/h. how long will it take the second train to catch up with the first train?

The lecturer in this particular example gave the following guidance to the students:

1. Take t to stand for the number of hours the second train travels to catch up with the first
2. Find in terms of t how long the first one travels before being caught up with by the second train.
3. Find the distance travelled by each train
4. Find t by equating the two distances found in (3) above

The lecturer then allowed the students to work out the answer following the above guidance.

After the students had worked out the question the lecturer added some explanation and explained the question as shown below:

Let t = the number of hours the second train travels
Then t + 1 = the number of hours the first train travels (since the first train departs 1 hour earlier. We display the information in table form using the equation
Distance = Speed X Time that is, D = ST

	Speed (km/h)	Time (h)	Distance (km)
First train	60	t + 1	60 (t +1)
Second train	80	t	80t

Then 60 (t + 1) = 80t since both trains have covered the same distance

$\Rightarrow$ 60t + 60 = 80t

$\Rightarrow$ 60t - 80t = -60

$\Rightarrow$ -20t = -60

$\Rightarrow$ t = -60/-20

$\Rightarrow$ t = 3

$\therefore$ It takes the second train 3 hours to catch up with the first train.

4.8.3: Students' activities during mathematics lectures

On this question, and like many other questions in the questionnaire, the students were free to indicate as many choices as they felt appropriate. As such, the total percentage from the individual responses was more than 100%. Out of the 238 respondents 198 (83.2%) believed they engaged in the activity of listening to the lecturers' explanation during mathematics lectures. One hundred and ninety two (80.7%) of the students said they engaged in asking the lecturers questions. One hundred and eighty eight (80%) felt they engaged in answering lecturers' questions while 175 (73.5%) said they engaged in working out questions on their own in exercise books. Five (2.1%) did not respond to the question.

Data obtained from the interviews indicated that the activities in which the students engaged depended on the method of teaching employed by a particular lecturer.

Responding to the question concerning activities the students engaged in during lectures, a student said:

> It depends on the method of teaching the lecturer uses. Even for the discussion method there is a time when he is explaining the essence of what he is teaching and during that time we pay attention but when he poses a question we participate in giving out answers so it is a two way system: at one time we become attentive we listen to what he is teaching then at the same time we become participants in the lesson.

Data obtained from the observations were in agreement with the above comments. The researcher observed that lecturers engaged in several activities during the lesson, sometimes exchanging activities with their students. For instance, at one moment the lecturer would be talking while the students listened and in another instance a student might be explaining some concepts while the teacher and other students listened.

4.8.4 Student participation in learning activities

One hundred and sixty one (67.6%) of the students indicated that mathematics lecturers encouraged the students to participate in learning activities in class. Seventy five (31.5%) of the respondents said that mathematics lecturers sometimes encouraged students' participation in learning activities while two (0.8%) did not agree to the statement that the mathematics lecturers encouraged students' participation in learning activities.

The above student views seem to agree with the lecturers' views. Four of the lecturers said that students participated generally well in learning activities. The other four of the lecturers indicated that the general participation of students was fairly good. Data from

lesson observations confirmed that students were given opportunities to participate in class activities. A particular case was where one of the lecturers gave the question below to second year students as a way of allowing them to discover and apply certain mathematical principles to their situations.

Question

Find the equation of the tangent to the curve $y = x^2$ at (1,1)
In this question students were supposed to find out on their own if the point (1,1) is on the curve $y = x^2$ or not that is $1 = 1^2$

$\Rightarrow \quad 1 = 1$

$\therefore \quad (1,1)$ lies on the curve $y = x^2$

The students were then expected to apply a mathematical principle which states that the gradient of a curve at a point is the same as gradient of the tangent at that same point
For the curve $y = x^2$ its general gradient is $\frac{dy}{dx} = 2x$
At (1,1) the gradient is $2(1) = 2$
And this is also the gradient of the tangent

At this point the students were expected to use the equation of a straight line given the point and the gradient that is $y - y_1 = m(x - x_1)$ where (x_1, y_1) is the given point on the tangent and m is the gradient of the tangent.
Thus $y - y_1 = m(x - x_1)$

$\Rightarrow y - 1 = 2(x - 1)$

$\Rightarrow y - 1 = 2x - 2$

$\Rightarrow y = 2x - 2 + 1$

$\Rightarrow y = 2x - 1$ which yielded the required equation of the tangent

For the above question the lecturer allowed individual students to work out the required answer on their own. However, the lecturer offered guidance whenever it was possible.

4.8.5: Mathematics lecturers' use of teaching/learning aids in teaching

One hundred and fifteen (48.3%) of the students indicated that the mathematics lecturers did not make use of teaching/learning aids in their teaching. Seventy three (30.7%) were in agreement that sometimes the lecturers did make use of teaching/learning aids while 49 (20.6%) indicated that mathematics lecturers did make use of teaching/learning aids always. One (0.4%) of the respondents did not indicate any response.

Seven of the lecturers were in agreement that they sometimes made use of teaching aids in their teaching while one felt that the lecturers did not make use of teaching/learning aids in their mathematics teaching. Some of the teaching aids that lecturers made use of were: charts, models (for instance the model of the earth for Earth Geometry topics). Apart from these, the lecturers made use of the interactive white board, computers (power point presentations) and overhead projectors (OHPs). All these teaching aids were available in varying amounts in both colleges.

The students indicated even from the interviews that the lecturers in their teaching, apart from chalk and chalkboard, used no special teaching/learning aids.

4.9: Students and learning difficulties in mathematics

Two hundred and nine (87.8%) of the students indicated that they sometimes experienced difficulties in their mathematics learning. Six (2.5%) felt they always experienced difficulties in their mathematics learning while 18 (7.6%) said they did not

experience difficulties in their mathematics learning. Five (2.1%) of the students did not indicate any response.

Four of the lecturers were in agreement with the majority of the students' responses that students sometimes experienced difficulties in their mathematics learning. Three of the lecturers indicated that students always had difficulties in learning mathematics while one of the lecturers felt that students did not experience any difficulties in their learning of mathematics.

The lecturers who indicated that students had difficulties in learning mathematics went further to mention some difficulties students experienced in their mathematics learning. These difficulties included: failure to understand and apply mathematical concepts, failure to understand mathematics questions and break them into understandable components, tendency by students to memorise mathematical concepts without understanding, and failure to relate what is known to what is to be known.

4.10: Lecturers' responses to students' learning difficulties

Of the 238 students under study 118 (49.6%) indicated that lecturers responded helpfully towards students' learning difficulties. Sixty three (26.5%) of the students said the lecturers were very helpful towards students' learning difficulties. Forty eight (20.2%) of the students felt lecturers were fairly helpful while two (0.8%) of the students indicated that lecturers were not helpful at all. Seven (2.9%) of the students did not respond to the question.

4.11: Mathematics learning/teaching and the learner centred approach

Students' opinion as to whether mathematics lecturers used the learner centred teaching approach were that 141 (59.2%) of the students felt that the lecturers did use the learner centred teaching approach sometimes. Eighty (33.6%) of the students said lecturers always used the LCT approach in their teaching of mathematics. Ten (4.2%) of the students felt lecturers did not use the LCT approach while seven (2.9%) did not respond.

The research findings revealed that mathematics lecturers encouraged group work and student participation in learning activities. The majority of the students, that is, 236 (99.1%) in the research indicated that their mathematics lecturers either always or sometimes encouraged student participation in learning activities. A student participant in the study narrates a case in point:

> Our lecturer for methodology in his lesson asked the students for the advantages of the lecture method. Individual learners gave out answers, which were discussed by the whole class, and if the class agreed that the given answer was correct the lecturer wrote it on the chalkboard. The answers, which were not correct, were also discussed and refined by the learners while the lecturer provided the direction of the discussion. The answers written down on the chalkboard with the participation of the learners were given as notes to the class on the lesson. The lecturer ensured that all the answers written down came from us the learners. This made us feel free to express our ideas and started giving answers. It was motivating to see the lecturer writing our answers on the chalkboard. He then told us to copy the answers in our notebooks. Everyone who gave an answer felt happy because his/her answer was to be written down in the friends' notebooks.

This agrees with Campbell and Kryszewska (1992:7), who indicated that "students bring a lot with them, they all have their own ideas, opinions, experience and areas of

expertise." That being the case students should be allowed to share those ideas, opinions and experiences in a classroom atmosphere that is not threatening to them.

The above situation describes a healthy learning environment in which even if the student gave a wrong answer the lecturer and built on the wrong answer to develop into other aspects of the lesson. The lecturer respected the contributions of the students and in that way the students were willing to contribute even in subsequent lessons. It was not only in methodology lectures that the LCT approach was implemented or used. The content lecturers also used the LCT in their lessons. On the use of LCT in content lessons one of the students had this to say:

> The lecturer posed a question - 'What is an equation?' We were busy trying to define it. Then the class settled at the definition 'A mathematical sentence containing the symbol is equals to.' As a helper, monitor and a resource person, the lecturer helped the class by saying that when we use the word 'is' we do not use 'equals to.' Instead it should be 'is equal to.' We thereafter arrived at what was agreed by the class to be the correct definition. The lecturer then asked us to give examples of equations and write them down. Because of the pleasant environment that existed, we were able to follow, enjoy and participate in the lesson.

The student above concluded by saying the following; "if every lecturer was to make use of the LCT approach a lot of value would be added to our learning. Students in that case would never forget the learning experience just as I am able to narrate."

4.12: The use of LCT and mathematics lecturers' performance

One hundred and one (42.4%) of the students indicated in the questionnaire that when lecturers used the LCT approach in their teaching, the lecturers' performance in class

was good. This is to say the lecturers carried out their teaching duties to the satisfaction of the learners. Fifty one (21.4%) of the students indicated that, the lecturers' performance was very good when the lecturers used the LCT approach. Forty five (18.9%) felt the lecturers' performance was average when the LCT approach was used. Three (1.3%) of the students were of the opinion that the lecturers' performance was poor when the lecturers used the LCT approach while one (0.4%) indicated that the lecturers' performance was very poor when LCT was used. Thirty seven (15.5%) of the students did not indicate any choice.

The lecturers' opinion seemed to agree with that of the students as six of them indicated that their performance was good when they used the LCT approach in their teaching. The remaining two of the lecturers indicated that their performance was average when they used LCT approach in their teaching.

One hundred and thirteen (47.5%) of the students indicated that the lecturers' performance when they did not use the LCT approach was average. Forty seven (19.7%) of the students pointed out that actually the lecturers' performance was good even when they did not use the LCT approach. Twenty seven (11.3%) of the students felt that the lecturers' performance was very good even when they did not use the LCT approach. Twenty three (9.7%) of the students said the lecturers' performance was poor when they did not use the LCT approach. A further seven (2.9%) of the students felt the performance of the lecturers was very poor when the lecturers did not use the LCT approach in their teaching. Twenty one (8.8%) did not indicate any choice at all.

One would expect the results to be very different when the lecturers used the LCT approach from a situation when they did not use it. It had earlier been observed that six of the lecturers said that their performance was good when they used the LCT approach in their teaching while two indicated that their performance was average when they used LCT approach in their teaching. This being the case one would probably expect six of the lecturers to indicate that their performance was not good when they did not use the LCT approach. However, the situation was that four of the lecturers felt their performance was good even when they did not use the LCT approach. Three of the lecturers said their performance was average when they did not use the LCT approach while one did not respond to the question.

4.13: The use of LCT and students' performance

One hundred (42%) of the students felt that their performance was good when their lecturers used the LCT approach in their teaching. Fifty one (21.4%) of the students indicated that their performance was very good while 48 (20.2%) of them pointed out that their performance was average. Two (0.85%) of the students felt their performance was poor when lecturers used the LCT approach and one (0.4%) confessed that the performance of students was very poor when the lecturers used the LCT approach. Thirty six (15.1%) of the students did not indicate any choice.

The lecturers indicated that when they used the LCT approach the performance of the students was good. Six of the lecturers indicated that students' performance was good

Even if the four lecturers had undergone training in LCT methodologies, three of the lecturers trained felt the training they received was inadequate. Only one felt the training was adequate. As such, all the three lecturers who indicated that the training they received was inadequate proposed that they undergo more training in the use of the LCT approach.

In fact, from the college records only two lecturers could claim not to have had some training in LCT approach. The other two, though they indicated that they did not have such training, probably thought in terms of training which lasted for a very long period of time and not in form of a workshop. Otherwise six lecturers had undergone training in the use of the LCT approach.

CHAPTER FIVE

DISCUSSION OF FINDINGS

5.1: Introduction

In this chapter the findings on the implementation of the LCT approach at Nkrumah and COSETCO and the effect of the approach on the learning process are discussed.

5.2: Methods of teaching mathematics usually used

From the research findings it is clear that mathematics lecturers usually used the Discussion, the Lecture and the Question and Answer methods of teaching in their mathematics teaching. Apart from the three methods of teaching there were other methods of teaching used by the lecturers but such methods were used to a lesser extent. However, the three methods of teaching indicated above were of great importance in the teaching of mathematics at the two colleges.

In any lesson the lecturer needed to introduce the topic and this usually involved giving enough background by explaining. This is where the lecture method came in: The lecturers gave background information in most of the lectures observed before actually bringing in other methods.

Asking of questions was important in initiating discussion among students or between the lecturer and the students. Students' participation in a given discussion largely depended on how provocative the question was to allow them want to say something on

the topic. As the students got involved in the discussion they generated more ideas for the discussion at hand.

The discussion method afforded individual students an opportunity to contribute to the learning taking place in class. However, in ensuring that the discussion method yielded the desired results of active learning by the students, it was important to consider a number of things. As Thekwane (2001) puts it, in using the discussion method it was important to consider the following questions: Who should talk? About what? In what ways? What questions were important? And what made an answer right or an idea true? These questions would help the lecturer to focus the discussion in the right direction. It should not be that because it is a discussion all students should talk at the same time about anything they choose to talk about and in the way that each student chose. However, the discussion should proceed in a certain direction with proper guidelines so that each student benefited from the discussion. All the discussion activities should be well spelt out. Students should give each other opportunities to contribute to the discussion thereby respecting their friend's views.

The other teaching method the lecturers indicated as the one they usually used was the Question and Answer method. This method involves planning and arranging questions in such a way that they will generate a discussion as students give answers. The questions to be asked should be well thought out and planned by the lecturer in such a way that they bring out the main ideas of the lesson. The students should be trained to handle the method in a way that respects other students' views.

5.3: Methods of teaching enjoyed by students in their mathematics learning

Asked which methods of teaching the students enjoyed most in learning mathematics, the majority of the students indicated that they enjoyed most the discussion method followed by the Question and Answer method and the Demonstration/ Performance method. The lecture method was the fourth preferred method of teaching most enjoyed by the students. While the lecturers usually used the Lecture, Discussion and the Question and Answer methods, these methods may not necessarily have been the most liked or the ones enjoyed most by the students. However, the reason the lecturers used them regularly could be that the methods of teaching were enjoyed most by the same lecturers. The meaning is that the methods of teaching the lecturers enjoyed most and eventually used regularly might not have been the methods of teaching the students enjoyed and liked. It is probably for this reason that the students preferred the Demonstration/Performance method of teaching to the Lecture method of teaching, although the lecturers used the lecture method of teaching at a more regular basis than they used the Demonstration/Performance method.

The Demonstration/Performance method ranked number four in its use by the lecturers. However, the students preferred the Demonstration/Performance method of teaching to the lecture method probably because the Demonstration/Performance method gave the students the opportunity to be actively involved in the lesson as they performed the activity that the lecturer had demonstrated. Students liked and enjoyed the methods of teaching that involved them in the learning process unlike those that reduced them to mere listeners such as the lecture method of teaching.

In this study the students indicated the Lecture, the Directed discovery, the Free discovery and the Guided discovery methods of teaching as the methods of mathematics teaching that they enjoyed least in their mathematics learning. Apart from the lecture method of teaching which involved total lecturer dominance, the other three methods of teaching least enjoyed by the students and hence not liked were all the discovery methods of teaching. The indicators were clear that while the students did not enjoy and like the methods of teaching that gave them little or no participation in the activities of the class, they at the same time did not enjoy and like those methods of teaching that seemed to tell them to do it all on their own. Concerning this, one student had this to say, "I enjoy least the mathematics methods of teaching where a student is expected to find more information on his/her own other than from the lecturer. How can students be good future teachers like that?" Therefore lecturers should ensure that there is a balance between the lecture method of teaching and those methods that require students to discover answers on their own. The lecturer should provide guidance and direction as to what the students should discover on their own

It has already been pointed out that the lecturers usually used the Lecture, Discussion and the Question and Answer methods of teaching in their teaching. However, the lecturers indicated that they enjoyed the Question and Answer method most followed by the Discussion method and last the Lecture method. Both the lecturers and the students in this study agreed that the three methods of teaching mentioned were the ones the lecturers usually used in the teaching of mathematics. The lecturers used these methods because they enjoyed and liked them.

5.4: Method of teaching used and students' understanding of mathematics

From the research findings of this study 125 of the students were of the opinion that they understood mathematics better when the Discussion method of teaching was used. Sixty students felt they understood mathematics better when the lecturers used the Question and Answer method while 59 of the students indicated that they understood mathematics better when the lecturers used the Demonstration/Performance method of teaching. In other words the students understood mathematics better if the Discussion, Question and Answer and the Demonstration/Performance methods of teaching were used. This confirms the preferences of the students who earlier had indicated (page 51) that they enjoyed their mathematics learning most under the Discussion, Question and Answer and the Demonstration/Performance methods. These were the same methods of teaching in the same order of preference under which the students felt they understood mathematics better.

It is evident that the method the students liked and enjoyed most in their mathematics lessons was the same method under which their understanding was better. From the foregoing one might suggest that the reason for students to enjoy learning under a particular method could be that such a method helped students in understanding the content better. In addition, the understanding of the lessons could be due to the fact that the students liked the methods of teaching used.

5.5: Methods of mathematics teaching under the LCT approach

This study also showed that certain methods of teaching could be classified under the LCT approach while others could not be classified in this way. One hundred and Seventy nine (75%) of the students under study classified the Discussion, Free discovery, Question and Answer and the Guided discovery as the LCT approaches. Six of the lecturers classified the Discussion, Guided discovery, the Demonstration/Performance and the Exploratory discovery as the LCT approaches. Of all the methods of teaching listed above the Discussion method came out distinctly as one of the LCT methods of teaching. Both lecturers and students were in agreement that the Discussion method of teaching could be classified as one of the LCT approaches.

The Discovery methods (Free, Guided, Exploratory, and Directed) do also qualify to be classified as the LCT approaches although there is no common understanding as to which discovery methods are more learner centred. For this reason the choices by students differed from that of lecturers as to which Discovery methods were learner centred. Basically all Discovery methods are learner centred as they require the full participation of the learners in a learning situation.

5.6: Use of the LCT approach

This research revealed that the majority, 221 (93%), of the students indicated that their lecturers did make use of the LCT approach either always or sometimes. Seven (3%) of the students did not indicate whether their lecturers used the LCT approach or not.

Probably the reason they could not respond to this question was that they did not know when the lecturers used the LCT approach and when they did not.

From the research findings of this study, the students were agreed that their mathematics lecturers did encourage group work and student participation in learning activities. This was reflected by 161 (67.6%) of their responses. This participation involved a number of things. First and foremost it involved as Evans (1970) puts it, placing the learner at the center of the learning process. It is the learner who is important in the learning situation. As such the learner should learn and he/she can learn if he/she participates in the activities of the class.

5.7: Relationship between lecturers' activities and those of students

Apart from their participation in lessons, the activities which the students and lecturers engaged in indicated whether the LCT approach was being implemented in the two colleges or not. There seemed to be a corresponding relationship between the activities of the lecturers and those of the students. It was observed that while the lecturer was explaining facts (talking) or commenting on students' questions, the students listened to the lecturer's explanation or comments. Also while a student explained facts the other students and the lecturer listened to the student's explanation. When the lecturer asked questions the students responded by answering the questions. As such there was an interaction in the classroom between the students and the lecturers. However, what determines whether the activities lecturers or students engaged in could be said to be learner centred is the level of participation of the students in the class activities.

Activities such as listening to lecturer's explanations, copying work from the chalk board indicate passive participation in the learning situation and can therefore not be classified to be LCT approach. Similarly, it can be observed that activities where the lecturer was very active would translate into passiveness on the part of the students. Such activities included among others: lecturer explaining facts; lecturer commenting on students' questions or answers and lecturers working out questions on the board. In these activities the lecturer played a dominant role in the activities of the class.

Related to the activities that the lecturers and students engaged in was the organisation of class activities. Without good organization there cannot be order and a place for each of the activities. Generally, students were happy with the organization of class activities by the lecturers and said that the lecturers organised their activities in a way that encouraged learning.

5.8: Use of teaching aids

From the findings another aspect indicating whether the LCT approach was in use or not and the extent to which it was in use in the two colleges was the level to which learning/teaching aids were used. The study revealed that lecturers did not make use of teaching aids to a level which promoted the LCT approach to the maximum. Of all the students in the study 122 (51.3%) felt the lecturers used teaching aids at either a regular basis or from time to time while 115 (48.3%) of the students were of the opinion that lecturers did not make use of any kind of learning/teaching aids in their teaching. One student (0.4%) did not respond to the question. Of the 122 students who indicated that

the lecturers made use of teaching aids some of them failed to indicate or mention the type of teaching aids which were used. Further, the questioning of students revealed that some of the items thought of as learning/teaching aids were the obvious ones which were always there whatever teaching approach the lecturer used. Items such as chalk and chalkboard might not be regarded as learning/teaching aids as these are found to be in use in almost every lesson. Nonetheless they are teaching aids.

Students who felt that learning/teaching aids were not in use indicated that this was the case in most post secondary school institutions. Such institutions had minimal use of learning/teaching aids because the required learning/teaching aids are expensive. Learning/teaching aids used in lower institutions of learning cost much less compared to those used in higher institutions of learning. As such it becomes extremely difficult to obtain and make use of such expensive equipment. Students in higher institutions of learning need teaching aids such as computers which can be used to present lessons using power point.

Lecturers themselves agreed with the students who said the learning/teaching aids were being used though not to a large extent. Seven of the lecturers indicated that though they did not always make use of the learning/teaching aids in their teaching they used the teaching aids from time to time during lectures. Though it is true that lecturers do make use of some teaching aids from time to time there was, however, the problem of irregular and inadequate supply of learning/teaching materials to the two colleges. Lecturers might have not used learning/teaching aids at a regular basis due to the fact

that the learning/teaching aids were not available. Even during times when the lecturer made use of some kind of learning/teaching aids, the students depended on the lecturers for tasks. The students did not have textbooks, which could have helped them to easily access the work to be done. Instead the lecturers wrote the tasks on the chalkboard, which the students copied in the exercise books. This was time consuming instead of making use of textbooks.

5.9: The LCT approach and performance in the two colleges

It is evident from the results that LCT was being implemented in the two colleges and there seemed to be some positive aspects of the teaching/learning process directly associated with the LCT approach. This is seen from the number of students who indicated that their performance was good when lecturers used the LCT approach. At the same time the students felt their lecturers' performance was good when the lecturers used the LCT approach. It was a general feeling of the students that their performance and that of their lecturers was at best average when the lecturers did not use the LCT method. However, there was a small number of 26 students (11%) that felt their performance was still good even when the lecturers did not use the LCT approach.

It should be noted here that when performance is said to be good or bad it does not refer to some set criteria of assessment. Good performance in this context referred to one or more than one of the following: good performance in daily class activities, general good feeling of the students towards one another and the lecturer which eventually ensures a

conducive learning environment, good lecturer-student relationship in class, and students' willingness to learn as seen from their participation in class activities.

5.9.1: The performance of students

This study revealed that the majority, 211 (89%), of the students were of the opinion that their performance was affected by the method of teaching that lecturers used in their teaching. In other words the students were saying that it really mattered which methods of teaching the lecturer used in his/her teaching. The methods used would eventually affect students' performance either positively or negatively. As already mentioned the students enjoyed learning mathematics when particular methods of teaching were used while when other methods were used the students tended not to enjoy the learning. The lecturers were also in agreement that the performance of students was affected by the methods of teaching used.

The students' performance entailed the active involvement of the students in the lessons: the way the students responded to the learning environment; the way they answered and asked questions; their contributions in class and their alertness during those lessons. Student performance here referred to the daily involvement of the students in the lessons. It did not mean the performance of students in particular tests though lecturers did administer tests but it would be difficult to tell whether any student's performance in those tests could be attributed to the LCT as the approach was not used throughout in every lesson. Therefore, student performance referred to the participation and involvement of the students in the lessons. However, there are factors

that may affect the performance of the students even when the lecturers use the LCT approach. One of such factors is the size of the class.

5.9.2: The performance of lecturers

Performance as regarding the lecturers refers to the way in which the lecturers carried out or executed their classroom duties. For instance how they presented their lessons; Was it in an efficient manner? Did they carry with them their students through out the different stages of the lesson? Did they ask the right and major questions of the lesson? The observations revealed that lecturers conducted their lessons in the way that suggested good performance. The lecturers brought the students on board in their lessons. In many lessons key and right questions of the lessons were asked and learning was seen to take place as observed from the participation of the students in those lessons.

5.10: Helping students with learning difficulties

Even if 151 of the students indicated that their performance was either very good or good when the lecturers used the learner centred approach, there were indications that students experienced difficulties in their mathematics learning. Lecturers shared the same opinion with their students that students encountered difficulties in their mathematics learning even under the LCT approach

It was the responsibility of the lecturers to help the students with learning difficulties. Both the students and lecturers indicated that the lecturers were helpful to students with

learning difficulties. In this regard 221 (96.3%) of the students indicated that the lecturers were generally helpful in dealing with the students with learning difficulties. The lecturers gave an understanding ear to such students both in class and when contacted outside class. The lecturers helped the students by identifying with them areas of student misunderstanding of the mathematics concepts. In doing that the lecturers never assumed that students had prior knowledge of what they were going to teach but for each topic lecturers started from the basics and then built on to the higher mathematical ideas and concepts. The students had to be engaged in the learning experience and allowed the learning to be enjoyable.

5.11: Training in the LCT approach

One important aspect in the implementation of the LCT approach is the training of lecturers in the approach. For the lecturers under study four of them had received training in the LCT approach. This training was provided by the BeSSTT project. This training handled issues to do with the way the LCT approach could be implemented in a classroom situation. The lecturers who underwent the training felt that even if they were trained in the use of the LCT approach the training they received was inadequate. The lecturers revealed that the period of training was not enough and they were not exposed to all the key components of the LCT methodology. They felt that many areas of the approach could have been looked at in more detail.

Also, another area they felt should be addressed was the training needs of lecturers in the Education Departments at the two colleges. Since only lecturers from the

mathematics and science departments were trained, there was need to include all lecturers from the Education Department in order to bridge the gap that was created by the non-inclusion of this department in the training programme.

Lecturers in this study felt that lecturers in the Education Departments at the two colleges were key to the successful implementation of the LCT approach. Education lecturers if trained would be of great value to the learning of the students, as they would receive a complete understanding and use of the approach. All students regardless of their subject combinations took all the education courses offered in the two colleges, as such they would be more conversant with the approach when the education lecturers made use of it.

The Education Department was and still is at the centre of most of the preparation of a student teacher for his/her future work as a teacher. Students at both colleges had more courses or subjects from the Education Department than they had from the Mathematics Department. While they had only content and methodology from the Mathematics Department, they have the Theory and Practice of Education (TPE), History and Philosophy of Education (HPE), Educational Psychology (EP) and Educational Sociology (ES) from the Education Department. It was in the Education Department that students learnt what it took to be a teacher. As such excluding the department in the training was not the best thing to do at the two colleges of education.

Another group of lecturers who needed training in the LCT approach were those whose subjects combined with mathematics. For Nkrumah, it was felt that the lecturers who taught History, Physical Education and Geography should have undergone training in the LCT approach also. This would have greatly helped the students to benefit more from the use of the approach. The use of the approach in the mathematics combinations would encourage uniformity and consistence in the way students learned. If this training was lacking in the other lecturers, as was the case now it was possible that the other lecturers might be pulling in the opposite direction.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1: Introduction

In this chapter the conclusions and recommendations of this dissertation are made based on the findings.

6.2: Conclusion

This study shows that lecturers were implementing or using the LCT approach in their teaching. This was reflected in the activities, which they engaged the students and themselves in. By and large the lecturers engaged the students in working out problems on the chalk board, working out problems in their exercise books, answering questions posed by the lecturers or their fellow students, asking questions and explaining some concepts to the whole class. In other words there was general student participation in the procedures of the class.

Apart from the activities conducted in class another pointer to the implementation of the learner centred approach was the methods of teaching that were used in class. While it was true that a number of methods of teaching were used in class, it was clearly spelt out by both lecturers and students that lecturers usually used the Discussion, Question and Answer, Demonstration/Performance and the Lecture methods in their classes. The first three of these methods clearly encouraged learner participation in the learning situation. The lecture method, though seen to be a teacher centred method was an effective method in drawing learners to the learning situation. The lecturers did not use

the lecture method in isolation but to complement the other three. In using the lecture method the lecturers had to introduce the topics by briefly giving the background. The lecturer had also to point out the main points of the lesson at the end as a way of summarising it.

The lecturers explained that there was no single lesson in which they made use of only one method of teaching from the beginning up to the end. The common approach was that in every lesson lecturers employed a variety of teaching methods. However, the Discussion, Question and Answer, Demonstration/Performance and the Lecture methods dominated in most of the lessons. The same was true of the activities in which the students engaged in while in class. There was no one activity which was used throughout the lesson. It was observed that each lesson consisted of many activities though some activities were employed to a very large extent.

Since no single activity was carried out throughout any given lesson, it is true to say that there were moments when students were engaged in activities, which were not learner centred. Though the learner centred approach was used by the lecturers, there were times when the lecturers did not use the approach in the same lessons. In any given lesson there were a variety of activities and some of those activities were not learner centred. Examples of activities that were not learner centred included: students listening to lecturers' explanation, while the lecturer was explaining some facts, and lecturer giving out instructions to students.

Listening is a passive activity in which an observer cannot tell whether the listening is taking place or not. Merely sitting quietly and looking at the lecturer did not guarantee that the students were listening. Similarly, when the lecturer gave out instructions there was no guarantee that those instructions were understood let alone being followed and implemented.

There was a relationship as observed from the study among the following: the methods usually used by the lecturers in their mathematics teaching, the methods of mathematics teaching enjoyed most by both lecturers and students and the methods of mathematics teaching under which students understood mathematics better. It was established that the lecturers usually used the Discussion, Question and Answer and the Demonstration/Performance methods. These were the same methods that the students indicated as the methods of teaching mathematics, which they enjoyed most in their mathematics learning. It was not surprising that the same three methods and in the same order were said to be the methods under which the students understood mathematics better. The relationship was even stronger in that for someone to enjoy something he/she must first be exposed to that thing and that was when he/she would appreciate its merits. The students were exposed to the three methods as the lecturers frequently used them. The students enjoyed learning mathematics under these methods.

This study shows that the students liked the Discussion, Question and Answer and the Demonstration/Performance methods because the methods involved students' active participation. As such both lecturers and students classified the same methods as

methods of teaching mathematics falling under the LCT approach. In other words both lecturers and students were in agreement that the LCT approach was in use at the two colleges. However, it was also true that the LCT approach was much more prominent in methodology lectures.

This study found that student performance in mathematics could be affected by the lecturers' method of teaching either positively or negatively. As such lecturers' choices of teaching methods are of great importance. The lecturer should consider and make use of methods of teaching that involved the students instead of those, which made students passive participants. In making students become active participants it is necessary to involve them in class activities. This will create in them a sense of ownership for the learning taking place.

Further, this study revealed that the mathematics lecturers needed more training in the LCT approach so as to have a firm grip in the use of the approach. This would enable both the new and old members of the department to benefit from the training. The new members would be exposed to the needs and demands of the approach while the old ones would consolidate their knowledge in the use of the LCT approach. Apart from training the mathematics lecturers, there was need to include lecturers from the Education Department in the LCT approaches training. It was also felt that the training of lecturers in the LCT approach should not be a one-time event but it should be on going. From time to time lecturers even from other departments in the two colleges

should come together and see how best they could implement the LCT approach in their own subject areas.

6.3: Recommendations

This study has revealed a number of issues regarding the implementation of the LCT approaches at Nkrumah and COSETCO. In view of the above the following recommendations are made:

1. Colleges should facilitate orientation workshops in the LCT approaches for newly appointed lecturers, as is the case for primary teachers' colleges. This will equip the lecturers with the LCT approaches so that they could also equip their students in readiness for roles as teachers in schools. This can be done by setting time and resources for the training of new lecturers.

2. Colleges should maintain small enrolment numbers per class so that each student receives maximum attention from the lecturers. Alternatively, the two colleges should expand in terms of infrastructure and number of lecturers. Government can source funding from cooperating partners such as VVOB, local banks and companies.

3. Colleges should hold LCT workshops at regular intervals for all lecturers as part of the colleges' continuous professional development (CPD).

4. Colleges should embrace the LCT approach as a college programme and not just for selected departments. This they can do by integrating LCT activities into the already existing college CPD programmes.

5. Colleges should organise one seminar per term for mathematics and science lecturers alternately at Nkrumah or COSETCO. This is in order to allow lecturers share ideas in their subject areas. Cooperating partners such as VVOB can be approached for financial assistance and their effort can be supplemented by the two colleges. Facilitators can be drawn from the School of Education of the University of Zambia (UNZA).

6. Lecturers should use methods of teaching as much as possible that encourage student participation

7. Lecturers within the same section should observe each other's lessons and discuss the presentation of such lessons with the objective of promoting efficient ways of presenting lessons.

8. Lecturers of mathematics together with lecturers whose subjects combine with mathematics should have regular professional meetings in order to share ideas in the different ways of using the LCT approach in their lessons.

9. Further research could focus on the role of questions in the teaching of mathematics using the LCT approaches in colleges of education.

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Appendix A

THE UNIVERSITY OF ZAMBIA

SCHOOL OF EDUCATION

Dear Respondent,

The purpose of this questionnaire is to gather information on the implementation of learner centred teaching (LCT) at your college. The information gathered will be for academic purposes and therefore will be treated with anonymity and confidentiality. You **do not** need to write your name on the questionnaire.

You are requested to respond to the questions truthfully by putting a tick √ in the brackets [ ] provided against your answer or write down your answer(s) where spaces are provided.

QUESTIONNAIRE FOR MATHEMATICS STUDENTS

1. Sex: M [ ] F [ ]
2. Indicate your age:.....
3. College.....
4. Year of study: i. First year [ ]
   ii. Second year [ ]
5. Which method(s) of teaching do your lecturers **usually** use in their teaching of mathematics?
   i. Discussion [ ]
   ii. Demonstration/Performance [ ]
   iii. Directed discovery [ ]
   iv. Guided discovery [ ]
   v. Exploratory discovery [ ]
   vi. Free discovery [ ]
   vii. Experimentation [ ]
   viii. Lecture [ ]
   ix. Programmed learning [ ]

x. Question and Answer [ ]

xi. Other

specify:.....

.....

6. Which method(s) of mathematics teaching in Question 5 do you enjoy **most** in your mathematics learning ?

.....

.....

7. Which method(s) of mathematics teaching in Question 5 do you enjoy **least** in your mathematics learning ?

.....

.....

8. Mention the teaching method(s) under which you **understand** mathematics better.

.....

.....

9. Which of the teaching method(s) in Question 5 would you classify under the learner centred teaching (LCT) approach ?

.....

.....

10. In your opinion can the performance of students in mathematics be affected by the lecturers' teaching method (s) ?

i. strongly agree [ ]

ii. Agree [ ]

iii. Undecided [ ]

iv. Disagree [ ]

v. Strongly disagree [ ]

11. Do your mathematics lecturers do all the explaining (talking) while in class?

i. Always [ ]

ii. Sometimes [ ]

iii. No [ ]

12. Do your mathematics lecturers encourage student participation in learning activities?

i. Always [ ] ii. Sometimes [ ] iii. No [ ]

13. Do your mathematics lecturers make use of teaching/learning aids in their teaching?

i. Yes [ ] ii. Sometimes [ ] iii. No [ ]

If your answer to question 13 is Yes , then proceed to question 14 and continue answering the questionnaire. If your answer to question 13 is No proceed to question 15 and continue answering from there

14. Name the teaching/learning aids which are usually used:

.....

.....

15. During mathematics lectures what activities do your lecturers **usually** engage in?

i. Explaining facts (talking) [ ]

ii. Asking questions [ ]

iii. Answering questions from students [ ]

iv. Commenting on student questions [ ]

v. Listening to students' explanations [ ]

vi. Giving instructions [ ]

vii. Working out questions on the board [ ]

viii Others

(specify):.....

.....

16. What activities do you as students **usually** engage in during mathematics lectures?

i. Listening to lecturer's explanation [ ]

ii. Answering lecturer's questions [ ]

iii. Answering fellow student's question(s) [ ]

iv. Asking lecturer questions [ ]

v. Asking fellow student questions [ ]

vi. Listening to fellow students' explanations [ ]

vii.Carrying out lecturer's instructions [ ]

viii.Copying work from chalk board to the exercise books [ ]

ix. Working out questions on the chalk board [ ]

x. Working out questions on your own in exercise books [ ]

xi. Working out problems in groups [ ]

xii. Others (specify)

.....

.....

17. How would you classify the organization of class activities by your mathematics lecturers?

i. Very good [ ]

ii. Good [ ]

iii. Fairly good [ ]

iv. Poor [ ]

v. Very poor [ ]

18. Do you experience difficulties in your learning of mathematics?

i. Always [ ] ii. Sometimes [ ] iii. No [ ]

19. How do mathematics lecturers respond to your learning difficulties?

i. Very helpful [ ]

ii. Helpful [ ]

iii. Fairly helpful [ ]

iv. Unhelpful [ ]

v. Very unhelpful [ ]

20. In your opinion do your mathematics lecturers use the LCT approach?

i. Yes [ ]

ii. Sometimes [ ]

iii. No [ ]

If your answer to question 20 is Yes or sometimes, then proceed to question 21 and 22 and continue answering the questionnaire. If your answer to question 20 is No proceed to question 23 and continue answering from there

21. How would you classify the performance of your mathematics lecturers when they use the LCT approach ?

i. Very good [ ]

ii. Good [ ]

iii. Average [ ]

iv. Poor [ ]

v. Very poor [ ]

22. How would you classify your own performance as a student when your mathematics lecturers **use** the LCT approach?

i. Very good [ ]
ii. Good [ ]
iii. Average [ ]
iv. Poor [ ]
v. Very poor [ ]

23. How would you classify the performance of your mathematics lecturers when they **do not use** the LCT approach ?

i. Very good [ ]
ii. Good [ ]
iii. Average [ ]
iv. Poor [ ]
v. Very poor [ ]

24. How would you classify your own performance as a student when your mathematics lecturers **do not use** the LCT approach?

i. Very good [ ]
ii. Good [ ]
iii. Average [ ]
iv. Poor [ ]
v. Very poor [ ]

THANK YOU FOR YOUR PARTICIPATION. END OF QUESTIONNAIRE

Appendix B

THE UNIVERSITY OF ZAMBIA

SCHOOL OF EDUCATION

Dear Respondent,

The purpose of this questionnaire is to gather information on the implementation of learner centred teaching (LCT) at your college. The information gathered will be for academic purposes and therefore will be treated with anonymity and confidentiality. You **do not** need to write your name on the questionnaire.

You are requested to respond to the questions truthfully by putting a tick √ in the brackets [ ] provided against your answer or write down your answer(s) where spaces are provided.

QUESTIONNAIRE FOR MATHEMATICS LECTURERS

1. Sex: M [ ] F [ ]
2. Indicate your age:.....
3. College.....
4. Which method(s) of teaching do you **usually** use in your teaching of mathematics?
   - i. Discussion [ ]
   - ii. Demonstration/Performance [ ]
   - iii. Directed discovery [ ]
   - iv. Guided discovery [ ]
   - v. Exploratory discovery [ ]
   - vi. Free discovery [ ]
   - vii. Experimentation [ ]
   - viii. Lecture [ ]
   - ix. Programmed learning [ ]
   - x. Question and Answer [ ]
   - xi. Others (specify):.....

5. Which method(s) of mathematics teaching in Question 4 do you enjoy **most** in your mathematics teaching ?

.....

.....

6. Which method(s) of mathematics teaching in Question 4 do you **least** enjoy in your mathematics teaching ?

.....

.....

7. Which of the teaching method(s) in Question 4 would you classify under the learner centred teaching (LCT) approach ?

.....

.....

8. In your opinion can the performance of students in mathematics be affected by the teaching method which you use?

i. Strongly agree [ ]
ii. Agree [ ]
iii. Undecided [ ]
iv. Disagree [ ]
v. Strongly disagree [ ]

9. Do you do all the explaining (talking) while in class?

i. Always [ ] ii. Sometimes [ ] iii. No [ ]

10. Do you encourage group work among your students during your lessons?

i. Yes [ ] ii. Sometimes [ ] iii. No [ ]

If your answer to question 10 is Yes or sometimes, then proceed to question 11.

If your answer is No proceed to question 12

11. How do your students respond to group work?

i. Very well [ ]

ii. Well [ ]

iii. Fairly well [ ]

iv. Poorly [ ]

v. Very poorly [ ]

12. How would you rate the general participation of students in your lessons?

i. Very good [ ]

ii. Good [ ]

iii. Average [ ]

iv. Poor [ ]

v. Very poor [ ]

13. Do you make use of teaching/learning aids in your teaching?

i. Yes [ ] ii. Sometimes [ ] iii. No [ ]

If your answer to question 13 is Yes or sometimes, then proceed to question 14. If your answer is No proceed to question 15

14. Name the teaching/learning aids which you usually use:

.....

.....

15. During mathematics lectures what activities do you **usually** engage in?

i. Explaining facts (talking) [ ]

ii. Asking questions [ ]

iii. Answering questions from students [ ]

iv. Commenting on student questions [ ]

v. Listening to students' explanations [ ]

vi. Giving instructions [ ]

vii. Working out questions on the board [ ]

viii Others

(specify):.....

.....

16. What activities do you **usually** engage your students in during mathematics lectures?

i. Listening to your explanation [ ]

ii. Answering your questions [ ]

iii. Answering fellow student's question(s) [ ]

iv. Asking you questions [ ]

v. Asking fellow student questions [ ]

vi. Listening to fellow students' explanations [ ]

vii.Carrying out your instructions [ ]

viii.Copying work from chalk board to the exercise books [ ]

ix. Working out questions on the chalk board [ ]

x. Working out questions on their own in exercise books [ ]

xi. Working out problems in groups [ ]

xii. Others (specify)

.....

.....

17. Do your students experience difficulties in their learning of mathematics?

i. Yes [ ] ii. Sometimes [ ] iii. No [ ]

If your answer to question 17 is Yes or sometimes, then proceed to question 18. If your answer is No proceed to question 19

18. State the type of difficulties mathematics students experience

.....

.....

19. In your opinion would you say you use the LCT approach in your teaching?

i. Yes [ ] ii. Sometimes [ ] iii. No [ ]

If your answer to question 19 is Yes or sometimes, then proceed to question 20 and 21.
If your answer is No proceed to question 22

20. How would you classify your performance when you use the LCT approach ?
    i. Very good [ ]
    ii. Good [ ]
    iii. Average [ ]
    iv. Poor [ ]
    v. Very poor [ ]

21. How would you classify the performance of your students when you use the LCT approach?
    i. Very good [ ]
    ii. Good [ ]
    iii. Average [ ]
    iv. Poor [ ]
    v. Very poor [ ]

22. How would you classify your performance when you **do not use** the LCT approach?
    i. Very good [ ]
    ii. Good [ ]
    iii. Average [ ]
    iv. Poor [ ]
    v. Very poor [ ]

23. How would you classify the performance of your students when you **do not use** the LCT approach?
    i. Very good [ ]
    ii. Good [ ]
    iii. Average [ ]

iv. Poor [ ]

v. Very poor [ ]

24. Did you receive any training in the LCT approach?

i. Yes [ ] ii. No [ ]

If your answer to question 24 is Yes, then proceed to question 25 and 26.

25. In your opinion was the training adequate to enable you use the LCT approach effectively?

i. Yes [ ] ii. No [ ]

If your answer to question 25 is No, then proceed to question 26.

26. Would you need some more training in the LCT approach?

i. Yes [ ] ii. No [ ]

THANK YOU FOR YOUR PARTICIPATION. END OF QUESTIONNAIRE

Appendix C

INTERVIEW GUIDE FOR MATHEMATICS STUDENTS

INTRODUCTION

The purpose of this interview/questionnaire is to gather information on the implementation of learner centred teaching (LCT) in your college. The information gathered will be for academic purposes and therefore will be treated with anonymity and confidentiality. Your participation is greatly appreciated.

SEX: M[ ] F[ ]

1. . What methods of teaching do your lecturers usually use in their mathematics teaching?

2. (a) How are lessons organised under the methods in (1)?
   (b) How effective do you think the methods in (1) are in ensuring mathematics learning? Explain.
   (c) What activities are you often engaged in during your mathematics lessons?

3. (a) Do your mathematics lecturers make use of teaching/learning aids in their teaching?
   (b) If answer in (a) is yes how often are teaching/learning aids made use of?
   (c) Mention some teaching/learning aids which your lecturers usually make use of in your mathematics learning.

4. In your opinion what is LCT?

5. Which methods (or activities) of teaching/learning would you classify under LCT?

6. (a) Do you think the mathematics lecturers at your college use LCT in their teaching? Explain.
   (b) If yes in (a) how are lessons organised under LCT?

7. What can you say about your response to LCT?

enjoyment	excitement	boredom
confusion	participation	understanding

8. Do you think there is a difference in your understanding of mathematics when LCT is used as compared to other approaches? Explain.

9. Would you use LCT approaches in your own lessons as a teacher?
   (a) If so explain how you would do it.
   (b) If not give reasons why you would not use the approaches

THANK YOU FOR YOUR PARTICIPATION. END OF INTERVIEW

Appendix D

INTERVIEW SCHEDULE FOR LECTURERS

INTRODUCTION

The purpose of this interview/questionnaire is to gather information on the implementation of learner centred teaching (LCT) in your college. The information gathered will be for academic purposes and therefore will be treated with anonymity and confidentiality. Your participation is greatly appreciated.

SEX: M[ ] F[ ]

1. What methods of teaching do you usually use in your teaching?

2. (a) How do you organize the lessons under the methods in (1)?
   (b) How effective do you think the methods in (1) are in ensuring learning? Explain.
   (c) What activities do you often engage your learners in during your lessons?

3. What is the place of teaching aids in your lessons?

4. In your opinion what is LCT?

5. Which methods (or activities) of teaching would you classify under LCT?

6. (a) Do you often use LCT in your lessons?
   (b) If yes in (a) how do you organize the lessons?

8. What can you say about your students' response to LCT?

enjoyment	excitement
boredom	understanding
confusion	participation

7. Do you think there is a difference in learners understanding when you use LCT as compared to other approaches? Explain.

8. Do you have problems in using LCT approaches? If so explain specifying the problem(s).

9. What suggestion(s) would you give to help in eradicating the problem(s)?

10. Do you think the training you received in LCT was adequate to enable you use the approach effectively?

THANK YOU FOR YOUR PARTICIPATION. END OF INTERVIEW

Appendix E

INTERVIEW GUIDE FOR MATHEMATICS HEADS OF SECTION/DEPARTMENT

INTRODUCTION

The purpose of this interview/questionnaire is to gather information on the implementation of learner centred teaching (LCT) in your college. The information gathered will be for academic purposes and therefore will be treated with anonymity and confidentiality. Your participation is greatly appreciated.

SEX: M[ ] F[ ]

1. What methods of teaching do your lecturers usually use in their teaching?

2. (a) How are lessons organized under the methods in (1)?
   (b) How effective do you think the methods in (1) are in ensuring learning? Explain.
   (c) What activities do the lecturers often engage the learners in during lessons?

3. Do mathematics lecturers make use of teaching aids in their lessons?

4. What are the teaching aids available in the department/section for use?

5. In your opinion what is LCT?

6. Which methods (or activities) of teaching would you classify under LCT?

7. Do you think mathematics lecturers are using LCT in their lessons? How then do they organise the lessons?

8. What can you say about the mathematics students' response to LCT?
   enjoyment excitement boredom
   confusion participation understanding

9. Do you think there is a difference in learners understanding when LCT is used as compared to other approaches? Explain.

10. Do you think mathematics lecturers have problems in using LCT approaches? If so explain specifying the problem(s).

11. What suggestion(s) would you give to help in eradicating the problem(s)?

12. Do you think the training the mathematics lecturers received in LCT was adequate to enable them use the approach effectively?

THANK YOU FOR YOUR PARTICIPATION. END OF INTERVIEW

Appendix F

REVIEWING THE LEARNER - CENTRED APPROACH IN THE TEACHING OF MATHEMATICS AT NKRUMAH AND COPPERBELT TEACHER'S COLLEGE - OBSERVATION SCHEDULE

Time in intervals of 3minutes

ACTIVITIES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	1
Lecturer explaining (talking)																		
Lecturer asking a question																		
Lecturer answering student question																		
Lecturer commenting on student question																		
Lecturer listening																		
Lecturer writing on board																		
Lecturer giving instructions																		
Student(s) listening to lecturer																		
Student answering lecturer's question																		
Student asking lecturer																		
Student(s) listening to student																		
Student answering student's question																		
Student asking student																		
Students writing in note books																		
Student(s) working out a question on the board																		
Students working out questions on their own in note books																		
Students working out a problem in groups																		

Appendix G

QUESTIONNAIRE ANALYSIS FOR LECTURERS

College: Nkrumah and Cosetco

1. Sex

	Nkrumah		Cosetco
M			
F			
	TOTAL		

2. Age

	Nkrumah			Cosetco	
Age	Tally			Number	
	TOTAL				

3. College

	Nkrumah		Cosetco
	TOTALS		

4. Lecturers' views of the teaching methods they usually use (d) in their teaching of mathematics

	Nkrumah		Cosetco		Total
Discussion					
Demonstration/Performance					
Directed discovery					
Guided discovery					
Exploratory discovery					
Free discovery					
Experimentation					
Lecture					
Programmed learning					
Question and Answer					
Others					
	TOTAL				

5. Mathematics teaching methods lecturers enjoy **most** in their mathematics teaching

	Nkrumah		Cosetco		Total
Discussion					
Demonstration/Performance					
Directed discovery					
Guided discovery					
Exploratory discovery					
Free discovery					
Experimentation					
Lecture					
Programmed learning					
Question and Answer					
Others					
	TOTAL				

6. Mathematics teaching methods lecturers enjoy **least** in their mathematics teaching

	Nkrumah		Cosetco		Total
Discussion					
Demonstration/Performance					
Directed discovery					
Guided discovery					
Exploratory discovery					
Free discovery					
Experimentation					
Lecture					
Programmed learning					
Question and Answer					
Others					
	TOTAL				

7. Mathematics teaching methods classified by lecturers to be under the LCT approach

	Nkrumah		Cosetco	Total	
Discussion					
Demonstration/Performance					
Directed discovery					
Guided discovery					
Exploratory discovery					
Free discovery					
Experimentation					
Lecture					
Programmed learning					
Question and Answer					
Others					
	TOTAL				

8. Lecturers' views as to whether performance of students was affected by the teaching method (s) used

	Nkrumah		Cosetco	Total	
Strongly agree					
Agree					
Undecided					
Disagree					
Strongly disagree					
	TOTAL				

9. Lecturers' views on whether they did all the explaining (talking) while in class

	Nkrumah		Cosetco	Total	
Always					
Sometimes					
No					
	TOTAL				

10. Lecturers' views on whether they encourage group work among their students during lectures

	Nkrumah		Cosetco	Total	
Always					
Sometimes					
No					
	TOTAL				

11. Lecturers' views on how students respond to group work

	Nkrumah		Cosetco	Total	
Very well					
Well					
Fairly well					
Poorly					
Very poorly					
	TOTAL				

12. Lecturers' rating of the general participation of students in lectures

	Nkrumah		Cosetco	Total	
Very well					
Well					
Fairly well					
Poorly					
Very poorly					
	TOTAL				

13. Lecturers' responses as to whether they make use of teaching/learning aids in their teaching

	Nkrumah		Cosetco	Total	
Always					
Sometimes					
No					
	TOTAL				

14. Teaching/learning aids (if any) which the lecturers usually use in their teaching:

15. Activities the mathematics lecturers usually engage in while in class according to the lecturers themselves

	Nkrumah		Cosetco	Total
Explaining facts (talking)				
Asking questions				
Answering questions from students				
Commenting on student questions				
Listening to students' explanations				
Giving instructions				
Working out questions on the board				
Others				
	TOTAL			

16. Activities lecturers usually engage their students in during mathematics lectures

	Nkrumah		Cosetco	
Listening to lecturer's explanation				
Answering questions from lecturer				
Answering fellow student's question(s)				
Asking the lecturer(s) questions				
Asking fellow student questions				
Listening to fellow students' explanations				
Carrying out lecturer's instructions				
Copying work from chalk board to the exercise books				
Working out questions on the chalk board				
Working out questions on their own in exercise books				
Working out questions in groups				
Others				
	TOTAL			

17. Lecturers' views as to whether their students experience difficulties in their mathematics learning

	Nkrumah		Cosetco		Total
Always					
Sometimes					
No					

18. Difficulties mathematics students experience according to lecturers

19. Lecturers' response as to whether they use(d) the LCT approach in their teaching

	Nkrumah		Cosetco		Total
Always					
Sometimes					
No					

20. How lecturers classified their own performance when they used the LCT approach

	Nkrumah		Cosetco		Total
Very good					
Good					
Average					
Poor					
Very poor					
	TOTAL				

21. How lecturers classified the performance of their students when the lecturers used the LCT approach

	Nkrumah		Cosetco	Total	
Very good					
Good					
Average					
Poor					
Very poor					
	TOTAL				

22. How lecturers classified their own performance when they **did not use** the LCT approach

	Nkrumah		Cosetco	Total	
Very good					
Good					
Average					
Poor					
Very poor					
	TOTAL				

23. How lecturers classified the performance of their students when lecturers **did not use** the LCT approach

	Nkrumah		Cosetco	Total	
Very good					
Good					
Average					
Poor					
Very poor					
	TOTAL				

24. Lecturers response on whether they received any training in the LCT approach

		Nkrumah		Cosetco		Total
Yes						
No						
	TOTAL					

25. Lecturers response on whether the training they received in the use of the LCT approach was adequate

		Nkrumah		Cosetco		Total
Yes						
No						
	TOTAL					

26. Lecturers' views on whether they needed more training in the use of the LCT approach

		Nkrumah		Cosetco		Total
Yes						
No						
	TOTAL					