

**PERCEPTIONS OF TEACHERS ON INTEGRATING OF ART AND DESIGN
IN THE TEACHING AND LEARNING OF MATHEMATICS AT LOWER
PRIMARY SCHOOL LEVEL IN CHIPATA DISTRICT**

BY

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The Requirements for the Award of The Master's Degree in Education
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DECLARATION

I, **Harrison Phiri** declare that this dissertation is my original work and has not been presented for a degree in any university.

Signature.....Date.....

Name :

I, confirm that the work reported in this dissertation was carried out by the candidate under my supervision as University of Zambia supervisor. This dissertation has been submitted for review with my approval.

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CERTIFICATE OF APPROVAL

The dissertation by Harrison Phiri is approved as fulfilling part of the requirement for the award of a Degree of Master of Education in Primary Education of the University of Zambia.

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DEDICATION

I dedicate this piece of writing to my wife Ruth K. Phiri and my children who have been very supportive and endured hardship during the time I was away from them. I could not manage to pay for their school fees promptly and meet the other costs for their daily basic needs. To my young brother Mabvuto Phiri who provided me with both moral and financial assistance in many different forms I say may the almighty Jehovah God shower him with abundant wave of blessings for being so supportive when I needed help from him.

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May God the almighty bless them all.

ABSTRACT

The performance in mathematics at various levels of education in Zambia has persistently not been good despite a number of interventions put in place by the Ministry of Education and other stakeholders.

Mathematics plays an important role in our daily life hence the need for every individual to be numerate. Teachers should perceive integration of art and design as one of the ways to help improve the teaching of mathematics.

The purpose of the study was to establish teachers' perceptions on whether integrating art and design at lower primary level could help improve learner performance in mathematics.

A descriptive survey research design was used in the study. The sample comprised 84 participants, 4 lecturers from a public College of Education in Chipata; 30 primary school teachers. The study was conducted in 10 primary schools. In total 50 primary schools pupils were involved in the study. Simple random technique was used to select a sample of teachers. A non-probability sampling procedure known as purposive sampling technique was used to select lecturers. Group interview and questionnaires were used to collect information from the respondents. Data was analysed using content analysis, a procedure for the categorisation of verbal or behavioural data, for purposes of classification and summarisation.

Out of the 34 teachers and lectures involved, the study revealed that 30 respondents representing (88.2%) had positive views towards the integration of art and design in the teaching and learning of mathematics. These respondents felt integrating art and design in the teaching of mathematics at the lower levels of education could motivate and encourage learners to enjoy mathematics. The other 4 participants representing (11.8%) of the participants also had different views on the subject.

The study revealed that there were less play and practical activities in classes. Classrooms were void of teaching aids and objects which enhance learning at this level. Integration of art and design in the teaching of mathematics was very minimal. This also resulted in the use of inappropriate teaching methods which were mostly void of play activities suitable for the lower primary level.

The study recommends that art integration into mathematics should start with primary colleges of education where teachers are trained. Teachers should be equipped with artistic skill in the production and use of teaching aids right from the college.

The findings of the study suggest that the foundation of the learners at lower level of education was compromised as teachers did not have the right attitude in integrating art in the teaching of mathematics.

Keywords: *Perception, integration of art mathematics, art and design, teaching and learning materials, teaching aids, teaching methods.*

ACRONYMS

CDC	Curriculum Development Centre
CPD	Continuing Professional Development
DEBS	District Education Board Secretary
ECE	Early Childhood Education
ECZ	Examinations Council of Zambia
GCE	General Certificate of Education
HLE	Home Learning Environment
KCSE	Kenya Certificate for Secondary Education
MESVTEE	Ministry of Education, Science, Vocational Training and Early Education.
MoE	Ministry of Education
REPSSI	Regional Psychosocial Support Initiative
SACMEQ	Southern and Eastern Africa Consortium for Monitoring Education Quality
SES	Socio-economic Status
UK	United Kingdom

DEFINITION OF TERMS

Perception: is a belief or opinions, often held by many people and based on how things seem. Someone's ability to notice and understand things that are not obvious to other people. An attitude or understanding based on what is observed or thought.

Art: a skill or special ability. An activity through which people express particular ideas.

Integration: to combine two or more things in order to become more effective.

Numeracy: is the ability to reason and to apply simple numerical concepts.¹ Basic numeracy skills consist of comprehending fundamental mathematics like addition, subtraction, multiplication, and division. It is the ability to use mathematics in everyday life.

Numerate: is being numerate means having the confidence and skills to use numbers and mathematical approaches in all aspects of life, at work, in practical everyday activities at home and beyond.

Mathematics: the study of numbers shapes and space using reason and usually a special system of symbols and rules for organizing them.

Curriculum: a group of subjects studied in a school, college and university.

Subject: An area of knowledge which is studied in school, college or university

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CHAPTER 1

INTRODUCTION

1.1 Background

This chapter discusses a number of aspects as part of the research which includes problem statement, purpose of the study, main objectives of the study, specific objectives, research questions, significance of the study, scope of the study, limitations of the study, conceptual framework, and definition of terms. Each of the components included here address different aspects of the research to make it a whole entity. They have all worked as a unity to help in shaping the direction of the research.

Pupils are not performing to the expected standards in numeracy and later on in mathematics in most primary schools in Zambia. In the mid-1990s, the Ministry of Education recognised the severity of poor performance in mathematics and began ground work to address it. In *Educating Our Future 1996*, the Ministry of Education identified development of basic numeracy and problem solving skills as a priority target for primary mathematics education. The aim was to ensure that those who left school were able to function effectively in society while those who continued in school had adequate basis for further education (*Educating Our Future, 1996*).

Like literacy, numeracy is a crucial life skill. For many, numeracy is as important as literacy for everyday living. Numeracy is the ability to apply mathematical concepts in all areas of life. Numeracy skills involve understanding numbers, counting, solving number problems, measuring, sorting, noticing patterns, adding and subtracting numbers and so on. The main numeracy skills include, knowledge of numbers or figures, understanding relationships between numbers, interpreting mathematical information, ability to remember, visual perception of information and the ability to organise it (*MESVTEE, 2013*).

Numeracy is sometimes described as the ability to do calculations with numbers. However, it also includes awareness of the shape, length, time, and size, as well as the ability to count, to estimate and to think in number terms. These are key elements of numeracy that everyone needs in her/his personal and working life, (*MESVTEE, 2012*).

Numeracy skills are very important mathematical skills that are useful not only for children in school but for job application as well. If one wants to be a successful businessman, worker, manager, leader or student, you will definitely need at least some basic mathematical skills.

Numeracy skills are basic mathematical skills that include a range of abilities to understand and analyse numerical data to get information and to make the right decisions and conclusions. They also include the ability to express ideas and situations using numerical or mathematical information. Mathematics also is everywhere in our daily life; in purchases, banking, and homes and in transport.

To have numeracy skills does not mean to be a great mathematician. It means to have some basic mathematical skills and some analytical thinking.

A good understanding of money, data, statistics and probability is required in today's world. Mathematics lessons focus on developing a learner's numeracy skills. However, as with literacy, numeracy is not confined to one subject. Numbers, shapes, size, time, counting, estimation and calculation frequently feature in lessons relating to other subjects. So teachers should always be ready to support a learner's progress with numeracy, regardless of the subject and topic they are teaching, (MESVTEE, 2013).

Despite the important role that mathematics plays in society, as stated in this research, there has always been poor performance in the subject at grades 7, 9 and 12 national examinations. The 2014 National Assessment Report shows that the trends in national mean performance in mathematics reveals that there was generally no improvement in mathematics performance over the period between 2003 and 2014, (MESVTEE, 2014). Despite the priority placed on mathematics and a lot of interventions put in place, learner-performance has continued to be unimpressive. There is evidence about the scenario from successive National Assessment Surveys on learning achievements and the Southern and Eastern Africa Consortium for Monitoring Education Quality (SACMEQ) report. Performance in mathematics has stagnated at below the level of 40 per cent since 1999 as mean results from the National Assessment Surveys indicate.

Table 1: Performance Analysis

1999	2001	2003	2006	2008	2012	2014
34.3	35.1	38.5	38.5	39.3	38.3	35.8

Trend in mean performance in mathematics at grade 5 as can be seen from Table 1 above shows that between 1999 and 2014 has remained between 34% and 38%. Current achievement levels on average are at 38 per cent while the desired level is 70 per cent. The poor performance is also depicted in the Southern and Eastern Africa Consortium for Monitoring Education Quality (SACMEQ III) results published in 2011, where Zambia was ranked the lowest mean performance in mathematics among a group of 15 countries, (MoE, CDC-National Numeracy Framework, 2014; Examinations Council of Zambia (ECZ) Performance Review, 2014)

Table 1 above further reveals that the 2012 and 2014 Survey Reports have a downward trend in the national performance. (MESVTEE, National Assessment Report, 2014). The general performance of learners in mathematics has been poor. According to the Grade 5 (ECZ) National Assessment Survey Report of 2012, there was a drop in the national mean from the last three surveys of 2003, 2006 and 2008.

This, to some extent is an indication that probably the foundation at grades 1-4 had been poor. Hence, the need to establish the teachers' perceptions on whether integrating art and design in the teaching and learning of mathematics could improve learner performance in the subject area.

However, the problem of poor performance in mathematics is not only a challenge to the Zambian education system, but it also exists in other countries in the world. Recent research also indicates that low levels of numeracy are a long-term problem in the UK, and it is further stated that numeracy skills have got worse, not better, (<http://www.nationalnumeracy.org.uk>) . Performance in mathematics as reflected by the Kenya Certificate of Secondary Education (KCSE) has also remained poor over the years (Aduda, 2003).

Some factors contributing to poor performance among others include; understaffing, inadequate teaching and learning materials, lack of motivation and poor attitudes by both teachers and students and retrogressive practices and inappropriate teaching approaches and methods. Other factors are also at play such as the academic

qualification of teachers assigned to teach in Early Childhood Education (ECE) and lower section in schools (MESVTEE, 2014).

1.2 Statement of the Problem

Despite the priority placed on mathematics and a lot of interventions put in place, learner-performance has continued to be unimpressive. Pupils are not performing to the expected standards in numeracy and later on in mathematics in most primary schools in Zambia (MESVTEE, 2014).

The quality and effectiveness of the education system depends heavily on the quality of its teachers. Teachers are the key persons in determining success in meeting the systems' goals. However, it was not known what perceptions teachers had about the integration of art and design in the teaching and learning of mathematics. The purpose of the study was to establish teachers' perceptions on whether integrating art and design at lower primary level could help improve learner performance in mathematics (MESVTEE, 2014).

The calibre of teachers is of paramount importance. They make learners perceive mathematics as know the answer rather than strategy for solving it. Teacher-centred method and non-use of teaching/learning aids in their lessons are some of the factors, among others, contributing to poor performance in mathematics (NIF III 2011-2015)

It is assumed that if the aspects of teachers' positive perception of the elements of design, production and effective use of teaching and learning materials, and the use of appropriate teaching methods in line with the learners' age groups were well integrated and put to best use, they would help improve learner-performance in mathematics at lower primary school level.

1.3 Purpose of the Study

The purpose of the study was to establish teachers' perception on whether integrating art and design in the teaching and learning of mathematics at lower primary level could help improve learner performance in the subject area.

1.4 Objectives of the Study

The study had the following objectives;

1. To establish the teachers' perceptions on integrating art and design in the teaching and learning of mathematics.
2. To establish art-related teaching and learning materials teachers can use in mathematics lessons.
3. To explore teaching methods used by teachers during mathematics lessons that involve the use of art related learning and teaching materials.

1.6 Research Questions

The study was guided by the following questions:

1. What are the teachers' perceptions on integrating art and design in the teaching and learning of mathematics?
2. What art- related teaching and learning materials can teachers use in mathematics lessons?
3. What teaching methods do teachers use during mathematics lessons involving the use of art- related learning and teaching materials?

1.7 Significance of the Study

The study makes an important contribution to the field's understanding of the integration of art and design in the teaching and learning of mathematics. The study has brought to the fore the understanding that actually art and design is integrated in the teaching and learning of mathematics.

It is hoped that the findings of this research will not only add to the body of knowledge but also provide some stakeholders involved in the provision of education at this level with suggestions on addressing the problem of poor performance in mathematics. This would be done by establishing whether teachers perceived integrating art and design in the teaching and learning of mathematics could help improve learner performance in the subject area. Every individual needs mathematics in order to be economical and fully make good use of time, space and other material resources. From this background, there

is an indication that mathematics plays an important role in our daily life hence the need to improve pupil performance in mathematics for every individual to be numerate. The purpose of the study was to establish teachers' perceptions on whether integrating art and design at lower primary level could help improve learner performance in mathematics. This should therefore start by laying a good and solid foundation for the learners at their early stages of their school education (MESVTEE, 2012).

The study was guided by the conceptual framework given below in figure 1.

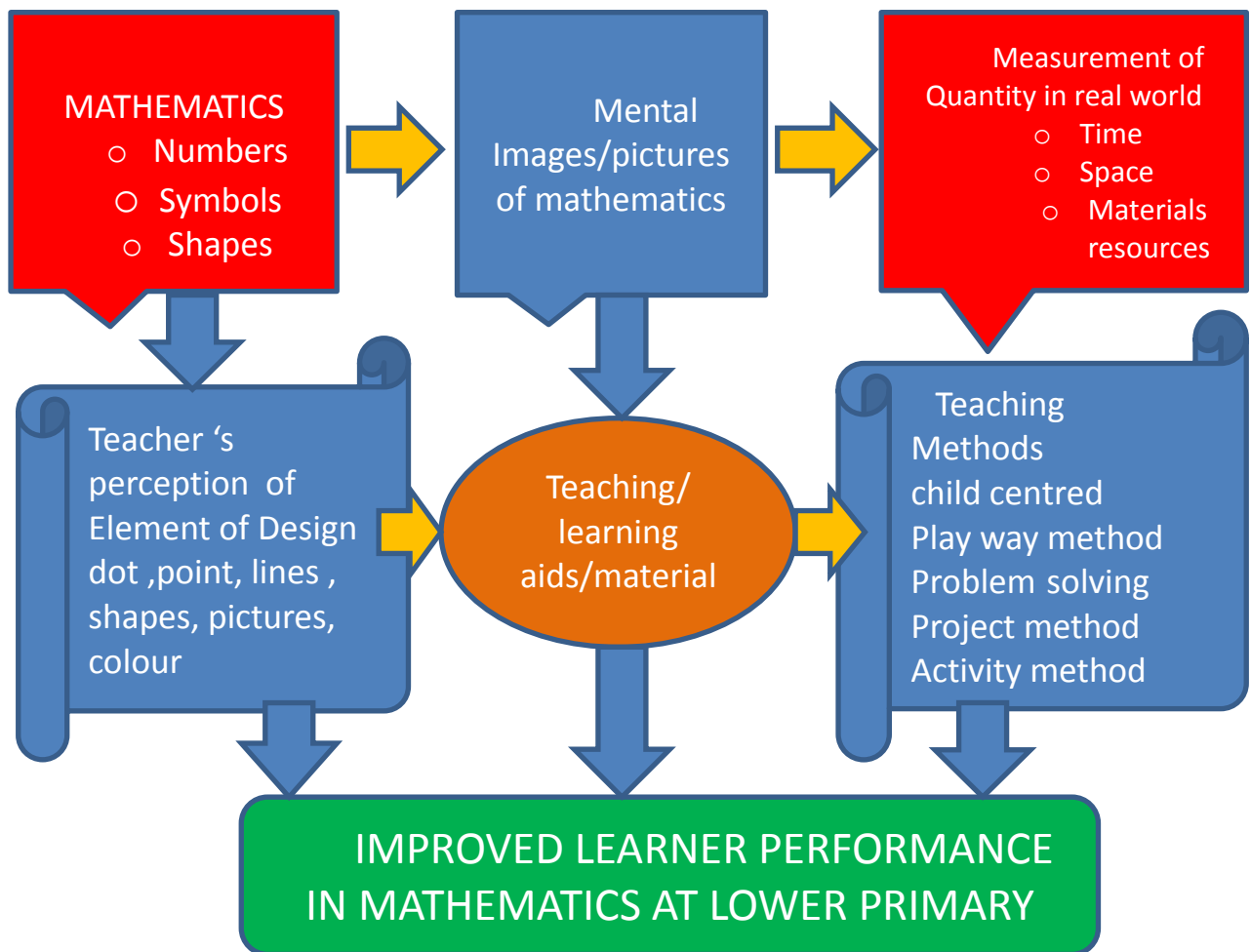


Figure 1: Conceptual Framework

Mathematics is the study of numbers, shapes and space using reason and usually a special system of symbols and rules for organising them (Walter, 2008).

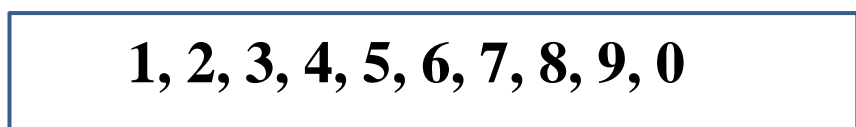


Figure 2: Numbers

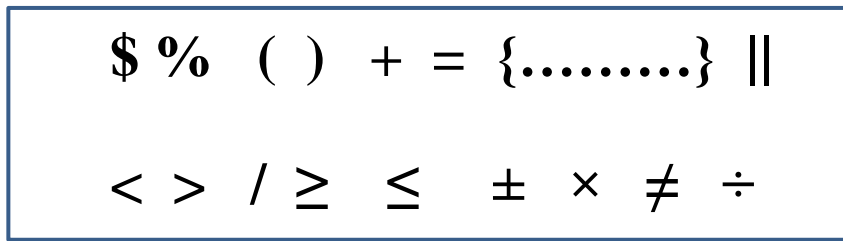


Figure 3: Symbols

Symbols in mathematics are used to work with numbers to apportioning all measures of quantity which exist in form of time, space and material distribution. Symbols form a set of the rules for organising and dealing with the world of mathematics.

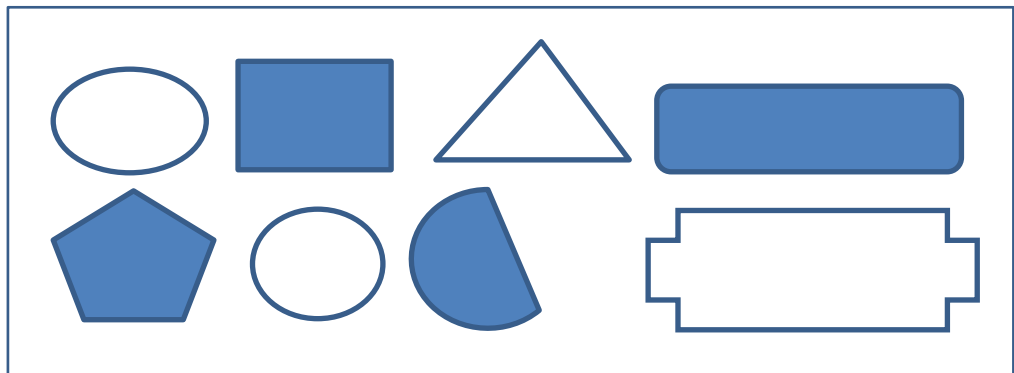


Figure 4: Shapes

Teaching and learning of mathematics involves the use of numbers, symbols and shapes which are a direct product of art and design. These concepts are well learned, mastered and internalised through visual perception when they are presented in picture form through the use of the principles and elements of art and design, namely; the dot, lines, shapes, forms and colours. Both the teacher and the learner need to master these elements and use them to interpret mathematical concepts through visual perception and graphical representation of the measure of quantity throughout the journey of numeracy skill acquisition. Shapes are also used in numeracy in fractions, measurements, sets, graphs, charts, angles, counting, icons/pictures, symbols, visual perception, association and relations (MESVTEE,2012).

1.9 Mental images

Before the mathematical symbols, shapes and numbers exist mentally, they should have been seen and presented on paper, on the chalk -board, in books or as real objects in real life. They are later transferred into pictorial or graphic presentation using art to bring the world out there closer to or in the classroom. Both the teacher and the learner need this knowledge and skill. The teacher uses the skill to demonstrate, produce symbols, shapes and numbers which are useful tools for teaching mathematics. The artistic skills help the teacher to master accuracy, consistency and correct use of elements of design in the world of mathematics. The learner is also expected to master and acquire the knowledge and the skill for correct and accurate presentation of mathematical shapes, symbols, numbers and drawings and for writing purposes for the rest of their academic journey. This knowledge and skill is vital because it helps both the teacher and the learner to interpret the world of mathematics with accuracy and confidence (Purpura, 2011).

1.9.1 Measurement of Quantity in real World

Things in the world or real life exist in quantities, Numbers are used as the measure of quantity. We cannot talk about numbers without connecting them to things around us. For learning purposes in school and as things exist in our surrounding it is not always possible to bring all the things closer to us and the classroom. It is for this reason that the use of pictures and other visual representations of the world around us become paramount as pictures act as a substitute to real objects not close to sight.



Figure 5: Pictures representing different things in numbers; Pupils' mathematics book-lower primary.

Mathematics is an abstract form of presenting measure of quantity but art works help both the learner and the teacher to figure out the idea of the measure of quantity being talked about. In essence, art connects mathematics to the real world.

Numbers represent a measure of quantity in terms of space, time and material resources. This measure of quantity is apportioned depending on the aspect that is at play. Time, is segmented into seconds, minutes and hours. Distance, is segmented into millimeters, centimeters, meters, kilometers.

1.9.2 Material Resources

Capacity and Density

Material resources are segmented into grams, kilograms, tones. Millilitres and litres. All these are forms of measure of most quantities. This apportionment is done in order to set limits and become economical in the use of *time, space and material resources* in our daily life. All individuals need numeracy skills to help them to be accountable in their use of personal and public resources. People tend to be wasteful if they do not have adequate numeracy skills in the use of *time, space material resources* in their daily lives.

1.9.3 Teachers' perception on integrating art in the teaching of mathematics.

In drawing, learners learn to identify different types of lines which include dotted, regular, irregular, vertical, horizontal diagonal, parallel, zigzag curved and spiral. Lines are one of the most important elements in the teaching of mathematics, art and design. They comprise a group of the most important elements in that all forms of writing, drawing and initial design starts with good knowledge of using lines. Lines of different types as mentioned above and are used to present mathematical concepts in a variety of ways as shapes, forms and as lines on their own (MESVTEE,2012).

These elements are components or parts which can be isolated and defined in any visual design or work of art. They are the structures of the work of art, and can carry a wide variety of messages. These elements include; the point or dot, line, shape, form, space, movement, colour and pattern. These terms describe a number of concepts that the eye/mind use to group points into meaningful images.

In shapes, learners acquire the skill of identifying different types of shapes such as regular and irregular shapes, squares, rectangles, circles and triangles. Learners could also learn through tracings geometrical shapes in their early learning stages and relate them to objects in their learning environment.

An object is another very important element in both mathematics, and art. Objects in our environment, whether man-made or natural, are said to exist in basic shapes identified and perceived through the shapes they form. Both letters and numbers are identified by different shapes. Since writing is expressed in art and design accuracy in the presentation of all forms of line expressions, it therefore becomes cardinal to early learning process of literacy and numeracy. As children learn to identify different shapes in both numeracy and art their accurate presentation and use become paramount.

Shapes are also used in numeracy in fraction, measurement, sets, graphs, charts, angles, counting, icons/pictures, symbols-visual perception, association and relations. The presentation of these elements need to be well mastered and interpreted from the early stages of the learner's academic journey if accurate and correct concept of mathematics are to be enhanced.

Figure 6 below shows how some shapes are used to interpret different mathematical concepts such as sets and fractions.

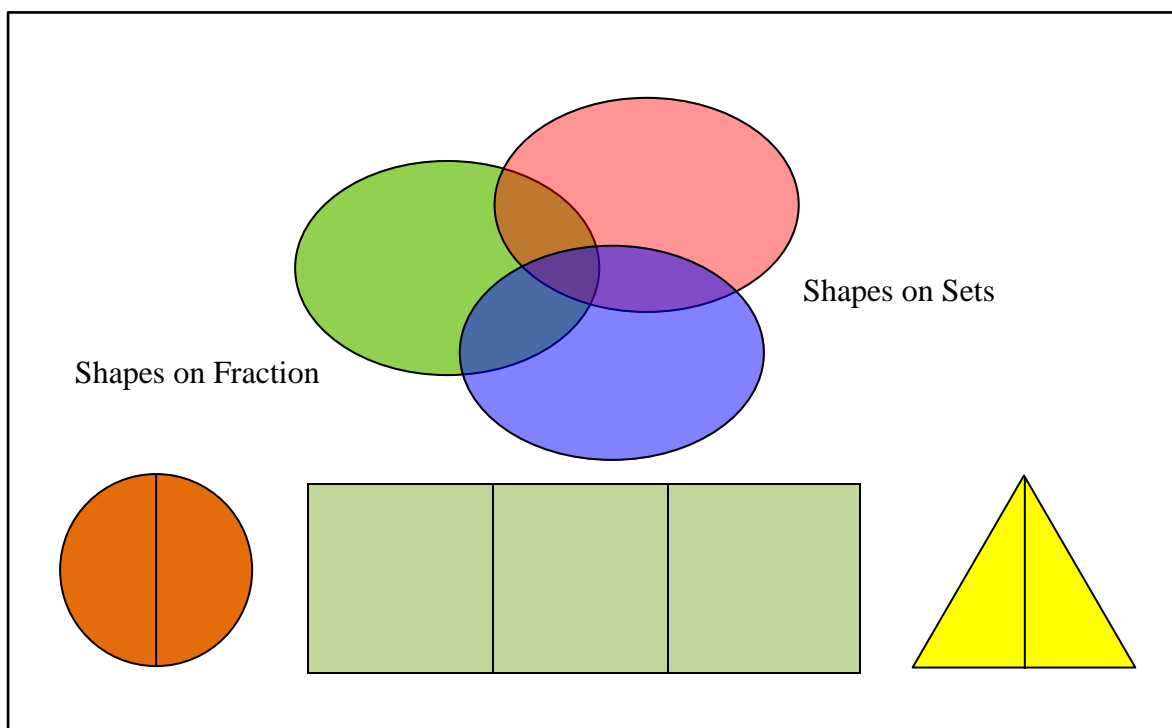


Figure 6: Shapes for teaching sets and fractions

The use of these lines, points and colour also helps to define different categories used in the representation of mathematical concepts. However, it is not just a matter of presenting the points and line, one needs to be accurate in the presentations but rather, artistic skills are also needed to do that.

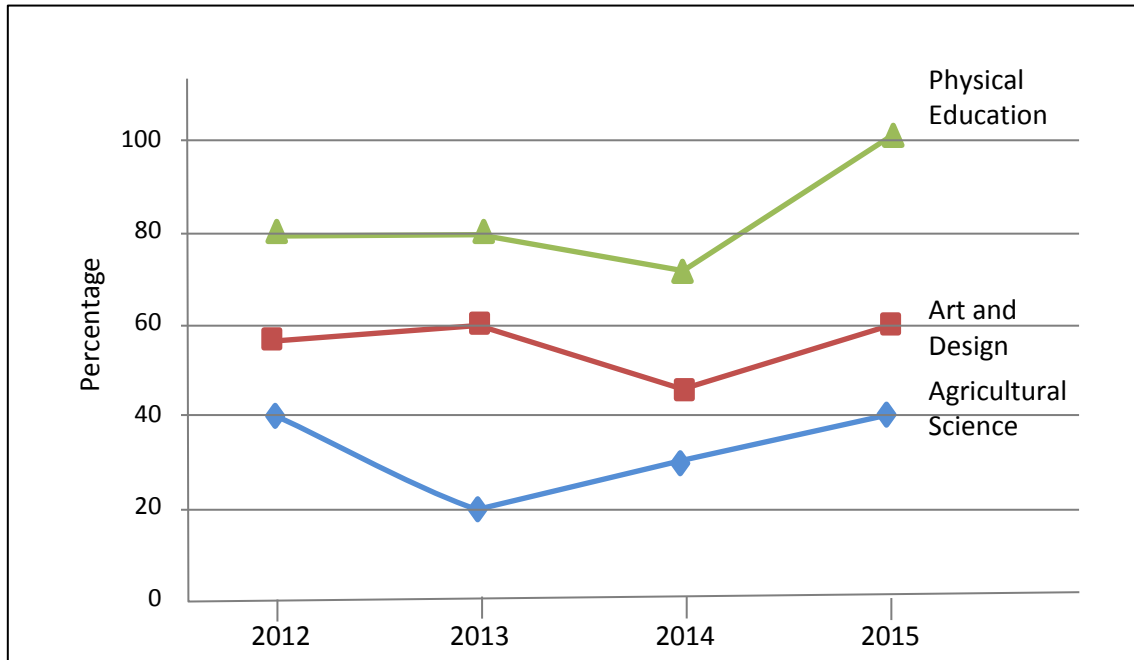


Figure 7: Performance in three Practical Subjects at Zonde Basic School

Figure 7 above represents the point and line graph. The chart here shows how lines and points form of art can be used to define quantity in mathematics. Colors were also used to define categories, representing different practical subjects. The points and lines were used to show the performance of pupils in Physical Education, Agricultural Science, Art and Design at Zonde Basic school between 2012 and 2015.

Other than lines, bars are used as part of art to work out mathematical concepts.

Figure 8 below shows how art can be used to define quantity in mathematics using a bar chart. The use of colour also helps to define different categories used in the representation of mathematical concepts. Accuracy is important in line and shape drawing if correct information is to be presented. A combination of different elements of art were used to define crop production over a period of time between 2007 and 2010 and how the performance of each crop was during that period.

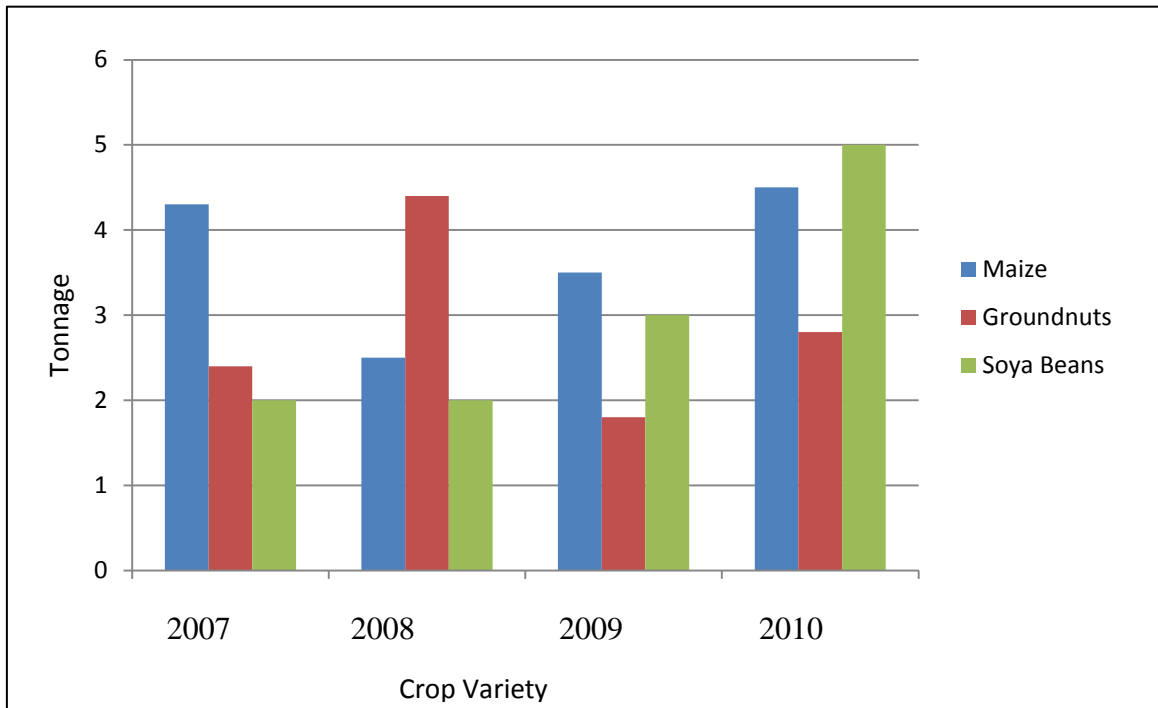


Figure 8: Crop production Unit at Bende Secondary School

Figure 9 below shows the pie chart. Here it shows how art can be used to define quantity in mathematics using different segments of the pie chart and colour to define different categories used in the representation of various mathematical concepts. The chart shows how pupils performed in 4 academic subjects in a particular academic year.

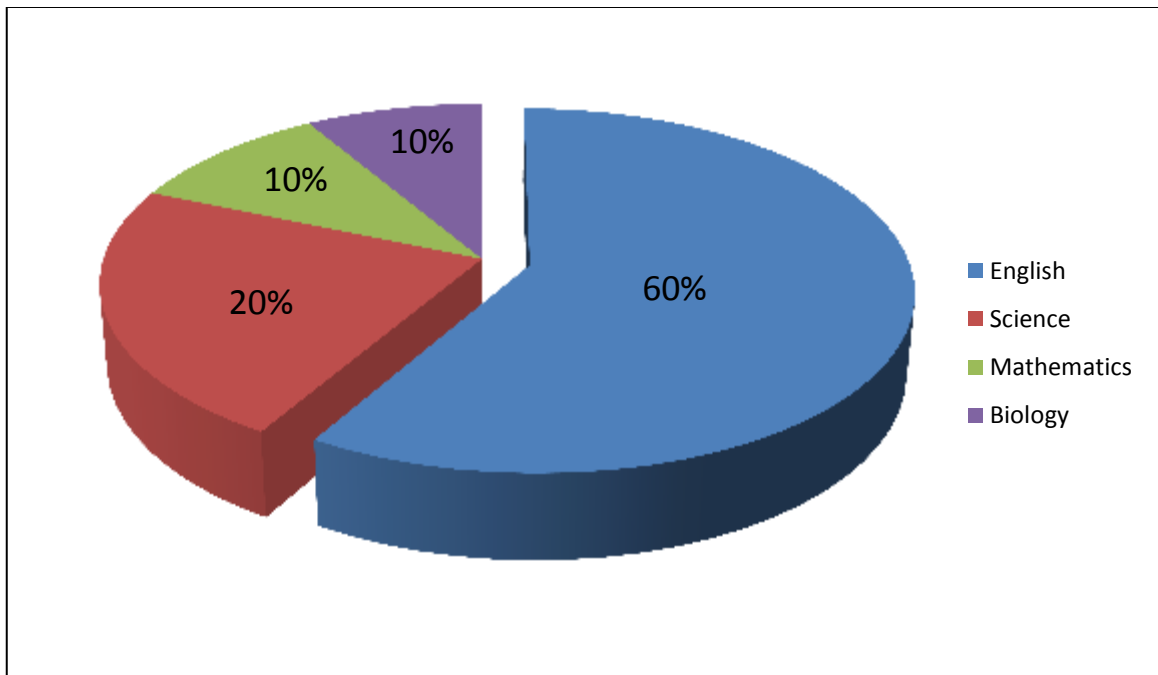


Figure 9: Pie Chart; School Results in 4 Subjects for 2014

Figure 10 below shows live stock population record at Tionge farm.

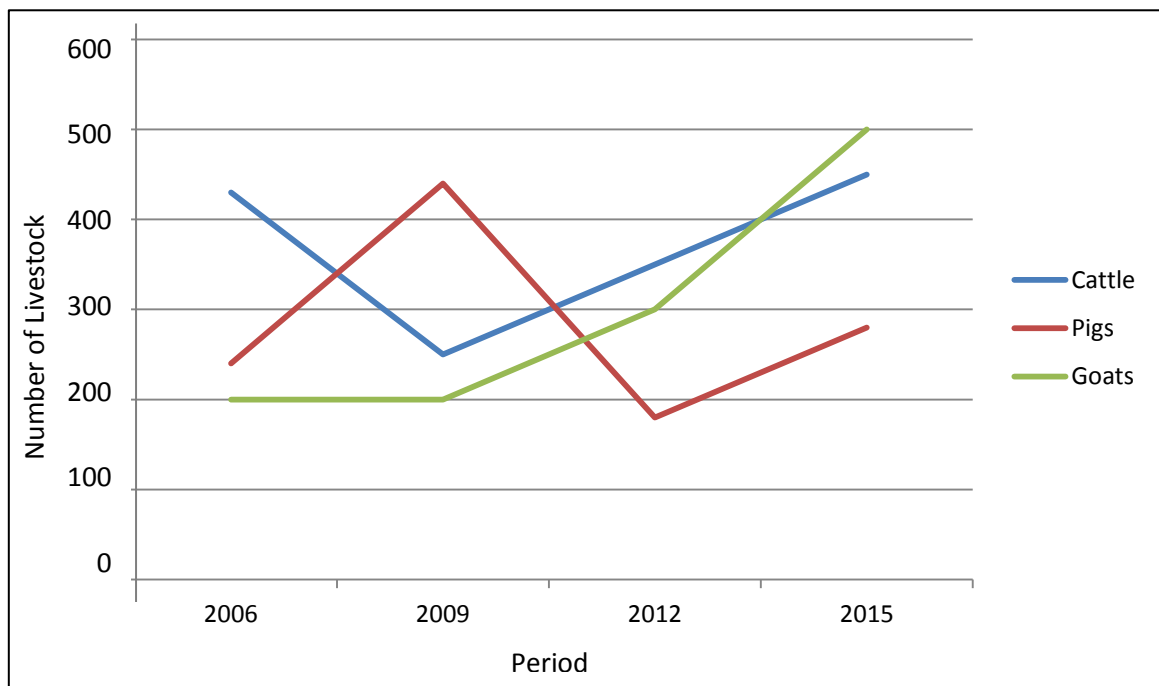


Figure 10: Line graph showing livestock production.

The figure above shows the line graph. Line movements here convey different information and the use of colour also represents different categories and also make the art work to look more attractive to the recipients of the information presented. The information given in figure 10 shows the production rate of three different live stocks at a farm for a period of 9 years. The line movements show production rate for each live stock for the period.

Figure 11 below shows how print media houses use art to show that numbers do not exist on their own but rather they represent things around us.



Figure 11: Learning and teaching using aids; Pupils mathematics book-lower primary.

Some teachers make efforts to ensure that they provide an appealing learning environment to the younger learners by making teaching aids of their own. They achieve this by applying their creative artistic skills. Figure 12 is a demonstration of the application of such skills in the production of teaching aids.

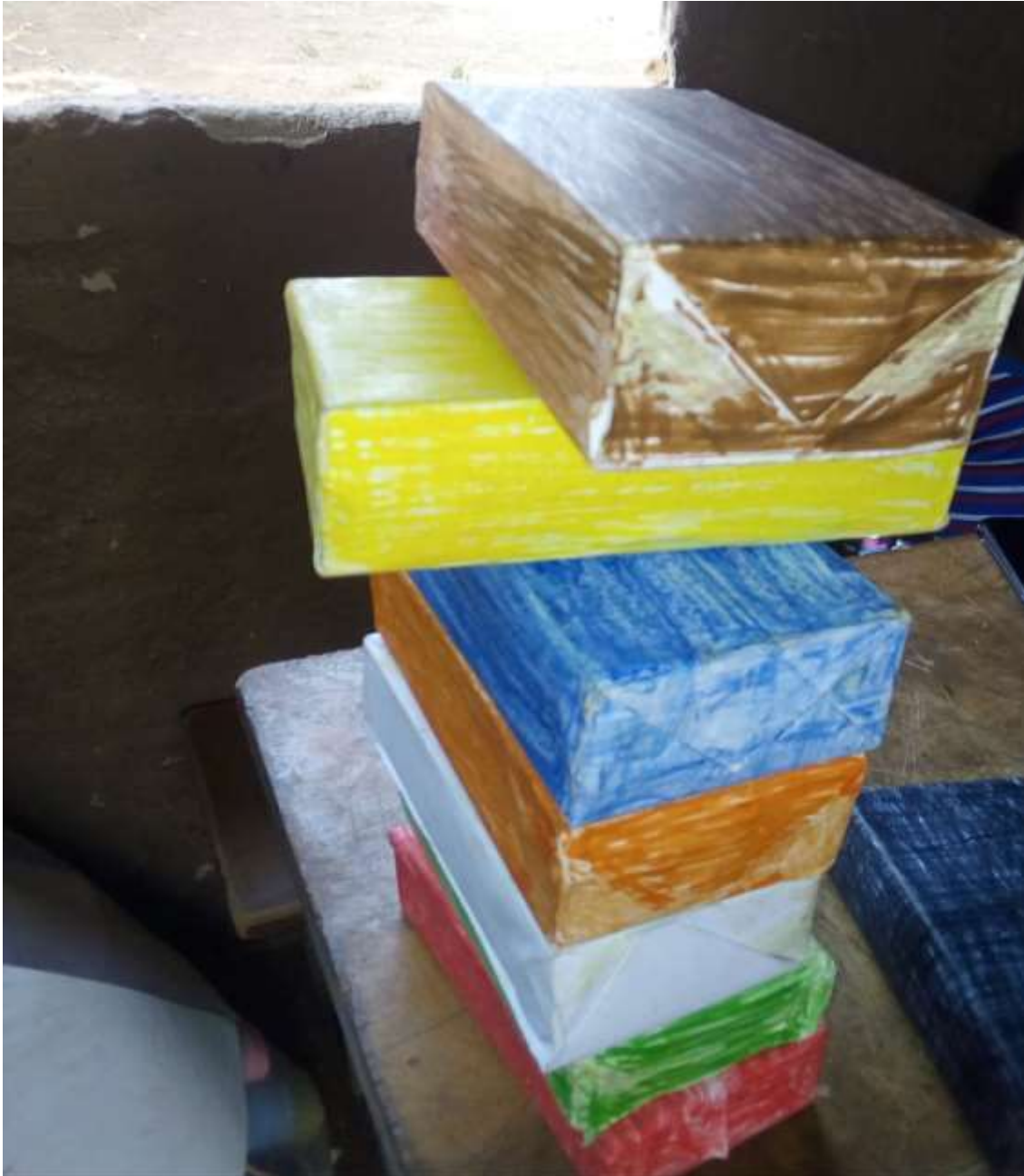


Figure 12: Learning and teaching using aids made by some teachers.

Figures 10 to 15 show some of the useful artworks that are produced by print media and those improvised by teachers using artistic skills and locally available materials from the junk. This teaching aid has both numbers and shapes that have been grouped in sets of twos. This is one way of demonstrating that counting is not always done in abstract but rather associated with a number of different pictorial or graphic representation on paper and other media. The pictures can be used to teach addition and multiplications in twos. This helps to connect mathematics to the world around us and these are useful

tools to teach the young ones. The picture in figure 13 below shows how pictures of things found in the immediate environment of the learners are connected to numbers.

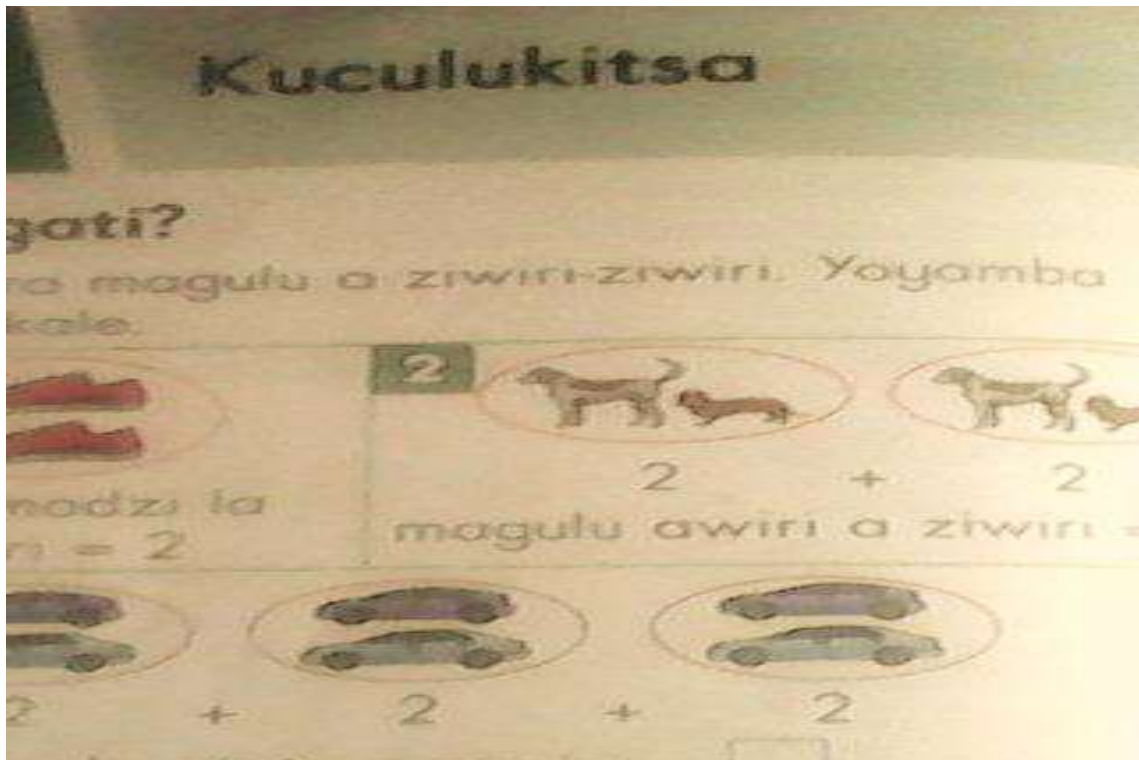


Figure 13: Pupils mathematics book-lower primary.

This is a demonstration that things in our surrounding exist in numbers and it is not always possible to bring all the things closer to us and the classroom. Art and design is for this reason used to represent the mathematical information in form of pictures and other visual representations of the world around us. Pictures act as a substitute to represent real objects around and other things not close to us. Mathematics is an abstract form of presenting measure of quantity but art-works help both the learner and the teacher to bring out the idea of measurement of quantity being talked about using symbols, pictures and shapes. Art works help connect us to mathematics and the real world.

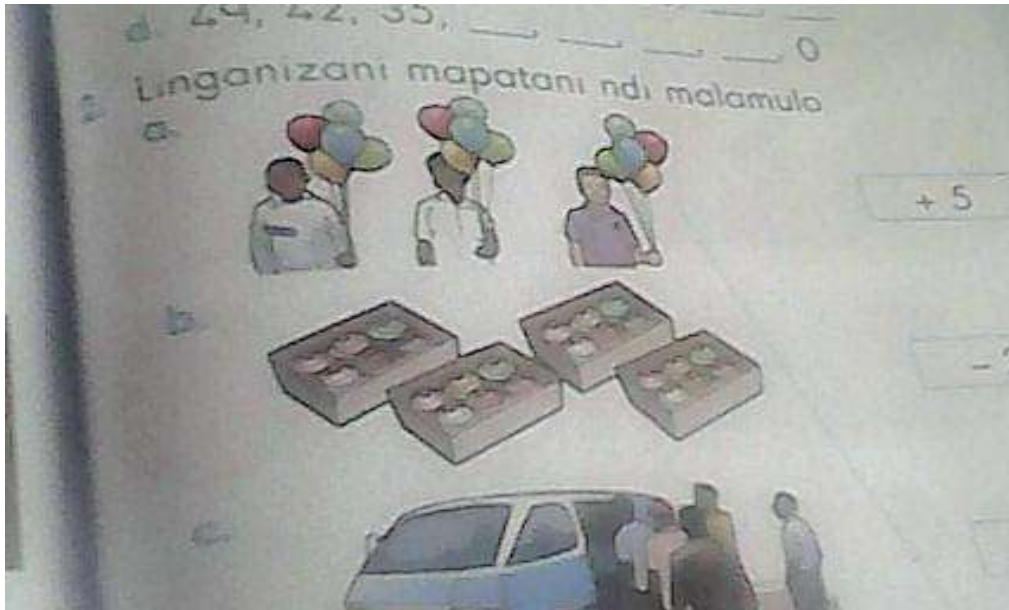


Figure 14: Pupils mathematics book-lower primary.

The pictures above show some of the useful artworks that are produced by print media that are used to teach mathematics.

Apart from the pictures found in in pupils' books, teachers could use their initiative to organise and produce teaching aids in form of wall charts and other small model objects that teachers could make on their own using artistic knowledge and skills .

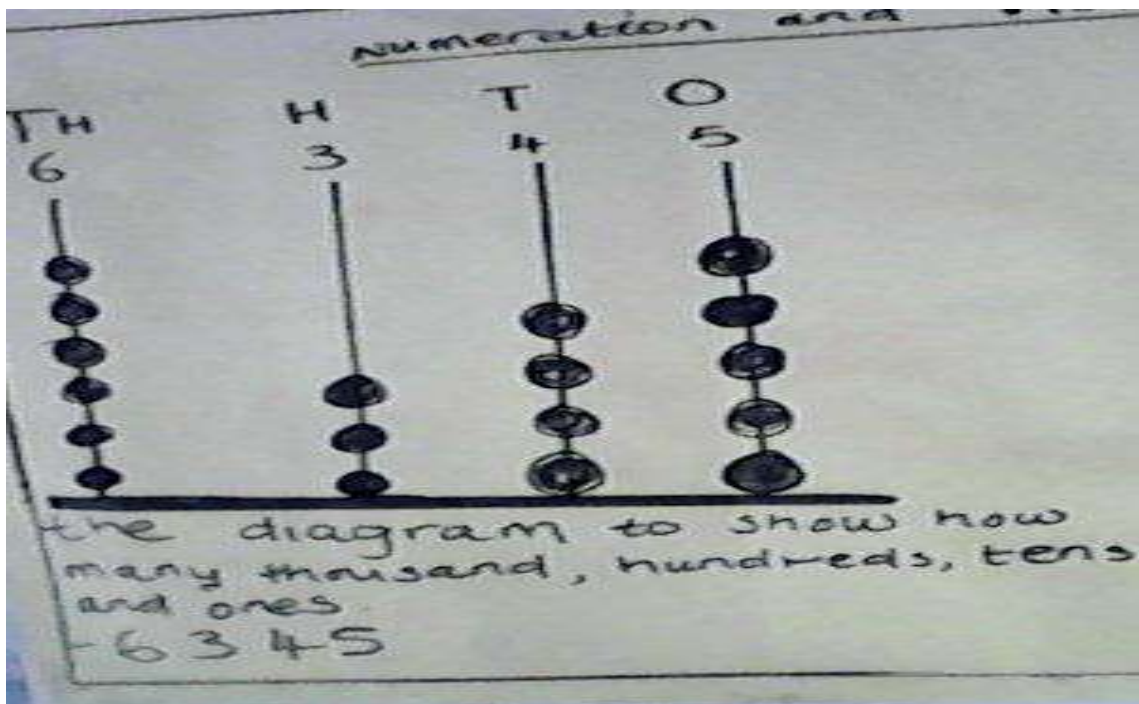


Figure 15: Teaching aid made by some teachers.

Teachers could also use their initiative to reproduce teaching aids from pupils' books to make the pictures or numbers larger and clearer to the learner. These could be in form of charts and other small models objects that teachers could make on their own using the artistic knowledge and skills.

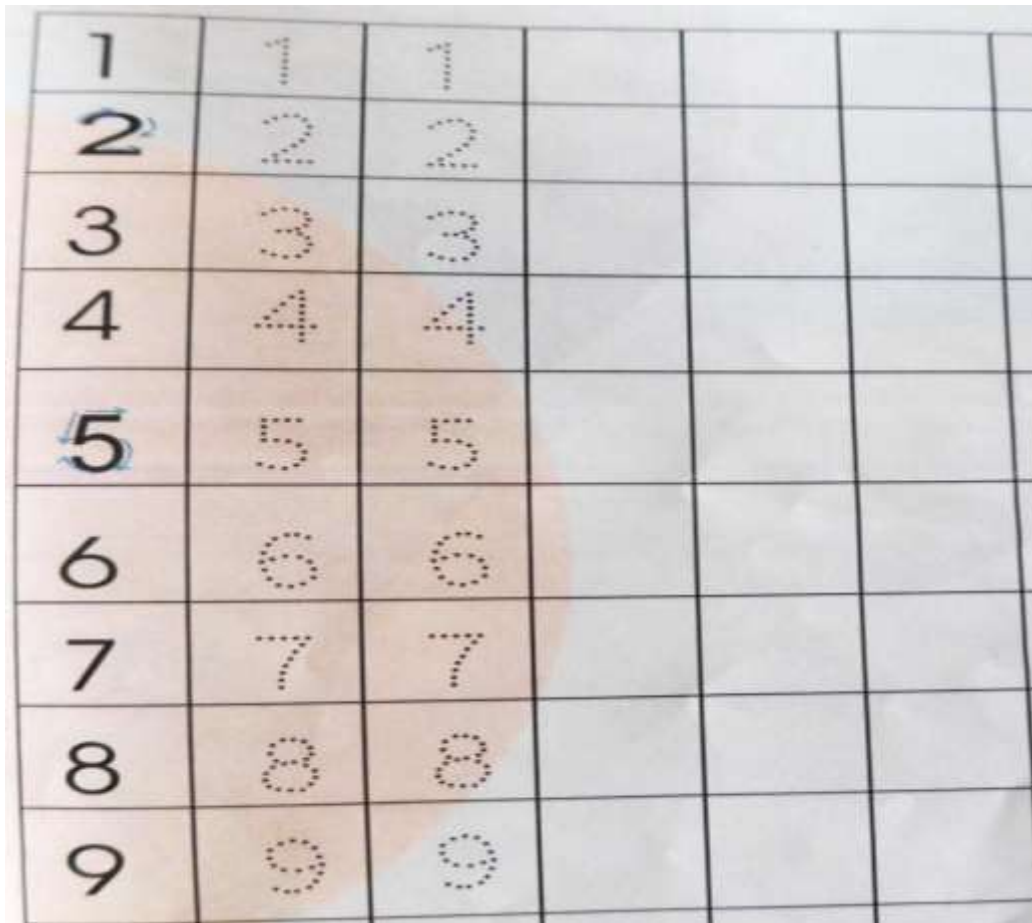


Figure 16: Numbers; Learning and teaching using aids; Pupils mathematics book- lower primary

Young learners learn to write numbers through activities such as tracing as an initial stage of number writing, and later they practice free hand drawing and writing of different shapes, numbers and symbols used in mathematics, taking into consideration the children's learning stage. Learning takes place step by step, adding to different levels of skills in line with the age group of the learners.

Teaching methods

The teaching methods to be used are dependent on the age group of the learners, the type of teaching and learning materials. Much of learning at the lower levels of

education is done through play-way. In this case the teacher should take into consideration the teaching methods suitable for age of his learners. Pupil centred, play way method, problem solving, project method and activity method are some of the recommended teaching methods as they provide the learners the opportunity to explore and manipulate the materials found in their immediate environment. Teaching of this nature would afford learners an opportunity to approach learning from concrete to abstract as opposed to the prevailing situation where most of the teaching and learning processes move from abstract to concrete. This could be one of the reasons contributing to poor performance that is manifested in learners at later grades of their education ladder. The foundation is not well set, and this seem to have negatively impacted on performance in the subject. The teacher-centred teaching method has taken the center-stage, leaving learners to take passive role in the learning process where they are supposed to become the major players in the learning process.

1.10 Ethical Consideration

1.11 Limitations of the Study

The sample was not representative enough because of a small number of ten schools, five from urban and five from rural areas were covered which was not representative enough to generalise the findings of the study conducted. The radius for the rural school visited was about 40 kilometers from Chipata town as was how far the researcher could go in terms of resources were concerned. The information presented did not include lesson observations to answer research questions 2 and 3 which could have made the study more viable but only relied on information gathered from teachers and pupils. Data analysis was not treated separately in terms of responses given by urban or rural respondents. Some respondents were hesitant to fill the questionnaires. Some respondents were hesitant to fill in the questionnaires leaving some questions unanswered. There was little literature to refer to on the topic as not much research has been done locally on the topic.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter discusses the literature that was consulted and used in this study. The first part of the material deals with the problem of poor performance in mathematics at different levels of education and evidence from different sources to show the extent of the problem. It also looks at why mathematics knowledge is important to every individual. In addition it looks at the ways in which art and design could be integrated by using good practices that could help improve learner performance in the subject where art has been effectively integrated. The literature also sheds more light on how teachers could be eclectic in the use of a variety of teaching and learning materials, learning activities and teaching methods which would promote and encourage learners to take the centre-stage and become the major players of the learning process.

2.2 The Importance of Mathematics to every Individual

Mathematics is an important tool for the development and improvement of a person's intellectual competence in logical reasoning, spatial visualisation, analysis and abstract thought. When learners have acquired some knowledge in mathematics they develop numeracy reasoning, thinking skills and problem-solving skills. Mathematics is very important not only in science and technology that is vital for the development of the country but also in everyday life and workplace. Every individual needs this skill in order that one becomes economical and fully benefits in the utilisation of time, space and other resources for the improvement of one's life and that of society at large (MESVTEE, 2012).

If one were to be a successful businessman, worker, manager, leader or student, one will definitely need at least some basic mathematical skills. As such, good foundation of learners at early levels of education in numeracy skills is very vital. If learners are not well handled at this level, correction of the situation at a later stage would not yield any good results. Effective teaching methods of mathematics by teachers should therefore be taken seriously as early as possible at lower level of children's education journey (MESVTEE,2014).

Numeracy skills involve understanding numbers, counting, solving number problems, measuring, sorting, noticing patterns, adding and subtracting numbers and so on. It is the ability to apply mathematical concepts in all areas of life. Numeracy skills are basic mathematical skills that include a range of abilities to understand and analyse numerical data to get information and to make the right conclusions and decisions. They also include the ability to express ideas and situations using numerical or mathematical information (Purpura, 2011)

Mathematics also is everywhere in our daily life – in purchases, in banking, in homes, in transport and in many other aspects of life. However, to have numeracy skills does not necessarily mean to be a great mathematician. It means to have some basic math skills and some analytical thinking (MESVTEE,2012).

Knowledge of numbers or figures, means understanding the relationships between numbers, Interpreting mathematical information, the ability to remember, visual perception of information and the ability to organize information. The main numeracy skills include: argumentation and logical thinking, calculation skills, understanding trends, language skills, scheduling skills, budgeting, measurement and statistical analysis, working with graphical information and specialized software However, this seem to be lacking in many learners and people at large (Purpura, 2011)

Every individual needs numeracy and mathematical skills to do everyday things like: to solve problems, to analyse and to interpret data to get information from basic facts, to understand patterns and make choices. Children’s everyday experiences are full of learning opportunities that lay the foundations for numeracy. Children begin to develop numeracy skills from a very early age (MESVTEE,2014).

The Ministry of General Education has taken this very seriously by ensuring that its focus is always to promote the effective teaching of numeracy from the lower level of education. The introduction of Early Childhood Education (ECE) in schools is a good example of how the Ministry values the issue of improving learner performance in mathematics from the very initial stages of education. Mathematical skills and ideas can be introduced into everyday activities such as encouraging pupils to count fingers, toes and toys, recognises numbers on objects like clocks or remote controls, decide on how many slices of apple a child wants. Numeracy skills are very important mathematics

skills that are useful not only for children in the school but also for one's daily life dealings (MESVTEE, 2012)

In addition, mathematics equips learners with vital skills to live in modern age of science and technology and enable them to contribute to the social and economic development of the country and the world at large. Mathematics plays a vital role in the development of highly skilled and technological based manpower. It also prepares and enhances the learner's prospect of employment and further education as it also plays a key role as a tool for other learning areas and subjects (Steen,2001).

Through the study of mathematics learners develop ethical values necessary for accountability in financial matters. It helps them develop the skill of interpretation of financial information. In addition it helps the learners acquire skills for planning, budgeting and effective decision making, (MESVTEE, 2012). The statements above are stressing how important mathematics is in relation to peoples' everyday life activities. It is no wonder that its role in society cannot be over emphasized. It is for this reason that society expects the education system to produce citizens who have this critical and vital skill for personal and national development (Steen,2001).

If the subject of mathematics is given this serious recognition and status, it simply means it should be everyone's concern that the subject is taken seriously by all stakeholders involved in the provision and beneficiaries of education at various levels. To work in conformity with the demand of society, the school curriculum should be designed in such a way that mathematics relates to all subjects and provide a necessary mathematical pre-requisite for further education (MESVTEE 2012)

However, teachers should not make learners perceive mathematics as know the answer but rather engage learners into practical and hands-on activities that involve the use of art and design in their lessons. Rabkin, (2004) identified non-use of teaching/learning aids, non- involvement of learners in a variety of activities in mathematics lessons and the use of teacher centred methods as some of the factors among others contributing to poor performance in mathematics.

As a result of this, results in mathematics have remained unsatisfactory in the Zambian education system as reflected by the National Assessment Reports. This is an indication that the foundation in mathematics teaching and learning at grades 1-4 has been poor.

(MESVTEE, 2014). Hence, the need to investigate whether teachers' perception on integrating art and design could be one of the interventions to enhance learner performance in mathematics.

2.3 Elements of Design

Art and design cut across all subject areas taught in the Zambian school curriculum where perceptual and manipulative skills application are concerned. Art and design provides a number of activities that help learners to develop visual and perceptual skills. They learn the skill of how things fit together, interpretation and creation of visual images. Teachers are required to use a lot of charts, graphs and maps, tables, illustrations, art and craft, pictures, shapes, images, puzzles, building blocks, number games, problem solving games and exercises and many more such activities. (REPSSI Module 4, pp 44). This is how important the knowledge and skills in art and design can benefit the learners in improving their performance in mathematics (Catterall,1999).

These elements of art and design play an important role in the teaching of mathematics from pre-mathematics and further more at various levels of education. The major components shared with mathematics from art and design include; point or dots, lines, forms, shapes, and space, movement, colour (MESVTEE, 2012: Zachary, 2015)

The above mentioned terms describe a number of concepts that the eye and mind use to group points into meaningful images. Accuracy in the presentation of all forms of line expressions is cardinal to early literacy and numeracy. As children learn to identify different shapes in both numeracy and art their accurate presentation and use becomes paramount. Shapes are also used in numeracy in fraction, measurement, sets, graphs, charts, angles, counting, icons/picture, symbols-visual perception, association, relations (MESVTEE ,2012, Catterall,1999).

This also points to the fact that teachers do not perceive these elements of design to have any bearing on the teaching of mathematics at this stage. There is little recognition of the relationship between mathematics and art. On the contrary, there is so much useful knowledge that art provides that could be used in the teaching of mathematics to make it more interesting, fun, motivating and enjoyable to learn.

This was in line with what Riley (2012) observed on the attitude teachers had on the integration of art into the teaching of mathematics. Relay (2012) stated and I quote

“While at first glance teachers feel the integration of art and mathematics would seem like trying to mix oil and water.” This above statement shows that not all teachers perceive integrating art and design could improve the teaching and learning of mathematics at the lower level of primary education. However, she argues that there were many useful ways to integrate these two subjects. Children can use lines, shapes and colours and other elements of design to enhance their understanding of mathematics. Riley (2012 here is trying to say that teachers usually feel that art and mathematics are not compatible, their existence might be said to be independent of each other. Furthermore, a closer look at art and mathematics reveals that the two subject areas share a lot that make the subjects greatly depend on each other (Ingram & Seashore, 2003).

This further suggests that teachers need to be eclectic in applying a lot of artistic skills in most of their mathematics lessons from the very initial stage and later as the pupils advance in their school education. They also needed to apply art and design concepts in areas such as visual perception, shapes, graphs, signs symbols letters, numbers enlargement of pictures, proportion, space, accuracy, critical thinking, problem-solving, creativity, innovation, improvisation, measurement and balance. Catterall,(1999) suggests that applying these principles could enhance learner performance in mathematics for the children,

According Riley (2012), some teachers did not perceive these elements of design to have any bearing on the teaching of mathematics at this stage. She says some teachers felt there was subtle relationship between mathematics and art. However, she argues that there is so much useful knowledge that art provides that could be used in the teaching of mathematics to make it more interesting, fun, motivating and enjoyable to learn. The following are some of the examples of the elements useful in the teaching of mathematics at the lower levels of education;

Colours; - Identification of colours; blue, yellow, red, white and black with the explanation of the use of these colours for various pictures. Though this component might seem to be more inclined to art and design , it is also part of mathematics syllabus, it is used to identify certain objects using their colours and used to present and explain a variety of mathematic concepts, Colour can also be used on the topic on sorting and matching. It also makes mathematical art- works in books to look attractive

and beautiful to look at. Different colours can be useful in presenting a variety in pie charts, bar graphs, sets and coloured shapes (MESVTEE (2012)

Modeling; -

Students would be helped to learn the skill of modeling different objects, shapes and imaginative objects. There are a number of ways in which mathematics and art would use this skill, such as in pottery, ceramics and in sculpture. In all these, a combination of mathematics and artistic knowledge is vital and required to carry out the work effectively. This skill could be used by both the teachers and learners in making their own teaching aids to enhance accuracy and efficiencies in using materials on their own (Erin, 2015).

2.4 Teaching and Learning Materials

There are so many ways in which mathematics can be well-defined and explained to young learners using pictures and real objects to show the pupils what the teacher means when he or she mentions those measures of quantities to them. Teaching in this way would be made to be more concrete, there would be the aspect of not only knowing something in abstract but also have the actual feel and seeing the object talked about or a picture presentation of things talked about in the lesson. This would also provide a direct link between mathematics and reality to the young learner (Rabkin, 2004).

People involved in the provision of education argue that teaching aids are important in the learning process because they create a visual and interactive experience for the learner. Learners enjoy learning when they see real objects, pictures and other forms of visual aids (Erin, 2015).

As children get older, they learn more numeracy and mathematical skills, including size and measurement – for example, when they can set the table, fill a water bottle, pack belongings to fit into a bag, divide food into equal shares compare things of different sizes; big small, medium, long, short and use money to buy things (MESVTEE, 2012)

As the learners become more engaged, they are more likely to understand content of the topic being taught as it said that in mathematics, real objects are the best visual aids for they help the learner to master skills (Riley,2012, Zachary, 2015).

A study done by STEP UP ZAMBIA PROJECT (2015) suggests that teaching and learning materials keep the teacher focused on the curriculum and motivate pupils to engage in the learning process. As a result, pupils are more likely to grasp and master concepts. Normally, these materials are given to pupils for use during lessons or they are stuck on walls and trees to convey information. The real situation on the ground is that teachers do not have enough text books in form of teachers' guide and pupils' books. Currently, the pupil-book ratios are very low. However, books should not be the only source of teaching and learning materials mathematics- activities and projects should be encouraged in this case. This information points to the fact that when people talk about teaching and learning material those involved in the production of these materials use artistic knowledge and skills,(USAID/ZAMBIA STEP UP ZAMBIA PROJECT, 2015).

The presence and use teaching aids during the lessons enhances learning in a class when the teacher is present or absent. Talking walls are in essence work of art which helps to reinforce the spoken word, conceptualise ideas, and keep the class busy with different works. Talking walls make pupils understand concepts learnt in class, both during and after class. They help motivate pupils by helping them to be interested and contribute to the lesson. This stimulates pupils' interest to learn and capture pupils' attention. Talking walls are useful in self-study after class or when the teacher is away as this can also help slow learners to catch up as they refer to the teaching and learning material on their own and this would in turn help them to catch up (Catteral,1999).

However, in order to remain effective, talking walls need to be updated, stored properly and used to enhance lessons rather than be used as substitute for teaching. Talking walls should not be a substitute for the presence of the teacher. Producing teaching aids to make talking walls helps pupils to become actively engaged in the learning process since they learn by creating their own lesson. Making use of local materials in making talking walls stimulates pupils' interest as they work with a variety of familiar objects found in their immediate environment. Talking walls could be replaced over time to match with new topics and different lessons taught. There is need to provide lockable classrooms and storage facilities for talking walls and other materials to sustain this form of teaching. Achievement in numeracy and reading is compromised by financial constraints, limited parental involvement in providing education materials that help in numeracy learning (USAID/ZAMBIA STEP UP ZAMBIA PROJECT 2015).

While it is appreciated that a lot of books on literacy and numeracy have been produced, a lot of work has also to be done in the production of objects that can be used in the teaching of numeracy. Just like publishing houses are engaged in the production of written materials, there should be deliberate consideration to engage business houses and publishing houses into the production of plastic, lighter metal, fabric, wooden objects that would enhance pupil performance in numeracy in addition to what the teachers should produce using locally available materials such as seed, wood, plastic, lighter metal such as tins, clay soil and other safe to use junk.

In the event where the schools are not provided with synthetic or manufactured teaching and learning materials, all primary teachers should be equipped with artistic skills through Continuing Professional Development (CPD) so that they become self-reliant in material production for literacy and numeracy teaching. Teachers need to have talking walls in their classrooms to enhance literacy and numeracy teaching.

Erin, (2015) argued that teaching aids assist the learning process to be effective. These aids consist of visual, audio and hands-on tools to help involve the learners and enhance their learning experience. Teaching and learning resources help to make the learning process more effective and conceptual. Teaching and learning resources help to grab the attention of learners, build interest and motivate them towards the learning process, Erin,(2015) further explains teaching aids would provide learners with a realistic approach and experience to mathematics. However, it has been observed that some learners are still relying on fingers or routine manipulative skills to solve these kinds of problems instead of using a variety of activities (MESVTEE, 2012)

In a bid to improve learner-performance in numeracy some teachers utilise their creative teaching skills to produce teaching materials aids to enable their students experience the benefits and fun of mathematical ways of thinking and to cultivate a strong sense of quantities and figures in students. At the same time, some teachers do not see the importance of using teaching and learning materials in their lessons. In numeracy classes, in the lower elementary school years, each child has his or her own mathematics set of activity which the teacher uses regularly in the course of his or her teaching.

Rather than just looking at teaching aids as tools for imparting knowledge, teachers have to develop mathematics lessons designed to create a certain type of learning environment. They need to cultivate an environment that encourages students to learn

and think on their own, and to pursue their own interests and their desire to know why and how things work. However, this aspect is lacking in many teachers. They conduct their mathematics lesson without using teaching and learning aids.

Early Childhood Learning

The first couple of years of childhood are considered to be a vital part of life for the development of numeracy and literacy. There are many components that play key roles in the development of numeracy at a young age, such as Socio-economic Status (SES), parenting, Home Learning Environment (HLE), and age (Osborn, 2010). A teacher has the obligation to understand that poor-pupil performance in mathematics emanates from a number of factors such as those mentioned above. Such knowledge is vital as this would help the teacher to use teaching methods and materials to help bridge the gap as interventions in the teaching of mathematics.

Studies done on the impact of creating a conducive learning environment by providing necessary teaching and learning materials, suggest that children who are brought up in families with high socio-economic status tend to be more engaged in developmentally - enhancing activities (Melhuish, et al, 2008).

Parents play an important role in providing the children with the objects that enhances the acquisition of numeracy skills in the home with what is also given in school by the teachers. These children are more likely to develop the necessary abilities to learn and to become more motivated to learn. More specifically, a mother's education level is considered to have an effect on the child's ability to achieve in numeracy. That is, mothers with a high level of education will tend to promote learning activities to have children succeed more in mathematics (Osborn, 2010).

Nonetheless, parents are suggested to collaborate with their children in simple learning exercises, such as reading a book, painting, drawing, and playing with numbers. On a more expressive note, the act of using complex language, being more responsive towards the child, and establishing warm interactions are recommended to parents with the confirmation of positive numeracy outcomes. When discussing beneficial parenting behaviors, a feedback loop is formed because pleased parents are more willing to interact with their child, which in essence promotes better development in the child. To

this end there must be continued collaboration between the home and the school learning activities (Osborn, 2010).

Along with parenting and Socio-economic Status, a strong home-learning environment increases the likelihood of the child being prepared for comprehending complex mathematical schooling, (Melhuish, et al, 2008).

For example, if a child is influenced by many learning activities in the household, such as puzzles, colouring books, mazes, or books with picture riddles, then they will be more prepared to face school activities. The problem of poor performance is wide spread because there are very few parents who can afford the materials listed above. The main concern in this study, is to look at ways of teaching that would benefit the majority both those who come from low income and high income background. One of the suggestions is to go the art-way where the use of artistic skills would help the teacher to have the skill of material organisation, production of teaching and learning aids and the use of effective teaching methods (Zachary, 2015).

There are a variety of instructional materials used in teaching and learning of mathematics. Teachers could choose and use different materials according to their creativity and what is available in their working environment. Examples of some of the instructional materials are as follows: Games, photo storytelling, Objects and Computers (Erin, 2015)

Whether teachers use art-related teaching and learning materials in their mathematics lessons or whatever subject or grade one teaches, the use of learning aids is superior to non-use of them. The provision of a good learning environment is what distinguishes a good teacher from a bad one. Classrooms are usually void of teaching aids. This is an indication that teachers do not use teaching aids in their mathematics lessons. The information provided here suggests a number of art-related knowledge and skills could be used in the production of teaching and learning materials by using cheap and locally available materials that are at the teachers' disposal and could be easily obtained in the pupils' and teachers' immediate working environment (MESVTEE, 2014).

Zachary, (2015) suggested that age is accounted for when discussing the development of numeracy in children. He stated that children under the age of 5 have the best opportunity to absorb basic numeracy skills. After the age of 7, achievement of basic

numeracy skills becomes less influential. For example, a study was conducted to compare the reading and mathematics abilities between children, of the ages 5 and 7, each in three different mental capacity groups, under-achieving, average, and over-achieving. The differences in the amount of knowledge retained were greater between the three different groups at age 5, than between the groups at age 7. This simply suggests that learning progresses in stages. The quality of education given during the early stage would determine the quality of the learners in later grades in their learning process. (Zachary, 2015).

This was supported by what was revealed in the (2014, CDC) document which stated that the younger one is the greater the chances one has to retain more information, like numeracy, (MESVTEE, CDC 2014). The consideration of age is an important aspect in teaching in that it would help the teacher design learning activities and use of teaching and learning materials in line with appropriate age group (<https://en.wikipedia.org/w/index.php?title=Numeracy&oldid=654529102>). It is for this reason that the focus of this study is targeted at lower grades of school education. The earlier the children learn the relation of art and design in the learning of mathematics the more benefits there would be in understanding the subject area. For mathematics, especially at a lower level, it turns abstract numeracy skills and operations into concrete experiences in a learner's mind making comprehension of such skills and operations easy and enjoyable (Steen, 2001).

Nonetheless, if homes cannot provide such an environment of learning using modern skills, it is the teacher's responsibility to make such provisions. Teachers need to use the initiative, innovations and creative skills by ensuring that such an environment is provided in the classroom for the young learners to find numeracy more interesting and funny to learn. Conducive learning environment could be created if teachers used the artistic skills effectively.

Further, the different uses of pictures can develop learners to have multiple numeracy skills such as addition, subtraction, multiplication and division, and making it easier for the learners to apply such skills into real life situations effectively.

To this end, a number of teachers of numeracy do not appreciate pictures in the teaching of numeracy and associate pictures more with subjects as languages, social sciences and as mere art work. This in turn makes learners enjoy more of these subjects with pictures

than numeracy which only has digits and symbols. However, the same digits, symbols-letters and numbers form part of essential art work. Children need to understand the proper interpretation of these before they incorporate them into mathematical concepts. Art and design could be the channel through which this can be attained (Riley,2012).

It is from this background that teachers should see the use of pictures appropriate in mathematics, as the best way of demystifying mathematics and motivating learners to enjoy doing mathematics and numeracy. This consequently, through collection, description, classification and interpretation of pictures and brain storming and what pictures to use in a lesson such as sorting in sets, teachers would enable learners to understand the outcome in a given topic.

While it is argued that numerals and symbols can communicate facts and information, pictures and photo-story telling can allow imagination, creativity and critical thinking in learners. Not only do pictures inspire learners in their learning, but this also plays a vital role in activating and building their background knowledge and increase confidence level when doing numeracy calculations (Riley,2012).

2.5 Studies done on Teaching mathematics using art

Art and design has a lot to share with mathematics. Art is a skill or special ability. It is an activity which people use to express particular ideas (Walter, 2008). In this case, the major areas where the art ideas should be expressed is in the area of mathematics teaching and learning. However, it should be noted that not all art is useful in teaching mathematics.

At first glance the integration of art and mathematics would seem like trying to mix oil and water, however there are many useful ways to integrate these two subjects. Children can use lines, shapes, colours and other elements of design to enhance their understanding of mathematics. They can also apply mathematics theory to pictures and objects. This argument is supported by Riley, (2012) who says that people usually feel that art and mathematics are not compatible and that their existence might be said to be independent of each other. However, taking a closer look at the two subjects reveals that they share a lot of important aspects that make them greatly influence and benefit each other.

Other studies also indicate that it is becoming increasingly more common and has been for years, for art teachers to integrate other subject areas into their art lessons. Even though many art teachers have actively been integrating art across the curriculum for decades, new ways to connect what they do in a relevant way to many contents is cardinal, particularly to numeracy teaching, (Ingram & Seashore, 2003).

A study of a Minneapolis and Minnesota Art integration programmes showed that the programmes had the greatest effect on disadvantaged learners. Low-performing students in these programmes consistently defied teachers' expectations as they found pathways to success through the arts that had eluded them in conventional classrooms. Many of these students went from being withdrawn or disruptive to becoming active and productive class members, (Ingram & Seashore, 2003). This statement comes in the wake of some benefits that came as a result of integrating art in the teaching of mathematics. However, this does not suggest that this is a probable solution to the low performance in mathematics.

Further, standardised test scores of students in 23 arts-integrated schools in Chicago, Illinois, most serving low-income students, rose as much as two times faster than the scores of youth in more traditional schools, (Catterall & Waldorf, 1999). Achievement in mathematics for learners was found to increase when visual representations were included as a regular component of instruction. Visual representations were found to assist students in developing a deeper understanding of mathematics and increase retention of information, (Gerlic et al, 2001). This further support the benefits yielded as a result of effective art- integration in the teaching and learning of mathematics.

Other scholars who conducted similar studies were in support that educational programmes incorporating art were associated with academic gains across the curriculum as reflected in standardised test scores, and they appeared to have a more powerful effect on the achievement of struggling students than more conventional arts education programmes do. This was in line with the research done by Rabkin & Redmond, (2004) .They also observed that over the last few decades, funding for art instruction in schools has steadily decreased because of a greater concern for academic fundamentals. This has direct link to the decision makers, school administrators and the teachers on how they perceive the support to be given to art and design in terms of fund allocation. Rather than viewing art education as separate from academics, schools

should begin combining the two for the benefit of both, (Rabkin & Redmond, 2004). The situation is not quite different in the Zambian set up. Funding has not been so good to provide much of the needed teaching and learning materials in both mathematics and art.

Integration of art into traditional subject matter of numeracy is one of the ways to improve academic achievement in under-performing schools while simultaneously making them more pleasant places to teach and learn. While not all art-integration curriculums need to look exactly, all curriculums need some form of art-integration.

Bruner, (1960) indicated that knowing is a process, not a product; and Denies,(1967) whose work specifically relates to mathematics instruction suggested that children need to build or construct their own concepts from within rather than having these concepts imposed upon them. If teachers all the time dominate the lessons they leave no room for the young learners to build and construct their own concepts using their abilities learning for learning to takes place. They instead take a passive role that in turn does foster the effective way of the learning process (Bruner, 1968, Denies,1967),

Many of the syllabuses of subjects offered at primary school level reveal that mathematical components are incorporated into all other subjects across the primary school curriculum, but of course at different levels depending on a particular subject.

It is from this point that mathematics should not be taught as a different entity but rather related to real life situation and well integrated with other subjects and not taught as stand-alone subject. Mathematics should be well integrated with other subjects. Art and mathematics are more complementary by looking at broader areas they share. Recognition of one can in turn improve the other. This further suggests that teachers need to apply a lot of artistic skills in most of their numeracy lessons for the children from the very initial stage and later as they advance in their school education. They need to apply art and design concepts in areas such as visual perception, shapes, graphs, signs symbols, letters, numbers, enlargement of pictures, proportion, space, accuracy, critical thinking, problem-solving, creativity, innovativeness, improvisation, measurement and balance. Promoting this can enhance performance in numeracy,(MESVTEE, 2012).

A quotation from a mathematics syllabus says, *“Mathematics offers learners an opportunity for creative work and moment of joy and pleasure. It is very interesting for*

students and indeed all learners when they discover ideas and insight that they would help them pursue mathematics even outside school walls. It aims at developing clear mathematical thinking expression in a learner and also develops ability to recognise problems and solve them with related mathematical knowledge and skills,” (MESVTEE, CDC.2012).

However, it should be noted that both mathematics and art subject areas aim at producing a learner who is creative, innovative, who has good experimental and manipulative skills, who is accurate in carrying out tasks, resourceful, good at decision-making, with sound judgment, has ability to solve problems and also be self-motivated, (MESVTEE,2012). If all these attributes are the core business of subject areas, in mathematics, art and design, there is greater need to make the two subjects to be well-integrated so that they fully benefit each other,(Catterall,1999).

It is from this observation that the researcher would want to find out why the performance in mathematics is still low when it is evident that art and design and mathematics are complementary subject areas in the curriculum and should be perceived as such by teachers in primary schools and beyond.

2.6 Teaching Mathematics Using Objects

Current research has established a substantial relationship between the use of manipulative material and students’ achievement in the mathematics classroom. According Enrin,(2015) he argued that this was lacking in most mathematics lessons. He said most teachers taught using expository methods and in this way, the acquisition of manipulative skills in children is hampered. He further argued gives that children at this level enjoy manipulating the objects found in their immediate environment and they learn through the use of shapes, images, puzzles, building blocks, number games, problem-solving games (Riley,2012,; Erin, 2015).

This argument to point to the fact that physical facilities could contribute positively to students’ academic performance. If well-chosen and well used, teaching and learning materials could provide the needed physical facilities that would enhance the teaching and learning of mathematics at this level of education. Learning theorists have suggested for some time that children’s concepts evoke through direct interaction with the environment and the materials provide a vehicle through which this can happen.

This message has been conveyed in a number of ways. Piaget (1971) suggested that concepts were formed by children through a reconstruction of reality, not through an imitation of it; (Ruthus,1988). This also confirms the argument stated above that a teacher needs to provide a variety of situations in order to make teaching and learning more appealing to the children.

Ruthus,(1988), reasoned that teaching with objects was an excellent means to enhance learner's sensory literacy, allowing them to develop the ability to compile evidence through sight, touch, hearing, smell, and even taste, and to analyse and articulate that evidence. This suggests that teachers need to be resourceful, innovative and creative in sourcing these objects for classroom use during mathematics lessons.

Mathematical activities' means a range of activities where learners freely and with determination engage in to learning basic numeracy and mathematical concepts, and skills. They include both physical and non-physical activities. Physical mathematical activities are hands-on activities or activities dealing with concrete objects (Riley, 2012).

Non-physical mathematical activities are those that involve learners thinking about mathematical problems, exploring ways to apply mathematical knowledge, and explaining and representing mathematical thinking, (MESVTEE,2014). These hands – on activities are usually artistic in nature that teachers need to be familiar with and use them to make their teaching of the subject more appealing and beneficial to the young learners. These are manipulative and processing skills that learners gain in the lesson through subjective learning as they conduct activities accurately. This is done by giving learners problems which appeal to their investigative and problem-solving skills as prescribed in the curriculum (Erin, 2015, Rabkin,2004)

Physical facilities contribute positively to students' academic performance. Well-chosen and used teaching and learning materials provide the needed physical facilities that would enhance the teaching of mathematics.

Studies conducted on art integration indicated that classrooms were void of objects that stimulate interest in learners especially at lower primary level where much of learning is done through play. Studies have shown that play is one of the main ways that a child learns about the world and how things are connected with others. It is therefore

important to bring this into the classroom to provide learners with real life situation in and outside the school environment, (REPSSI, 2013). Further, Erin, (2015) suggests that Play becomes meaningful if learners are availed with a rich environment with a variety of playing objects for hands-on classroom activities (Erin, 2015).

As an addition to other forms of classroom materials, teaching with objects offers a direct, tactile experience for learners. Educational research over the past fifty years has clearly established that hands-on learning is a rewarding, essential experience for all learners. In addition, some children respond more readily to objects than they do to other, more abstract teaching materials (Erin , 2015).

Teaching using objects can help those children achieve better understanding of topics presented, perhaps eve offering them a leadership role among their peers. It is also a powerful way to facilitate concept learning, the skill of classification which helps children develop high levels of reasoning and assessment abilities. The literature further tries to shed more light on the many benefits that could be yielded if the classroom could be made more captivating with the provision and use of assorted useful and relevant objects during mathematics lessons (Catterall,1999).

Ruthus, (1988) also confirms the argument stated above that a teacher needs to provide a variety of situations in order to make the learning more appealing to the children. Mathematical activities mean a range of activities where learners freely and with determination engage in learning basic numeracy and mathematical concepts and skills. He further suggested that learners need to be exposed to physical mathematical activities or hands-on activities dealing with concrete objects. These include both physical and non-physical activities. Non-physical mathematical activities are those that involve learners thinking about mathematical problems, exploring ways to apply mathematical knowledge, and explaining and representing mathematical thinking. (MESVTEE, 2014).

In addition Ruthus,(1988) further argued that physical facilities contribute positively to students' academic performance. Well-chosen and used teaching and learning materials provide the needed physical facilities that would enhance the teaching of mathematics. He further suggests that these hands-on activities are usually artistic in nature that teachers need to be familiar with, and use them to make their teaching of the subject more appealing and beneficial to the young learners. He says this is done by giving

learners problems which appeal to their investigative and problem solving skills as prescribed in the curriculum (Ruthus, 1988).

Studies done by Rabkin, et al (2004) have shown that teaching with objects is an excellent means to enhance learner's sensory literacy, allowing them to develop the ability to compile evidence through sight, touch, hearing, smell, and even taste, and to analyse and articulate that evidence. The literature further suggests that the teachers need to be resourceful, innovative and creative in sourcing these objects for classroom use. Lessons incorporating objects are effectively carried out in small groups, allowing students to work cooperatively, share their learning with companions, and pool their knowledge together. Group work also allows learners to test their ideas in the relative security of a small number of peers before sharing insights with the class as a whole (Erin, 2015, Rabkin,2004).

Most importantly, it is argued that teaching with objects arouses curiosity, and thus is an ideal forum for encouraging learners to develop their own questions about the items they are exploring, and to learn to develop strategies for answering those questions. (MoE, 2000).

Teachers need to be made to appreciate and realise that art and design is one of the subject areas that could help the teacher to be resourceful, innovative and creative by directly involving themselves in the organisation and production of meaningful teaching and learning materials using locally available materials. This would in turn add variety and value to the teaching and learning process. It is at this point that teachers should appreciate the need to acquire artistic skills that are useful in teaching, in order for them to produce and use teaching and learning materials that should be appropriate and meaningful to the level of the learners of a particular age group (MoE, 2000).

From the onset of the provision of early education, numeracy and literacy skills are enhanced through art as young learners get engaged in art- mathematics related projects and activities. The acquisition of mathematics skills follows a developmental sequence. Children learn the structure of mathematics before they can use and understand its vocabulary and symbols Children learn about the basic structures of mathematics by seeing the relationship between things by matching things that are the same or equal is a basic mathematics concepts. Sort and categorize are important early mathematics skills (Purpura, 2011).

One of the specific aims related to numeracy at the lower primary school has been to ensure that learners acquire essential literacy, numeracy and communication skills. The grades 5 to 7 competencies have been provided as a direct reminder of what happens before grade 4 so that from the start, the teacher understands that poor performance at grade 4 and grade levels of early childhood below eventually result in poor performance at grades 5 and 7 levels and beyond. It therefore calls for the early child education teachers up to grade 4 to clearly understand the great responsibility they have in the improvement of performance in numeracy among learners (MESVTEE, 2014; Purpura, 2011).

Language skills and numeracy skills go hand in hand. Talking with children about mathematics concepts in everyday activities will help them understand how and why mathematics is useful in their lives. For example, the following can be points for discussion: big and small (size), high and low (height), heavy and light (weight), fast and slow (speed) , close and far (distance) ,many and few (amount), first, second and last (ordinal) do not only enhance literacy skill acquisition but also mathematics, (Bullock&James,1994; Purpura, 2011).

It is further suggested that everyday activities can be useful in learning of numeracy. Children could also learn numeracy when they are involved in activities in their everyday life so that they see the connection between school and their home environment which teachers tend to ignore in the teaching and learning process of the young ones. For example, count toys, mangoes in the tree, fruit at the grocery store or trees on the street utensils in the home and furniture are things that children encounter every day (Melhuish et al, 2008).

Erin,(2015) argued that the use of objects encourage children to compare sizes of stones, bushes and trees, and describe shapes of leaves, colours of flowers or sizes of birds. Sometimes teachers need to take a walk and point out how each house or block has a number in a series. They could also count the steps between one house and the next. Therefore, any form of teaching that involves mathematics should relate directly to the objects found in the immediate environment of all learners (MESVTEE,2014).

However, this activity is not common in most schools as there is less use of objects during mathematics lessons. Even the use of shape-sorting or cutting out different shapes from paper using different colours which are simple activities for the children

are rarely used in their mathematics lessons. Talking with children about shapes by counting the sides, describing colours and looking for other objects that are of the same shape would be some ways of providing variety in the lesson (Rabkin, 2004).

Buying and selling situational activities could be arranged where children could be exposed to real commodities and money so that they have a feel of the real situation. Such activities would help children learn to count, measure, add and estimate, (MESVTEE, 2014). This literature cited a number of benefits that the use of objects may bring in the classroom which would enhance the learning process that would benefit the learner if well implemented. The study makes an important contribution to the field's understanding of the integration of art and design in the teaching and learning of mathematics. The study has brought to the fore the understanding that actually art and design is integrated in the teaching and learning of mathematics

2.7 Learning Mathematics through Games

There are several educationally useful ways of incorporating games into mathematics lessons. Games can be used as lesson or topic starters that introduce a concept that will then be dealt with in other types of activities. Some games can be used to explore mathematical ideas or develop mathematical skills and processes and therefore be a main component of a lesson, (Gough, 1999). The most common use of games is for practice and consolidation of concepts and skills that have already been taught. Games can be used as the basis for mathematical investigation. Playing an opposite game invites children to physically explore the mathematical comparison of high and low, fast and slow, up and down and big and little. For example, draught, chess, snakes and ladders and dice are the types of game that use colour differences of materials such as marked boards for draught, and objects as required by a particular type of the game.

Teachers' and pupils' books, the syllabi and Mathematics Framework, (2014) contain a variety of games and activities which directly relate to mathematics. When considering the use of games for teaching mathematics, educators distinguish between an activity and a game. Gough, (1999) states that a game needs to have two or more players, who take turns, each competing to achieve a winning situation of some kind, each able to exercise some choice about how to move at any time through playing. This could be one way that would make children learn through meaningful play activities.

Studies have further shown that songs and reading books that have numbers in them that use repeat, rhyme and have rhythm would help children understand about patterns. Trying simple board games, card games and puzzles with shapes and numbers, like ‘snap’, matching pairs also help young learner to grasp mathematics concepts easily. Playing outside games also help them to understand numbers. Football could be such an outside game. It requires a limited number of players, time limit, limited space on which the game is played limited size of goal posts, colour of the attire for each team and limited number of people to officiate (MESVTEE, 2014).

From this stand point, the question is whether teachers really perceive integration of art and design in the teaching and learning of mathematics as a vehicle that could help enrich classrooms with useful teaching and learning materials and enhance learner performance.

2.8 Photo -story in Mathematics

Photographs speak thousands of words, and can initiate a variety of associations such as learners can discuss and reflect on pictures as well, and they can also learn about people they have never heard of, places they have never been to, or names of objects they could not identify. In addition, pictures in photos story- telling bring out events, awareness to situations that were not known such as emotions, attitudes, values and feelings about people making link between mathematical thought and real life situations in learners. Rabkin & Redmond, 2004; MESTVEE, 2014).

Much of what is being explained in this study is partly the form of teaching and learning that is in place. The question is “To what extent do teachers recognize that these pictures in books are not mere works of art and design but rather are an integral part in the teaching of mathematics? “

Using photo-story telling, the teacher can grab the learners’ attention as well as to motivate them before shifting to the actual numeracy lesson.

Through creative photo- story telling in a fun way is believed that learners including low achievers and those who are reluctant to learn can be motivated, and their numeracy abilities can be developed. For example through collection, description, classification and interpretation of photos and brain-storming what photos to use in a lesson such as

sorting in sets, learners will be able to understand the outcome in a given topic (Rabkin & Redmond, 2004).

It is argued that while numbers and symbols can communicate facts information, photo story telling can allow imagination, creative and critical thinking in learners. Not only does photo-story telling inspire learners in their learning, but it plays a vital role in activating and building their background knowledge and increase confidence level. Photo story telling brings out events, truth and light in learners. They also bring out awareness to situations that were not known such as emotions, attitudes, values and feelings about people (MESTVEE, 2014).

The literature in this area sheds more light on how important it is for a teacher to use pictures to enhance teaching. Pictures are a direct form in which art is used in the teaching of mathematics. However, this does not imply that all forms of pictures are beneficial in the teaching of mathematics. A teacher needs to be careful on the type of photo-stories to use They need to be relevant, simple, appropriate to the age group and the topic of study. If no careful consideration on the choice of the stories is taken this might even mislead the learners and waste much of the useful learning time (Rabkin & Redmond, 2004).

2.9 Teaching Methods

A modern school is an activity school which emphasises the creative aspect of experience. Children's everyday experiences are full of learning opportunities that lay the foundations for mathematics that a teacher should be aware of, and make good use of it.

It is of course recognised these days that directed activities give reality to learning and effective teaching uses all available resources. Activities are meant to provide varied experiences to the pupil to facilitate the acquisition of knowledge, experience, skills and attitudes. An activity is anything which is carried out with a purpose in a social environment involving physical and mental action. Such activities help in the establishment of stimulating environment for creative expressions (MESVTEE, 2014).

Kochar,(1985) suggests that there is evidence on the idea that children enjoy wholesome living in stimulating environment where desirable attitudes, interests, and skills are formed and thrive. The child builds self-confidence and develops understanding

through work and play. Play is said to be the language of the child and affords children a safer release of physical and mental energy which ultimately relieves emotional tension. Kochar,(1985) further argues that play-way method can be utilized in the teaching of various subjects of the school curriculum to make them lively and interesting. The method can be utilised for teaching languages in a number of ways such as dramatization, play, debates, discussion, speeches, spelling, games, story games. This is also vital in that all forms of learning process take place through the use of language,

This would in addition help teachers provide an environment for mathematics teaching to be more of practical than theory work. Teaching and learning process should be made more concrete than abstract in nature.

However, in early grades, it appears that learners know their mathematics, but there is usually a sharp decline in performance from grade 1 to grade 2. According to Curriculum Frame work (2014) it was suggests that learners do not usually know the Level 1 facts with understanding. This probably could be one of the factors attributed to the mathematical pedagogical challenges children encounter in this subject area. Learners need to start applying the basic facts of mathematics with fluency, flexibility, and understanding to perform more complex tasks as early as possible before they advance to the next levels of education (MESVTEE, 2014).

According to Aduda's, (2003) findings, teachers use lecture method, discussions, question and answer methods. Castello, (1991) contends that the lecture method is ineffective in that it turns the learners into passive participants in the learning process. They resort into memorisation of facts, rules, and procedures rather than applying them in solving their own problems as they perceive the world around them, (Aduda, 2003). This argument suggests that the teaching methods mentioned are not very effective especially if they are applied to the young learner who want to explore and discover the world around them through play and direct engagement with the physical environment. As such, engagement of children into meaningful play activities would yield a lot of benefit in the learning and teaching of mathematics. For this reason it calls for teachers to reflect on the teaching methods and approaches used whether they are appropriate in the teaching of mathematics and encourage learner-centred approach where learners make full use of their learning environment.

Kochar, (1995) argued that play way method can be used in teaching mathematics for teaching numbers, and tables, a number of games can be used. Counting can be done with the help of beads, sticks, grains, seeds, bottle-tops, and stones. Play-way is the best way of learning. Whereas the adult learns through concentration of mind on essentials choosing merely those which are useful, rejecting the rest as undesirable because they want the shortest cut to success. Children learn in the nature's way, with all the sense fully active and eager, receiving perpetual streams of ideas which come from the heart of nature, gathering facts and knowledge by such scattering of mental energy through unexpected surprises with their alert attention from nature and life, (Kochar,1985). This is an important aspect that teachers need to take into consideration and not sticking to lecture methods only in order for them to cover more work at the expense of pupils natural way of learning.

Kochar, (1985) further argued that play is a wonderful motivator and provides training in self- discipline and self-advancement. Harmony of work and play keep the child fully absorbed in work. Play is the way of learning which provides an environment that is artistic in nature and which can be motivating to the young learners. The environment is made captivating to arouse curiosity in the young learners. This is one of the factors that teachers need to realise that art and design is one of those subjects that can help in creating such an enabling environment to enhance pupil performance in mathematics. The absence of play activities deprive the energetic young learners the platform where they can exhaust their energy and hinders them from effective early acquisition of useful and beneficial mathematics knowledge and learning skills (Kochar,1985).

There must be no point of separation that should make mathematics more difficult and art more interesting to learners while on the other hand they share many important principles.

However, a lot has to be done at the Early Childhood Education (ECE) and primary level because this is where good ground work has to be done. A good foundation is a basis for success in the whole of the learning process if the improvement of numeracy teaching and learning is to be achieved.

Much of learning at this level should be done through the works of art and design. Young learners make scribbles that gradually turn into meaningful and usable lines,

shape, forms, symbols, signs, charts and all sorts of pictures as aids to effective teaching and learning (MESVTEE, 2012),

Basic numeracy skills mainly involve the application of key mathematical concepts and sense operation, computation, measurement, geometry, probability and statistics. The subject is essential in many everyday aspects such as in the process of buying and selling and in the financial management (MESVTEE, 2014).

Instructional activities will vary according to the age group of the pupils. In elementary school, at kindergarten stage, activities like singing, dramatising, listening, observing, planning, collecting, talking, experimenting and constructing are useful in shaping in a learner. In some stages of a learner a variety of activities expand as children progress in the elementary programme. This may later include painting, drawing, designing, wood-carving, writing, composing, dancing, interviewing, acting, reading, map-making and graph-making, field trips, gardening and camping (Erin, 2015, MESVTEE, 2014).

It is not always necessary that an activity should only be motor or manipulative, it can also be mental. Grades 1-4 and Early Childhood Education (ECE) provide play activities as learning at this stage is enhanced through play, (Kochar, 1985). A teacher should use teaching methods that involve the use of art-related learning and teaching materials which are age-appropriate. Most teachers use teacher-centred methods or lectures to deliver their lessons. The age group used in the study was between 6 to 12 years. At this age, learning is done through the provision of a learning environment that provides a variety of activities. Teaching aids are used especially in primary education. They create an environment that is stimulating and conducive. Pupils are easily guided through discovery of knowledge on their own. It facilitates effective teaching and learning process (MoE, 2000).

The information discussed here provides a broader sense of knowledge which suggests that there are a lot of things that come to play if teachers are to make teaching and learning meaningful and effective as they try to lay a good foundation of the learners on their path to the world of mathematics later in life. If the path was made smooth and easy from the onset as suggested in the ideas above, then effective learning would be enhanced through such provision.

Kochar, (1995) stated that children are workers as such they are deeply interested and penetrating observers of many types of work. They watch work processes in the home and in the community with high degree of inquiring attention. Many of their worthwhile observations of work will find creative expression through talk, dramatic play, action on the playing field and in the learning laboratory. Hence the need to make their learning environment more interesting, fun and captivating,.

MoE,(2000) was supported by what Kochar (1995) stated that teaching of numeracy should not only be done in abstract, the provision of objects into the classroom will make it concrete and make learning more interesting. In addition learners must be exposed to more practical work in numeracy in order that they see the connection of the knowledge they acquire to real life situations This may become possible by integrating numeracy with art and design in the primary school curriculum to make the subject become more friendly by trying to make it joyful and fun for them and to pursue their own interests. Teachers need to cultivate an environment that encourages pupils to learn and think on their own, and to pursue their own interests.

All these different suggestions outlined in this study points to the fact that reliance on limited and same teaching methods are a hindrance to an effective learning process. Variety in the use of teaching aids, learning activities and teaching methods would be very essential if mathematics is to be made an easy and friendly subject right from the beginning. This further suggests that this could be a contributing factor for making mathematics a difficulty and disliked subject because teachers feel learners could understand the subject through verbal form of instruction.

However, these suggestions cannot go alone without the inclusion of visual perception and manipulative activities which involve the use of objects to work with and other reference learning materials such as charts, drawings which are portable and easy to carry- into classrooms. The teaching approaches for numeracy should therefore be those which promote subjective learning. Teachers should not perceive the production of creative teaching materials as burdensome but rather as the means to foster learning in numeracy and an intervention that can help yield desired results. MESVTEE,2014).

Another form of teaching method that has come in place in recent years is subjective learning. Fundamental aspect of subjective learning include the problem solving,

motivation, interest, Knowledge acquisition pursued through mathematics activities such as games (MESVTEE,2014)

In implementing the lesson for subjective learning, the teacher should present situations and problems which provoke critical thinking in the learner. The situation selected should be within the learner's social context. However, this social context does not exist in a vacuum. It is made up of physical facilities, comprising objects used in our daily life. This way of starting a lesson initiates learners' thinking critically. The process should allow for individual effort, collaboration, communication, and peer approval. As a result of the interaction, learners draw their own conclusions or develop their own learning.

However, it is suggested that as the teachers use subjective learning they should move away from the idea of being the source of all knowledge but rather be providers of conducive and enabling environment for effective learning and teaching to take place.

In subjective learning, the teacher should provide pupils with learning activities which are set to arouse interest and motivation for them to keep searching and investigating for the solution to the problems posed. Learners should be allowed to explore and discover phenomenon by themselves. (MESVTEE, 2014) In doing this, teachers promote creativity and a sense of independent thinking and build confidence in learners. Teachers need to provide learning situations which appeal to the learners and motivate them to go on working on a task.

2.10 Chapter Summary

This chapter discussed the literature that was consulted and used in this research. The first part of the material in the introduction dealt with the problem of poor performance in mathematics at different levels of education and the evidence provided by different sources to show the extent of the problem. The other part covered the reason why mathematics knowledge is important to every individual. In addition it looked at literature on art and other related subjects such as design and technology that have components that are very useful in the teaching of mathematics at the lower section of primary education. The areas were explained in detail and the way they connect to the teaching of mathematics. There was also literature which suggested ways in which art

and design could help improve learner performance in the subject where it has been effectively used.

The literature further covered revealed the useful components which form basic elements that form tools of art which are key to teaching mathematics. These are the dots, lines, shapes, forms and colour. These are useful elements that translate the major aspects of mathematics, numbers, shapes and symbols into art- works for mathematics teaching. It looked at ways in which art and design is thereafter used to produce teaching and learning materials in form of letters, numbers, symbols, shapes, signs, charts, graphs, pictures, illustrations and objects for easy teaching of mathematics. The artistic skills would be useful to both teachers and the learners in the teaching and learning of mathematics. The literature covered also looked at how the teaching aids thus produced would help the teacher provide young learners with a variety of activities for play such as drawing, construction, measuring, sorting, matching, modeling, designing, game identification and demonstration.

The literature further looked at some teaching methods and techniques that suggested the use of art- related ways of teaching and a number of teaching and learning materials that could be organised and produced using the artistic skills which in turn help the teacher to choose and apply the teaching methods that are age-appropriate which require the use of teaching methods that use more of child-centred, play-way, problem-solving, project, activity and role playing methods. This literature review suggests that the use of art and design- related skills would help the teachers to be eclectic in the use of a variety of teaching and learning materials, learning activities and teaching methods which encourage learners to take the centre- stage and become the major players in the learning process.

In addition, there were a variety of useful tools mentioned in the study that teachers could use in form of art, that would help the teaching and learning of mathematics to be more practical, concrete and captivating to the young learners at the lower level of their primary education. Further, it was not known whether teachers felt integrating art and design into the teaching of mathematics could improve learner performance in the subject area. This study sought to probe the assertion of teachers' perception that integrating art and design could help improve the teaching and learning of mathematics at lower primary level. Apart from this, the literature review helped to add some useful

information to the body of knowledge in the field of mathematics teaching and learning using artistic skills.

The study the literature consulted was trying to bridge the gap that no research has been done that looked at teachers' perception that whether integrating art and design in the teaching of mathematics could improve learner performance in the subject at the lower primary school level. It was assumed that teachers were not eclectic on the use of teaching and learning materials. There were less variety on learning and teaching activities during mathematics lessons. It was also felt that there was no variety on the teaching methods which teachers used to encourage learners to apply art knowledge and skills where learners should take the centre stage and become the major players of the learning process. Hence, the study looked at what attitudes, feelings, opinions, good teaching habits teachers hold in the use of artistic skills in their teaching of mathematics at lower primary level of education.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This section discusses the methodology employed in this study. It includes the research design, target population, sample size, sampling techniques, research instruments, data collection procedures and the method of data analysis has also been included. Each of the areas included in this chapter has been explained to indicate different aspects of the research they address.

3.2 Research Design

This research used qualitative research approach .This approach was used to collect information about the thoughts ,feelings, attitudes beliefs, values, perceptions, personality and behavioural intentions of the research participants,(Johnson,2004).

The research design used in this study was a descriptive survey. A descriptive Survey is a method of collecting information by interviewing, or administering a questionnaire to a sample of individuals. A survey method allows the researcher to collect a large amount of information quickly and effectively. It asks people to respond to preprinted questionnaires that ask them to respond briefly to a series of questions. It is a lot easier than observing how respondents actually behave. It is used when collecting information about peoples' attitudes, beliefs, preferences, opinions, habits, or any of the variety of education or social life, (Saccuzzo,1987) The major purpose of descriptive research is to give the description of the state of affairs as it exists. Descriptive studies are not only restricted to fact-finding, but may often result in formulation of important principles of knowledge and solutions to significant problems. A descriptive Survey is not just a collection of data; it involves measurement, classification, analysis, comparison and interpretation of data.

This research design was used because it allowed collection of data directly from the sample in order to have a deeper understanding and explanation of the situation in its natural setting. The choice of this research design helped to describe the characteristics of the target population and determine the relationship between variables and make it specific for solving the problem and this was what guided this study area (Kombo, 2010; Saccuzzo, 1987).

The major guiding factor was to find out teachers' perceptions on whether integrating art and design in the teaching of mathematics could improve learner performance in the subject area. The study focused on teachers' attitudes, opinions, habits and feelings of this study area (Johnson, 2004).

A research design can be thought as the structure of the research. It incorporates all the elements in a research project together. A design is used to structure the research to show how all the major parts of the research project work together to try to address the central research questions, Orodho (2003) in Kombo (2014) defines research design “as the scheme, outline or plan that is used to generate answers to the research problems.” Kombo,(2014). Further a research design can be regarded as an arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance with the research purpose. Research design is the conceptual structure within which a research is conducted (Kombo, 2014, Orodho, 2003).

Research design is a plan on how a study will be conducted. It is a detailed outline of how and investigation or study will take place. It provides a series of aspects to keep the researcher in the right direction. It specifies conditions and optimum research procedure to be followed in conducting a research study. A research design will include how data is to be collected, what instruments will be employed, how the instruments will be used, the type and category of the respondents ,number of the respondents and the intended means for analysing data collected (Johnson, 2004).

It helps to provide the researcher with guidelines shaping the study by considering pertinent questions of what the research is about, why embark on the study, where the study will take place. What type of data will be collected, the time frame in which the study will be carried out, the sample size, the techniques of data collection and how it will be used and how the data will be analysed are other guidelines to follow. Finally, it explains how the report of the findings will be prepared (Dominik, 2013). The research design gives direction to the study and to show the relationship of different constructs that the researcher wants to investigate (Kasonde, 2013).

3.3 Study Area or Site

The study was conducted in both rural and urban primary schools in Chipata district in the Eastern Province. This was done for the researcher to have a balanced view of what was obtaining on the two different geographical locations of the study.

3.4 Study Population

Population is a group of individuals who can be classified together because they have certain characteristics in common, (Johnson, 2004) The study population was for all primary school Head teachers, primary schools teachers and all lecturers in the Expressive Arts and Mathematics sections at a public College of Education in Chipata district of Eastern Province and all lower primary school pupils. In this study the population comprised the head teachers, lecturers, teachers and pupils .This made up the population of interest because the study was restricted to this group of individuals, the teachers and pupils (Kulbir, 2006).

3.5 Study Sample

It is not necessary to study an entire population; however a good sized sample or selected subset of population if chosen carefully can yield almost the same results as a whole population. The most important point to note is to ensure that the sample is representative of the large population (Saccuzzo,1987).

The sample for the study population comprised 84 participants: the head of section Mathematics and one lecturer, head of section- Expressive Arts and one lecturer of Art and design, at a public College of Education: ten head teachers, ten senior teachers ten primary school teachers, (30). 10 schools five from urban schools and five from rural schools. Ten pupil groups comprising five pupils, were used in the ten selected primary schools in Chipata district. The respondents shared common characteristics as they formed a group dealing with education matters. Lecturers at the college train students to become primary school teachers. They help would be teachers to master different teaching methods and teaching and learning materials they need to in their lesson delivery taking into consideration the age group they teach. Lecturers in this case are teachers of would be teachers. For this reason, the lecturers in this study were addressed as teachers.

These are all involved in the teaching at the Early Childhood Education (ECE) and primary level. The pupils were the participants who were directly affected in the teaching and learning process hence the inclusion. The two Heads of section and the two college lecturers represented the two subject areas art and mathematics who were involved in training of primary school teachers. The researcher wanted to establish whether the lecturers, head teachers, senior teachers and class teachers perceived art integration in the teaching and learning of mathematics could improve learner performance in the subject area.

3.6 Sampling Techniques

Purposive or deliberate/ judgmental sampling technique was used to select the sample. The process involved purposely hand-picking individuals from the population based on the authority's or the researcher's knowledge and judgment. Simple random technique was used to select a sample of teachers. This technique was used because it provided each element in the population an equal chance to be included in the study sample. A quantitative approach was used to select heads of section in charge of mathematics and expressive arts. Non-probability sampling techniques are sampling techniques where selection of individuals for the sample does not give all the individuals in the population equal chances of being selected (Msabila and Nalaila, 2013; Kulbir, 2006)

3.7 Instruments for Data Collection

In order to collect data from respondents, one questionnaire was used to collect information from primary school Headteacher, lecturers and primary school teachers. Focus group interviews were used to collect data from pupils. Ten pupil groups comprising five pupils were used in the selected 10 primary schools. These were from five urban primary schools and five rural schools in Chipata district.

Questionnaires were used to collect information about the thoughts, feelings, attitudes, beliefs, values, perceptions, personality and behavioural intentions of the research participants. This research used qualitative research design that requires such data collection instruments (Johnson, 2004).

1. Self-administered questionnaires for key informants
2. Group interview.

3.8 Procedure of Data Collection

Letter of authority from the school of education Postgraduate, Primary Education Department to go and collect data was obtained.

The researcher sought permission from the District Education Board Secretary (DEBS's) office to go into primary schools in the district to conduct the study. The researcher also got permission from the head teachers who allowed the teachers to participate in the study and administer the questionnaires to the teachers at the time that was convenient to them. The researcher randomly selected 5 primary school in the urban centre and distributed the questionnaires to teacher of Grades 1-4 at least one Headteacher or deputy head ,one senior teacher and one class teacher. A focus group comprised 5 pupils randomly selected from Grades 2,3 and 4,At the time the study was conducted the Grade 1 pupils had not covered much on mathematics learning. The same procedure, method and numbers of respondents was used to collect data for the study from the rural primary schools in the district.

The questionnaires were filled in by the interviewees and were collected upon completion on the time they proposed that was ideal for them to submit. The focus groups comprising 5 pupils were separated from their classes and the interview guide was administered to the pupils by the researcher in a separate classroom that was not occupied at that particular time. The interview was done in presence of one of the teachers.

3.9 Data Analysis

Data analysis involves the process of interpretation or stating what the study findings show, what they mean, their significance and what the answer is to the original problem posed in the Statement of the Problem (Kulbir,2006).

Descriptive data analysis involves measurement, classification, analysis, comparison and interpretation of data. This approach was used because it allowed to analyse the data in order to have a deeper understanding and explanation of situation in its natural setting. The choice of the descriptive data analysis helps to describe the characteristics of the target population and determine the relationship between variables and make specific judgment for solving the problem being studied, (Kombo, 2010; Johnson, 2004). In this case, the major variables used in the study were teacher's perceptions on

the role art could play to improve learner performance in mathematics, teachers' attitude on the use of teaching and learning aids in mathematics lessons and also teaching methods that were age-appropriate and art-related in nature.

3.10 Summary of the Chapter

This research used qualitative research approach. This approach was used to collect information about the thoughts, feelings, attitudes, beliefs, values, perceptions, personality and behavioural intentions of the research participants.

The research design used in this study was a descriptive survey. A descriptive Survey is a method of collecting information by interviewing, or administering a questionnaire to a sample of individuals. The study was conducted in both rural and urban primary schools in Chipata district in the Eastern Province.

The study population was for all primary school Head teachers, primary school teachers and all lecturers in the Expressive Arts and Mathematics sections at public College of Education in Chipata district and all lower primary school pupils. Purposive or deliberate/ judgmental sampling technique was used to collect data. Simple random technique was used to select a sample of teachers. A non-probability sampling procedure known as purposive sampling was used to select lecturers of mathematics and expressive arts at the college of education.

Data from respondents was collected using two different questionnaires. The first one was used to collect information from lecturers, primary school head teachers and teachers. Focus group interview was used to collect data from primary school pupils.

Letter of authority was obtained from the school of education Postgraduate, Primary Education Department to go and conduct the study in Chipata district. Permission was also sought from the head teachers to conduct the study in schools. Ten primary schools were randomly selected 5 from the urban set up and 5 from the rural. Questionnaires were distributed to the lecturers, teacher of Grades 1-4, Head teacher or deputy head, senior teacher and class teachers. The interview guide was used to collect data from pupil focus groups. Descriptive data analysis was used. This approach was used because it allowed analyzing the data in order to have a deeper understanding and explanation of situation in its natural setting.

CHAPTER 4

RESEARCH FINDINGS

4.1 Introduction

The findings of this study were based on the three objectives that were set at the outset of the study. These findings were also in line with the conceptual frame work. The combination of these two aspects provided a road-map in addressing the issue raised in this study of seeking the perception of teachers on the integration of art and design into the teaching and learning of mathematics at lower primary school to improve pupil-performance in the subject area of mathematics.

The study had the following objectives:

1. To establish the teachers' perceptions on integrating art and design in the teaching and learning of mathematics.
2. To establish art related teaching /learning materials teachers use in mathematics lessons.
3. To explore teaching methods used by teachers during mathematics lessons that involve the use of art related learning and teaching materials

4.2 Teachers' perceptions

The question the teachers were asked was whether the idea of art-integration into the teaching of mathematics would help improve the teaching of mathematics. There were also 4 lecturers that were involved in this study. They were also asked to answer the questionnaire on the feeling they had whether the idea of art-integration into the teaching of mathematics would help improve the teaching of mathematics. Out of the 4 lecturers involved in the study 3 indicated that that they a positive perception on art-integration. One out of the 4, one had a different view, he was not in support that art-integration into the teaching and learning would help improve learner performance. The lecturers were also involved in the study because they were involved in training of the primary school teachers. It was their responsibility to ensure that the teachers they trained had the right attitude and conversant with a variety of teaching methods that will make them effective teachers. In addition, as teachers leave the college they need to be equipped with the positive attitude on the importance of using teaching aids produced by print media and those that the teacher should supplement using their artistic skills

and locally available materials in their immediate environment. This the more reason why the lecturers were involved in this study. The major concern in this case was centred on their opinion on whether art integration would make a difference in improving learner performance in mathematics at the lower primary section.

The 34 respondents involved in the study had different views on the matter. The study revealed that 30 teachers and lecturers representing (88.2%) of the teachers involved had positive views towards the integration of art and design in the teaching and learning of mathematics. The other 4 representing (11.8%) of teachers and one lecturer also had different views as represented in table 2 below;

The 4 lecturers also had their own views concerning the issue. Out of the 4 lecturers involved in the study 3 indicated that that they had a positive perception on art-integration. One out of the 4, one had a different view, he was not in support that art-integration into the teaching and learning would help improve learner performance.

Table 2: Number of teachers and lectures interviewed

Sn	Respondents (34)	Positive views	Negative views	Total
1	Lecturers	3	1	4
2	Teachers	27	3	30
	Total	30	4	34
	Percentage	88.2%	11.8%	100%

The table above represents the number of both the lecturers and teachers and position of what they expressed in the answers they provided in the questionnaires that were administered to them.

The information given below are the responses given by the respondents involved in this study.

Lecturer 1 said *“It would help pupils to get actual information rather than estimation and generalization.”*

Lecturer 2, added, *“Learning would be interesting as learners would be learning through play and manipulation of objects.”*

Lecturer 3, commented, “Yes , mathematics sometimes uses art and design to make the learning and teaching more interesting.”

The same questionnaire was administered to teachers get what their perceptions were in response to the question of art integration into the teaching of mathematics. The information presented here was obtained from the responses given in the questionnaires.

Teacher 1 said: *“The integration of art and design into mathematics would help learners develop interest in mathematics because art has many useful and interesting components that would make pupils enjoy mathematics.”*

Teacher 3 from another school commented: *“If art materials were well integrated into the teaching of mathematics, it would be easy for the young learners to understand the visual or graphical presentations of numbers, symbols, pictures and shapes which are the major elements in fostering the understanding mathematics language.”*

Teacher 7 explained: *“The use of dots, lines, shapes, forms, pictures/illustrations, diagrams, and colour found in art are also very important components in mathematics.”*

Teacher 8 reasoned: *“The use of these elements of design would help learners to be accurate in drawing and interpretations of lines, shapes, measuring in mathematics. Pupils and teachers would also use the elements in the production of other visual charts and posters.”*

Yet teacher 12 argued:, *“The production of teaching and learning aids depends on the application of artistic skills by both the teacher and the learner. Certain topics such as shapes, sets, counting, matching, require a child to draw and paint.”*

Teacher 15 explained to say: *“Art and design would help broaden and quicken the understanding of some topics in mathematics. He further said. “Artworks would consolidate pupil understanding of mathematics through the interpretation of various art works. It would concretize concepts thereby enhancing understanding of mathematics.”*

Teacher 16 reasoned: *“Children learn better through play and manipulation of objects. Young learners enjoy playing with pictures and other materials which connect them to*

their immediate environment hence improve their understanding of mathematics concepts and the world around them.”

Teacher 18 further explained: *“Pupils would have wider exposure and be able to inter-relate art and mathematics issues and art integration would help learners to think critically as they manipulated art-related materials made available to them during the lesson, and it would help them to make learning of mathematics easy, fun and more interesting.”*

“It would help learners to have direct experience with the real world rather than guess, estimate or generalised ideas of things that they do not experiences. The use of teaching and learning aids would help in time-saving and has the power to motivate learners. Art-works would provide a variety of activities in mathematics lessons,” Teacher 20 further argued.

Teacher 21 reasoned: *“Art integration would in turn make learners enjoy more of those subjects with pictures, digits and symbols. Moreover, she said, “The same digits, symbols- letters and numbers form part of essential art-work.”*

“Children need to understand the proper interpretation of these digits, symbols- letters and numbers as they form part of essential art work before they incorporate them into mathematical concepts. Art and design could be the channel through which this could be attained” Teacher 25 further explained.

The 30 (88.2%) out of the 34 teachers and lecturers involved in the study were in support that the integration of art and design in the teaching and learning of mathematics could help improve learner performance of the pupils in the subject area of mathematics. They argued that teachers would find teaching easy and more interesting when they use teaching aids, and they also said learners would get attracted to learn and concentrate more when teachers use a variety of teaching and learning materials and varied teaching methods to suit the pupils’ age-group.

Both rural and urban schools were used to conduct this study. There were ten schools in total ,five from the rural set up and the other five from the urban.

4.3 Teaching and Learning Materials

Pupils in the groups of five in the ten schools where the study was conducted were asked to mention the materials teachers brought into the classroom during mathematics lesson and those the pupils were asked to bring. The responses from pupils' focus group were recorded during the interviews with various pupils involved in the study.

Table 3 below shows a list of art-related teaching and learning materials teachers themselves brought into the classroom and those they asked the pupils involved in this study to bring during the mathematics lesson in the schools where the study was conducted. Twenty two pupils named number cards as the most frequently used teaching aids representing 44%. It was followed by the use of stones mentioned by 12 pupils, representing 24%, and 11 pupils mentioned sticks representing 22% of the use of these particular teaching aids. The information provided further shows that the other forms of teaching aids asked for were not used much in the mathematics lessons as Table 3 below shows. The teachers had good knowledge of the art related materials that would help in the teaching of mathematics. However, few of them found their way into the classroom as seen from responses by the pupils who were the direct beneficiaries of the teaching and learning process.

Table 3: Teaching and learning materials used during mathematics lessons

SN	Teaching materials	Frequency	Percentage
1	Number Cards	22	44%
2	Stones	12	24%
3	Sticks	11	22%
4	Pictures	7	14%
5	Concrete Objects	6	12%
6	Bottle Tops	6	12%
7	Grain	5	10%
8	Abacus	4	8%
9	Money	4	8%
10	Wall Clock	4	8%
11	Shapes	4	8%
12	Drawings	3	6%
13	Pattern Cards	3	6%
14	Empty Boxes	3	6%
15	Ruler	3	6%
16	Tins	2	4%
17	Building Blocks	2	4%

18	Number Charts	2	4%
19	Number Tree	1	2%
20	Multiplication Tables	1	2%
21	100 Square Chart	1	2%
22	Additional Tables	1	2%
23	Wooden Counters	1	2%
24	Number String	1	2%
25	Puzzles	1	2%
27	Magic Square	1	2%
28	Pencils	1	2%
29	Pupils' Books	1	2%

The information was provided by different pupils from various schools visited in this study. The materials outlined in Table 3 above show a list of useful teaching and learning materials that would help teachers to be in the right direction if there was uniformity and consistence in the organisation, collection and use of these teaching and learning materials. The list consists of responses given by different pupils in those different schools though these were not uniform in all schools. Each school had its own list different from the other schools.

The items provided on the table comprises many of the useful tools that would make the teaching of the subject more practical and expose pupils hands-on activities. In essence these teaching aids were supposed to be sourced and provided by the teachers during lessons. From the responses given by the pupils it was established that there were teaching and learning materials that pupils could help source and others not. For example pupils could be engaged in sourcing and collection of such materials as assorted bottle tops, stones, seeds, sticks, tins, empty boxes, multiplication tables found on the covers of their exercise books. The teachers needed to provide materials pupils were unable to easily source such the abacus models, number cards, number charts, number tree 100 square charts, shapes, wall clocks, building blocks ,rulers, additional and subtraction tables, puzzles, magic squares and pupils' book. This list of items was mentioned by the pupils themselves. This was done to assess which items pupils were familiar with in their classrooms. The table above gives a picture that from this study, the provision and use of the described teaching aids by teachers was minimal looking the percentage give on the table. It also gives an impression that teachers know about these teaching aids but few of them are used during mathematics lessons.

4.4 Pupils' responses on the teaching materials teachers brought and used during mathematics lessons.

Pupils involved in the study were asked to name the materials teachers brought with them in mathematics lessons.

For example, Pupil 1 said, "Books,"

"Chalk," Pupil 2 said.

"Ruler and bag," Pupil 3 added

Further pupil 4 said: "Duster,"

"Register and file" commented Pupil 5.

Pupil 6 lamented: "Pen and pencil,"

"Paper and Seed," Pupil 7 said.

Generally, these were the commonest materials among others that pupils mentioned teachers brought with them into the classrooms during mathematics lessons. This shows that teachers in this study used basic materials or did not use enough or a variety of improvised teaching aids other than the few aids they asked the pupils to bring in their mathematics lesson. In other words, the materials pupils mentioned were more of the teachers' routine teaching tools. The different focus groups who took part in this study generally echoed almost the same list of materials presented above though they were interviewed from different locations and at different times.

As seen from the information provided by pupils in Table 3, it shows that teachers depended so much on the teachers' books which they used themselves and not pupils. There was little supplement of other teaching and learning materials that could be sourced within their local working environment that would make the teaching and learning of mathematics more meaningful and interesting to the learners. The use of the chalk- board and teachers guide book took a centre-stage.

Table 4: Learning activities

SN	Name of Learning Activities	Frequency(50 pupils)	Percentage
1	Counting	3	6%
2	Solving Problems on chalk board	1	2%
3	Group-work	1	2%
4	Pupil- demonstration	1	2%

Table 4 above shows the activities that pupils mentioned they were engaged in during the mathematics lessons. These were the few activities the pupils mentioned, which they mentioned were involved in during their mathematics lessons. The information provided on the frequency of the activities given in Table 6 above shows on how little learner involvement in the practical activities was in mathematics lessons as mentioned by the learners.

For example Teacher 1 said: *“I ask pupils to solving mathematics using bottle tops.”*

Teacher 2 added: *“I sometimes teach number counting using songs and dance,”*

“I use role playing in buying and selling,” Teacher 3 added.

Further Teacher 4 said: *“ I tell my pupils to solve multiplication mathematics using the table and number games.”*

When the responses given by pupils in focus groups discussion sessions were compared with teachers’ responses, the activities mentioned were few. The number of activities named by both pupils and teachers show that pupil-involvement in mathematical activities were done in a small way. This simply implies that fewer activities were carried out during mathematics lessons. Some pupils’ focus groups said they did not do much of the projects and play activities during mathematics lesson. The information revealed that teachers provided little variety to pupils in the mathematics lessons.

For example, when the researcher asked the pupils the games or activities they were familiar with, this is what Pupil 1 replied: *“We use number-wheel and matching exercises.”*

Pupil 2 said: *“Abacus and number cards mathematical calculations,”*

From the responses given by individual teachers and the pupils, they indicated that teachers mentioned few artistic and mathematics play activities which were not known and commonly used by the majority of teachers in the study.

To assess whether pupils were able to understand and interpret the materials shown to them. The researcher picked textbooks and asked the pupils to name different pictorial works found in the books and other few materials that were found in their classrooms. .

Pupil 1 said: *“These are shapes, numbers, signs, colour,”*

“ These are pictures dealing in sets in mathematics,” Pupil 2 added.

Pupils 3 said: *“This is a number-wheel and multiplication table; we use them during mathematics lesson.”*

“That chart is number-line, that one number-tree and that picture is on mathematics dealing with money,” Pupil 4 added.

“This chart there is a magic square and that one is a 100 chart,” Pupil 5 said.

Pupil 6 said: *“Our teacher brings number charts to help us when solving mathematics problems,”*

“We also use mathematical tables found at the back of our exercise books for multiplication and division in mathematics,” commented Pupil 7.

“We use pictures in the books and others are made by the teacher,” Pupil 8 added.

Pupils were able to identify shapes, numbers, signs, colour, mathematics dealing with sets, number-wheel, multiplication tables, number line, number-tree, 100 chart, magic square, mathematics dealing with money and a variety of pictorial works when they were exposed to them. This indicated that art and design was a useful tool in this respect. Pupils were able to identify and interpret pictorial work presented to them in those different forms as outlined above.

One teacher at one of the schools in the rural location was found using a variety of self-improvised teaching aids as shown in the figure below.



Figure 17: Self-made teaching and learning aids

This is what she explained: *“The school does not have enough books to give all the pupils during my mathematics lessons. I decided to make a variety of teaching aids of my own. This has helped my pupils to enjoy mathematics because they use the materials even when they are on their own.”*

Her classroom had a variety of self-made teaching and learning materials using locally available materials. When the researcher asked what material she used to make her teaching aids, she said: *“I use materials such as tins, empty packaging boxes, bottle tops, seed, sticks card boards and leaves which I ask pupils to help in the collection. I also use my artistic skills to organise and produce the teaching and learning aids I need for my grade 3 class.”*



Figure 18: Self-made teaching and learning aids.



Figure 19: Self-made teaching and learning aids, Improved teaching aids, a Collection of House-hold Products packages

Improved locally-produced teaching and learning materials produced by one of the teachers. The collections of package models of household products were used to make teaching aids to explain on buying and selling topics.

The teacher who was found using these materials said she used them with the pupils when teaching mathematics on different topics such as counting; in addition, multiplication, division, subtraction and colour-sorting. This was one of the ways teachers could use their artistic skills in improvising to supplement on occasion when the school did not have adequate teaching materials or as just one way of providing a variety in teaching techniques.



Figure 20: Self-made teaching and learning aids



Figure 21: Self-made teaching and learning aids, Improvised teaching aids, a collection of bottle tops, metal and plastic.

The materials she produced were on different topics in mathematics. The class looked good and provided a physical environment ideal for the young to play around. The pictures show assorted bottle tops which one of the teachers was found using in her mathematics lessons. The collection of these materials was done by the teacher with the involvement of the pupils of her grade 3 class.



Figure 22: Self-made teaching and learning aids, Improvised teaching aids, a collection of bottle tops, metal and plastic.

Teachers are required to use lots of charts, graphs and maps, tables, illustrations, art and craft, pictures, shapes, images, puzzles, building blocks, number games, problem - solving games and exercises, and many more such activities. (REPSSI Module 4, pg44) These elements of art and design play an important role in the teaching of mathematics from pre-mathematics and further more at various levels of education. The major components shared with mathematics from art and design include (MESVTEE, 2012)

4.5 Teaching Methods Used

Table 5: Teaching methods teachers used.

SN	Teaching methods	No of teachers using the method	Percentage
1	Question and Answer	23	76.7%
2	Group Work	21	70%
3	Discussions	14	46.7%
4	Teacher Exposition	10	33.3%
5	Learner-Centred	07	23%
6	Brain Storming	03	10%
7	Project Method	02	0.7%

The teaching methods that teachers applied in this study were; Question and Answer, Group-work, Discussion, Teacher Exposition, Learner centred, Brain storming and Project Method. The 30 respondents involved in this study representing 76.7% used Question and Answer, 21 representing 70% used group work, 14 representing 46% used discussion ,10 used Teacher Exposition, representing 33.3%,7 used Learner centred representing 23% , 03 used Brain storming representing 10%, and 2 used Project Method, representing 0.7%. From the responses given by the teachers, it shows that some of the methods they mentioned that they frequently used were more of Teacher-centred than Learner-centred approaches. In the methods they employed, there were fewer activities that were mentioned that were art-related in nature which in other ways did not promote the use of learner centred-teaching methods.

Out of 30 teachers who were in touch with pupils in the classroom only 12 teachers mentioned they used Learner-centred, Brain-storming and Project Method. The rest, 18 of them used Question and Answer, Group-work, Discussion, and Teacher Exposition,

Teacher 1 explained: *“I use question and answer method in my teaching,”*

Teacher 2 said: *“I involve pupils in group work and discussion to make them participate in my lesson.”*

“I use teacher exposition as an effective way of delivering my lessons,” said Teacher 3.

Teacher 4 contributed: *“I use learner-centred because I find it to be a more effective way of teaching, I involve pupils in my lessons.”*

“I engage pupils in brain storming and I sometimes use project method,” said Teacher 5.

Teachers’ responses indicated that pupils were not exposed to games that were artistic and mathematical in nature. There were very few suggested activities found in mathematics teachers and pupils’ books were used during the lessons. From what was mentioned it shows that there was very little use of play way, project methods, activity methods, problem solving and role play. Those methods mentioned were not used by teachers in this study. On table 3 above, question and answer, group work, discussion, teacher exposition were the teaching methods preferred by the majority of teachers in this study. The methods used mostly were those that did not encourage and engage young learners in hands on activities.

CHAPTER 5

DISCUSSION OF FINDINGS

5.1 Introduction

The findings of the study have been tailored in line with the three objectives outlined in chapter 1 of this study. Thus, the discussion gives details of what the study findings show, what they mean and their significance to the original problem posed in the Statement of the Problem. The three study objectives are listed below:

- Teachers' perception on integration of art and design in the teaching and learning of mathematics.
- Teaching and learning materials used by teachers and pupils during mathematics lessons.
- Teaching methods used that involve the use of more of child centred-methods

There were 30 teachers and 4 lecturers as participants in this study who were given questionnaires to answer and express their opinion on whether the integration of art and design in the teaching and learning of mathematics would help improve learner performance in the subject area.

The study revealed that 30 (88.2%) of teachers and lecturers had a positive attitude towards the integration of art and design in the teaching and learning of mathematics. However 4 (11.8%) out of the 34 participants had different views on the matter. The study was conducted both in urban and rural primary schools. The results were analysed together because there were no major distinctions on the responses they gave on the topic. They gave the same views. The findings were not very different. However the only interesting part was that the improvised teaching materials were found in rural schools. Meanwhile most of the junk materials that could be transformed into teaching were more available in town schools. No single out of 5 urban schools visited had walls with teaching aids. Only at 3 rural school classrooms out of five had teachers with teaching aids in their classes.

The 30 (88.2%) respondents felt integration of art and design into mathematics would help learners develop interest in mathematics. They said art and design had many useful components that were found useful in mathematics. The use of dots, lines, shapes, forms, pictures/illustrations, diagrams, and colour found in art were also very important

components in mathematics language. They said these elements were useful from the elementary to advanced levels of education in the field of mathematics teaching and learning.

This was in line with Riley, (2012) who indicated that dots, lines, shapes, forms, pictures/illustrations found in art were also very important and useful components in mathematics. Art involves pictures, shapes, diagrams, lines and measuring. In this way it would make mathematics easy for learners since children enjoy playing with a variety of art-works. Children can use lines, shapes and colours and other elements of design to enhance their understanding of mathematics. They can also apply mathematics theory to pictures and objects.

The majority of teachers (88.2%) mentioned that the use of these elements of design would help learners to be accurate in drawing of lines, shapes, measuring, and in the production of other visual charts and posters. All these need artistic skills. They reasoned that the production of teaching and learning aids using locally-available materials depends on the application of artistic skills by both the teacher and the learner. Certain topics such as shapes, sets, counting, matching, require a child to draw and paint. They further argued that the artistic skills acquired through the integration of art in mathematics would help learners to be accurate in drawing of lines, shapes, measuring, estimations and other visual interpretation of various art-works which are vital components in mathematics. This can help improve learner performance as teachers find teaching easy and more effective when they use teaching aids in their lessons.

Those in support of art-integration felt pupils would have wider exposure and be able to inter-relate issues in their immediate environment. They said art-integration would also help learners to think critically. Learners would get attracted and concentrate when they use teaching and learning materials. They further felt art-integration could improve learner-performance and teachers would find teaching more effective if they used teaching aids. It would help learners to get to actual information rather than estimation or generalised ideas. It is assumed that it is time saving and has the power to motivate learner. This idea was supported by the study conducted by (USAID/ZAMBIA STEP UP ZAMBIA PROJECT, 2015) that art-integration had the potential to improve learner performance in mathematics if well implemented.

They argued that Art-integration would help broaden and quicken the understanding of some topics in mathematics by young learners. Artworks consolidate pupil-understanding of mathematics through the interpretation of various art-works. They said children get attracted and concentrate when teachers use teaching and learning materials. It would help to concretise concepts, thereby enhancing understanding of mathematics. Art involves pictures, shapes, diagrams, lines, measuring, so it would make mathematics easy for learners since children enjoy playing with pictures. They further said that through the use of art and design children, learn the skill of how things fit together, and also the interpretation and creation of visual images.

They pointed out that teachers were required to use lots of charts, graphs and maps, tables, illustrations, art and craft, pictures, shapes, images, puzzles, building blocks, number games, problem solving games and exercises and many more such activities (REPSSI,2013 pp44)

Those in support further said learners enjoyed more of the subjects that combined the use of pictures than numeracy, which only has digits and symbols. Moreover, the same digits, symbols- letters and numbers form part of essential art work. They felt children needed to understand the proper interpretation of these before they incorporate them into mathematical concepts. Art and design could be the channel through which this can be attained.

The 30 respondents representing (88.2%) who had a positive view of art integration into mathematics said numerals and symbols could communicate facts and information in mathematics, but they said pictures and photo-story telling could also allow imagination, creativity and critical thinking in learners. In their responses, they argued that not only did the pictures inspire learners in their learning, but they also played a vital role in activating and building their background knowledge and increase of confidence level when doing numeracy calculations.

On the other hand, 11.8% of teachers involved in this study did not appreciate pictures when teaching mathematics and associated pictures more with subjects as languages, social sciences and as mere art-work. From the 34 teachers and lecturers who participated in the study, it was revealed that 4, representing 11.8% of respondents felt mathematics dealt with numbers all the time with the concepts of addition, subtraction, division and multiplication. They argued that art and design had little to do with

mathematics. They further said art-integration would crowd the subject and derail pupils' attention. They argued that art-integration into mathematics was quite involving and needed much time, and they said 30 minutes period allocated to lower grades was not enough to engage pupils into practical work .

In contrast, 27 (90%) of respondents also explained that learners would get attracted and concentrate when teachers used teaching and learning materials. They said that this could improve learner- performance. The respondents said teachers would find teaching easy when using teaching aids. They said it would help learners to have direct experience with the real world rather than guess, estimate or generalise ideas of things that they did not experience and that this exposure in turn would help improve learner performance. However, what should be noted is that not all artworks are useful in the teaching of mathematics.

5.2 Teaching and Learning Materials

The teachers in this study indicated that they had the knowledge of the art-related materials that would help in the teaching of mathematics as obtained from the responses given in the questionnaires. However, this was not what was obtaining, as indicated from their responses which showed that they did not use enough or a variety of improvised teaching aids other than the few aids they asked the pupils to bring in their mathematics lessons. In other words, the materials mentioned were more of the teachers' routine tools. Very few of the other materials found their way into the classroom as seen from the information provided. The findings further showed that the other forms of teaching aids mentioned by teachers were not used much in the mathematics lessons.

The information provided above revealed that most classrooms did not have even simple teaching and learning materials. From the responses provided in this study it showed that teachers depended on their knowledge and felt teaching aids rendered no relevance to in their mathematics lessons. They feel learners understand mathematics by mare teacher exposition teaching methods which should not be the case.

When pupils were asked to mention the materials teachers brought into the classroom during mathematics lessons, they mentioned that they brought books, chalk, files, duster stick, pens pencils, bags. This entails teachers brought just some basic materials as

mentioned for their routine teaching but not enough materials in form of teaching and learning aids for mathematics lessons.

For those teachers that used teaching and learning materials in their lessons said pupils were able to understand and interpret them. This suggested that art was making an impact on the teaching and learning process, and it would be difficult if learners did not understand the visual or graphical presentations of numbers, system of operation of symbols and shapes which are the major elements fostering the understanding of mathematics language.

The major materials pupils were asked to bring were bottle tops, sticks, seed, stones, beads, multiplication tables, pencils. These were useful materials but 4 (11.8%) of respondents in this study were found using these materials and the 30 (88.2%) depended much on the chalk-board-use and books, which in most cases were not enough for the pupils. For example of the ten schools visited only 4 (11.8%) of teachers in three schools were found to effectively use the teaching aids using locally-available materials such as bottle tops, seed, beads, empty packaging boxes of different products, stones, tins and plastics. All the teachers visited in the five urban schools did not have teaching aids in their classrooms. Pupils were deprived of the learning environment that promoted hands-on and interesting activities, Pupils were not also provided with activities that promoted problem -solving such as games and role- playing.

As seen from the information provided in this study it showed that teachers depended so much on the books. There was little supplement from other teaching and learning materials that could be sourced within their working environment those that would make the teaching and learning of mathematics more meaningful and interesting to the learners. This might be a contributing factor to making learners feel bored because teachers used same teaching and learning materials every day, there was little variety in terms of the provision of teaching and learning materials by teachers in their mathematics lessons .

While it is appreciated that a lot of books on literacy and numeracy have been produced, a lot of work has also to be done in the supply, provision and production of art-related teaching materials that could be used in the teaching of mathematics to the young learners so as to provide variety of activities.

Teaching aids assist in the learning process to be effective as attested by the majority of teachers in this study. These aids consist of visual, audio and hands- on tools to help involve the learners and enhance the learning experience. Teaching and learning resources help to make the learning process more effective and conceptual, and to grab the attention of learners, to build interest and motivation in the learners' learning process, and to provide learners with a realistic approach and experience. Learners are still relying on fingers or routine manipulative skills to solve these kinds of problems instead of using a variety of activities.

Some teachers utilised creative teaching materials and aids to enable young learners to experience the benefits and fun of mathematical ways of thinking and to cultivate a strong sense of quantities and figures in them. They further said that in numeracy classes in the lower elementary school years, each child had his or her own mathematics activity set which the teacher used regularly in the everyday course of teaching. Rather than just looking at teaching aids as tools for imparting knowledge, teachers said they had to develop mathematics lessons designed to create a certain type of learning environment. They reasoned that teaching aids were easy to improvise, and teachers could teach using locally available materials. However this was not what was obtaining in this study. This was not in line with the statement below which states that teachers need to create an environment that encourages students to learn and think on their own, and to pursue knowledge through interaction with physical materials (USAID/ZAMBIA STEP UP ZAMBIA PROJEC, 2015).

The trend in schools where the study was conducted was that classrooms were void of teaching aids and objects which enhance learning at this level. Many schools did not have teaching and learning materials in form of textbooks for both teachers and pupils and even simple wall charts made by teachers themselves. However, some teachers did use teaching aids during mathematics lessons. Out of the 10 schools visited in this study, only three classrooms of the target grades had some teaching aids. The interesting part was that those 3 primary schools were in the rural set up. Of the five school sampled in the urban set up no classroom was found with teaching aids for the grades involved in this study. No teacher was found with improvised teaching and learning materials such as those that were found in the 3 rural schools. There were more of junk materials to be used as teaching and learning aids in urban schools than the rural schools but the opposite was the case.

A similar study was conducted by REPSSI, (2013) where it was observed that to a larger extent teacher teaching at this level did not use teaching aids in their mathematics lessons.

The fewer teachers who used physical materials appreciated that pupils were able to understand and explain pictures well, and helped teachers to explain things to pupils that could not be seen or brought closer to them. Pictures help them to bring to mind the of the different things that exist in great numbers and quantities in the real world. Pictures also help to draw pupils' attention and curiosity to understand them. The teachers said pupils could interpret and make sense of pictorial work found on various teaching learning aids

There were very few physical materials in most schools to provide learners with hands-on learning environment. Both mathematics and art areas aim at producing a learner who is creative, innovative, who has good experimental and manipulative skills, who could be accurate in carrying out tasks, is resourceful, good at decision-making, who can make sound judgment, has the ability to solve problems and to be self-motivated. However, this was lacking in that teachers did not create that classroom atmosphere (MESVTEE, 2012).

5.3 Teaching Methods Used

There was little use of teaching techniques that involved the use of art-related teaching and learning materials. The teaching methods that teachers said they applied in this study were; Question and Answer, Group-work, Discussion, Teacher-Exposition, Learner-centred, Brain-storming. From these responses, the methods used by the teachers in this study show that they were more of teacher centred than Learner-centred approaches. Teacher-exposition took a leading role with less or no play activities assigned to the learners and this was in line with Aduda,(2003)'s findings indicated that the teachers used lecture method, discussions, question and answer methods. Further, Castello, (1991) argued that the lecture method was ineffective in that it turned the learners into passive participants in the learning process. The learners resort to memorisation of facts, rules, and procedures rather than applying them in solving their own problems as they perceive the world around them (Aduda, 2003).

Meantime, this was lacking in most mathematics lessons. The teachers indicated that they taught mostly by the use of expository methods and there was little use of other teaching methods that involved the use of manipulative by children at this level enjoy manipulating the objects found in their immediate environment and they learn through the use of shapes, images, puzzles, building blocks, number games, problem-solving games (Erin,2015).

Data obtained from teachers' responses showed that they dominated the lessons as they left no room for the young learners to build and construct their own concepts, using their abilities for learning to take place. Findings presented indicate that learners instead took more of a passive role that in turn did not foster the effective way of the learning process in the subject appropriate to this age group.

This argument suggests that the teaching methods mentioned were not very effective and appropriate especially if they are applied to the young learners who wanted to explore and discover the world around them through play and direct engagement with the physical environment.

In the responses given by the teachers in this study it was revealed that teachers did not engage pupils in activities that promoted the use of learner-centred teaching methods which were art-related in nature during the mathematics lesson by both the pupils and the teachers. From this data presentation it shows that there was little use of play way, project methods, activity methods, problem solving and role play these methods.

“It is recognized these days that directed activities give reality to learning and effective teaching uses all available resources. Activities are meant to provide varied experiences to the pupil to facilitate the acquisition of knowledge, experience, skills and attitudes. An activity is anything which is carried out with a purpose in a social environment involving physical and mental action. Such activities help in the establishment of stimulating environment for creative expression (MESVTEE, 2014).

The study showed that teachers knew some of the teaching methods play or activities by name but they did not expose them to learners as learning activities. Pupils were not exposed to games that were mathematical in nature; very few suggested activities found in mathematics books were used during the lessons. However, very few of the suggested activities are given to pupils during mathematics lessons. Teacher-exposition takes a

leading role with less or no play activities assigned to the learners. If teachers took time to read through these locally produced documents and apply those suggestions they could become effective teachers (MESVTEE, 2014).

There was little use of play-way, project methods; activity methods, problem-solving and role-play. The study shows that physical facilities contribute positively to students' academic performance. Well-chosen and properly used teaching and learning materials provide the needed physical facilities that would enhance the teaching of mathematics.

Teachers in this research used much of teacher-centred approach as opposed to learner centred approach. There were less play and practical activities in classes that involved the use of the play way method, problem-solving, project methods. There was also little exposure of pupils to games. Integration of art and design in the teaching of mathematics was very minimal.

The pupils were also asked to name the activities that they were engaged in during the mathematics lessons. They were able to name some play activities they were involved in during mathematics lessons. These included among other: such as solving mathematics using bottle tops, number counting using songs and dances, role-playing in buying and selling, multiplication using table and number games. Some of the pupils who were asked were not able to name any of the activities. Most respondents said they did not do any of the projects. The games known or activities commonly used were number-wheel and matching exercise. Individual teachers knew some of the different play activities which were not known and commonly used by most respondents used in this study.

When the learning activities pupils were involved in were compared with the teaching methods that the teachers mentioned or used, it showed that teachers did not use a variety of teaching methods and learning activities that provided learners with enough practical form of learning. The information provided in this study on the frequency of the activities given to learners during mathematics lessons showed that there was little learner involvement in the practical activities in mathematics lessons. The activities mentioned by pupils were few and were used sparingly and sporadically by teachers and pupils in the lessons.

5.4 Chapter Summary

Most teachers did not make use of artistic skills and tools that art and design provide in their mathematics lessons. These are useful elements that translate the major aspects of mathematics, which include numbers, shapes and symbols into art-works for mathematics teaching. Art and design is then used to produce teaching and learning materials in form of letters, numbers, symbols, shapes, signs, charts, graphs, pictures, illustrations and objects to ease the teaching of mathematics. Teachers had little knowledge and skills in the proper use of elements of design and artistic skills.

From the responses given by the teachers, it was revealed that most teachers taught in abstract. Generally classrooms where the study was conducted did not have teaching and learning aids. They did not take advantage of using artistic skills and tools that could help them provide learners with a rich learning environment. The study revealed non-use of a variety of teaching and learning materials and learning activities by most teachers.

The study revealed that some teachers applied inappropriate teaching methods to the age group that required the use of such methods as child-centred, play-way, problem-solving, project, activity and role-playing methods. Teachers instead used much of teacher-centred or lecture methods as opposed to the above stated methods revealed in the literature. The teaching methods teachers used did not promote the use of art-related knowledge and skills that encouraged learners to take the centre-stage in their learning process.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The conclusion of the study was tailored in line with the three objectives and the conceptual framework. This chapter gives details of what the study findings show, what they mean and their significance to the original problem posed in the Statement of the Problem. The three study objectives were thus:

1. To establish the teachers' perceptions on integrating art and design in the teaching and learning of mathematics.
2. To establish art-related teaching and learning materials teachers could use in mathematics lessons.
3. To explore teaching methods used by teachers during mathematics lessons that involve the use of art- related learning and teaching materials.

6.2 Teachers Perception

The study revealed that teachers had a positive attitude towards the integration of art and design in the teaching and learning of mathematics. They felt that integrating art and design into mathematics teaching would help learners to develop interest in the subject because art and design would help both teachers and learners to be creative, innovative, learn to improvise and make learning more practical and interesting.

On the contrary, teachers in this study did not apply most of the positive attributes mentioned such as the use art-related skills such as creativity, innovativeness and skill of improvisation in the organisation and production of appropriate teaching and learning aids useful in the teaching of mathematics at lower primary level. They did not use much of art and design ideas effectively and consistently which would help provide a physical and practical environment, and make learning of the subject more practical, fun, motivating and interesting to the learners at this level of education.

6.3 Teaching Materials

Teachers in this study conducted their mathematics lessons without teaching and learning aids, such as charts, graphs, maps, tables, illustrations, pictures, building

blocks, number games and photo-story telling, teaching using objects and other physical facilities, role-playing and play-way methods. Classrooms were void of such teaching and learning materials.

6.4 Teaching Methods

Teachers in this study did not use teaching methods that provided learners with hands-on and problem-solving activities. Instead they preferred using the teacher-centred method or lecture method. They said it saved on time that could be instead wasted if they allowed children to take a centre-stage in the learning process. The study showed that teachers knew some of the teaching methods and play activities by name but they did not expose them to learners as learning activities. Pupils were not exposed to games that were mathematical in nature. Very few suggested activities such as games, projects, and art-mathematics activities found in pupils' books or teachers' guide were implemented in the classroom by teachers.

There was little use of play-way, project methods; activity methods, problem-solving and role-play method. Teachers did not use a variety of teaching methods and learning activities that provided learners with enough practical form of learning. There were less activities that promoted the use of learner-centred teaching methods which were art related in nature during the mathematics lesson by both the pupils and the teachers .

It can be stated that the objectives of the study point to the fact that the foundation of the learners at lower level of education is compromised as teachers do not have the right attitude in integrating art in the teaching of mathematics. The quality and effectiveness of the education system depend heavily on the quality of its teachers. They are the key persons in determining success in meeting the systems' goals. The calibre of teachers is of the paramount importance. The educational and personal well-being of learners in schools hinges crucially on teachers' competences, commitment and resourcefulness.

To provide quality education, teachers need to have the right attitude and understanding about the tools used, thus the teaching and learning materials used and the appropriate teaching methods which should also be appropriate to a level of a particular age group. This in turn would help to lay a sound and solid foundation for future improved learner performance in mathematics unlike what has been revealed in this study. Mostly, the teaching and learning is done in abstract by not using artistic knowledge and skills to

provide young learners with a physical learning environment. This also results in the use of inappropriate teaching methods which are void of stimulating play activities suitable for the young learners.

The study makes an important contribution to the field's understanding of the integration of art and design in the teaching and learning of mathematics. The study has brought to the fore the understanding that actually art and design is integrated in the teaching and learning of mathematics. Art and design has useful elements that could help translate the major aspects of mathematics, which include lines, numbers, symbols, shapes and pictures into art-works for mathematics teaching. Art and design skills could also be used to produce teaching and learning materials in form of letters, numbers, symbols, shapes, signs, charts, graphs, pictures, illustrations and physical objects to enhance the teaching and learning of mathematics.

6.5 Recommendations

1 Art integration into mathematics should start with primary colleges of education where teachers are trained. Teachers should be equipped with artistic skills in the production and proper use of teaching aids during mathematics lessons

2 Subject specialists, teacher education officers and resource Centre co-coordinators need to embark on workshops where teachers should be equipped with skills to be creative, innovative, to develop skills on improvisation, in organising and production of teaching aids using locally available materials for their mathematics lessons.

3 School administrators need to intensify on the orientation of teachers of the lower section through Continuing Professional Development (CPD) with emphasis on mathematics teaching and learning process using art- integration.

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APPENDICES

Appendix 1

QUESTIONNAIRE ONE

**QUESTIONNAIRE FOR TEACHERS, SENIOR TEACHERS HEADTEACHERS
AND HEAD OF SECTIONS**

Mathematics and Expressive Arts.

1. Do you think integrating Art and Design in the teaching and learning of numeracy could improve learner performance in the subject area?

Yes:

Give reasons:.....
.....
.....

No:

Give reasons

.....
.....

2 Do you think pupils understand pictorial work found in books?

.....
.....

3. Name some play activities in which pupils are involved during mathematics lessons.

- (a).....
- (b).....
- (c).....
- (d).....

4. How much of the suggested games, projects, and art/mathematics activities found in pupils' books or teachers' guide are implemented in the classroom by teachers?

- (a).....
- (b).....
- (c).....
- (d).....

5..What Art teaching and learning materials do you bring to use in your numeracy/mathematics lessons?

- (a).....
- (b).....
- (c).....
- (d).....

6. What teaching approaches/methods do teachers use when teaching numeracy?

- (a).....
- (b).....
- (c).....

7. How effective have the methods used been in the teaching of numeracy?

.....

8.. Is numeracy/ mathematics an easy subject to teach?

Yes.....

No.....

.....

9. What challenges do you face when teaching numeracy?

- (a).....
- (b).....
- (c).....
- (d)

QUESTIONNAIRE TWO

INTERVIEW QUESTIONS FOR PUPIL FOCUS GROUPS

1. What learning and teaching materials do teachers bring and use during numeracy/ mathematics lessons?

- (a).....
- (b).....
- (c).....

2. What learning/teaching materials do your pupils use during numeracy /mathematics lessons?

- (a).....
- (b).....
- (c).....

3. Do you bring any objects to use during numeracy and mathematics?

Mention some ;

.....

4. Do you understand pictorial work found in books?

.....

.....

.....

.....

5. Name some play activities you are involved in mathematics lessons.

- (a).....
- (b).....
- (c).....

6. What suggested games, projects, mathematics activities found in your textbooks (pupils books) do you do in the classroom with your teacher?

(a).....

(b).....

(c).....

7. Do these Art materials make numeracy or mathematics an easy subject to learn?

Yes: Give reasons

No Give reasons

8. What challenges do you face when learning mathematics?

(a).....

(b).....

(c).....

(d).....

Appendix 2: Field Work Permission Form



THE UNIVERSITY OF ZAMBIA
SCHOOL OF EDUCATION

Telephone: 291381
Telegram: UNZA, LUSAKA
Telex: UNZALU ZA 44370

PO Box 32379
Lusaka, Zambia
Fax: +260-1-297702

Date: 2/11/2015

Handwritten notes:
- K...
- S...
- H...

23 MAY 2017
Handwritten signature: [Signature]

TO WHOM IT MAY CONCERN

Dear Sir/Madam

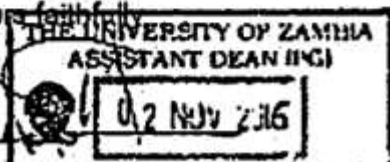
RE: FIELD WORK FOR MASTERS / PhD STUDENTS

The bearer of this letter Mr. HARRISON PHIKI..... Computer number 5.14.7.07.306... is a duly registered student at the University of Zambia, School of Education.

He/She is taking a Masters/PhD programme in Education. The programme has a fieldwork component which he/she has to complete.

We shall greatly appreciate if the necessary assistance is rendered to him/her/

Yours faithfully



Daniel Schemu (Dr.) EDUCATION ASSISTANT DEAN POSTGRADUATE STUDIES - SCHOOL OF EDUCATION

cc Director, DRGS
Dean, Education