INFLUENCE OF MATERIAL AND SOCIAL REINFORCERS ON MATHEMATICS PERFORMANCE IN PRE-SCHOOLS IN MIRANGINE DISTRICT, KENYA.

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DECLARATION

This project report is my original work and has not been presented for an award of degree in any other university.

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This project report has been submitted for examination with my approval as the University supervisor.

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DEDICATION

This research project is dedicated to my dear wife Mary Wanjiku, my beloved children Caroline Gathoni, Irene Waigumo and Martin Mutitu whose unconditional love, support and understanding made me determined to complete my studies. Special thanks go to my parents, Mutitu Gakira and Teresiah Gathoni for their selflessness in my upbringing and great inspiration to my education.

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LIST OF ABBREVIATIONS AND ACRONYMS

DEO : District Education Officers

KCPE: Kenya Certificate of Primary Education

KCSE: Kenya Certificate of Secondary Education

KNEC: Kenya National Examination Council

MR: Material Reinforcers

MSS: Mean standard Score

NACECE: National Centre of Early Childhood Education

NO: Number

SR: Social Reinforcers

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Kenya National Examination Council (KNEC) News letters 2005-2009 indicates that mathematics has been interchanging the last position (5) with the second last. Candidates sit for five papers; Mathematics, Science, English, Social Studies and Kiswahili. The mean standard scores for five subjects in the five years were 39.43,42.72,42.92,43.11 and 44.96 Mathematics, Social studies, Kiswahili, English and Science respectively. From the data it can be realized that apart from being the poorest subjects in performance, it is the only subject whose range and the next is more that one mean score; 3.29 compared to Social studies. According to the National Journal of Science and Mathematics education (2009), the poor performance could be attributed to the poor background the pupils have had in the lower levels starting from pre-schools. The journal notes teachers level the blame to poor preparedness in the preceding levels.

The National Centre of Early Childhood Education NACECE has identified various objectives to be realized in pre-schoolers' education. Among the objectives includes: Appreciating mathematics in real life, develop early mathematical concepts and skills, perform simple additions and subtractions from a set not exceeding nine. Others include number values; develop positive attitudes towards mathematics among other objectives. Despite this, Phonex institute, a research farm based in Nairobi in study carried out between January and March 2010 noted that about 10% of class 8 pupils in Kenya can not solve a class 3 mathematics problems.

NACECE has put in place thematic teaching method in pre-schools in Kenya. The method entails intergrating of the subject with all the other areas of study. This is aimed at making the learners view the subjects as part of day-to-day affairs and concrete as much as possible as Phonex Institution notes, : Mathematics remains abstract…."

According to Fister (1994), parents have always been ready to go to any length so long as their children pass examination. In the real life situation, Fister notes, teachers have unconsciously and traditionally applied social and material reinforcers in motivating their learners and in particular the former.

Social reinforcers are socially mediated by teachers, parents, other adults and peers. They express approval and praise for appropriate behavior. Comments ("Excellent work") I like the way you're working with your group") written approval ("way to go"), and non-verbal expressions of approval ("smiling, clapping nodes of approval are very effective reinforcers. Teachers should ensure that social reinforcers are not ambiguous (make sure the student knows exactly what they are being praised for).

Material reinforcers are the tangible reinforcers. These categories include edibles and non-edible such as toys, balloons, stickers and wards. These type of reinforcers should be applied with caution. According to Hindz (1989), parents may have reasons to object to certain reinforcement, for instance, toys can make other students envious, while edibles are discouraged particularly in schools due to the societal diversities and on healthy ground.

Material reinforcers also referred to as tangibles can be in form of awards, certificates, displaying work and letters sent home to parents commending the students progress among others. These are powerful motivating reinforcers and for many students are absolutely necessary when first implementing reinforcement. According to Frezzer (1988) the tangible rewards should be presided by a social reward. According to Jolivette (2000), teachers rewards should be gradually taper back the schedule of reinforcement such that material reinforcers do not have to be provided every time desirable behaviors occur. Access to the reinforcers particularly M.R must be limited (students will not engage in desirable behavior if they can obtain the reinforcers in other ways. Similarly, a reinforcer looses its value when a student has constant access into it.) One of the ways to handle this problem is to value the reinforcers and also make it difficult for the learner to predict what to expect on expressing the desired behavior.

1.2 Statement of the problem

Although NACECE has set very clear and elaborate objectives of teaching Mathematics in Kenya Pre-schools, their achievements have remained elusive to substantial extent. The poor performance in the subjects is reflected in the subsequent levels. According to Fister (1994) teachers have unconsciously and traditionally applied social and material reinforcers in motivating their learners. To what extent are the rewards relevant in motivating the learners towards better achievements academically.

1.3 The purpose of the study

The purpose of the study was to investigate influence of material and social reinforcers on mathematics performance in pre-scholars in Imagined district, Kenya.

1.4 Objectives of the study

The study was guided by the following specific objectives:-

1. To establish whether children taught mathematics and motivated using social reinforcers perform well.
2. To establish whether children who are taught mathematics and motivated using both social and material reinforcers perform well
3. To investigate whether the type of reinforcement influence retention of mathematical concepts.
4. To investigate whether children taught mathematics and motivated using both S.R and M.R participate effectively in class than using S.R only.

1.5 Research Questions

The study attempted to address the following research questions:

1. Do children who are taught mathematics and motivated using social reinforcers perform well?
2. Do children who are taught mathematics and motivated using social and material reinforcers perform well?

3. Does the type of reinforcement influence retention of mathematical concepts
4. What is the effect in participation in mathematics learning process on the application of either S.R or S.R +M.R?

1.6 Significance of the study

The study may be quite significant to various stakeholders directly or indirectly involved in the education of the pre-schoolers in Kenya. These include the policy makers, teachers, the children and parents. It is important for the policy makers to establish what else can be done to enhance performance in the subject.

Teachers being the curriculum implementers should know the best ways of motivating their learners. Parents will not relent in the provision of any thing demanded by the school which may enhance academic performance. This may include financing in the purchase of material reinforcers if need be. Fister (1994) says that parents can go to any length so long as their children pass examination. Children will be the direct beneficiaries from the study because it seeks to establish the best ways of motivating them t o perform well in mathematics.

1.7 Limitation of the study

The fact that quasi experiment is not a true experiment implies that some other factors out of the researchers control may have influenced the outcome of the study; for the instance a lot of interference may have taken place between post-test and retention test. Inadequate literature was also a major challenge because not much has been done in this field, moreover most scholars have bias towards intrinsic motivation, Hall (1980).

1.8 Delimitation of the study

The study was carried out in Mirangine District. The district has 34 public pre-schools with three divisions, Dundori, Tumaini and Ngorika , fifteen, ten and nine respectively. The pre-schools are located within the public primary schools compound with a total enrolment of 1028 by August 2011 with 34 teachers. All the institutions are managed by the respective headteachers from primary section.

1.9 Basic assumptions

It was the researcher's assumption that children perform better when learning mathematics when they are motivated. Further the researcher assumed that all the teachers in the sample pre-schools were trained and that teaching experience did not play any significant role (assuming the teachers had diverse length of teaching experience) in the outcome of the study. The researcher also assumed that the teachers applied the prescribed reinforcer to the letter. The researcher further assumed that the responses provided by respondents during the study were true reflection of what was on the ground.

1.10 Definition of key terms

The researcher has identified various key terms used in the study frequently. The terms includes; material reinforcers, mathematics, social reinforcers, participation and preschoolers. The terms have been defined to enhance better understanding on their application in the study.

Material reinforcers: These refer to the tangible objects for motivation or 3- dimension object which includes erasers, pencils, rulers and exercise books.

Mathematics: It refers to manipulation of numbers and patterns which includes recognition, writing, adding and subtracting.

Social reinforcers: These are forms of verbal rewards for example praising the child for work well done or any form of recognition for instance a smile, shoulders pat among others.

Participation: This refers to voluntary response to teacher's questions, competition for example raising hands, completion of task, willingness to ask questions and time spent on a task.

Pre-schoolers : These refer to children between five and six years.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This section dealt with various findings on the role of material reinforcers in motivating learners. It has discussed the effect of MR, goal setting to learn and the role of SR and MR. Other areas discussed include reinforcement and school environment, K.C.P.E review on mathematics 2005-2009 by KNEC and mathematics issues in Mirangine District. The researcher has also discussed theories of motivation based on intrinsic and extrinsic motivation. The section ends with conceptual frame work.

2.1 Distracting effect on material rewards

Nabil (1976) carried out a research on the effect of material rewards with young children in Oklahoma. He wanted to establish the significance of material rewards on children's academic performance. The researcher had a ample of 144 children from pre-schools, second and fifth grad. Two choices successive discrimination task was compared under three reinforcement condition; material reward, markers and knowledge of results. The two events in constant order to make hundred percent pay off possible. The subjects in the reward and marker groups learnt the task more slowly in the fifth grade that the second and pre-school respectively.

The findings suggest that a distracting effect of material reward is present in probability learning and may explain superior performance of reward group typically found in probability learning studies. In another study by Peabody (1970) on comparison of the effect of verbal (social) and material reward on learning of lower class pre-school children was done. A combination of two rewards conditions was included to investigate the effect on learning. The information value of the two types of rewards was manipulated to determine if they differed in information properties as well as in incentive value. The children learned more effectively when given verbal rewards in comparison to candy reward. It did appear that candy function as a destructor. No differences in information properties in the two rewards were found. Nabil (1976) argues that though MR may enhance performance on learning task is wanting. He argues that though MR may enhance performance; it could only be short lived. According to him MR distract the task and hence interferes with performance.

Peabody(1970) advice on use of MR if need be is to reduce the value of the reward and consequently its capacity for distraction. Rewards selected by children themselves rather than teacher Nabil argues more distracting effects. Further the teacher should vary rewards and not let the learners be explicit on the anticipated reward.

2.2 Goal setting to learn

Richard (1991) argues that in setting of motivational goal learners are encouraged to adopt performance goals for themselves. In an experiment, subjects were given instruction either to set standards (goals) for themselves or simply " do your best". Richard is quick to add that performance can also be influenced by the value the learners attribute to the goal. From this context the researcher intents to encourage teachers in the sample schools to treat the children as individuals with diverse abilities.

The teachers should help the learners set realistic goals which can be reasonably be achieved with practice and effort. The learners can be discouraged by not even approaching levels that are too high, Adderfer (1967). On the other hand goals that are easy to meet result in lack of motivation.

2.3 The role of social and material reinforcers

Nancy (1978) of the University of Kansas carried; out an experiment on a four year Negro girl with an extremely low frequency of talking. Though the teacher's social attention was always given for all spontaneous speech, if the child spontaneous verbalization were request for materials, those materials were withheld until she was responded to the teacher's question about those materials.

When the girl was silent the teacher withheld their attention and the material.

A high frequency of verbal behavior was quickly established. When both teacher's attention and materials were provided only when the child was not verbalizing the child's frequency of talking immediately decreased.

When social attention and material were again made contingent upon spontaneous speech and answering questions the child frequency of talking frequency increased to its previous high level.

The content of child's behavior which increased was primarily a repetition of request to the teacher with little change noted in non-request verbalization or verbalization to other children. Further experimental analysis demonstrated the social interaction per se was not the reinforcers which maintain the increase in verbalization rather for the child, the material reinforcer which accompanied the social interaction appeared to be the effective component of teacher's attention. The researcher would wish to establish whether the outcome of such an experiment would be duplicated in a normal classroom situation motivating children to improve their mathematics performance.

The effects of contingent reward on child interest in academic mathematics were investigated in token economy analogue by Baroody (1987). Three measures of interest where examined using an A- B design; (1) Amount of activities produced (2) Quality of activity produce (3) Time spent engaging in the activity. Reward was delivered contingent upon the first of the measures.

Experimental subjects were exposed to baseline, reinforcement and follow up conditions. A control group received baseline procedure throughout.

No evidence of substantial undermining of interest occurred on any measure although two subjects displayed an immediate transient decrease in post-reward performance.

2.4 Reinforcement and the school environment

A study by Samson (1969), showed that teachers were aware of the importance of incentives in learning to mathematics. The majority thought that most children were eager to learn but that success was the most important factor in encouragement and praise even small effort and that children were greatly disheartened when they fail thus encouragement and, praise even small effort was important. Adam (1990), in his support for incentives argues that incentives such as reward, presents, praise, promotion, medals among other forms of reinforcers should be instituted by teachers to enhance motivation.

The larger the varieties of the incentives the larger the number of learners, Adair (1990). In his book, *Understand motivation* page 44 Adair puts it "… money anyway often means more to people as tangible symbol of recognition…." To him material reinforcer is significant and a driving force to academic performance, mere recognition according to him is not motivating enough. According to Hall (1980), when selecting a reinforcers in a classroom situation, one qualification is that it should not be expensive. Adam further argues that the reward should match the effort the learner projects. It is like mistake for teachers to assume that they automatically know what will serve vas reinforcement to kids, Hall (1980).

The rule of the thumb for the teacher is to try the potential reinforcer. If the behaviour increases, then it is a reinforcement and vice versa. While it is more difficulty to find effective reinforcer for some learners than others according to Hall, there is always something that will reinforce him/her. The only time this will not be true is if the learners is dead.

2.5 Kenya Certificate of Primary Education (K.C.P.E) Mathematics review 2005-2009

Kenya National Examination Council (KNEC) News letters 2005-2009 indicates that mathematics has been interchanging the last position (5) with the second last. Candidates sit for five papers; Mathematics, Science, English, Social Studies and Kiswahili. The mean standard score for the five subjects in the five years were 39.43, 42.72, 42.92, 43.11 and 44.96 Mathematics, Social Studies, Kiswahili, English and Science respectively. From the data it can be realized that apart of being the last subjects in performance, it is the only subject whose range and the next is more than
one mean score; 3.29 compared to social studies.

It is only in the mathematics subject where the destructors in the objective questions made no significant meaning. While the KNEC could explain why a given percentage
of candidates chose a given option for a given question (statement) in other four papers, the council attributed most selected options to probability in the mathematics papers.

This was so particularly to the candidates who had scored less than 30%.
This is supported by Phonex Institute findings in year 2010 that about 10% of class 8 pupils in Kenya could not handle class 3 mathematics problems effectively.

National Journal of Science and Mathematics Education (2007), attributed to poor performance in mathematics to poor background the pupils have had in the lower levels starting from pre-schools. The journal notes that teachers level the blame to poor preparedness in the presiding levels and children's poor attitude towards the subject which is predominant in the society. Poor teaching methods in mathematics have also been said to contribute to the dismay performance. The methods are said to be examination oriented which alienates the key objectives of making the subject part of real life. The journal has also contributed the poor performance to the kind of motivation the children have heard which it argues is wanting.

According to NACECE the pre-school curriculum should set a strong base to other levels of learning. Through the application of thematic method of teaching which involves integrating all the other areas of curriculum, the organization hopes that the objectives will be realized. In essence teachers often apply social reinforcers particularly praise to motivate their learners. Could supplementing social reinforcers with material reinforcers enhance performance in pre-school mathematics in Mirangine district? The society would have no problem even if it would, mean awarded the child with MR every t9ime he/she excels in school. This is supported by Fister (1994) who argues that parents would always go to any length so long as their children pass examination.

2.6 Concept of retention

According to Brown (2009) effort is the most important component of success, therefore learners must work hard to succeed. Brown therefore encourages learners to view their performance as a measure of their efforts and not their innate ability and that effort lead to positive feedback. If the effort does not earn the desired feedback the leaner may withdraw. According to the study conducted by Australian Association for research in Education (2005) on the other hand argues that a major factor which directly affects performance and retention of Mathematical concepts in learners is controlled not by the learners themselves but by the teacher. This factor is called pedagogical knowledge and it is not the knowledge of any kind of Mathematics but instead the knowledge of how to teach. Brown further argues that time spent by the learner with or without parental interaction is crucial to the long term retention and understanding of Mathematical concepts even in elementary Mathematics.

Through hard work and study periods, the learner can get a second chance over concept on their own terms while repetition helps the learner to retain concept in their long term memory. The moment the learner understand the relevance of the concept Brown adds, "…the teacher's role is as well complete". According to Baroody (1987) teachers should set goals for their learners and their corresponding rewards. According to John (1985) a lynx will only chase a snow rabbit for a short distance because food gained if prey is caught cannot replace energy loss. Baroody further argues that reward (not committal on the nature) in school may promote stronger engagement in school activities.

2.7 Mathematics issue in Mirangine District K.C.S.E

Poor performance in mathematics in Secondary Schools in Mirangine District is a matter of concern to all the stakeholders. According to Mirangine District Education Day journal (2011), out of 11 secondary schools with a total enrolment of 507 candidates who sat for Kenya Certificate of Secondary Education (K.C.S.E,) only three candidates scored grade 'A' (Excellent).

It is everybody's concern that 198 candidates had grade 'E' (Poor). The best school in the district, Nyakiambi had a mean grade of 5.9 (out of the possible 12), the second best was Ngorika with a mean grade of 3.68. The last school was Rutara with a mean grade of 1.64. The district's mean score was 2.74. The subject took the last position compared to others which had been the trend over the years. The mean grade of 1.64 as in Rutara's case implies that the children lack basic concepts in mathematics. It is categorical that teachers will blame poor performance in mathematics to the poor background which includes the pre-schools. The researcher wanted to establish whether supplementing the traditional social reinforcers with material reinforcers may improve mathematics performance in pre-schools in Mirangine distict.

2.8 Theories of motivation based on intrinsic and extrinsic motivation

According to Cassandra (1979), motivation is a driving force by which human beings achieve their goals. In understanding human behaviuor, psychologists have long been interested in what motivates specific action.

Motivation is said to be intrinsic or extrinsic. According to the various theorists, motivation is the basic needs to minimize physical pain and maximize pleasure.

It may include specific needs such as eating or a desired object, goal, state of being ideal or it may be attributed to less apparent reason such as atruison, selfishness, morality or avoiding morality. Motivation is related to but distinct from emotion. Intrinsic motivation occurs when people are internally motivated to do something because of either being pleasure; they think it is important or they feel that what they

are learning is significant. Although one of the objectives of teaching mathematics in pre-school in Kenya by NACECE is to integrate the subject in the real life situation,

the goal remains elusive when most children are not able to relate the symbols and numerals to real life situation. This can be proved by sitting example from Phonex Institute (2010) findings that about ten percent of class 8 pupils in Kenya can not

handle class 3 mathematics.

The teaching of mathematics and motivating the learners through intrinsic motivation which is very common in most institutions of learning hence remains insignificant particularly when it comes to pre-schoolers. This is supported by Frezer (1988)

who say that he is skeptical on whether young children are mature enough to give

any significant value to social reinforcers.

It has been shown that intrinsic motivation for education drop from grades 3-9 though the exact cause can not be asserted. In young students according to Cassandra (1979), has been shown that contextualizing materials that would be presented in an abstract manner increases the intrinsic motivation.

Extrinsic motivation comes into play when a learner is compelled to do something or act in certain way because of factors external to him/her like money or good grades, Atkinson (1964). A Meta analysis of 128 studies examined the effects of extrinsic rewards on intrinsic motivation. As predicted engagement contingent, completion of contingent and performance contingent rewards significantly undermined free choice; intrinsic motivation as did all rewards, all tangible rewards and all expected rewards. Positive feedback enhances both free choice behaviour and self reported interest.

Tangible rewards intended to be detrimental for children than college students and verbal rewards tended to be less enhancing for children than college students.

A research by Netbell (1973), asked two groups of children to do some drawing.

One group was promised a good player medal for their work, while the other was promise nothing. On return visit, the groups were given papers and crayons and what they did was observed. The group which had been given medal previously spent significantly less time drawing as compared to non-rewarded group. Can this be duplicated in classroom situation by promising material reinforcers on top of social reinforcers in relation to social reinforcers only?

2.9 Conceptual framework

The experimental group was provided with both social and material reinforcers.

The value/ amount of reinforcers was directry proportional to the learner's performance. The MR included erasers, pencils, crayons, markings and exercise books.

The control group was provided with social reinforcers only for example verbal or written praise, clapping, teacher smile on work well done, pat at the back among other social reinforcers. The application of either S.R or the combination of S.R and M.R was expected to influence the child's participation in Mathematics and eventual level of performance.

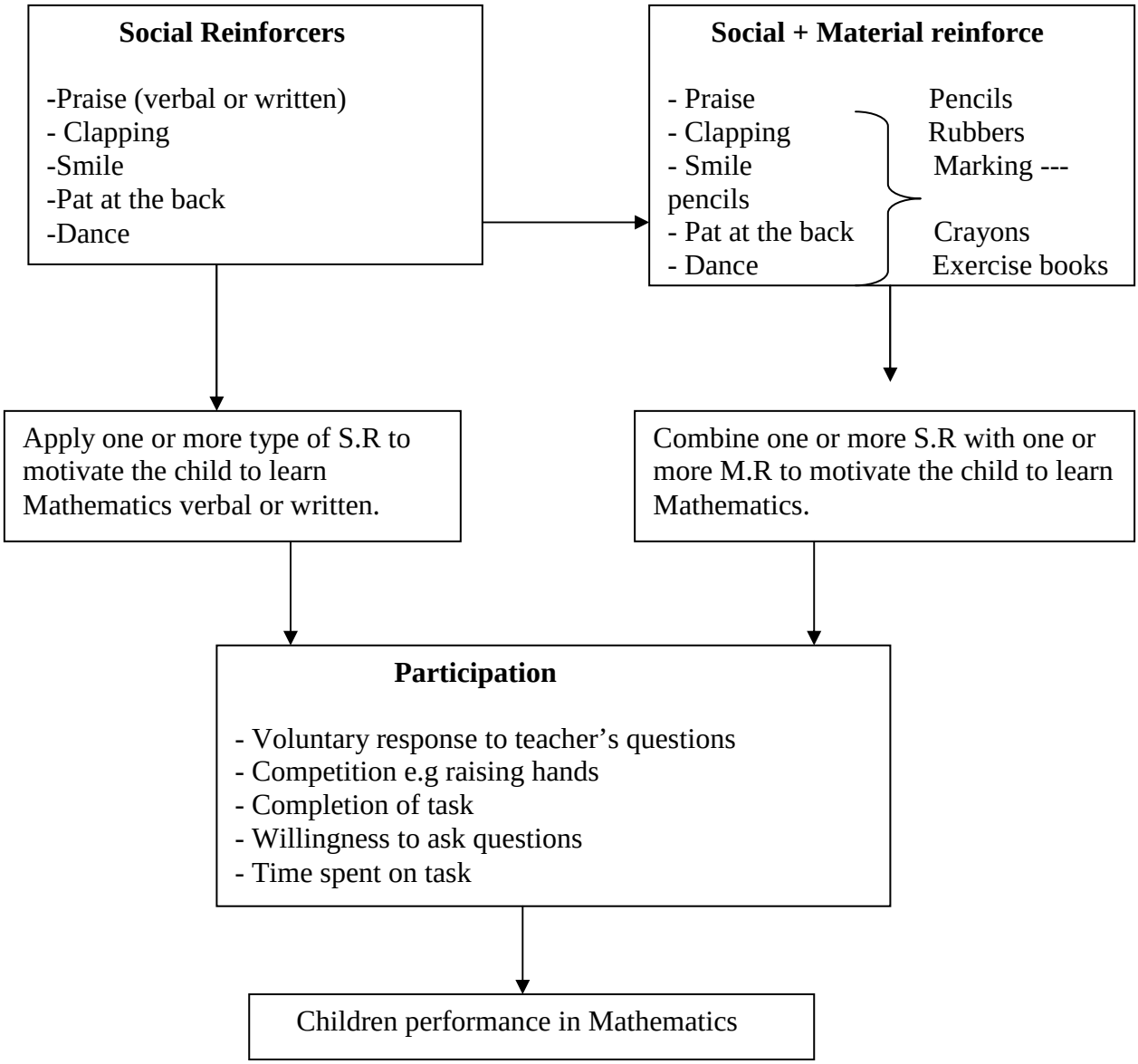


Figure1: Conceptual framework

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter discusses the research design, target population sampling and sample size. Other areas include; the study instruments, validity and reliability, procedure of data collection, finally data analysis and ethical issues.

3.1 Research design

The research design was quasi experimental. According to Campbell (2006) many of the research questions that would like to answer simply can not be answered by resulting to true experiments due to ethical reasons. A quasi experiment design is one that looks a bit like an experimental design but lack the key ingredient-random assignment. The research was carried out in public pre-schools because they have relatively similar characteristics. According to a survey by Kenya Agricultural Research Institute(KARI;2011) Oljoro orok branch about 80 percent of families in Nyandarua county where Mirangine district belongs earn an average of 2.5 dollars a day a minimal income to sustain a family.

There were four pre-schools in total; two for the control groups where social reinforcers including praise, smile, clapping and dancing for, among other non-tangible elements of motivation were applied. Material reinforcers were totally excluded in this category.

The other two pre-schools were the experimental group where both social and material reinforcers were applied for motivation purpose.

3.2 Target population

One hundred and twenty children, four teachers and four headteachers took part in the study. According to Campbell (2006), a quasi experiment may only require a small sample for convenience and management purposes. The sample was derived from the 34 public pre-schools in the district. Most public pre-schools in the district have a relatively similar social-economic background. Another common characteristic of the sample pre-schools in the district is their management by the *mother* primary school's head teachers. At the same time the teacher's are employed by the parents with relatively equal salaries. The above characteristics implied that the child's performance in the sample pre-schools was solely as a result of what the respective pre- schools offered.

3.3 Sample and sampling procedure

A sample of four pre-schools was selected in the district. The district has three administrative divisions; Dundori, Tumaini and Ngorika fifteen, ten and nine pre-schools respectively. The researcher applied the already existing administrative clusters to select the samples from. To get sample pre-schools from the respective clusters, the researcher applied simple random sampling procedure to give every pre-school equal opportunity of being selected. Dundori cluster of 15 pre-schools by virtue of its number received two pre-schools while Tumaini and Ngorika received one each.

3.4 Instruments for data collection

The researcher applied various instruments to collect data. These included pretest; on mathematics performance on both experimental and control groups and questionnaires for the teachers before the commencement of the study and after. Other tools included observation schedules on participation and retention tests. This enabled the researcher establish the children's pre-requisite knowledge of the curriculum to be experimented on and after.

3.5 Validity and reliability

Haberman (1979) refer content validity as the degree to which a test can stand by itself as an adequate measure of what it is supposed to measure .On the other hand reliability concern the extent to which measurement are repeated by a person using the same measures of an attribute .To ensure validity and reliability, the researcher pilot- tested the instruments prior to the actual experiments in two pre-schools other than sample pre-schools .The researcher used test- retest technique to ascertain the instrument reliability. This involved administering the same instrument twice to the same group of respondents. The researcher allowed a time lapse of one week between the first and the second test registering correlation of 0.78.

3.6 Procedure for data collection

The researcher proceeded to collect data after receiving permission from District Education officer Mirangine district and from respective pre-school headteachers. This was followed by piloting two pre-schools; the control and experimental groups collected through convenience sampling technique .There were questionnaires for teachers who took part in study to establish their roles in motivation in mathematics prior to the experiment and also on individual teacher's evaluation on the level of participation prior and after the quasi experiment.

After teaching every mathematics lesson the teacher gave a test of five sums and a - *semi summative* one of ten sums after the end of every week for four consecutive weeks designed by the researcher .As the teaching /learning progressed the teacher filled in a participation questionnaire also designed by the researcher on what they had observed in the course of teaching/learning .A post -test was carried out on what the learners had gone through for the entire four weeks with sums which were relatively similar in concepts with what they had learnt.

3.7 Data analysis

There were various methods by which data were collected and analyzed. These included the measures of central tendencies; the mode, range, mean, median and standard deviation; all in percentages. The researcher established the daily mean score for the class performance, weekly and eventually monthly in the four sample schools.

The weekly mean scores for both the experimental and control groups were represented in histograms. The researcher established range median and standard deviation of the two groups. The researcher applied a histogram to compare the relationships in mathematics performance in experimental and control groups .Other data captured in the histogram included the levels of participation prior and after the quasi experiment. Histogram was further used to compare the findings in the pre –test and post- test in mathematics performance, participation and retention. The retention test was carried out four weeks from the post-tests.

3.8 Ethical issues

The researcher strictly adhered to the professional guidelines. The data collected were confidential and only meant for the research. To hide the respondent's identity and those of the pre-schoolers the researcher applied code numbers instead of names.

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSIONS OF FINDINGS

4.1 Introduction

This chapter seeks to compare data collected from teachers and children in both experimental and control preschools in mathematics performance. Data collected in each of the two experimental preschools have been merged and hence treated as a unit. The two control pre- schools as in the case of the experimental groups have also been merged and treated as a unit. The discussions addressed the research objectives of the study which include:

1. To establish whether children taught mathematics and motivated using social reinforcers perform well.
2. To establish whether children who are taught mathematics and motivated using both social and material reinforcers perform well.
3. To investigate whether the type of reinforcement influence retention of mathematical concept.
4. To investigate whether children taught mathematics and motivated using both SR and MR participate effectively in class than using SR only.

4.2 Demographic Data

There were four teachers in total in the study, two from experimental preschools and the other two from the control groups. The number of children participants in the entire study was fifty in each group plus or minus four. The information provides a clear picture on the role of social and material reinforcers, participation and retention of mathematical concepts.

4.3 Pre-test mathematics performance: Experimental group

Prerequisite knowledge of every study works as springboard for further research, Berg (1995). The researcher first established the level of children prerequisite knowledge in Mathematical concepts. The children performance was categorized into ten levels. This was to be compared with later finding in children's mathematics performance.

Table1: Experimental group performance before experiment

Scores	Frequency	Percentage
0-10	1	1.96
11-20	3	5.88
21-30	2	3.92
31-40	2	3.92
41-50	5	9.80
51-60	6	11.76
61-70	14	27.45
71-80	11	21.57
81-90	4	7.84
91-100	3	5.88
	51	100

Table 1: Indicates that majority of children scored between 61-70 percent representing 27.40 percent. The class registered a mean score of 60.90 percent. The class further registered a median of 64.78 percent, standard deviation of 21.29 and a range of 90.

The findings does not agree with Phonex Institute(2010) research findings that says that about ten percent of class 8 pupils in Kenya can not effectively solve lower primary mathematics problems siting class3. In this case it was only about two percent of the children who could not effectively solve mathematics problems of their level. The mean score for the class was at the same time much more than ever best KCPE in the country.

4.4 Pre-test mathematics performance: Control group

The study sought to establish the level of children's prerequisite knowledge in mathematical concepts prior to the commencement of the quasi experiment.

Ten levels were identified and their respective frequencies and percentages.

The findings were to form the base for future comparison in the group after four weeks and assessment on retention.

Table 2:Pre-test control group mathematics performance

Scores	Frequency	Percent
0-10	2	3.70
11-20	2	3.70
21-30	3	5.56
31-40	2	3.70
41-50	4	7.41
51-60	7	12.96
61-70	12	22.22
71-80	12	22.22
81-90	8	14.81
91-100	2	3.70
	54	100

Table 2: Shows that majority of children scored between 61 and 80 percent representing 44.44 percent. The class means score was 61.60, a median of 66.33, standard deviation of 22.19 and a range of 88 percent. Like in the experimental group's findings, the control group's findings negates the Phonex Institute (2010) findings that about ten percent of class 8 pupils can not effectively handle class 3 mathematics problems.

The relatively good performance in the control group like in the experimental group disagree with Hall(1980) view that poor performance in higher levels in mathematics performance could be as a result of poor preparedness in the lower levels.

4.5 Pre-test mathematics performance: Experimental and control groups

The study analyzed the relationship in mathematics performance in experimental and control groups prior to the commencement of the study. This enabled the researcher compare performance at different levels which formed the point of reference for future comparison which included the post-test, after four weeks and the assessment test on retention in the group.

Figure2: Pre-test performance : Experimental and control groups

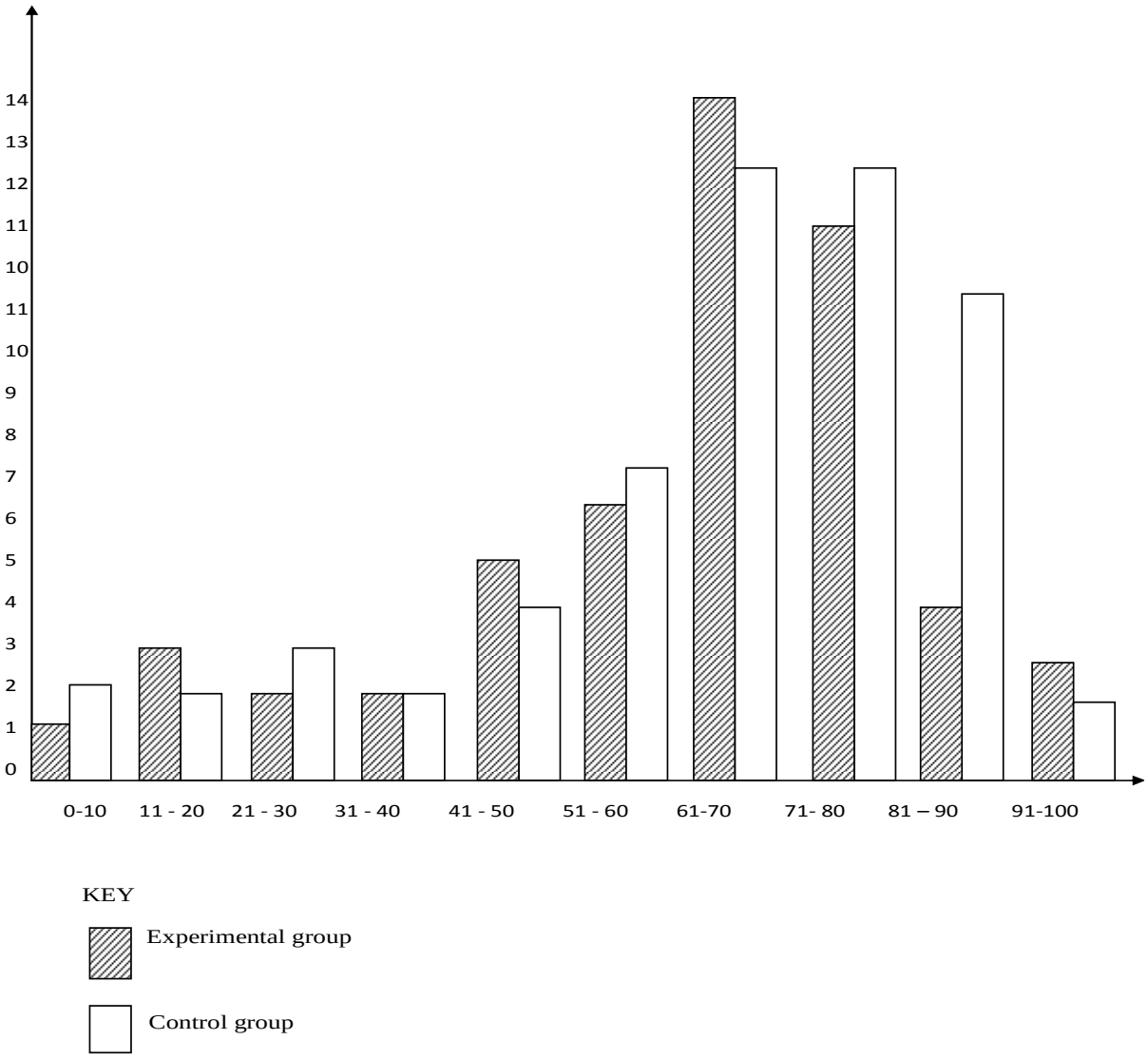


Figure 2 show the comparison in mathematics performance in experimental and control groups. The findings of the pre-test performance indicate that most children scored between 61and70 percent, this represents 26.83percent. The findings of the preschools in the control group indicates that majority of the children scored between 61 and 80 percent.

The difference between the mean range scores of children scoring below 61 percent and those above 60 percent was 18.41 and 20.36 experimental and control groups respectively. The findings in both experimental and control groups pre-test findings agrees with KARI Oljororok branch (2011) research findings that suggests that the population in Mirangine District got relatively similar characteristics. This could be supported by the pre-test mean score of 60.90 and 61.06 control and experimental groups respectively.

4.6 Pre-test observation schedule on participation: Experimental group

The study sought to establish the children's participation levels according to their respective teacher's judgment. Children were categorized into three levels; active, average and below average. The findings formed a point of reference for future comparisons on participation after two and four weeks.

Table 3: Pre-test level of participation: Experimental group

Level of Participation	Frequency	Percent
Active	10	19.61
Average	30	58.82
Below average	11	21.57
	51	100

Table 3: Shows that majority of children's participation was average accounting to 58.82 percent. Those who were active were 19.61 percent while those below average were 21.57 percent.

The level of participation put into account child's attention span or concentration in the course of learning, child's willingness to answer and ask questions and time spent on the task. The researcher further put into account child's –teacher relationship and the level of competition among the children. The research findings disagreed with the National journal of science and Mathematics education (2009) view that there is general negative attitude towards Mathematics and other Science subjects. Only 21.57 per cent of children participation in experimental group was below average.

4.7 Children's level of participation after two weeks: Experimental group

Data on the level of children's participation were collected after two weeks from the commencement of the quasi experiment. The data collected were then compared to the initial data collected in the group.

Table 4: Children's participation level after two weeks : Experimental group

Level of participation	Frequency	Percent
Active	12	24.49
Average	28	57.14
Below average	9	18.37
	49	100

Table 4 table shows that like in the experimental group, majority of children's participation was average representing 57.1 percent with an insignificant negative deviation of positive 1.41 percent.

Children who were active were 24.07 as compared to 19.61, a positive deviation of 4.46 percent. Children below average were 18.52 percent as compared to 21.57 a negative deviation of 3.05 percent. The significant improvement particularly in the active participation could be explained by Nancy (1978) says that active verbalization for a Negro girl with extremely low frequency of talking was as a result application of material reinforcers which accompanied the social interaction.

4.8 Children's level of participation after four weeks: Experimental group

Data on the level of children participation were collected after four weeks. The data were compared with those collected after two weeks and those from the pre-test.

Table 5: Children's participation level after four weeks: Experimental group

Level of participation	Frequency	Percentage
Active	9	19.15
Average	27	57.45
Below average	11	23.40
	47	100

Table 5 indicates that the level of active participation category decreased from 24.49 to 19.15 percent a negative deviation of 5.34 percent with accompanying social reinforcers with material reinforcers. The level of the average category increased to 57.45 from 57.14 percent. This could be attributed to the increase in the quite active category. The margin of 0.31 seem to be relatively insignificant compared to the 4.88 margin between the average and active category from 21.57 to 18.37 a negative deviation of 3.2. This could have been as a result of sharing between the two categories.

The findings agree with Nabil (1976) who says that positive influence of candy as a type of material reinforcer is short lived. The participation in the fourth week almost replicated the pre-test findings save the below average category whose participation increased to 23.40 from 21.57 percent.

4.9 Pre-test observation schedule on participation after two weeks: Control group

The study sought to establish the level of children's participation according to respective teacher's view after two weeks from the commencement of the quasi experiment.

The levels were categorized as active, average and below average.

Table 7: Post-test observation schedule on participation after two weeks: Control group

Level of participation	Frequency	Percentage
Active	13	24.07
Average	31	57.41
Below average	10	18.52
	54	100

The result of the findings indicates that there was an insignificant improvement in the active participation of 24.07 as compared to 23.08 per cent in the pre-test of 0.99 percent.

The level of average participation decreased to 57.41 from 59.62 a negative deviation of 22.21 percent. The below average category increased to 18.52 from 17.31 percent a positive deviation of 1.21 percent. Like in the experimental group the findings disagrees with National Journal of Science and Mathematics Education (2009) findings that says that there is general negative attitude towards Mathematics. Only 18.52 percent of children were below average in participation.

4.10 Pre-test: Children's participation: Control group

Data on children's level of participation were collected before the commencement of the quasi experiment. The data were to be compared with the later findings in the category.

Table 6: Pre-test: Children's participation: Control group

Level of participation	Frequency	Percentage
Active	12	23.08
Average	31	59.62
Below average	9	17.31
	47	100

Table 6 indicates that children's participation in all the three categories; active, average and below were 23.08, 59.62 and 17.31 respectively. The active category registered a negative deviation of 0.99 percent as compared to the findings in the pre-test.

The average category registered a positive deviation of 2.48 as compared to a negative deviation 1.06 of the below average category. The pre-test findings on participation disagrees with most scholars view for example Hall (1980) whose journal reports that most teachers believe that most students got negative attitude towards mathematics back from pre-schools. The test findings established that only 17.31 percent of children participation was below average. The increase in the average category was contributed by the decrease in the active category and the decrease of the below average category.

4.11 Pre-test: Children's participation after four weeks: Control group

Data on the level of participation of the control group were collected four weeks from the commencement of the quasi experiment. The data were then compared with those collected after two weeks and those from the initial findings.

Table 8: Children's participation after four weeks: Control group

Level of participation	Frequency	Percent
Active	14	28
Average	27	54
Below average	9	18
	50	100

Table 8 Shows that there was quite a significant difference in the participation particularly in the active category registering 28 percent as compared to 23.08 registered after two weeks a positive deviation of 4.92. As compared to the pre-test findings, the deviation was also quite significant 3.93 percent.

The disparities were also registered in the average categories which decreased by 3.14 percent. The disparities could be explained by the increase of the active category. The disparities in the average category remained insignificant registering 18.52, 18.37 and 18 percent pre-test, after two weeks and fourth week respectively. The relative great improvement particularly in the active category agrees with Brown (2009) who says that effort lead to positive feedback and that if the effort does not earn the desired feedback the learner withdraws. The active category hence seem to have appreciated positive feedback and hence improvement in performance.

4.12 Post-test performance after four weeks: Experimental group

The study sought to establish children's mathematics performance after four weeks from the commencement of the quasi experiment. The data were then compared with the initial findings in the group.

Table 9: Post-test performance after four weeks: Experimental group

Scores	Frequency	Percentage
0-10	-	-
11-20	1	2.13
21-30	2	4.26
31-40	3	6.38
41-50	2	4.26
51-60	8	17.02
61-70	13	27.66
71-80	11	23.40
81-90	6	12.77
91-100	1	2.13
	47	100

Table 9 indicates that majority of the children scored between 61 and 70 percent representing 27.66 percent as compared to 27.45 percent in the same class. The 61-70 percent was also the modal class in the pre-test but with insignificant deviation of 0.21 percent. The class range decreased to 82 percent as compared to the 90 percent of the pre-test. The mean score increased to 62.23 from 60.90, a positive deviation of 1.33.

The class registered a median of 66.65 percent compared to the initial score of 66.33 percent insignificant negative deviation of 21.29 a negative deviation of 1.87.

There was no significant difference in performance in terms of different intervals although the mean score increased to 62.23 from 60.90. The findings agreed with Brown (2009) who says that time spent by the learner with or without parental interaction is crucial to the long term retention and understating mathematical concepts even in elementary mathematics.

4.13 Post-test performance after four weeks: Control group

The study sought to establish children's performance four weeks from the commencement of the quasi experiment. The data were then compared with the pre-test findings in the group.

Table 10: Post-test performance after four weeks: Control group

Scores	Frequency	Percent
0-10	1	2
11-20	1	2
21-30	-	-
31-40	3	6
41-50	5	10
51-60	6	12
61-70	13	26
71-80	11	22
81-90	8	16
91-100	2	4
	50	100

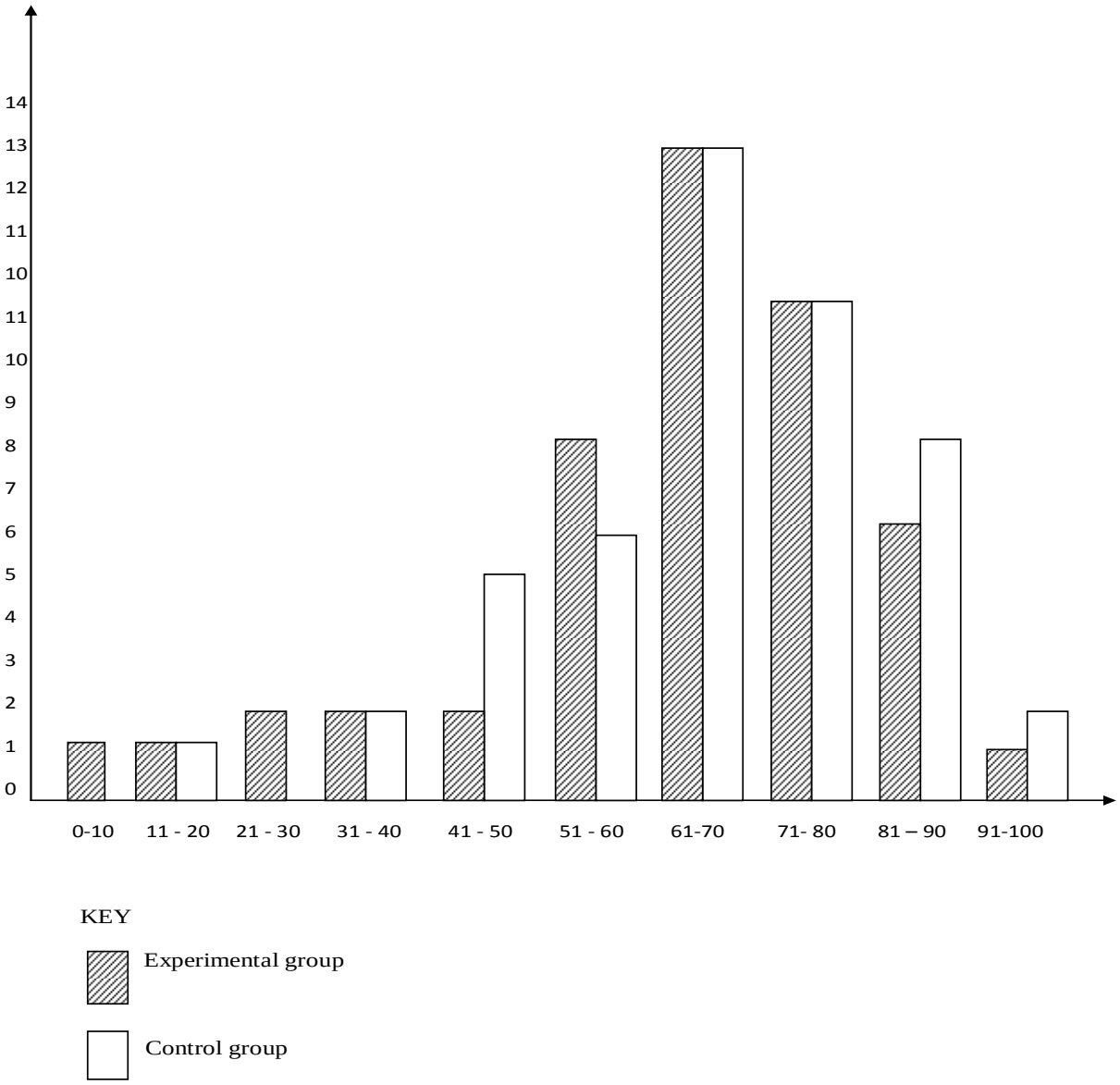
Table10 indicates that majority of children scored between 61 and 70 percent representing 26 percent of the class as compared to 22.22 percent in the same class, a positive deviation of 3.78 percent. The class range increased to 90 as compared to 88 percent in the pre-test while the class mean score increased to 65.4 percent from 61.60 which represent a positive deviation of 3.8 percent. The class registered a median of 67.42 percent as compared to 66.33 percent registered in the pre-test, a positive deviation of 3.8 percent.

The standard deviation was 19.57 as compared to pre-test deviation of 22.19 a positive deviation of 2.62 percentages. The sustained level of performance of the control group pre-test, after two weeks and fourth week respectively agrees with Borwn (2009) who says that the moment the learner understand relevance of a concept "…The teachers role is as well complete". The understanding, Brown adds is influenced by the teacher's pedagogical knowledge. The sustained performance also agrees with Adam (1995) who says that reward (not committal on the nature) must make sense to the learner for it to bear fruits as a type of motivation. All in all the fourth week performance in the control group was relatively similar to the experimental group.

4.14 Post- test performance experimental and control groups

The researcher sought to compare children's mathematics performance in experimental and control groups after four weeks of the experiment.

Figure3: Post-test performance: Experimental and control groups



The findings of the post-test of both experimental and control groups indicates that most of the children scored between 61 and 70 percent representing 26 percent of the children.The difference (range) between the mean scores of children scoring below 61 percent and those scoring above 60 percent was 19.03 and 20.17 experimental and

control groups respectively. There was a tie in 11-20, 31-40 and 71-80 classes. The mixed -up performance in the different categories between experimental and control groups disagrees with Atkinson (1964) who says that tangible rewards tend to be detrimental for children than college students and verbal rewards tend to be less enhancing for children than college students. The substantial improvement of the control group performance in some categories could agree with Peabody (1970) who says that children learn effectively when given verbal reward in comparison to candy rewards. This view is though diluted by some of the categories who performed relatively the same or had dismay performance.

4.15 Retention test: Experimental group

The data were collected three weeks after the post test. The information was compared to the performance in the post-test.

Table 11: Retention test: Experimental group

Scores	Frequency	Percentage
0-10	1	2.08
11-20	-	-
21-30	3	6.25
31-40	2	4.17
41-50	3	6.25
51-60	10	20.83
61-70	11	22.92
71-80	13	27.83
81-90	5	10.42
91-100	-	-
	48	100

Table 11 indicates that majority of children scored between 71 and 80 percent representing 27.83 percent of the class. The class range score decreased significantly to 76 percent from 82. The class mean score was 64.26 percent as compared to 63.90 percent in the post test, an insignificant positive deviation of 0.36 percent. The class median decreased marginally to 65.50 percent as compared to the post-test median of 66.65 per cent a negative deviation of 1.15 percent. The class registered a standard deviation of 19.76 as compared to 19.42 in the post-test a negative deviation of 0.36 percent.

Key areas to be noted from the findings are that all the intervals maintained their performance. This could support the KARI (2011) view that Mirangine District population got relatively similar social -economic characteristics. This implies that children only *reproduce* what the teacher has offered.

4.16 Retention test : Control group

As in the experimental group, the data on retention in control group were collected three weeks after the post- test. The data were then compared to those collected in the post test.

Table 12: Retention test : Control group

Scores	Frequency	Percent
0-10	-	-
11-20	-	-
21-30	3	6.12
31-40	4	8.12
41-50	4	8.16
51-60	6	12.24
61-70	12	24.49
71-80	11	27.45
81-90	7	14.29
91-100	1	2.04
	49	100

Table12 indicates that majority of children scored between 61-70 percent representing 24.49 percent almost a replica of pre-test and post-test. The class range decreased significantly to 67 percent from 90 percent, a negative deviation of 23 percent. The class mean score was 66.84 percent as compared to 65.40 percent in the post- test a positive deviation of 1.44 percent. The class registered a median of 66.33 percent as compared to 67.42 percent in the post-test, a negative deviation of 1.09 percent. The class further registered a standard deviation of 20.90 as compared to the post test findings of 22.19

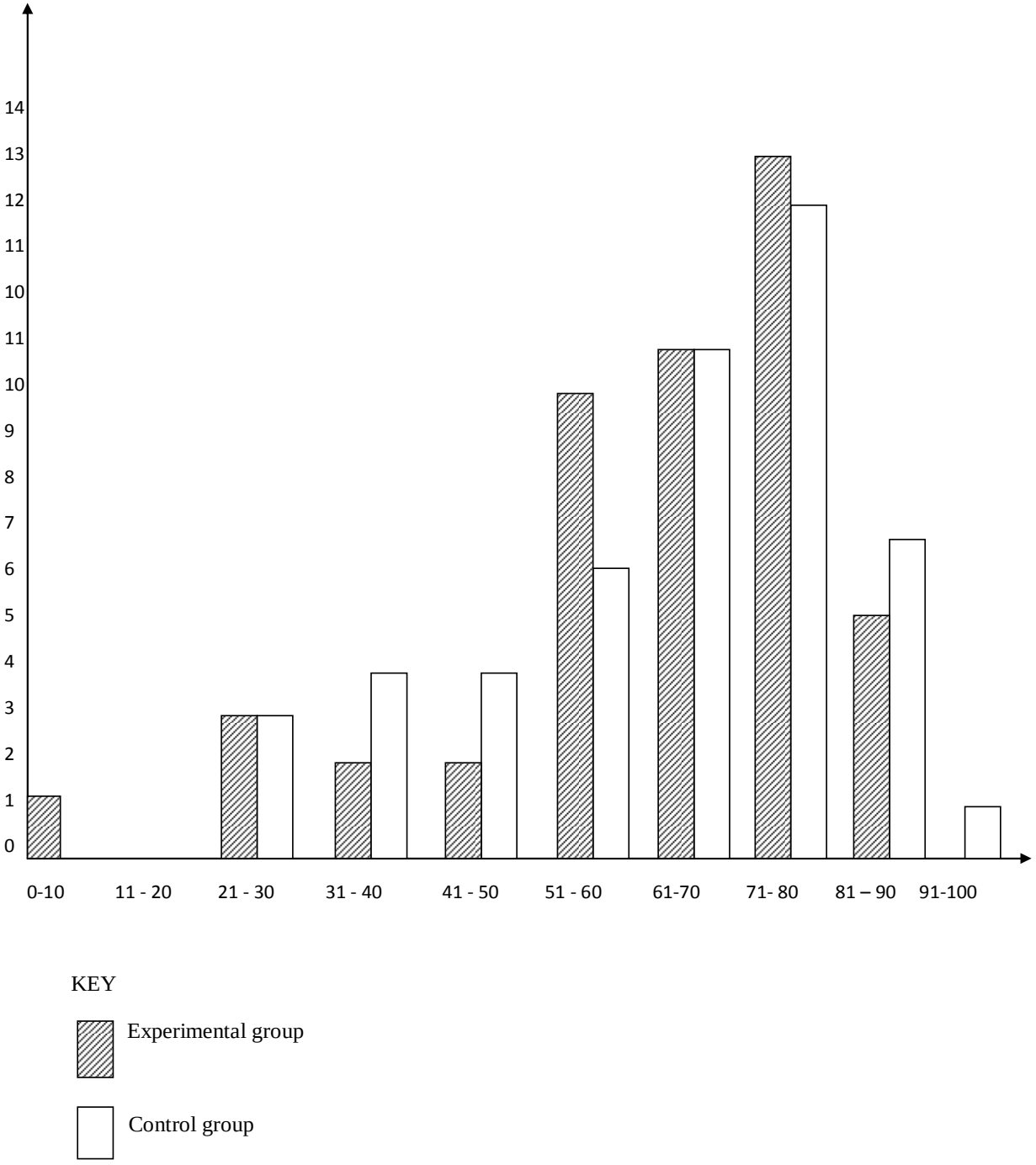
percent a positive deviation of 1.29 percent.

The findings in the control group tend to disagree with KARI (2011) that the population in Mirangine District got relatively similar social - economic characteristics unlike in the experimental group. There was substantial improvement in the retention of Mathematical concepts particularly in the 0-10 and 11-20 intervals who improved in performance. The improved performance agrees with Atkinson (1964) who says that engagement, completion and contingent rewards significantly undermine free choice and hence supporting social rewards.

4.17 Retention test experimental and control groups

The researcher sought to establish whether there is relationship in mathematics performance on the type of reinforcer applied to motivate children. Comparisons were analyzed according to respective clusters.

Figure 4: Retention test: Experimental and control groups



A significant change was recorded in the change of modal class from 61-70 to 71-80 in the experimental group while the control group retained the 61-70 class. There was though a significant difference in the range in the categories 80 and 88 experimental and control groups respectively. The experimental mean score of 64.26 of the retention test as compared to 63.90, a positive deviation of 0.36percent was 1.08 percent less as compared to the control's group positive deviation. The control group mean score was 66.84 as compared to 66.33 of the group's post test; a positive deviation of 1.44.

The study did not establish any significant/explicit differences from any group on retention from the diverse intervals. The retention levels were either interchanged or recorded a tie. The experimental group had a standard deviation of 19.78 as compared to 20.90 of the control group deviation of 1.12 percent. The findings in the experimental and control groups implies that the retention of Mathematical concepts are not necessarily in what the teacher does in classroom but to the individual learner. This view is supported by Brown (2009) who says that the most important component of success and retention of concepts is in the learner's hard work. It is further noted that all categories in both control and experimental groups maintained their level of performance. The findings agree with Tinton (1999) who says that the retention of concepts is imparted by the learner's pre- entry attributes.

CHAPTER FIVE

SUMMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS OF THE STUDY

5.1 Introduction

This chapter presents a summary of findings based on research objectives, conclusions from the findings and recommendation derived from the conclusion. It also provides suggestions for further research.

5.2 Summary of major findings

The main purpose of this study was to investigate influence of the material and social reinforcers on mathematics performance in preschools in Mirangine district. In the study, reinforcers have been treated as an independent variable. On the other hand social reinforcers have been supplemented with material reinforcers to form the other independent variable.

The study's first objective wanted to establish whether children taught mathematics and motivated using social reinforcers perform well. According to the research findings children taught mathematics and motivated using S/R performed relatively the same as those motivated by accompanying SR and MR and hence responding to the second objective which wanted to establish whether children taught mathematics and motivated using both SR and MR perform well.

The study's third objective wanted to investigate whether the type of reinforcement influence retention of mathematical concepts. According to the research findings. There was retention of mathematical concepts in both the experimental and control groups with equal measures of

non-retention depending on the subject matter. For example the degree of retention in both control and experimental groups was the same in role learning while there was some diversities in addition sums.

The forth objectives wanted to investigate whether children taught mathematics and motivated using both SR and MR participate effectively in class than using SR only. According to the research findings, the level of active participation of social reinforcers was sustained throughout the period. On the other hand children in the experimental group where both SR and MR were applied were quite active in the first two weeks but the trend diminished to explicate the pre-test findings by the fourth week.

5.3 Conclusion

The study concluded that there is no significant difference in children's performance in mathematics whether they are motivated using social reinforcers or accompanying social reinforcers with material reinforcers. The study also concluded that retention of mathematical concepts is not influenced by the type of reinforcers.

The researcher also concluded that application, of social reinforcers to motivate learners in mathematics learning process enhance active participation through out the learning process. Active participation by learners in the learning process with supplementing social reinforcers with material reinforcers though very active in the initial stages is short-lived.

5.4 Recommendations

The study recommends that teachers should diversify methods of motivating children particularly the slow learners. The study also recommends ability grouping in order to improve mathematics performance. This concern is derived from the distinct performance in the different categories the active, average and the below average categories.

5.5 Suggestion for further study

The research finding suggests that there is need to carry out a research on how to motivate young slow learners whose poor performance remains static. A study should also be carried out on the relationship between the level of a participation and mathematics performance in pre-schools.

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APPENDIX A: Pre –test observation schedule on participation

For each of the following tick only one.

Name of pre-school_____

Number of children _____

1. How would you rate the degree of attention span of children as you instruct them?

   0-20 ☐ 21-40 ☐ 41-60 ☐ 61-80 ☐ over 80 ☐

2. What numbers of children are ready to respond to your question orally?

   0-20 ☐ 21-40 ☐ 41-60 ☐ 61-80 ☐ over 80 ☐

3. What is the average time in minutes do children take to complete a task of five questions?

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 and over ☐

4. What is the average time in minutes do children take to complete a task of ten questions?

   Between 5 and 6 ☐ 7 and 8 ☐ 9 and 10 ☐ over 10 ☐

5. How would you rate your relationship (rapport) with children in the cause of teaching in percentage?

   0-20 ☐ 21-40 ☐ 41-60 ☐ 61-80 ☐ over 80 ☐

6. What percentage of children is willingly asks questions?

   0-20 ☐ 21-40 ☐ 41-60 ☐ 61-80 ☐ over 80 ☐

7. How would you rate the class mood in terms of percentage in the course of teaching /learning?

   Very poor 0-20 ☐ poor 21-40 ☐ Average 41-60 ☐ Good 61-80 ☐

   Excellent over 80 ☐

8. What is the level of competition amongst the learners in class percentage?

   0-20 ☐ 21-40 ☐ 41-60 ☐ 61-80 ☐ Over 80 ☐

9. a) Do you have discussion group in this class? Yes ☐ NO ☐

If ‘’yes what is the level of discussion in mathematics in percentage?

   0-20 ☐ 21-40 ☐ 41-60 ☐ 61-80 ☐ Over 80 ☐

10. How would you rate the participation level of children as you teach compared to the previous lesson?

    Better than ☐ Same ☐ Less than ☐

APPENDIX B: Pre-test: Mathematics test

Fill in the missing numbers

1. 1 2 _ 4 5 _ 7 8 9
2. 1 _ _ 4 _ _ 7 _ 9
3. 1 2 _ _ _ 6 _ _ 9
4. 1 2 3 _ 5 _ _ _ _
5. 1 2 _ _ _ _ _ _ _

Put together

6. 1+2 = ☐
7. 2+4= ☐
8. 3+2= ☐
9. 6+3= ☐

Number recognition (Oral)

6=six

3=_____

5=_____

9= _____

2= _____

Marked out of 100 %

APPENDIX C: Continuous assessment test

	WEEK I					WEEK II					WEEK III					WEEK IV				
CHILD'S CODE NO.	SCORE OUT OF					SCORE OUT OF					SCORE OUT OF					SCORE OUT OF				
	5	5	5	5	10	5	5	5	5	10	5	5	5	5	10	5	5	5	5	20
M.S.S																				

APPENDIX D: Post-Test: Mathematics test

Fill in the missing numbers

1. 1 ____ 3 4 5 6 ____ ____ ____

2. 3 ____ ____ 6 7 ____ 9

3. ____ ____ ____ 4 5 ___ 7 ____

4. _____ ____ ____ ____ 7 ___ 9

Put together

2 +3 = ☐

1 + 6= ☐

6+2= ☐

4+5= ☐

1+7= ☐

4+4= ☐

3+4= ☐

8+1= ☐

Number recognition (Oral)

4=Four

3=

9=

6=

1=

7=

2=

5=

Marked out of 100 %

APPENDIX E: Retention Test

Fill in the missing numbers

1. 1 2 ____ ____ ____ ____ ____ ____ 9

2. ___ ____ 3 ____ ____ 6 ____ ____ 9

1. 1 2 ____ ____ ____ ____ ___ ___ ____

Put together

1. 3 + 2= ☐
2. 3 + 4 = ☐
3. 6 + 1 = ☐
4. 7 + 2= ☐
5. 2 + 2 = ☐
6. 3 + 3= ☐

Number recognition

2= Two

4=_____

6=_____

1=_____

8=_____

5=_____

7=_____

9=_____

3= ____

Marked out of 100%

APPENDIX F: AUTHORIZATION LETTER

ALL COMMUNICATION TO BE ADDRESSED TO DISTRICT EDUCATION OFFICER

DISTRICT EDUCATION OFFICES
P.O BOX 124-20100
MIRANGINE.
3RD FEBRUARY 2012

YOUR REF:

OUR REF: MD/21/74/MAY/NB
ALL HEADTEACHERS
PUBLIC PRIMARY SCHOOLS
MIRANGINE DISTRICT

REF: RESEARCH AUTHORIZATION – PATRICK MUTITU GAKIRA

The bearer of this letter who is undertaking Master's degree in Education in Early Childhood has been authorized to carry out research on influence of social and material reinforcers in Mathematics performance in the district for a period of approximately two months.

Kindly accord him the necessary assistance to facilitate a successful conduct of his research.

NJOROGE M.B

MIRANGINE DISTRICT EDUCATION OFFICE