

GAMES FOR LEARNING MATHEMATICS AT BASIC LEVEL

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– DEEPAK THAPA

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GAMES FOR LEARNING MATHEMATICS AT BASIC LEVEL

**A
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BY
DEEPAK THAPA**

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DEGREE OF MASTER'S IN MATHEMATICS OF EDUCATION**

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TRIBHUVAN UNIVERSITY
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त्रिभुवन विश्वविद्यालय
शिक्षा शास्त्र केन्द्रीय विभाग

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Letter of Certificate

This is to certify that **Mr. Deepak Thapa**, a student of Academic Year 2070/71 with Campus Roll No: 467, Thesis No 1380, Exam Roll No: 280404 and T.U. Regd. No. 9-2-29-1197-2009 has completed this thesis under the supervision and guidance of **Ms. Sarala Luitel** during the period prescribed by the rules and regulations of Tribhuvan University, Kirtipur, Kathmandu, Nepal. This thesis entitled on “**Games for Learning Mathematics at Basic Level**” has been prepared based on the results of his investigation. I recommend and forward that his thesis is submitted for the evaluation as the partial requirements to awards the degree of Master of Education.

.....
(Prof. Dr. Bed Raj Acharya)

Head

Date: 2021/01/24



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Letter of Approval

This thesis entitled “Games for Learning Mathematics at Basic Level”
submitted by **Mr. Deepak Thapa** in partial fulfillment of the requirements for the
Master's Degree in Education has been approved.

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Recommendation for Acceptance

This is to certify that **Mr. Deepak Thapa** has completed his M. Ed. thesis entitled "**Games for Learning Mathematics at Basic Level**" under my supervision during the period prescribed the rules and regulations of Tribhuvan University, Kirtipur, Kathmandu, Nepal. I recommend and forward his thesis to the Department of Mathematics Education to organize final viva-voce.

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Ms. SaralaLuitel

Supervisor

Date: 2021/02/11

Declaration

This thesis contains no material, which has been accepted for the award of other degree in any institutions. To the best of knowledge and belief this thesis contains no material previously published by any authors except due acknowledgement has been made.

.....

(Deepak Thapa)

Date: 2021 /02/11

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I dedicate this thesis to my wonderful family, including my father and mother, my wife and son, sister and brother, who are the inspiration for everything I do. My immense gratitude goes to my father who supported, encouraged, and endured me throughout this journey. The completion of this thesis would not have been possible without his love and understanding. Finally yet importantly, I specially express my heartiest gratitude to friends for their kind cooperation.

.....

Deepak Thapa

Abstract

This is a survey study entitled “Games for Learning Mathematics at Basic Level”. The Primary focus of the present study was an evaluation of the effectiveness of games when used in basic level mathematics students. The sample of study included 40 students of grade four of government school: Shree Dharmodaya Madhyamic Vidhyalaya, Airawati Gaupalika, Pyuthan district. In this particular research, researcher adopted experimental design that included both qualitative and quantitative research methods. The quantitative data obtained from achievement test and standard deviation, correlation and co-efficient of regression were used for analysis of quantitative data. Qualitative data obtained from observation and interview with both teacher and students who experienced the use of mathematics games supported the quantitative findings concerning the effectiveness of games in mathematics classes.

The results from achievement test papers suggest that there were statistically significant pre–post differences for achievement of students. In-depth information for qualitative data were provided from observations and interviews. The data were analyzed to shed light on students’ interactions during the games and to triangulate and to clarify and explain students’ responses to the learning environment and attitude questionnaires. Analysis of the interviews suggested that the students generally enjoyed mathematics more when games were included in their lessons, and that the use of mathematics games had improved their feelings positively about how well they were performing in mathematics. During the study, teachers had seen often reluctant to use games in their mathematics classrooms; my study is significant as the results have the potential to encourage mathematics teachers to incorporate the use of games in their classrooms as a viable alternative pedagogical approach.

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Abbreviations

A	:	Agree
B.S.	:	BikramSambat
C.B.S.	:	Central Bureau of Statistics
C-Group	:	Control Group
D	:	Disagree
E-Group	:	Experimental Group
MANCOVA	:	Multivariate Analysis of Covariance
MOEC	:	Ministry Of Education and Culture
MOG	:	Method Of Game
S.N.	:	Serial Number
S.P.S.S.	:	Statistical Package for Social Science
SAHSS	:	Shree Amar HiegherSecondray School
SCPS	:	Shree Chandraswori Primary School
SD	:	Standard Deviation
TGT	:	Team Game Tournament
V.D.C	:	Village Development Committee.
Var.	:	Variance

Chapter I

INTRODUCTION

Background of Study

Mathematics and game take place in the whole period of individual's life at different levels. Game is not a wasting activity that child spends and just provides entertainment as many adults think. Game is the most interesting activity of children. By means of game children develops their sensitivity about themselves and his environment to improve their knowledge and ability. Mathematics and mathematical thought are not limited to school curriculum that is isolated from children's life. Child lives with mathematics spontaneously and grows up with mathematics. (Yasin&I ik, 2003).

Pedagogues and mathematicians in other countries look for the ways to make mathematics liked and make it more attractive. The problems of mathematics teaching are due to nature and characteristic of mathematics. In our school, it is taken as difficult subject from the basic level to learn. The major influence on the development of basicschool level mathematics curriculum, instruction and research is due to the perception of the natural role of mathematics in our society. "Understanding of the different concepts of the mathematics is important to the development and successful implementation program in primary school mathematics as it is to conduct and interpretation of the research studies"(Dossey,1992, p.36).

Students often lack motivation when it comes to learning mathematics and this, in turn, can affect their achievement. The results of past studies have suggested that the introduction of games in mathematics can improve students' attitudes but this has not been systematically verified in the Nepal at school level. Past research has

indicated that teachers who design, develop and implement innovative teaching methods in their classrooms are more likely to capture students' interests and to optimize their learning outcomes than those who do not. (Chandra & Fisher, 2009).

Teaching is an art. It does require the knowledge. From the past, many teachers have tried to help their pupils for learning. Successful of the teachers depends upon knowing the kind of help the individual child requires, as much help as the child needs at a given time, strategic timing if help, the amount and quality of resource available for use and the qualification of the those who did give help. The day-to- day mathematics learning is becoming harder and harder as compared to other subjects. There is a problem of mathematics teacher, to solve this problem the discipline of mathematics education was established consequently (Lyon, 1969).

In this study, the impact of mathematics games tested at the primary level. There is a significant body of research to support the potential of using games as an educational tool and to complement traditional lectures for enhancing students' learning. Past research indicates that games have the potential to draw students into the learning process and to encourage them to participate through a more interactive environment. The use of games can also provide educators with an interactive means of delivering knowledge that is particularly useful for teaching cause and effect. Finally, as an educational tool, games have the capacity to engage and motivate students.

Role of mathematical game when considering the use of game for teaching mathematics, educators should distinguish between 'activity' and 'game'. 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 the playing . The key idea in this statement is that of 'choice'. In

this sense, something like snakes and ladders is not a game because winning relies totally on chance. The players make no decisions, nor does that have to think further than counting. There is also no interaction between players – nothing that one player does affect other players 'turns in any way (Gough, 1999, p:12-15).

When students are motivated and engaged in a task, learning is more likely to occur than when they are not. Introducing and practicing mathematical concepts through active involvement, such as game playing, could contribute to developing the learning process. The use of games is beneficial, both in terms of examination performance and student perceptions of the learning experience. Game playing not only stimulates students' interest in mathematics, but also can promote creativity and students' knowledge (Bragg, 2006).

Based on many theories on the teaching methods and teacher training propounded by several pedagogists as well as psychologists, none of the methods could be accepted as the panacea for all kinds of problem in the teaching mathematics at the Basic level. Therefore, I used this method of game to find out learning mathematics at Basic level at Grade four.

Statement of the Problem

In traditional learning system there use only teacher's centered method such as students are not interested in teaching learning activities thus, the result seem low achievement. Nowadays, how to increase the number of students and quality of achievement in learning activities is an issue. It is important to invent new method in teaching learning activities. Playing game, I think, would be one of the most important methods to teach mathematics. According to Khine and Saleh (2009), games can provide experience in experimentation, exploration, trial and error,

imagination, role-play and simulation and that the challenge that lies ahead for educators is to draw on strategies to transform traditional approaches to a new learning model that infuses the use of educational games in the formal curriculum.

Bragg (2006) also suggested that students be encouraged to reflect on their learning during and after the game-playing experiences. My study explored whether it might be useful for mathematics teachers to use more creative pedagogical practices, such as games, in improving the students' attitudes and achievement towards mathematics at the primary level. Only a handful of studies have been carried out to investigate the effectiveness of mathematics games at the college level. In addition, to impart the basic concept of mathematics teachers have to focus to primary classes. This study was mainly concern about gain the mathematical knowledge learning via games verses traditional learning at primary level. Based on this circumstance I have sought the answer the following questions:

-) Are there any significant differences the learner's achievement between teachings using by game or without using by game at Basic level?
-) Is using mathematical games effective in improving students' attitudes to mathematics and students' mathematics achievement?

Objectives of the Study

The general objective of this study is to explore effectiveness of game method in primary level. The specific objectives of this study are follows:

-) To compare the learner's achievement between students' taught by using games and without using games at Basic level
-) To analyze the effectiveness of games in improving the students' attitudes to learn mathematics at Basic level

Rational of the Study

The subject of mathematics is the useful tool for other relevant subject e.g. vocational training and highly specialized courses of learning. the main theme of teaching mathematics is not the acquisition of knowledge but the acquirement of the power acquiring knowledge because acquisition of knowledge is concerned only with the product of knowledge and the power of acquiring knowledge is concern with process of knowledge which gives the power of acquiring knowledge.

This study had the following significances in the teaching and learning of mathematics.

-) The study was significant as its results have the potential to encourage mathematics teachers of Basic level to incorporate the use of games in their classrooms as a viable alternative pedagogical approach.
-) The results of the present study have the potential to influence educators, researchers and curriculum developers to incorporate the use of mathematical games in the curriculum Basic level as a practical way to improve mathematics achievement.
-) It helps to development an effective instructional planning.

Statistical Hypothesis

The Following null and alternative hypotheses are hereby stated:

Null Hypothesis. There is no significant difference between the average achievement score of experimental and control group i.e. $H_0 = 0$ on pre-test

Alternate Hypothesis. The average achievement score of experimental group is not equal to the control group i.e. $H_1 \neq 0$ on post-test.

Definition of the Study

Achievement score.The achievement score was obtained by the students in achievement test of basic level mathematics construct by the investigator at grade four.

Experimental group.Experimental group of students to whom I allowed to learn mathematics using game method.

Control group.Control group is the group of students to whom researchers taught by traditional method.

Traditional method.Method where the teacher was the authority of teaching learning activities and students were passively accepts the facts exposed by the teacher. The interest and expectation of the student are highly underestimated by the teacher. The teacher explains and illustration, questions but the students do not have approach to the explanation.

Game for Learning

Here are some games to learn mathematics concepts to grade four students.

They are follows in table:

Table1: Game for Learning

Games	Learning Achievements
1) Stick's game	1) To learn measure the angles and know about the straight angle, obtuse angle, right angle and acute angle. 2) To make the different triangle, different quadrilateral, and polygons.

2) Marble's game (there are various colored marbles)	To learn about the concept of simplification.
3) Shot put game (chhelofaalne)	To learn about the concept of the length and measure their distance.

Delimitation of the Study

There are various factors which was influence the researcher. Some of these are bellows

-) This study limited to check effectiveness of game method at primary level.
-) This study was limited in a sampled school named Shree DharmodayaMa.Vi., AirawatiGaupalika, of Pyuthan District
-) This study was limited to the students of grade four.
-) This study was limited to compute the achievement between control group and experimental group, whereas 20/20 students were selected in both groups.
-) During the experiment students were taught concept of triangle, addition, subtraction, simplification and measure of distance.

Chapter II

REVIEW OF RELATED LITERATURE

This chapter attempts to review the research studies and literature in the domain of mathematics achievement with special references. Extensive literature review provides knowledge gap in the prior studies and guideline for the further study of task. The purpose of review of literature is to study open the text and background of the study. So many books, reports and related studies have been reviewed in order to explain the present problem of the study. It helps to conduct the research programs and give the better ideas for the research to formulate research hypothesis. To conduct this research some studies reviewed by the researcher about trained teacher on mathematics achievement. In this study, review has divided into two parts: empirical literatures and theoretical literature. They are as follows:

Empirical Literature

Even though there is lack of materials (or literatures) related to the current study in the libraries of Nepal. The researcher has hereby tried to describe some of the works, which is deemed related to the present study, and some researchers played the game they are follows:

Shrestha(1995) conducted his research study entitled "A study comparing the effectiveness of the discovery method and traditional method in selected lower secondary class of Nepal." It was an experimental research. In his study, he concluded that the discovery method is more effective for teaching mathematical concepts than that of traditional method. From the study of this research, I got chance to know about the different strategies of developing game for learning mathematics. The role of game for learning activities is very useful for developing student's mathematical

skills from game as well as to solve their mathematical problems from discovered new mathematical games for learning and it helped me to discovered new games for learning.

Bhusal (2000) did a research on “A study on the effectiveness of teaching geometry using discovery module and expository module of teaching in secondary level.” With the aim to find out whether the discovery module of teaching in geometry is more useful than expository to prove geometrical theorems as well as to compare the achievement between the group of the students taught by using discovery and expository method of teaching. They were taught for 3 weeks. The t-test was applied to draw conclusion that the discovery method is better than expository method in teaching geometry.

Neupane (2001) did an experimental research on " A study on the effectiveness of play-way method in mathematics teaching at primary level " with the aims to explore the effectiveness of the play method of teaching mathematics at primary level and to compare the achievement of students taught by play- way method verses traditional method. A pre-test and post-test equivalent group design was adopted. The researcher developed an achievement test. Two schools were sampled. The t-test was applied and concluded that the play-way method resulted significantly better method over traditional method of teaching at primary level. The study of this research, it helped me to extend the theory on game teaching and made me familiar with the technique and how to teach through the game.

Ghimire (2001) did a research on “A study on the effectiveness of experimental verification in teaching the deductive proofs of geometric theorems secondary level” with the aim to study the effect of prior use of experimental verification in proving geometric theorems and enhancement of understanding the

facts, principles and concept of geometric ideas. Posttest only equivalent group was adopted. He taught both the groups on the same selected units of grade IX geometry. The researcher made achievement test. The t-test and f-test were applied and concluded that experimental verification has significant effect on teaching geometry.

Zhenyu (2002) did research on " Designing Game-Based Interactive Mathematics Learning Environments for Children" with the conclude. It is important to represent the mathematical concepts in an appropriate way because representation greatly influences the educational effectiveness of the game. This research suggests to me a representation should reflect what the game designers want the student to think about, and that using the game representation as used in other accompanying modes of mathematics education such as textbook and lectures, was help students transfer and integrate understanding between the different modes.

From the study of this research, it can help me to that this is important considering significant role of attitudes for motivation of learning activities and therefore integration proper didactical can increase quality of mathematics education. Research suggests that use of method of game (MOG) is an effective means of improving students' attitude towards mathematics. It has been shown that method of games attraction and gain students' attention, contributing to their increased motivation and engagement with mathematics (Squire, 2005; Young-loveridge, 2005).

Fengfeng& Barbara (2007) studied about the game playing for mathematics learning cooperative or not? They took grade five multivariate students and they taught them through play way method. Their findings were investigated the effects of game playing on fifth-graders mathematics performance and attitudes. One hundred twenty five were recruited and assigned to a cooperative team-games-tournament (TGT), interpersonal competitive or no game playing condition. A state standards-

based mathematics exam and an inventory on attitudes towards mathematics were used for the pretest and posttest. The students' gender, socio-economic status and prior mathematics ability were examined as the moderating variables and covariate. Multivariate analysis of covariance (MANCOVA) indicated that game playing was more effective than drills in promoting mathematics performance, and cooperative game playing was most effective for promoting positive mathematics attitudes regardless of students' individual differences.

Although much of the research on the effectiveness of method of gaming on learning is inconclusive at this point (Fletcher & Tobias, 2006), there is strong evidence that appropriately designed educational games do have the potential to enhance children's learning of mathematics (Bragg, 2007; McGovern et al., 2007).

Vankus (2008) did a research entitle " Games based learning in the teaching of mathematics at lower secondary school" with the aim to find the basis of this games based learning in teaching mathematics researches dealing with using of didactical games in mathematics education and also on the basis our own researches we can identify potential of didactical games for mathematics teaching. This potential is considering results of our recent research also in improving of pupils' attitudes towards mathematics and its teaching.

Maskey (2032)conducted his research studies entitle "A comparative study of mathematical achievement of Primary School student under different class size. 'He concluded that mathematics achievement of the third grade students is affected by their class size. The students of smaller class size had better achievement in mathematics than the larger. From the above research work, it helped me to game for learning the students of smaller class size rather than larger for better achievement. So game for learning mathematics is also divided into smaller group for better learning.

Only a handful of studies have been carried out to investigate the effectiveness of mathematics games at the primary level in Nepal. As such, my study of the effectiveness of mathematics games at the primary level has built on and extended these past studies.

Theoretical Literature

Hildebrandt (1995) reports an action research she conducted beginning in the fall 1995 on using invented games to promote mathematical reasoning among primary school children. The author describes the 'money game' she used in her methodology and how her research evolved during implementation. To play the money game, you need a pair of dice and few dollars in coin (i.e. pennies, nickels, dimes, and quarters). Students should be in small group or teams. Teams roll the dice in turn. The amount shown on the dice is the number of cents the team gets from the bank. The first team to reach a total of one dollar wins.

Hildebrandt (1998) discusses principles she learned for playing invented games with students. For example, Hildebrandt observed that group games can provide a rich context for social and mathematical development that repeated play gives children opportunities to develop new strategies for performing mathematical computation and that the best games are those that allow multiples strategies for problem solving, completion and collaboration (p. 191-195).

Halton and et al. (2001) explore the importance to play in learning mathematics. The paper is divided into seven sections. The first section introduces the concepts of play and outlines the structure of the paper. The second section reviews several perspective on play, in general, as presented in the literature, and the authors define what they mean by mathematical play in the third section. Mathematical play is

problem solving through experimentation and creativity to generate and follow ideas. The learner is able to explore the limits of the problems situation and follow their thoughts wherever they may lead. Mathematical play is a learner-centered activity in which the students are given autonomy.

Margot (2005) analyzed the Vygotsky developed Social Constructivism theory. According to this theory, "students need to construct their own understanding of each mathematical concept, so that the primary role of teaching is not to lecture, explain, or otherwise attempt to 'transfer' mathematical knowledge, but to create situation for students that was foster their making the necessary mental constructions, teach playing mathematical games and make freedom environment to solve the problem of child". Therefore, the role of game is very important at basic level in school. This research helped to me how the student wants to construct his or her own knowledge through the game for learning mathematics.

Fengfeng & Barbara (2007) studied about the games playing for mathematics learning cooperative or not? They took grade five multivariate students and they taught them through play way method. This findings were investigated the effect of games playing on fifth graders mathematics performance and attitudes. One hundred twenty five fifth graders were recruited and assign to a cooperative team-games-tournament (TGT), interpersonal competitive or no game playing condition. A state standards-based mathematics exam and an inventory on attitudes towards mathematics were used for the pre-test and post-test. The student's gender, socio-economic status and prior mathematics ability were examined as the moderating variables and covariate. Multivariate analysis of covariance (MANCOVA) indicated that some playing was more effective than drills in promoting mathematics

performance, and cooperative game playing was most effective for promoting positive mathematics attitudes regardless of students' individual differences.

Khine and Saleh (2009), argued that games can provide experience in experimentation, exploration, trial and error, imagination, role-play and simulation and that the challenge that lies ahead for educators is to draw on strategies to transform traditional approaches to a new learning model that infuses the use of educational games in the formal curriculum.

According to Paraskeva et al. (2010), the use of games is a fun, engaging, motivating, interesting and encouraging way of teaching. They also state that games have the potential to teach complex new information to students and that, in their opinion, both academic performance and interpersonal relationships are likely to be enhanced using games. (p. 499).

In addition, Khine and Saleh (2009), argued that games can provide experience in experimentation, exploration, trial and error, imagination, role-play and simulation and that the challenge that lies ahead for educators is to draw on strategies to transform traditional approaches to a new learning model that infuses the use of educational games in the formal curriculum.

According to Annetta et al. (2010) argued a significant body of research to support the potential of using games as an educational tool and to complement traditional lectures for enhancing students' learning. Past research indicates that games have the potential to draw students into the learning process and to encourage them to participate through a more interactive environment. The use of games can also provide educators with an interactive means of delivering knowledge that is particularly useful for teaching cause and effect. Finally, as an educational tool,

games have the capacity to engage and motivate students and the learning from games is more likely to be retained.

Kitty (2015) conducted her research is "People of all ages love to play games that are fun and motivating. Games gives students opportunities to explore fundamental number concepts, such as the counting sequence, one-to -one correspondence, computation strategies, Engaging mathematical games can also encourage students to explore number combinations, place value, patterns, and other important mathematical concepts. Further, they afford opportunities for students to deepen their mathematical understanding and reasoning. Teachers should provide repeated opportunities for students to play games, and then let the mathematical ideas emerge as students notice new patterns, relationships, and strategies.

The related literature review provided the strong knowledge about the topic. This related literature was previous research report, articles, thesis, teaching materials, theories, paper, other booklets and internet can be found that concern with curriculum and so on. Playing games are the vital role to creating well conception of students in subject matter. From the review of literature, we must identify the study what has been established and what has not been try to be found yet. It also provides knowledge to find out the different facts in research for further study of task. The purpose of review of literature is to study open the text and background of the study. It helps to conduct the research programs and give the better ideas for the research to formulate research hypothesis. The playing games are being a necessary part of teaching to provide visual and sensory experiences for the students.

This study was undertaken in two distinct stages. In the first stage, achievement test papers were administered to collect quantitative data. This stage of the study employed a more positivistic framework, favoring an objectivist view. The

second stage of the study involved the collection of qualitative data and employed an interpretative framework, drawing on elements of the interpretative paradigm.

Conceptual Framework

Being based on the above- mentioned theoretical perspectives adopted for this study, I have made an effort an operational framework on which the entire study will be based. Among various concepts, I have selected the related concept from review mostly based on game for learning mathematics at primary level. Following figure clearly demonstrates the interrelationship between and among the variables under study.

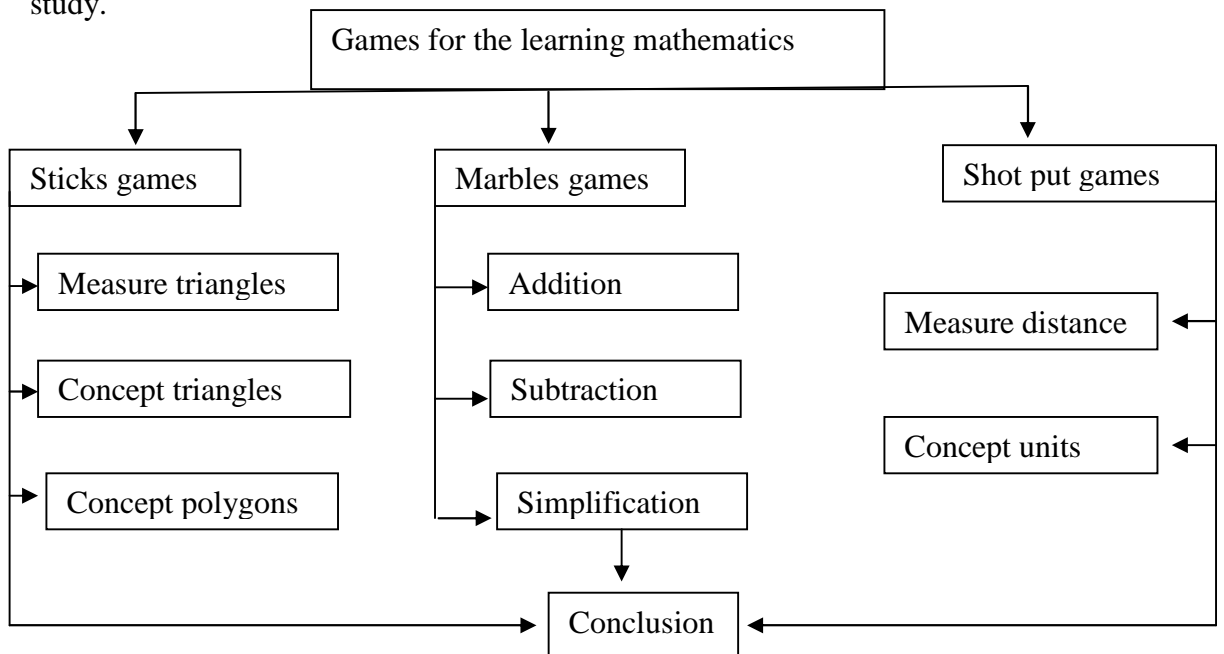


Figure 1: Conceptual Framework of the Study

I have examined that how games are effective when used in Basic level mathematics. Here, researcher used three types of games namely sticks games, marbles games and short foot games. Students had taught to measure triangles, concept of triangles and concept of polygons through tick games. Addition, subtraction and simplification had taught through marbles games. Students were taught to measure distance and concept of unit through playing shot put.

Chapter III

METHODS AND PROCEDURES

Whereas previous chapter reviewed literature pertinent to the present study, this chapter outlines the research methods used to collect and analyses the data. The overarching aim of the study was to examine the effectiveness of mathematics games when used at the Basic level. In this chapter the population of the study ,procedure for the selection of the sample, construction validation , reliability of the instrument ,analytical design of the study ,data collection procedure and data analysis and interpretation procedure are described and discussed.

Design of the Study

Research design is the design of the path about how does the research was conduct. It is detail path of investigation. Thus, research design comprises the overall strategy followed in collecting and analyzing data.

To meet the objective of the study, the researcher used quasi-experimental design. In quasi-experimental research, the researcher manipulates at least one independent variable, independent variable, controls other relevant variables and observes the effect on one or more dependent variables. It involves a comparison of two groups like experimental and control group.

Among the various experimental designs, pre-test and post-test design of quasi-experimental design was preferred most in this study because this design is often used in classroom experiments when experimental and control group are naturally assembled as intact classes.

In this study, quantitative data, collected using achievement test paper, were supplemented with qualitative data derived from interviews, observations and

narrative stories to provide contextual information. The main tools for primary data are achievement test paper that was followed experimental method.

Study Site

For this study, I had selected two schools named Dharmodaya Ma.VI., and BalbikasPra. VI. of AirawatiGaupalika of the Pyuthan district. These schools were selected because researcher knew previously this place. .

Affecting Variables and Control extraneous variables Exercise in the

Experiment

The main affecting variable and control exercise in the experiment as follows

Teacher Variable

I taught both experimental and control groups. I taught for same duration of the time and same chapter, which controls certain extraneous variable such as researcher's qualification emotion and other variables

Content

I taught same content to both experimental group and control group from the same curriculum, same textbook prescribed by government of Nepal. I provided to both groups same handout, notes and questions to students but some variables are limited in this research.

They are follows:

Independent Variable

In this study, the independent variables are method of instruction used in classroom instruction in accordance with the characteristics of learning game.

Dependent variable

In this study, mathematics achievements are dependent variable which is measured by test of students between two groups experimental and control group.

Controlling Extraneous Variable

Since the aim of this study is to examine the games for learning mathematics achievement of grade four students. Intervening variables such as parental education and socio-economic condition, teacher's qualification, school condition are almost the same in the both groups. These students who are extra due to his parent education are not included in this research and those students of whose socio-economic condition are high also not included in this research. I try to find these intervening variables by using interview among the whole students. In this study all students are included from farmer and poor-economic family background.

Intact Group for the Study

In this research experimental approach was applied. As a key tool, achievement test was taken after experiment. I selected two schools namely Shree Dharmodaya Ma. Vi and BalbikasPra. Vi. of AirawatiGaupalika. In schools, there were 35 and 24 students in class four respectively. Researcher selected 20 students from each school and equally divided them into two groups namely one is section A and other were section B from odd and even rolls number for the fulfillment of this purpose. I had chosen section A for control group and section B for experimental group by lottery. Pre-test had conducted to identify whether the group were comparable or not. After that experimental group were divided by four groups. Each group had containing five students.

After assessment test, four students who got highest score and mathematics teacher of both schools were chosen for interview.

Tools for the Data Collection

This study is based on both primary and secondary sources of information. In order to fulfill the specific objectives of the study, the analysis is mainly based upon the primary data. The primary data collected through the achievement test paper, observation and interview.

Achievement Test Paper (pre-test and post-test)

As a key tool of this study, researcher used achievement test. Achievement test depend on 3 games there was 20 questions in which 15 was objectives and 5 was short questions. I had developed those questions from the prescribed textbook of standard grade fours' mathematics curriculum. Before the test was developed, I discussed with subject teacher of both schools and experts. Student responses on the pre- and post-assignments were used to find students conceptions and to assess any changes in student conceptions after the lessons.

Since the aim of this study is to examine the games for learning mathematics achievement of grade four students. Intervening variables such as parental education and socio-economic condition, teacher's qualification, school condition are almost the same in the both groups. The students who were extra due to his parent education are not included in this research and those students of whose socio-economic condition were high also not included in this research. I tried to find these intervening variables by using interview among the whole students. In this study, all students are included from different social and economic family background. After the end of the experiment, the same test paper was given to the experiment and control groups. I was

mark the test paper of the students and I observed the students behavior of both groups. I divided equal time of length to teach both experimental and control groups. I taught three weeks to each group by one is playing game learning method and another is traditional learning method approaches.

Observations

Observations of classrooms during the playing of games were used to examine the students' interactions and how they worked together as they played the games to the introduction of games in primary level. I observed the every student during experiment time their behavior and checked out their emotion, enjoyment and difficulty after the experiment with both groups. The observations added to the richness of the database as a whole. All classes were exposed to mathematics games were observed during the six-week period.

Interview

Interviews were conducted with students and mathematics teachers of both schools. Interviews with students that were exposed to the games were conducted to provide insights into their responses to the use of the games. These interviews involved a semi-structured format, with questions that were used to guide the researcher, thereby providing a degree of consistency across all interviews whilst ensuring a degree of flexibility to pursue avenues that were of interest. These interviews sought teachers' views of the games and their comments on problems that they encountered. Like the student interviews, these interviews were semi-structured.

Data Analysis Procedures

To examine the effectiveness of mathematics games, my study involved the triangulation of quantitative data and qualitative information. To analyze the obtained

data I used the constant comparison method and following statistical procedure for quantitative data by calculating mean and standard deviation for both groups with their secured marks in the test. The two tailed test was used to compare the achievement of using game and without using game at primary level at 0.05 level of significant.

For the scoring, the data I was collect the number of views by using the test paper. I analyzed how many students were understood the learning by playing game method and how much students were follows on same method of playing games.

Then after, a narrative, based on observations in all classes that were exposed to the games, was used to provide an understanding of the games in action. Finally, interviews with teachers and students who were exposed to the games were analyzed to provide insights into students' responses to the questionnaires and information regarding their reactions to the use of games in their lessons. Through these interviews, I sought to understand teachers' views towards the games.

Validity and Reliability of Test

The reliability is the degree in which a test consistently measures whatever it measures. The more reliable test is, the more confidently we can have that the scores obtained from the repeated administration of the test are essentially the same. Thus, reliability refers to the consistency of the results. Rational equivalence reliability was adopted to determine internal consistency by determining how each item on the test related to all other items and to the total test. The most common method of reliability is the split half method in which the test is divided into halves, the common way is odd even method. It is determined through the application of point Biserial correlation coefficient (r_{pbis}), which is calculated by using the formula given In the appendix D.

Applying point Biserial correlation coefficient (rpbis) the mean calculated value (correlation coefficient) of the reliability was found to be 0.76. It indicates that mathematical achievement test is reliable.

According to Creswell (2003) 'validity refers to whether the questionnaire of survey measures what it intends to measure'. The researcher needs to identify threats to internal validity and external validity of research. Internal validity threats are experimental procedure, treatment or experience of the participants that threats researcher's ability to draw correct inferences from the data in the research. External validity threats arise when researchers draw incorrect inferences from the sample data to other person, other setting and past or future situations. To maintain validity, researcher prepared specification chart. Apart from this, Researcher had also got the feedback from exports and thesis supervisor.

Chapter IV

DATA ANALYSIS AND INTERPRETATION

This chapter deals the statistical analysis and interpretation of data obtained using achievement records and questionnaire. This chapter presents the results of the study collected using a mixed-method approach involving students achievement scores, interviews and observations of classes. The statistical data has tabulated and analyzed using mean, standard deviation, correlation and Regression. The qualitative data has analyzed to examine students' interactions during the games and to triangulate, clarify and explain students' responses to the learning environment and attitude questionnaires. Moreover, the information obtained from observation and interviews with students and teachers has helped to explain pre-test and post-test differences for those scales for which differences were statistically significant. This chapter has reported results and analyses for my study that involved a mixed method approach.

Analysis of Achievement Score

Comparison of Achievement Score of the Students in Experimental & Control Group in Pre-test

The main objective of the study was to compare the achievement between two groups. Researcher calculated the statistical tool t-value to check whether the different is statistically significant or not in the experimental and control groups for the achievement score in pre-test. For this, researcher showed the statistical data are tabulated in table three.

Table 2: Comparison of Experimental & Control Group Achievement in Pre-test

Group	Sample	Mean	Standard deviation	Variance	Tabulated t-value	Calculated t-value	Remarks
Experimental	20	3.1	2.12	4.53	1.96	-0.074	Null Hypothesis Accepted
Control	20	3.15	2.03	4.127			

Source: Fieldwork, 2019.

Table 2 indicates that, the mean marks obtained by experimental and the control groups in pre-test were 3.1 and 3.15 respectively which were slightly different. The calculated t-value in the test is -0.074, whose absolute value is smaller than the critical or tabulated t-value 1.96 at 0.05 level of significance with degree of freedom 38 in two tailed tests. Therefore, the null hypothesis is accepted, so there is no significance difference between the mean score of the experimental and control groups on the pre test. This indicates that the two groups of same school on same environment are comparable.

Further, on comparison of the absolute means of the two groups, it follows that the students under the playing of game perform better than the students under the traditional method.

Comparison of Achievement Score of the Students in Experimental & Control Group in Post-test

The main objective of the study was to compare the achievement score between experimental and control groups of the students taught by using games for learning and traditional learning. For this, researcher takes group wise mean, standard deviation and variance were calculated with their marks obtained in the test for the

verification of the hypothesis. There is no significant different between the achievement score of the students taught by games for learning and traditional learning in post-test. In addition, researcher showed the statistical data are tabulated in table four.

Table 3: Comparison of Experimental & Control Group Achievement in Post-test

Group	Sample	Mean	Standard deviation	Variance	Tabulated t-value	Calculated t-value	Remarks
Experimental	20	22.1	5.24	27.49	1.96	4.669	Null Hypothesis Rejected
Control	20	14.2	5.45	29.78			

Source: Fieldwork, 2019.

Table 3 indicates that, the mean marks obtained by experimental and the control group in post-test was 22.1 and 14.2 respectively. The different between experimental and control groups of mean is 7.9. The calculated t-value in the test is 4.669, which is greater than the critical or tabulated t-value 1.96 at 0.05 levels of significance with degree of freedom 38 in two tail tests. Therefore, the null hypothesis is rejected and hence there is no significance difference between the mean score of the experimental group & control group on the achievement of the students. I.e. the alternative hypothesis, there is significance difference between the mean score of the experimental group and control group on the achievement of the students. Thus the difference of the means is found significant at 0.05 level of significant for two tailed test. This indicates that the students in the games for learning were benefited in the achievement of teaching by using game method than the students in traditional

learning. It means that games method for learning is better than the traditional learning in matrix. In this ways researcher conclude that the quantitative data of games method learning is more practicable as compare to traditional learning.

The results show that the students' post-test scores were significantly higher than their pre-test scores. The above figure indicates that playing of game in teaching mathematical is effective than the traditional method. Thus, the result of analysis, the researcher reveals that the student's achievement and performance were more effective if taught by playing game in teaching mathematics than the achievement of the students taught by traditional method at Basic level.

Finding from the study indicate that the teaching mathematics with playing games helped the students to move beyond than that of traditional one "for their own sake or for flimsily conceived incentive purposes" (Williamson 2009, p.31). Through method of game with a variety of educational games, students were more familiar with the problem solving in mathematics. They became much happier to learn mathematics ' creatively and enthusiastically through games that include the elements of collaboration and competition, and authenticity of learning, inquiry learning, reflective thinking, and mathematical problem solving.

Qualitative Analysis

The pre-test–post-test design, involving the achievement test before and after the introduction of mathematics games, was used to determine effectiveness. Finally, interviews with students who participated in the games activities were conducted to help to explain the quantitative data. Interviews were also conducted with the teachers of mathematics about the effectiveness of mathematics games in their classes.

I had interviewed with Mira who was the teacher of primary level of the sampled school. She was an experienced mathematics teacher of about 15 years. As we were already known to each other, the atmosphere was relaxed. She told me that she is keen to try new teaching methods but does not do so because of time constraints. Although she had read of different methods of teaching, she had not tried them for fear that her students' grades might be jeopardized.

In addition to being engaged, students exhibited excitement, suggesting that the games made them more motivated. All of the teachers who were interviewed felt that games had made their students more motivated to learn and to be involved. As Mira stated, *"I think playing games affects the students in a very positive way. When using traditional methods of teaching, some of the students think that mathematics is dry and uninteresting but, with the games, they realize that mathematics can be fun."*

I also interviewed with another teacher Khagendra, who used to teach at secondary level in the same school since six years. He told me that he used few games sometime in his classes. He commented, *"I have enjoyed playing games with my students because the students became more motivated. The advantage of using the games is that it makes my students more motivated."* He further added, *"I see lots of benefits because I think that the students find it different, and it makes them more active as active learners. The pitfall will be the timing. When you are tight with timing, it is difficult to play many games with them"*.

In my question of any disadvantages of this method he stated, *"The class sometimes becomes too noisy during the game playing. The students often seem to be aggravated and shout out the answers – not fighting, but raising their voices at each other. It's just a matter of noisy classroom, that's all"*.

Almost all students who were interviewed agreed that they felt interesting to play way method. In addition, they stated that teacher rarely used games method while teaching mathematics. To the end of experiment, one of participant student commented, *“I learn easily concept of mathematics and enjoy over all classes.”* The students, who were interviewed, perceived their teachers be lazier to use games in their classes. These students also generally agreed that the teacher seemed to be more interested in traditional techniques.

In the observation of experimental class, I saw that students were enjoying play way method. It was effective to all kinds of students. Teacher could teach a large number of students in a simple way. Games helped to give concepts of mathematical problems. However, teacher should be active over the period and should link the tricks of games with mathematical problems that help them conceptualize the matter.

Playing games only do not make sense but teacher should analyze them relating with numerical problems. Most of the students told they used to play few games at their home but they did not relate that with their book. During the interview a student stated, *“After this class, I come to know that mathematics is not only in our studies, but we are using mathematics everywhere, even in our daily activities. I use to play Ludo at home every day on fathers’ mobile but before this class, I was unknown about learning from that. However, I play well.”* Moreover, another student commented: *“Mathematics is very important because we can use it in our lives. In my life, I use math every day. If I buy or sell something, I use math.”*

As, Mira said often teachers did not identify applications of a mathematics topic to real life. Teacher should teach by explaining and linking with their course problems. She suggested that, *“when we start a new lesson, teacher should tell how*

the lesson is related to real life because sometimes we take lessons and students don't know how they can use it."

I was interested in finding out how students regarded their mathematics class. Students were asked about their enjoyment of mathematics both before and after the use of games in their classroom. The students who were interviewed generally felt that they did enjoy mathematics more when the games were included. One student commented: "*Having games in mathematics makes the lesson interesting. Games help me to understand the topic more easily than when the teacher is on the board explaining. With games, we did not feel bored, it was fun and I had a better understanding of mathematics.*"

The narrative suggests that the use of games provided opportunities for students to interact with each other. Research indicates that student interaction through classroom discussion and other forms of interactive participation was foundational to deep understanding and related to student achievement (Bruce, 2007). In a study of mathematics classroom activity, student interaction was one of the essential characteristics of effective mathematics teaching (Ross, McDougall, Hogaboan-Gray & LeSage, 2003).

According to the narrative, students shared ideas and helped one another and, if the answer was correct, the teacher would ask one of the members of the group to present the solution to the rest of the class. Alternatively, if the answer was incorrect, the teacher explained the solution to the whole class. According to Bruce (2007), encouraging productive argumentation and justification in class discussions leads to greater student understanding in mathematics. As students played the games in class, they continuously argued and justified their solutions before agreeing on an answer.

Finally, most of the students and teachers who were interviewed told that the use of mathematics games positively affected the outcomes of mathematics.

Chapter V

SUMMARY, CONCLUSION AND RECOMMENDATION

This chapter presents the summary and conclusion of the study. Moreover, after the analysis and interpretation of collected data, an attempt has been made to some recommendations for the further work. The first section of this chapter presents summary of the research, the second section presents finding and the last section presents recommendations based on the finding of the study.

Summary

Researcher did the experimental research which goes in experimental approach. The present study intended to answer the question whether the performance of pupils of primary level taught by playing game in teaching mathematics affects great achievement as compared to traditional method. In order to conduct the experiment, researcher developed a teaching module and taught the student of experimental group by games method and control group by tradition learning for six weeks.

For data collection of the study, the investigator develops the pre-test (oral test) with the help of the class teacher of grade four of sampled school. Post-test was also developed and tested the reliability before the administration. Pre test and post test consists 10 and 16 items on the chapter of triangle, polygons, length and measurements and addition, subtraction with concept of simplification respectively from the curriculum and the prescribed textbook of grade four.

At the end of the experiment, researcher performed a standardized achievement test. This test was administered on both groups. The scores obtained by the students in the test were analyzed using mean, variance, standard deviation and t-

test. Initially researcher took a pre-test and the so formed result indicated that there is no significance difference between the achievement between the control and experimental group. But in post-test the result indicated that there significance difference between the control and experimental group.

On the basis of the analysis of the scores, the findings of the study are as follows: The basis of the analysis and interpretation of the data obtained from the achievement test was found that the average score of the students of experimental group is higher than the average score of the students of control group is higher than the average score of the students of control group. Statistically the mean difference was found significant. Thus, it was concluded that the learning through games was effective method in teaching mathematics at grade four.

Findings

On the basis of the analysis of the scores, the findings of the study are as follows: The basis of the analysis and interpretation of the data obtained from the achievement test was found that the average score of the students of experimental group is higher than the average score of the students of control group. Statistically the mean difference was significant. I found that student's behavior significantly changed through teaching games method.

There was a high level of engagement of the students and they were excited when playing the games, suggesting high levels of motivation and increased involvement in the learning process. . It caused for collaborative work and problem solving with active interaction between student-student and teacher-students, where teacher play role of facillator. These observations and interviews with students and teachers suggested greater student interactions during the mathematics lesson. Such

interaction in the mathematics classroom has been recognized as the foundation for deep understanding, leading to more effective teaching and learning in mathematics in primary level. As a result, game method caused the active participation of all of the students in their class room and assignment.

Conclusion

It is concluded that learning mathematics through games is more effective than traditional learning in teaching at primary level. Games method for learning better motives students to learn numerical problems. It helps students to understand and perform better in achievement test over traditional learning in teaching mathematics at primary level. Hence it is concluded that “the achievement of the student taught by playing games was significantly different than the achievement of the students taught by traditional method.”

The findings of my study also suggest a strong and positive association between the learning environment and the student enjoyment of their mathematics lessons and their academic efficacy. The practical attempts, involving the use of mathematics games, can be used to enhance students’ achievements towards mathematics.

Educational Implications

Education in the Nepal is undergoing profound transformation and teaching mathematics is taken as difficult subject at school level. Critical within this process is the introduction of advanced educational techniques, improvement of the innovative skills of teachers, and the enhancement of the self-learning ability of students. All of these processes require evaluation at all levels of their development – from policy formulation at government level through to implementation of the curriculum

framework at the school and classroom levels. These processes require different approaches to evaluation. Research involving the use of learning environment instruments, such as the WIHIC, could prove generally useful in evaluating the impact of these innovative curricula in terms of the learning environment created at the school and classroom levels. On the basis of findings of the study, some measures have been recommended for the teaching learning situation at class nine as given below:-

-) The results of this study suggest that it could be useful for mathematics teachers to use more creative pedagogical practices such as games in order to improve the classroom environment and students' attitudes towards mathematics
-) Students should be encouraged to get involved in active participation in the classroom.
-) Teaching through games is suggested to adopt in teaching mathematical problem at primary level.
-) The mathematics teacher should be encouraged to use games method in teaching activities.
-) The teacher training institute should focus their attention on playing game in teaching mathematics.
-) Curriculum designer, textbook writer should emphasize on playing game in teaching mathematics.

Recommendations for Further Study

The following recommendations are made for further study:

-) Study on designing different teaching and learning modules should be carried out, so that these modules can be used on classroom teaching.
-) Further study should be done on different districts of Nepal, using different research designs, different samples in different topics and in different levels.

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APPENDICES

APPENDIX I

LIST OF SYMBOLS

% = Percentage

H_0 = Null Hypothesis

H_1 = Alternative Hypothesis

S^2 = Variance of sample score

r_{11} = Reliability Coefficient

Σ = Summation

D = Discriminating index

N = Number of Students

P = Item Difficulty level

S = Standard deviation of sample score

T = Independent Variable

T1 = Pre-Test

T2 = Post-Test.

X = Mean score

APPENDIX –II

Sample Questions on the Achievement Tests

Class: - Four

Subject: - Mathematics

(Question will be asked as indicated)

Q.No.1) What is the Sum of 34 and 23 ?

- a) 56
- b) 45
- c) 67
- d) 87

Q.No.2) How many sides of Quadrilaterals?

- a) 2
- b) 4
- c) 5
- d) 7

Q.No.3) What is the measure degree of right angle?

- a) 60 degree
- b) 80 degree
- c) 50 degree
- d) 90 degree

Q.No.4) How many centimeter in 1meter?

- a) 50 c.m
- b) 100 c.m
- c) 60 c.m
- d) 80 c.m

Q.No. 5) If Hari have 2 red ball and Sita also gives 3 yellow ball to hari and hari gives 2 yellow ball to ram. How many balls will remain to hari?

- a) 3
- b) 4
- c) 5
- d) 6

APPENDIX –III

Sample Interview Schedule for Student

1. How is your mathematics? And, how well are you performing in mathematics after play way method?
2. How well have you been working with students in your class?
3. What has been your experience discussing your ideas with other students in your class?
4. What is your experience of teamwork with your classmates when doing assignments or playing mathematics games in class?
5. What do you think about importance of mathematics in your study?
6. How do you compare your enjoyment of mathematics before the use of games in your classroom and now?
7. How has the use of mathematics games in your classroom affected your feelings about mathematics?
8. What are your comments in this statement? “Lessons in mathematics are fun.”

Appendix IV

Sample Interview Schedule for Teachers

1. Before this study, had you previously been incorporating mathematics games in your lessons? If so, in which ways. Give examples. If no, why not?
2. Could you please briefly describe how you enjoyed playing mathematics games with your students?
3. In your opinion, what are the benefits and pitfalls of using games in the classroom?
4. Do you think the use mathematics games affected your students' attitudes and achievement in mathematics?
5. Do you have any other comments you want to make?

Appendix V

Sample Daily Lesson plan-1 (Control Group)

Name of the school: BalbikasPra. VI.

Date: 2075-8-4

Teacher's Names: Deepak Thapa

Time: 1.30 HRS

Subject: mathematics

Period: 1st

Class: v

Unit: Concepts of Simplification

1. Specific Objects: On the completion of this unit, students will enable to learn about the concept of basic operation of simplification.
2. Teaching materials:
 - i) Book, Marker, White board, duster etc.
3. Teaching learning activities:
 - i) At first I will ask to student do you know about addition, subtraction, multiplication and division for to take attention of students. If they don't I will teach them.
 - ii) I will tell basic rules of simplification as at first we should solve the problem of division then multiplication then addition and last we solve subtraction.
 - iii) After telling basic rules, I will solve a problem on the white board with explanation.
 - iv) Then I will give them solve a problem themselves.
 - v) After checking their class work, I will suggest on their mistakes individually or group.

4. Evaluation: I will ask to few students few questions like: a) What is the basic rule of simplification?
5. Homework: Do the Questions 1 of exercise.

Appendix VI

Sample Daily Lesson plan-1 (Experimental Group)

Name of the school: BalbikasPra. VI.

Date: 2075-8-4

Teacher's names: Deepak Thapa

Time: 1.30 HRS

Subject: mathematics

Period: 1st

Class: v

Unit: Concepts of Simplification

6. Specific Objects: On the completion of this unit, students will enable to learn about the concept of basic operation of simplification.

7. Teaching materials:

i) Book, Picture card, various color of marbles, sticks,

8. Teaching learning activities:

vi) At first I will ask to student do you know about addition, subtraction, multiplication and division for to take attention of students. If they don't I will teach them.

vii) I will say students today lets we play a game by various color marble to learn and solve the problem of simplification.

viii) In this game after learned basic operation problem which is rules of game then we will play and who can solve the problem he will prized.

ix) Rules are: at first we should solve the problem of division then multiplication then addition and last we solve subtraction.

x) Now I divided marble to each students red color to Ram, green cooler to Hari. Black color to Bisal and yellow cooler to Gita.

9. Evaluation: a) Which sing do you first in simplification?

10. Homework: Do the Questions 1 of exercise.

Appendix VII

Sample Daily Lesson plan-3(Experimental Group)

Name of the school: BalbikasPra. VI.

Date: 2075-8-4

Teacher's names: Deepak Thapa

Time: 1.30 HRS

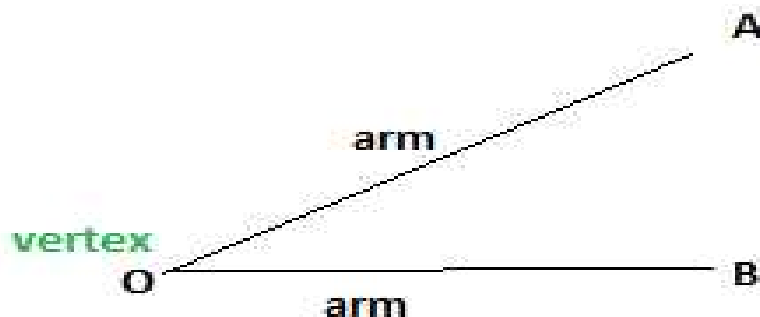
Subject: mathematics

Period: 1st

Class: v

Unit ; Angle

- 1) Objective; on the completion of the unit students will enable to learn about angle.
- 2) Materials: Picture cards of various angles and so many sticks.
- 3) Activities :
 - i) Saying anyone funny story to take attention.
 - ii) Listen to me carefully today we are going to study about angle.
 - iii) I said definition of angle "In geometry an angle can be defined as the figure formed by two rays meeting at a common point is called an angle"
 - iv) An angle represented by the symbol \angle . Here the angle \angle AOB



- v) Here the OA and OB line are called arms and point O is called vertex where as intersecting two lines and there made an angle.

Arms: The two lines are joining to form an angle is called arms of an angle here OA and OB lines are called arms.

Vertex: The common end points at which the two lines meet to form an angle is called vertex. Here the point O is vertex.

- vi) Now your turn all of you make an angle like above picture by using sticks and show me
- 4) Evaluation: make an angle by sticks on your ahead bench and copy that angle on your notebook.

Appendix VIII

Sample Daily Lesson plan-3(Experimental Group)

Name of the school: BalbikasPra. VI.

Date: 2075-8-4

Teacher's names: Deepak Thapa

Time: 1.30 HRS

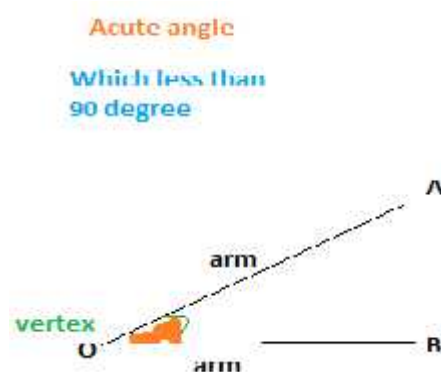
Subject: mathematics

Period: 1st

Class: v

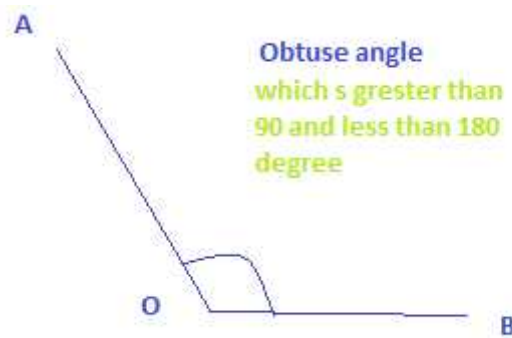
Unit : Various type of Angle

- 1) Objectives : on the completion of this topic students will enable to learn various type of angles
- 2) Materials : Picture cards of various type of angles and so many sticks.
- 3) Activities :
 - i) Attractive to students and said today we are going to study there are various type of angles they are Acute angle, Obtuse angle, Right angle, straight angle, Reflex angle and Complete angle .
 - ii) Basically angles can be classified on the basis of their measurement as acute angle, Obtuse angle, Right angle, straight angle, Reflex angle and complete angle showing picture cards of different type of angles.



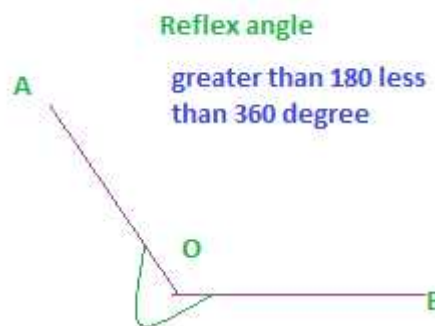


Right angle
Which is equal to 90
degree

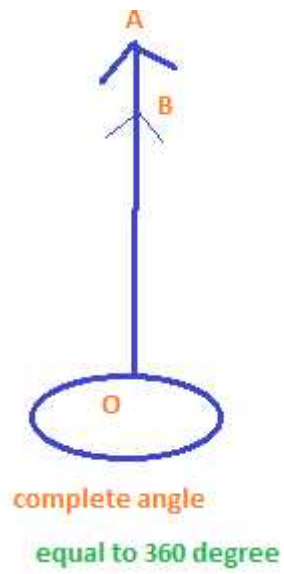


Obtuse angle
which is greater than
90 and less than 180
degree

Straight angle
Equal to 180 degree



Reflex angle
greater than 180 less
than 360 degree



iii) Likewise all of you make different types of angle via sticks and show me.

4) Evaluation: i) what is acute angle?

ii) What is reflex angle?