

**EFFECT OF REINFORCEMENT IN MATHEMATIC ACHIEVEMENT**

**A**

**THESIS**

**BY**

**ANJU SHARMA TIMALSENA**

**IN THE PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE  
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**Thesis**

**By**

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**Entitled**

"EFFECT OF REINFORCEMENT IN MATHEMATICS ACHIEVEMENT AT PRIMARY LEVEL" has been approved in Partial Fulfillment of the Requirement for the Degree of Master of Education.

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## LETTER OF CERTIFICATE

This is to certify that Miss Anju Sharma Timalsena, a student of academic year 2067/068 with Campus Roll No. 318, Thesis No. 913 T.U. Registration No. 9-2-375-65-2005 and Exam Roll No 281174 has completed her thesis under my supervision during the period prescribed by the rules and regulation of Tribhuvan University, Nepal. This thesis entitled "EFFECT OF REINFORCEMENT IN MATHEMATICS ACHIEVEMENT AT PRIMARY LEVEL" embodies the result of her investigation conducted in the year 2014 under the Department of Mathematics Education, University Campus, Tribhuvan University, Kirtipur Kathmandu. I recommend and forward that her thesis be submitted for the evaluation for awarding the Degree of Master of Education.

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## ABSTRACT

Mathematic is the most useful subject in our daily life. So, it is taught at every level up to secondary level as compulsory subject. From S.L.C result it has been seen that most of the students failed in mathematics. The researcher has tried to find out the effect of reinforcement in mathematic achievement at primary level.

This is an experimental research entitled *Effect of Reinforcement in Mathematics Achievement*. The objective of the study were 'to compare the achievement of the students taught by using reinforcement and without using reinforcement in mathematics' and to analyze the behaviors of students in learning mathematics at classroom. A pretest, posttest, non-equivalent group design was adopted to fulfill the objective of the study.

For this, two school were selected by convenience sampling method from Dhading district, which were similar in terms of achievement and socio-economic status. Both the experimental and control group were taught by researcher herself for 23 days by using and without using reinforcement respectively. Researcher taught the selected units of mathematics text book of grade three prescribed by government of Nepal. Student's behavior was observed by the researcher during the experimentation. After this, an achievement test was administered on the both group. The result of test was analyzed by using t-test at 0.05 level of significance difference.

It is found that the mean achievement score of the students taught by using reinforcement is better than the mean achievement score of the students taught by without using reinforcement. From the observation, it is concluded that almost of the students taught by using reinforcement were very competitive, active, regular, concentrative and laborious.

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## Chapter I

### INTRODUCTION

#### Background of the study

Mathematics is the study of numbers, data, space and shapes using a sophisticated and abstract system that involves mathematical processes, thinking, rules and symbols. Studying mathematics helps students to develop a unique and powerful way of investigating patterns, order, generality and uncertainty. For mathematics to make sense to students they need to know about it, know how to do it, and know why, when and where to use it. To help students develop their mathematical knowledge, Queensland teachers provide focused skill development and also support students to.

Mathematic has a close and friendly relation with every phase of human life. Mathematics helps individuals understand and interpret quantitative and qualitative aspect of concept and natural phenomena. Mathematic has been developed for fulfilling the daily life problem of men like counting calculating and remembering. Similarly Learning is “the act or experience of one that learns; knowledge of skill acquired by instruction or study; modification of a behavioral tendency by experience” (Webster’s Dictionary). Learning is often defined as a change in behavior (Birkenholz, 1999), learning is the process of progressive behavior adoption (B.F Skinner) learning is the basic human behavior, which refers to a more or less permanent change in behavior occurs as a result of practice. Thus, learning is life long process; it is the product of environment, discovery and continuous process. Mathematics learning also follows the above process of learning.

In the context of Nepal, the teaching and learning of mathematic is mainly based on lecture method. Which method is not effective in mathematic teaching and learning process? In lecture method teacher will be active and student remain passive. It resulted that the learning of mathematic is not fruitful, students were being puzzled. Teacher has vital role to

motivate the student in teaching and learning activities, but they don't pay attention towards it. Only the teacher centered approaches are being followed in classroom, so the students were not motivated to learn mathematic. Student feels monotonous while learning. For the effective teaching, active participation of students and teacher's meaningful presentation are mostly required. In the other hand, student's active participation is only possible when they are motivated and interested towards learning. there are different ways to motivate the students like as using teaching material, giving feedback, following the learner center teaching approaches, reinforcement etc. among them reinforcement is most important factor which forms positive attitude towards mathematic learning. Primary level student need reinforcement rather than lower secondary level students. Here comes the question "what is reinforcement?" the definition given by different psychologist are given bellow:

The concept of reinforcement comes with the learning in one way or the other. It is identical with the presentation of reward. It is such stimulus which increases the possibility of being repeated. It encourages the learner in the learning process for attaining the goal or purpose. It strengthens the relationship of stimulus-response mechanism.

Reinforcement defined by the effect that it has on behavior. It increases or strengthens the behavior. Reinforcement can include anything that strengthens or increases a behavior, including stimuli, events and situation. in classroom setting for example ,types of reinforcement might have include praise , getting out of unwanted work ,token rewards, candy, extra play time and fun time etc. reinforcement theory is one of the motivation theories; it states that reinforced behavior will be replaced, and behavior that is not reinforced is less likely to be replaced.

Reinforcement is a stimulus which follows and is contingent upon a behavior and increases the probability of a behavior. Considering the definition above would you conclude that negative reinforcement is identical to punishment? If you consider punishment following

an undesired behavior, does this in fact lead to *an increased occurrence of another specific behavior*? No, it does not. Effective punishment will reduce the frequency of a specific behavior, but it does not reinforce any particular behaviors.

Skinner showed how positive reinforcement worked by placing a hungry rat in his Skinner box. The box contained a lever in the side and as the rat moved about the box it would accidentally knock the lever. Immediately it did so a food pellet would drop into a container next to the lever. The rats quickly learned to go straight to the lever after a few times of being put in the box. The consequence of receiving food if they pressed the lever ensured that they would repeat the action again and again.

Positive reinforcement strengthens a behavior by providing a consequence an individual finds rewarding. For example, if your teacher gives you chaklet each time you complete your homework (i.e. a reward) you are more likely to repeat this behavior in the future, thus strengthening the behavior of completing your homework.

In 1920s the Russian psychologist Ivan Pavlov may have been the first to use the reinforcement with respect to behavior .Hull in 1943 equates reinforcement with derive reduction .Skinner in1938 and Tolman in 1932 deals in terms with stimulus .Thorndike in1911 described as a satisfier or annoyer. Similarly Denney and Adelman 1955 view it as a elicitor of behavior.

B.F skinner (1904-1990) was an American behavioral psychologist. He was the Edgar Pierce Professor of Psychology at Harvard University from 1958 until his retirement in 1974.B. F. Skinner's system is based on operant conditioning. The organism, while going about its everyday activities, is in the process of “operating” on the environment. In the course of its activities, the organism encounters a special kind of stimulus, called a reinforcing stimulus, or simply a reinforce. This special stimulus has the effect of increasing the behavior occurring just before the reinforce. This is operant conditioning: “the behavior

is followed by a consequence, and the nature of the consequence modifies the organism's tendency to repeat the behavior in the future." A behavior followed by a reinforcing stimulus results in an increased probability of the behavior occurring in the future. Skinner's observations can be divided into independent variables which can be manipulated by the experimenter, and dependent variables, which cannot be manipulated by the experimenter and are thought to be affected by the independent variables. Skinner is the experimental psychologist. So he did different experiments on rats and pigeons on the basis of reinforcement like as food, shock etc.

In behavioral psychology, reinforcement is a strengthening of a specific behavior due to its association with a stimulus. Reinforcement is an important part of operant instrumental conditioning. A reinforcer is the stimulus that strengthens the behavior, in contrast to punishment that weakens the behavior. The effect of reinforcement may be measured as an increase in the frequency of its expression (e.g., pulling a lever more frequently), duration (e.g., pulling a lever for longer periods of time), magnitude (e.g., pulling a lever with greater force), or decrease in latency (e.g., pulling a lever more quickly following the onset of an environmental event).

Therefore, this research has tried to explore the problems of the education system and the cause behind it. Not only that, this research has tried to dig out the solution which will help for future studies.

### **Statement of the problem**

This study mainly focuses on the effect of reinforcement on mathematics achievement in primary level. Mathematics plays an important role in our everyday life, so it is being an essential part of school curriculum. But it is taken as a difficult subject due to lack of best learning strategy. There is an inactive participation in mathematics learning. Teacher should solve such a problem by providing different opportunities to motivate the students. Reinforcement may be an important motivating factor. It encourages the student to perform

class work, homework appropriately. Also to avoid the making noise in classroom, it helps to teacher. This study has intended to answer the following research questions:

1. Does the use of reinforcement in mathematics classroom effect the student's achievement?

2 How does positive and negative reinforcement works at classroom?

### **Significance of the study**

Mathematic is an essential part of school curriculum. It has taught for all students as compulsory subject at school level. So, every student needs the fundamental knowledge of mathematic to solve his/her daily life problems. "How a child learns Mathematics" is an important issues in teaching Mathematics. A child can learn effectively if he/she is interested to learn. The better use of reinforcement creates interest in the student. Student will be motivated to get positive reinforcement rather than punishment. The study would help the teachers, parents, school administration, student themselves, etc. Following are the major significance of the study.

- This study would provide the reinforcement effect on mathematics achievements.
- This study would be guide to the teachers about managing the reinforcement in proper way in the classroom.
- This study would help to know about the student's behavior, while using reinforcement.
- This study would help to apply modern approaches of reinforcement training program.
- This study helps parents about how their children be motivated towards learning at home.

## **Objectives of the study**

The intended objectives of the study were as follows.

- To compare the achievement of the students taught by using reinforcement and without using reinforcement in mathematics.
- To analyze the behaviors of students in learning mathematics at classroom.

## **Hypothesis of the study**

Hypothesis helps to researcher to find out the fact in scientific way and testable form. So the researcher prepared the following hypothesis.

### **Research Hypothesis**

There is a significant difference between achievement of students taught by using reinforcement and without using reinforcement mathematic learning.

### **Statistical Hypothesis**

The above research hypothesis was translated in the following statical hypothesis:

1.  $H_0: \mu_1 = \mu_2$  (Null Hypothesis)

$H_1: \mu_1 \neq \mu_2$  (Alternative Hypothesis)

Where,  $\mu_1$  &  $\mu_2$  are the mean achievement scores of the students in mathematics of experimental and the control group in pre-test.

2.  $H_0: \mu_1 = \mu_2$  (Null Hypothesis)

$H_1: \mu_1 > \mu_2$  (Alternative Hypothesis)

Where,  $\mu_1$  &  $\mu_2$  are the mean achievement scores of the students in mathematics of experimental and the control group in post-test.

### **Delimitation of the study**

The study was bounded by the following limitation:

- The study was based on the experimental design.

- It was limited on the primary level of Shree Mahendra Higher Secondary School and Shree Nilkantha Higher Secondary School of Dhading district.
- The samples were selected from the grade three students of these two schools.
- Both experimental and control groups contained 20 students.
- The experimental class was taken for 30 days.
- The study was limited on the government school.
- The findings of this study could not be generalized in other level student.

### **Definition of Related Terms**

**Reinforcement:** Reinforcement is an event that encourages the student to do the expected behaviors and discourages the unexpected behavior. Where; expected behaviors are performing class work, homework, giving attention while teaching. And unexpected behaviors are making noise in the classroom.

**Experimental group:** In thesis study, the group that is taught by using reinforcement is known as an experimental group.

**Control group:** A group that is not taught by using reinforcement is known as experimental group.

**Achievement:** The student's score obtained in the test (which is prepared by the researcher) is defined as the achievement of student in this study.

**Treatment:** The different conditions under which experimental and control groups are applied are usually referred to as treatment.

**Posttest:** Post test is a test, which reassures the achievement after conduction the treatment.

**Experimental research:** An experimental research is a process, in which the researcher manipulates reinforcement as an independent variable and controls another extraneous variable and observes the effect on the mathematics learning (dependent variable).

***Mutual participation:*** Mutual is used to describe a reciprocal relationship between two or more people or things.

***Effect:*** A change produced by an action or other cause.

***Techniques:*** Those techniques which are used by mathematics teacher to reinforce the students toward subject matters in classroom.

## **Chapter II**

### **REVIEW OF LITERATURE**

The Review of literature is the process of reading, analyzing, evaluating, and summarizing scholarly materials about a specific topic. The review of related literature deals with the theories or research studies, which have been conducted earlier. It facilitated to select appropriate research problem. It helps to conduct the new research in a systematic manner by providing the general outline of the research study, and avoids unintentional replication. Through studying related research, investigators learn which methodologies have proven useful and which seems less promising.

.Higher education commission Pakistan (2004), did a research entitled "Effectiveness of rewards and punishment as modifiers of student's classroom behaviors" taking the population of the study comprised the teacher serving in government school of Punjab. The result of this study brought out clear picture of the reward and punishment practices that influence development of student's desire behavior.

Adhikari (2007), did a survey study "Teacher's Attitude towards Reinforcement in teaching mathematics at primary level" taking population of all the primary level mathematics teachers of Kaski district with the objective 'to find the attitude of public school teacher's toward reinforcement in teaching mathematics at primary level'. The researcher concludes that the entire teacher has positive attitude towards reinforcement and statement that "Reinforcement is the strategy for fast and slow learners of mathematics" was highly accepted.

Pokhrel (2007), did a research on "Effect of Reward on mathematics achievement of primary level" with the objective; taught with reward and without reward and to conform that the place of rewarding activities in teaching mathematics. He had selected the pretest posttest equivalent group design. He selected 50 students as a sample from two schools involving

experimental and control group. Experimental group and control group were taught by him on selected unit of grade III with and without reward respectively. After completing his experiment, researcher administered the posttest constructed by him. His two weeks experiment had shown that experimental group, who were taught by using reward were better than control groups, who were taught without using reward in teaching mathematics at primary level.

Pant (2010), did a research entitled "A Study on the Effect of Reinforcement in Mathematics achievement at Secondary Level" with the objective; to compare the achievement of student taught by using reinforcement and without using reinforcement'. The pretest posttest non-equivalent group design and adopted for his study. Two equivalent groups were established on the basis of pretest results. Shree Jhirpo Higher Secondary School of Sindhupalchowk district was purposively selected. By avoiding irregular students, he had selected 40 students as a sample by lottery method. Two groups were made experimental and control with the help of coin tossing. Both the experimental and controlled group was taught by him on selected unit of grade IX. After completing his experiment, researcher administered the posttest constructed by himself. The result of the test showed that the mean achievement scores in mathematics of experimental group were found greater than that of control group on posttest. He has concluded that reinforcement affects in mathematics learning at primary level. He has suggested about further study whether the reinforcement affects or not on the other level students.

Shahi (2010), did research on the "Motivation Techniques Used by Teacher in mathematics classroom" with the objective 'to evaluate in what extent secondary school teachers have use motivation techniques in real classroom teaching' and 'to analyze the teacher's view on the role of motivation for teaching and learning'. He found that most of the

teacher were unable to identify student's difficulties and problems, as a result students did not interested to learn and unable to understand the solution of problem clearly.

He emphasized that the teaching learning process was not effective due to the lack of using motivation. He concluded that motivation is an important factor in effective teaching and learning mathematics as the case with all lesson.

Rijal (2011) did a research on "Effect of Reward on learning mathematics at primary level" with the objectives 'to find the achievement of students taught with reward and without reward in mathematics teaching. For this study, two public schools were made homogeneous as nearly possible by selecting schools of similar status with respect to the no of students of grade VI and their marks of mathematics of final examination of grade V. Two schools SSSHS and SBLSS of Jaljale, Terathum were selected by convenience sampling method to avoid the selection bias. Researcher had determined the SSSHS as experimental group SBLSS as a control group. It was concluded that the mean achievement of student taught by using reward become higher than the mean achievement score of the students taught without using reward. This is also shown that the students taught using reward were more active regular and participating in all the activities than the students taught without using reward.

From the literature review, we have found that the use of reward brings better achievement in mathematics at Primary level and teacher has positive attitude towards using reinforcement. Where, reward is an example of positive reinforcement that influenced on the mathematics learning. Only achievements of student were measured on above research, there is a lack of analysis of behavior of the students. Does giving reinforcement only yield better achievement of student? Does the reinforcement help to change the behavior of student? To give the answer of these question the research 'Effect of Reinforcement in mathematics learning at 'primarylevel' is done.

## **Theoretical Literature**

The theoretical framework guides and integrates the research study. It is the platform of research program. It helps to researcher, how make a conclusion from the finding data. Our concern of the study is 'effect of reinforcement in mathematics achievement at 'Primary level', depends on the theory of reinforcement conducted by B.F. skinner, Hull, Thorndike, Spence etc. This study will be depending on the Skinnerian operant conditioning (theory of learning), which is given below:

Pressing a lever for food. To show the effects of operant conditioning, B. F. Skinner created the *Skinner box*,. A rat or other suitably small animal is placed in a typical Skinner box, and observed during learning trials that use operant conditioning principles. A box that measures about 30.5 cm on a side is programmed to present its inmate (rats and pigeon) with food as a reward for pressing a lever in the box. He discovered that once a particular type of consequence called reinforcement is well arranged, the behavior of the animal can be shaped at will. Skinner further posited that one of the most effective kinds of instruction might be done through the use of teaching machines.

He has generalized the essence of his theory in mathematics learning at classroom. According to skinner, the behavior of the students can be improved if we use the different type of reinforcement like as positive, negative and punishment. The amount of giving reinforcement is also an important thing, so the teacher should conscious about the reinforcement schedule. The schedule, intensity, and timing of reinforcement can be altered as the skill levels of the students increase. If the same reinforcer is used continuously during an instructional unit, the effectiveness of that reinforce will decrease and have little impact on the performance of the students. When planning what rein forcere to use during instruction, the time of the school year should be considered. For example, tangible reinforcers (e.g.,

tokens, candy), are best utilized at the beginning of the school year, preferably during the first 2-3 weeks.

Looking at Skinner's classic studies on pigeons' behavior we can identify some of the major assumptions of behaviorist's approaches

- Psychology should be seen as a science, to be studied in a scientific manner. Skinner's study of behavior in rats was conducted under carefully controlled laboratory conditions.
- Behaviorism is primarily concerned with observable behavior, as opposed to internal events like thinking and emotion. Note that Skinner did not say that the rats learnt to press a lever because they wanted food. He instead concentrated on describing the easily observed behavior that the rats acquired.
- The major influence on human behavior is learning from our environment. In the Skinner study, because food followed a particular behavior the rats learned to repeat that behavior, e.g. classical and operant conditioning.
- There is little difference between the learning that takes place in humans and that in other animals. Therefore research (e.g. classical conditioning) can be carried out on animals (Pavlov's dogs) as well as on humans (Little Albert). Skinner proposed that the way humans learn behavior is much the same as the way the rats learned to press a lever.

So, if your layperson's idea of psychology has always been of people in laboratories wearing white coats and watching hapless rats try to negotiate mazes in order to get to their dinner, then you are probably thinking of behavioral psychology.

Reinforcement strengthens the relationship of stimulus response. It is a medium or force which makes the learning effective. It can be applied in classroom or other learning process for the following function:

1. Behavior shaping and habit formation

Reinforcement is very useful to discard the undesirable behavior and to construct a desirable behavior. By the use of reinforcement, I.P. Pavlov constructed the new habit in his dog and changed the behavior of the dog.

2. Feedback to the learning

Reinforcement helps a learner to remain in the learning process. It encourages a learner respond over and over again until he/she gets success. It works as a feedback of the failure.

3. To help in programme instruction

Reinforcement is evident for programme instruction and appropriate learning environment. In the absence of reinforcement, any kind of instructions may fail to get desirable consequences.

4. To develop individual novelty

Reinforcement initiates a learner to learn him /herself rather imitating others. That is why it digs the individual potentialities out and let them bloom.

5. To get goal or purpose

Reinforcement is every time in goal oriented. Reinforcement prompts a person for attaining the goal or purpose.

Because of the individual differences, only one type of reinforcement may be proved as ineffective in the classroom teaching. In such case, to make the teaching effective, a teacher should find out the individual differences and can apply appropriate reinforcement which can meet the students need.

The basic definition is that a positive reinforcer *adds* a stimulus to increase or maintain frequency of a behavior while a negative reinforcer *removes* a stimulus to increase or

maintain the frequency of the behavior. As mentioned above, positive and negative reinforcement are components of operant conditioning, along with positive punishment and negative punishment, all explained below.

Food pellets for a hungry rat is an example of a positive reinforcer, for obvious reasons. A rat in a lever box can be trained quickly and easily to press a lever with amazing vigor in order to get a pellet now and then negative reinforcement would look more like this. And please think of these things being done within humane limits. You have a rat in a lever box, and you deliver an electric shock to the floor of the box so that the experience is noxious and not harmful. When the rat presses the lever, you turn off the shock. You can see that this use of noxious stimulation serves to increase the frequency of a specific behavior.

Reinforcement is when a behavior is increased or maintained by its consequences. Reinforcement may be either positive or negative. The term comes from behavioral psychologists - those who focus on the factors that cause and maintain behaviors (or actions). According to B.F. Skinner, there are three types of reinforcement they are given below

- 1 positive reinforcement
- 2 negative reinforcement
- 3 punishment

### **Positive reinforcement**

Which occurs when a behavior is increased because it is followed by the presentation of something desirable? For example, a child who is praised each time he puts his clothes in the laundry will be more likely to clean up his clothes again in the future. Example: A father gives candy to his daughter when she picks up her toys. If the frequency of picking up the toys

increases or stays the same, the candy is a positive reinforcer (to reinforce the behavior of cleaning up).

### **Negative reinforcement**

Which occurs when a behavior is increased because it is followed by the removal of something undesirable? Some experts believe that this is why self-harm and other impulsive behaviors are often maintained in people with borderline personality disorder (BPD)

For example, imagine that a triggering event such as an interpersonal rejection causes you to have a strong emotional reaction (e.g., fear and anger). If you engage in an impulsive behavior (e.g., binge drinking alcohol), the emotions are reduced and you feel better in the short term.

In other words, the impulsive behavior resulted in the removal of the undesirable event (the emotions). As a result, the impulsive behavior is more likely to occur the next time you encounter emotions (even if the long term result of the impulsive behavior is not healthy).

### **Punishment**

Punishment is a term used in operant conditioning to refer to any change that occurs after a behavior that reduces the likelihood that that behavior will occur again in the future. While positive and negative reinforcement are used to increase behaviors, punishment is focused on reducing or eliminating unwanted behavior.

### **Positive punishment**

It is the adding of an aversive (unpleasant) stimulus to decrease a behavior or response.

- Example: A mother yells at a child when he or she runs into the street. If the child stops running into the street, the yelling acts as positive punishment because the mother presents (adds) an unpleasant stimulus in the form of yelling.

## **Negative punishment**

It is the removal of a pleasant stimulus to decrease a behavior or response.

Example: A teenager comes home after curfew and the parents take away a privilege, such as cell phone usage. If the frequency of the child coming home late decreases, the removal of the phone is negative punishment because the parents are taking away a pleasant stimulus (the phone) and motivating the child to return home earlier

The different types of reinforcement can be used in mathematic achievement .it is necessary to know how and when they applied .for example , do we apply the positive reinforcement every time a child does something positive ? Do we punish a child every time if he does something negative? To answer these questions we should have the idea of schedule of reinforcement .which are given below.

## **Continuous reinforcement schedule**

It is such schedule, where learner is reinforced after every correct response. There are two type of continuous schedule, which are:-*fixed ratio and fixed interval*, A fixed ratio schedule refers to applying the reinforcement after a specific number of behaviors, for example a learner is rewarded after given five correct answer. In the other hand, the organism is reinforced at a certain time interval is referred to as a fixed interval schedule. For example, saying thank to students who are staying at classroom every 10 minute.

## **Variable reinforcement schedule**

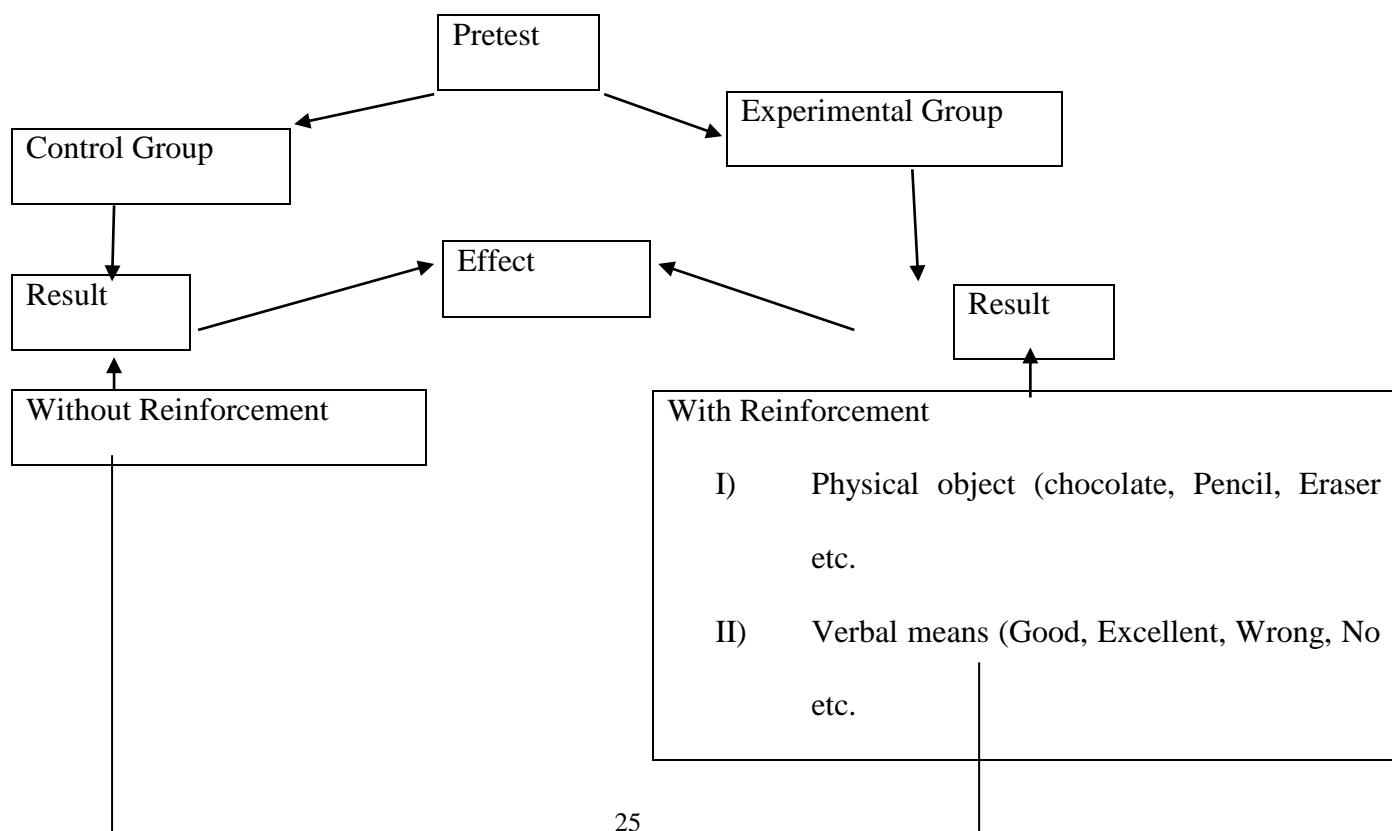
When reinforcement is applied on an irregular basis, they are called variable schedule. There are two types of variable schedule, which are: *variable ratio and variable interval*. A reinforcement schedule in which the number of responses necessary to produce reinforcement varies from trial to trial is known as variable ratio schedule. For example, first food delivered on 2 times lever presses, second food delivered on 6 times lever press, third food delivered on

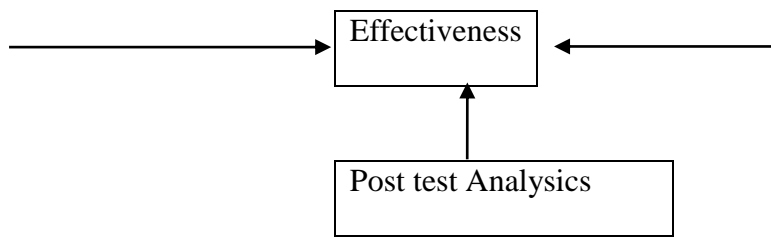
4 times lever presses in Skinnerian theory. In the other hand, reinforced on an average every  $n$ th amount of time is variable interval, the 'n' is an average. For example, Going fishing-you might catch a fish after 10 minutes, then have to wait an hour, then have to wait 18 minutes. By the help of these schedules, teacher must use the reinforcement properly in the mathematics classroom

### Conceptual framework of the study

The diagram below shows that mathematics teacher used variety of reinforcing factors as reinforcement techniques in mathematics classroom both of the group. Reinforcement always increases the likelihood of response behaviours. It is always given immediately. After completing experimentation, the researcher constructed an achievement test to measure the student's achievement and observation used to analyze the behavior of student to find that reinforcement either affect or not on the mathematics learning.

On the basis of following chart of conceptual framework my study has been guided.





At first, researcher specified the student's behavior of learning with respect to the pretest. Then she taught both of the group by using lesson plan. Researcher gave the class work and homework on both classrooms. The students of experimental group who had performed class work and homework properly were get physical object (chocolate, pencil, eraser, copy etc.) and verbal means (good, excellent, no, wrong etc.) But the students of control group who had performed class work and homework properly were treated just by the word 'good'. Then researcher takes the posttest on both groups. Then researcher found that the mean scores in mathematics of experimental group were greater than that of control group.

In this study the researcher was applied follow continuous reinforcement schedule. In which researcher gave a chocolate after one correct response. A single pencil was given after two correct responses. A single pencil and eraser are given after four correct responses. A single pen and pencil are given after six correct responses.

## Chapter III

### RESEARCH METHODS AND PROCEDURES

This chapter includes research design, population sample, instrument used to collect the data, item analysis, data collection procedure and data analysis are create to describe the overall procedure of the study.

#### **Research design**

This was an experimental research within this pretest-posttest non-equivalent group design adopted, which was in quantitative nature. In this experimental research, the researcher has manipulated reinforcement as independent variable, control other relevant variables and observe the effect on achievement (dependent variables). Along with different behavior of students was noted in the time of experimentation.

#### **Population of the study**

The study constitutes as all the students of grade III studying mathematics subject in Dhading district areas in different schools during the academic year 2070 B.S. were the population of the study.

#### **Sample of the Study**

The two public schools of Dhading district named as 'Shree Mahendra Higher Secondary School' and 'Shree Nilkantha Higher Secondary School' were selected by the convenience sampling method, which are similar in socio-economic status, results of the students and from same resource center. The researcher has selected all students from each school in the sample. The scores of the students were taken from the final exam in mathematics of grade II. There were 32 students in SMHSS and 36 students in SNHSS. For the selection of the students the researcher was made two comparable groups as possible as one to one corresponding on the basis of pre-test. Twenty students from SMHSS and twenty

students from SNHSS were selected as experimental and control groups by tossing the coin represents as the sample of the study.

The sampling criteria in both schools were as follows:

Classification of students	No. of students in sample
Distinction	2
First Division	5
Second Division	6
Third Division	5
Failure	2

### **Lesson plan**

For the experimentation, the researchers herself were developed 30 lesson plans were developed with the help of supervisor based on mathematics curriculum of grade III including the chapters time, money, distance, area, capacity, volume, weight (presented in appendix A) These activities were depended on the theory of reinforcement.

### **Variable Studied**

A variable is something that can be changed, such as a characteristic or value. Variables are generally used in psychology experiments to determine if changes to one thing result in changes to another.

*Independent variable:* An independent variable in a scientific experiment is the variable that is changed to test the effect on a dependent variable. Independent variables are the variables that the experimenter change to test their dependent variable. In this study, reinforcement is an independent variable.

*Dependent variable:* A dependent variable is the variable being tested in a scientific experiment. The dependent variable is dependent on the independent variable. As the

experimenter changes the independent variable, the change in the dependent variable is observed and recorded. In this study, Mathematics Achievement is a dependent variable.

### **Control mechanism**

**Subject Matter:** In both experimental and control groups, same content were taught from the same textbook prescribed by government of Nepal.

**Evaluation Applied:** After the end of experimentation, same test was given to the both experimental and control group. The researcher himself marked the test paper of students from both group.

**Selection of School:** Such two public schools were selected in samples, which are similar in socio-economic status, facilities, and results of students and from same resource center.

**Length of the experiment:** The experiment was conducted for 30 days to both experimental and control group.

**Equating the Groups:** Experimental and control group were made comparable on the basis of marks obtained in mathematics at the final examination of grade II.

**Students:** The student who are regular and not taking the tuition or extra class were selected in the sample.

**Teacher Variable:** The researcher herself taught both experimental and control groups.

### **Data collection Instruments**

An achievement test is the main instrument for the data collection. Some questions were developed by researcher herself by the help of teacher guide. Some questions were taken from their subject teacher and specification grid of grade III. The research had prepared three research tools; construction of achievement test, lesson plan, and observation.

## **Achievement Test**

Achievement test is a type of test, which is designed to measure subject and grade-level specific knowledge. Achievement tests are frequently used as a way to determine at what level a student is performing in subjects such as math and reading. Since our concern of study is ' to find the effect reinforcement in mathematics learning so it was better to use achievement test as a main tools a collecting data. For the purpose to make the group comparable, the pre-test of 30 marks from the textbook of class 3 prescribed by government of Nepal was prepared and adopted to both groups. The researcher constructed the achievement test consisted of 14 objective questions for each question to 1 mark and 4 subjective questions for each question to 4 mark on the basis of specification chart from prescribed textbook of mathematics for grade III. Which she had taught in the time of experiment with the help of subject teacher and supervisor.

## **Observation**

An extensive array of research methods used with the intention of observing consumer interactions with products and services in their natural surroundings. In this study, the researcher noted the student's participation, interaction, homework regularity, interest in learning etc. by regular class observation. The researcher used an observation note to keep record of students during the experimentation, which reflects the effect of reinforcement in mathematic achievement at Primary level.

## **Standardization of the Test**

### **Item analysis**

The researcher made two comparable groups from different two schools SMHSS and SNHSS were based on score obtained in mathematics at the final examination of grade II. They were taken as experimental and control group by tossing a coin (i.e. lottery method). Researcher herself taught the control and experimental group regularly for 30 days

Item analysis is defined as the process of detecting faculty item on the basis of difficulty level and discriminating index of each item. It is used to determine the utility, appropriateness and quality of the question. For the purpose of item analysis, the researcher prepared an achievement test and administered to 25 student of grade three of Shree Ijara Lower Secondary School of Dhading district which was not included in the sample. The terms were score one or zero according to the response in objective type question. And the scoring criteria of the subjective question are divided into 4 steps. Each right response of second step depended on the right response of first. The correct response of each step was marked with 1. For item analysis, all 26 students were divided into two groups by 50% of high marking students and 50% of low marking students from total. Out of them 27% from low marking students and 27% from high marking students were selected. (After canceling and modifying the items, the refined instruments if achievement test will be prepared.

### **Determination of Reliability and Validity of Test**

For the reliability of the test, the researcher followed the test-retest method, which was administered to grade three students of Shree Ijara lower secondary School. By the calculation of coefficient correlation, the reliability of the test was determined. The content validity of the test was set up and approved by mathematic experts as well as school subject teacher.

### **Data Collection Procedure**

This study is mainly based on the quantitative data obtained from the achievement test. The experiment was conducted for 30 days. Experimental group was taught by different method using reinforcement whereas control group was taught by conventional method.

In this study, researcher had selected two public school of Dhading district named as SMHSS and SNHSS as a sample schools by convenience sampling method from same Resource Centre. They were similar in socio-economic status and result of students. Two

groups from the two school were selected as experimental and control group by random sampling method each of them are consisting 20 students. Pretest was administered for both the groups. Both the groups were taught by the researcher herself. The experimental group was taught at 9 am to 9:45 am and the control group was taught at 3:30 pm to 4:15pm. During this period homework were checked and class work were given to both groups. At this time researcher noted the students behavior of both group. During the teaching period behaviors of students of experimental group were reinforced. But the control group was not given any reinforcement after homework, class work and behavior during teaching period. The prepared achievement test was administered to both groups of students.

### **Data Analysis Procedure**

The researcher analyzed and interpreted the collected data were statistically on students achievement. Mean, standard deviation and variance were calculate for both the groups according with their score and marks in the test. The mean achievement of experimental and control groups on post-test of students were compared by using t-test at 0.05 level of significance with  $N_1+N_2-2$  degree of freedom. The data based on regular teaching classes, students regularity, mutual participation, interaction, interest on homework among others. And the data obtained from the daily observation note were analyzed descriptively.

## Chapter IV

### ANALYSIS AND INTERPRETATION OF THE DATA

This is an experimental research related to find “The effect of reinforcement in mathematic achievement at primary level” the objectives of the study were to compare the achievement of the students taught by using reinforcement and without using reinforcement mathematic achievement in primary level and to analyze the behaviors of students in learning mathematic. A pre-test post-test non-equivalent group design was adopted for the purpose of the study. Sample and sampling process tools/ reliability and validity of tools/ experimental/ data collection process/ data analysis process Analysis and interpretation of the collected data is the most important part of the study. Data were collected from the research field. The score of the students were analyzed using the statistical method of analysis and achievement test were analyzed by using quantitative technique and the qualitative information on students learning difficulty and learning progress was analysis by using qualitative method. And then the obtained data were analyzed and interpreted under the following heading.

- Comparison of the Mean Achievement Scores of Experimental and Control Groups on Pretest
- Comparison of pre-test Result
- Comparison of posttest result
- Qualitative Analysis

#### **Comparison of the Mean Achievement Scores of Experimental and Control Groups on Pretest**

The score obtained by the students of the experimental and control groups in pre-test have been given in Appendix C. the mean variance standard deviation and t-test analysis has been summarized in the following table:

**TABLE NO 1**

**Comparison of pre-test Result**

Groups	Sample	Mean	Variance	S.D.	Calculated t-value	$\alpha$
Experimental	20	16.2	30.61	5.53	0.3197	
Control	20	16.8	39.82	6.31		

Critical point ( $t_{0.05, 38}$ ) = 1.645

From the above table it is clear that the mean, variance, and standard deviation of the score in the pretest of experimental groups were 16.2, 30.61, and 5.53. And similarly, the control groups were 16.8, 39.82, 6.31, which shows that mean score of experimental and control groups were nearly equal. Since the calculated t-value was 1.65 at 0.05 level of significance with degree of freedom 38. Therefore, the calculate t-value (i.e. 0.32) does not exceed the tabulated t-value (i.e. 1.65), the null hypothesis that there is no significant difference between experimental and control groups on pretest scores were accepted.

**TABLE NO 2**

**Comparison of posttest result**

C

Groups	sample	Mean	Variance	S.D.	Calculate t-value	Decision
Experimental r	20	21.2	29.11	5.40	2.0672	significance difference
Control C	20	17.2	45.15	6.72		

Criticalpoint ( $t_{0.05, 38}$ ) = 1.645

From the above table it is clear that the mean, variance, and standard deviation of the score in posttest of experimental groups were 21.2, 29.11, and 5.40 respectively. And similarly, the control groups were 17.2, 45.15 and 6.72 respectively. This shows that there

was significance difference between the mean score of both groups. The mean score of experimental groups were 21.2 which were highly greater than that the mean score of control groups were 17.2. It means that the better performance of experimental group over control group on the posttest scores might have been attributed due to new treatment given to experimental group in the reference of control group exercised in the experiment.

### **Qualitative Analysis**

The research is made on the basis of observation reports. Qualitative analysis is done with the help of the information collected through daily classroom observation. The research has been completely done on the topic "Effect of reinforcement in mathematics at primary level" with the objectives to compare the achievement of students taught by using reinforcement and without using the reinforcement in mathematics and to analyze the behavior of the students in learning mathematics at classroom. The research was experimental in nature. This helps to fulfill the objective properly.

Qualitative analysis is made on the basic of observation reports. In the research process, observation is an effective and suitable method for reliable primary data collection tools. Observation helps to seek information and knowledge through the use of sense organs. Etymologically, observation is an act of watching something and somebody carefully for a period of time, especially to clean something. On the basis of class room instruction the researchers observed the students activities. Achievement of mathematical knowledge depends upon the teaching method. If teaching method is interesting, they will get good knowledge as well as good marks in mathematics from the appendix A, when the research observed the classroom by the following process:

1. *How long is your (Black board) ? measure in and write in (cm and m.)*

*Ans: 1m and 50 cm long. (Experimental group)*

*Ans: 1m and 50 cm long. (Control group)*

2. *If there is 24 hours in a day then how many hours in 2 days?*

*Ans: 48 hour (Experimental group)*

*Ans: 40 hour. (Control group)*

3. *Convert in rupees*

150 paisa

Ans: 1 Ruppees 50 paisa (Experimental group)

Ans: 1 Ruppis 50 paisa (Control group)

4. How many paisa in one ruppies?

Ans: 100 paisa (Experimental group)

Ans: 100 paisa (Control group)

5. How to convert m. in c.m?

Ans: multiply by 100 (Experimental group)

Ans: multiply by 1000 (Control group)

6. How to convert ml in l?

Ans: divided by 1000 (Experimental group)

Ans: multiply by 1000 (Control group)

7. What is the unit of volum?

Ans: cube ( $^3$ ) (Experimental group)

Ans: Square ( $^2$ ) (Control group)

8. What is area?

Ans: space occupy by the object is called area. (Experimental group)

Ans: space occupy by the object is called area. (Control group)

9. How many gram in 5 kilogram ?

Ans: 5000 gm (Experimental group)

Ans: 5000 gm (Control group)

10. Add

$$\begin{array}{r} 4 \quad 3 \quad 7 \\ + \quad 4 \quad 6 \quad 1 \\ \hline \end{array}$$

Ans:

$$\begin{array}{r} 4 \quad 3 \quad 7 \\ + \quad 4 \quad 6 \quad 1 \\ \hline 8 \quad 9 \quad 8 \end{array} \quad (\text{Experimental group})$$

Ans:

$$\begin{array}{r} 4 \quad 3 \quad 7 \\ + \quad 4 \quad 6 \quad 1 \\ \hline 8 \quad 9 \quad 8 \end{array} \quad (\text{Control group})$$

For the experimentation researcher has divided two groups one is control group and the next is experimental group researcher thought control group for 30 day without using reinforcement. While teaching researcher noticed the problem almost students were seems inactive to learn mathematics they made noise in the classroom while the researcher taught. Most of the students didn't do the problem as homework and classwork. They only wrote the solution of problem in their copy which was solved by teacher. Most of the students were joking out of the matter so the discipline of class was not well. Rarely researcher asked the questions randomly but researchers didn't use any types of reinforcement of the right responses of pupils. The participation of students in learning activities was passive weak performance of students was observed only the highly achieve were participated for seeking the right answer of the question and a few students performed class work and homework properly the attendance rate of students was also low.

In next experimental group researcher taught by reinforcement technique for 30 days. It was found that most of the students of experimental group became more excited while using the reinforcement on teaching mathematics we can easily notice the friendly teacher student environment where they are enjoying the subject matter and always ready to learn more. Reinforcement is the most important factor of motivation in the classroom. It is necessary to use in classroom in suitable context. simply positive verbal reinforcement such as good fair excellent correct offer the right responses of the students and positive non verbal reinforcement like nods and smites speech pattern were seen in different posture. It contributed in the development of student's participation, interaction increasing confidence level enjoying class homework regularity of students and performance skill than the students of control group. Most of the students of experimental group were presented regularly in the classroom. The girl students were also participated more than the girl students of control group. In short most of the students of experimental group were very active laborious,

contrastive and competitive in comparison to the control group. The attendance rate of control group was lower than the experimental group.

Hence the achievement of the students taught by using reinforcement is better than the achievement of the students taught without using reinforcement on mathematics at primary level.

List the behaviours.

1	excited	Intrest in classwork	All were participated
2	active	laborious	Do homework
3	regularity	interaction	competitive
4	concentrative	Intrest in subject matter	regularity

The behaviours as listed above then tended to repeat and supported to be habituation in the behaviours.

## CHAPTER – V

### SUMMARY, FINDINGS, CONCLUSION AND RECOMMENDATIONS

This last and concluding chapter concern with summary, findings, conclusion and recommendations. After the analysis and interpretation of collected data, an attempt has been made to summarize and list the findings, conclusion and some recommendation for further study.

#### Summary

The investigator has studied the effect of reinforcement in mathematic achievement at primary level at government schools. The study had been conducted to explain and interpret the objectives which are: 'to compare the achievement of the students taught by using reinforcement and without using reinforcement mathematic achievement in Primary Level' and 'to analyze the behaviors of students in learning mathematics'.

The study was experimental design. The population of the study was all the students of grade three from Dhading district. The sample schools were selected through the convenience method of sampling which were named as 'Shree Neelkantha Higher Secondary School' and 'Shree Mahendra Higher Secondary School'. a pretest posttest non-equivalent group design was adopted to fulfil the objectives of the study. Two equivalent groups were established on the basis of pretest result. Each group of students contained 20 students. The t-test was applied in order to ascertain the difference between two groups. The researcher herself taught the selected unit to both (experimental and control) groups. The instruction period was 33 days only. a posttest was administered to the sample of the students in both groups with the same questions. The researcher had prepared research tools which are; construction of achievement test, teaching episodes (lesson plan), and observation. After completion of the experimental stage, an achievement test of 30 marks including 14 objectives and 4 subjective questions was adopted to both groups. Then the score obtained by

the students on posttest was analyzed and interpreted by using t-test at 0.05 level of significance. Experiment group was found to achieve better than the control group. Hence it is concluded that by using reinforcement caused better achievement than without using reinforcement.

### **Finding of the study**

Statistical analysis of the collected data yielded the following result as finding of the study.

- There is no significant difference between mean score of experimental and control group before experiment (pretest) but the mean scores in mathematics of experimental group were found greater than that of control group after experiment (posttest).
- The learning by using reinforcement is effective so, the students remember every answer of the question which was previously taught they don't forget any answer of the question so it is permanent.
- Reinforcement is the best strategy for fast and slow learners of mathematic but most of the slow learner.
- Reinforcement plays a vital role in enhancing students thinking skills from visual to descriptive analytical level.
- Most of the students were become very competitive, active, concentrative and laborious throughout the use of reinforcement.

### **Conclusion of the study**

From the above finding of the study it is concluded that the student's of the experiential group achievement scores increased in comparison to control group. While using reinforcement in study the students enjoy the subject mater and always ready to learn more and more. In the same wqay the studentsa participation, interteraction and the confidence level increase. They enjoy doing classwork and homework, I find regularity of students and their performane skill better than students of control group the

attendance rate of control group is lower than the experimental group. From over all analysis of the collected data, it seems that reinforcement helps to acquire better achievement in mathematic. Researcher used reinforcement as treatment for experimental group to motivate students for mathematic learning, which caused better performance. Hence it can be concluded that it is better to use the different types of reinforcement with the proper knowledge.

### **Recommendation and suggestions**

Due to the limitation of this study, the result may not be generalized to all area and all levels. On the basis of this study, some measures have been recommended for the improvement of the teaching situation in primary level classes as given below.

- It is recommended to study about the relationship between attitude of mathematics teachers towards using reinforcement and their teaching practices.
- To find out the influencing factors which create the difficulties to use reinforcement in teaching mathematics at primary level.
- More extension research studies must be designed and carried out in order to investigate the effect of the use of reinforcement teaching mathematics in large Samples and various schools of different parts of nepal.

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