DIFFICULTIES IN LEARNING ALGEBRAIC WORD PROBLEM

A

THESIS

BY

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Letter of Certificate

This is to certify that **Mr. Devi Prasad Chapagain,** a student of academic year 2072/2073 with Campus Roll No. 485/2072, Exam Roll No 7228274, T.U.Regd.No. 9-2-1-52-2012 and Thesis No 1399 has completed his thesis under rules and regulation of Tribhuvan University, Nepal. The thesis entitled "**Difficulties of Students in Learning Algebraic Word Problems"** has been prepared based on the result of his investigation conducted from the period of 24th Dec. 2018 to 2nd Jun. 2019 at the Department of Education, University Campus, Kirtipur- Kathmandu. I hereby, recommended and forward that his thesis be submitted for the evaluation as the partial requirement to award the Degree of Masters of Education.

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Letter of Approval

This thesis entitled **"Difficulties of Students in Learning Algebraic Word Problems"** submitted by Mr. Devi Prasad Chapagain in partial fulfillment for requirement of Degree of Masters in Mathematics Education has been approved.

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Date: ………………..

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Recommendation for Acceptance

This is to certify that **Mr. Devi Prasad Chapagain,** has completed his thesis entitled **"Difficulties of Students in Learning Algebraic Word Problems"** under my supervision during the period prescribed by the rules and regulation of Tribhuvan University, Kirtipur, Kathmandu, Nepal. I recommend and forward his thesis to the Department of Mathematics Education to organize final viva-voce.

…………………………

Abatar Subedi

(Supervisor)

Dedication

This work is affectionately dedicated to my Father Padam Lal Chapagain and Mother Bhagi Maya Chapagain who even in a very difficult situation gave me great span of their life for what I am now.

Declaration

This thesis contain 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 other except due acknowledgements has been made.

…………………………

Mr. Devi Prasad Chapagain

Acknowledgement

Abstract

The purpose of this study was to investigate the difficulties and analyze the causes of difficulties in learning algebraic word problem of grade ten students. This study was based on mixed method design with sample of all grade ten students of three public schools of Kirtipur, selected by random sampling. I used the achievement test of algebraic word problems for all students of related schools and interview guideline for three teachers and fifteen students who achieve less marks in respective test, as the tools of data collection. Mean and percentage were used to determine the difficulties. I categorized the difficulties in the areas of understanding, application, solving process and generalization.

Regarding as above categories, I found that most of the failure in algebraic word problems were on translating and representing verbal problem into algebraic expression, equations by using variables and symbols, difficulties in applying problems to manipulate formulas, apply different given conditions, difficulties in calculation problems in arithmetic operation, difficulties in generalization of pattern etc. Also the students had some cause of difficulties which were lack of pre knowledge. There was no proper interaction between teachers and students. Most of the students did not practice sufficiently at home. Moreover, lack of motivational role of parents and teachers is also the causes of students' difficulties in learning algebraic word problems.

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Chapter I

Introduction

Background of the Study

Algebra is the branch of mathematics that deals with symbolizing general numerical relationships and mathematical structures, and with operating on those structures. Algebra is often the first mathematics subject that requires extensive abstract thinking, a challenging new skill for many students. Algebra moves students beyond an emphasis on arithmetic operations to focus on the use of symbols to represent numbers and express mathematical relationships. Understanding algebra is a key for success in future mathematics courses, including geometry and calculus. NCEE (2015). It has a number of very useful benefits, it develops our reasoning, helps us to have an analytical thinking, quickens our mind, generates practicality and also its use can be applied in the day to day. The mathematics is part of our daily lives.

Also, the subject mathematics was also included in the teaching as a vital need of development of human mind. Mathematics is the numerical and calculation part of man's life and knowledge. It helps the man to give exact interpretation to his ideas and conclusion. It deals with quantitative fact and relationships as well as with problems involving space and form. Wikipedia define mathematics may be defined as the study of relationships among quantities, magnitudes and properties, and also of the logical operations by which unknown quantities, magnitudes, and properties may be deduced or the study of quantity, structure, space and change.

Thus, mathematics as an expression of human mind reflects the active will and desire for perfection. Its basic elements are logic and intuition, analysis and

construction. Learning and understanding mathematical language is challenging to all students. Mathematical vocabulary can be difficult to learn and remember because of how the words are used in everyday English, which often contrasts to how the words are used in mathematics. Basically, mathematics is an integrated part of arithmetic, algebra, geometry etc. So each of the part of mathematics is very useful in our daily. But in present time it is an important issue of difficulties in learning different area of mathematics. Among them, this research paper will introduce in learning difficulties about algebra in the content of algebraic word problem.

Coolman (2015), explain that algebra is a branch of mathematics dealing with symbols and the rules for manipulating those symbols. In elementary algebra, those symbols (today written as Latin and Greek letters) represent quantities without fixed values, known as variables. Just as sentences describe relationships between specific words, in algebra, equations describe relationships between variables. Moreover, algebra is one of the broad parts of mathematics, together with number theory, geometry and analysis. In its most general form, algebra is the study of mathematical symbols and the rules for manipulating these symbols; it is a unifying thread of almost all of mathematics. It includes everything from elementary equation solving to the study of abstractions such as groups, rings, and fields. The more basic parts of algebra are called elementary algebra; the more abstract parts are called abstract algebra or modern algebra. Elementary algebra is generally considered to be essential for any study of mathematics, science, or engineering, as well as such applications as medicine and economics. Abstract algebra is a major area in advanced mathematics, studied primarily by professional mathematicians.

Therefore, the algebra of mathematics is interrelated in different sector of mathematics and mathematics is also everywhere. So it is an essential part of life we

cannot run our daily task without it. For many students in algebra basically, solving algebraic word problem is boring, abstract, lacking in creativity, complex and very difficult to understand, so in present time most of the students were ignore because they feel it is a very hard and complicated content also, it lost much of our time to practices etc.

Word problems, this type of problem asks students to establish equivalences between the variables or noun referents in the problem. Nasser & Carifio (1993). Moreover, word problem also known as story problems, are an essential part of learning to use mathematics effectively. Word problems are often used in the mathematical problem solving curriculum and constitute an important part of mathematics from elementary school to secondary school level. Word problems are tasks, which require the combination of reading, comprehension, representation, and calculation. In word problems, situations are described in which there are some modifications, exchanges, and combinations of quantities, shapes, or other mathematical applications. Therefore, it is going to learning difficulties for most of the students. So this research paper introduced about learning difficulties in algebraic world problem.

Statement of the Problem

As discussed in the previous section, algebraic competence is important in adult life, both on the job and as preparation for postsecondary education. Learning to solve algebra word problems is one way that helps students develop their algebraic competence. However, several reports and empirical studies had showed that students tended to have difficulties with algebra word problems.

Through my own experience, when I was studying at secondary level as well as my teaching experience at secondary level of Samata Shikshya Niketan Boarding

School, Ilam, from 2070 to 2072B.S. Then I came face to face with the problems of learning in solving algebraic word problem in secondary level. The overall students' performance in mathematics at classroom work, test examination and final examinations very weak basically in algebraic verbal problem. So that student were not satisfied their results and they were ignoring the mathematics subject. Therefore, I'm interested to know why students are unable to solve the algebraic words problem and what the difficulties in learning algebraic words problem are. But I found no more research are done in this topic. Those research which are done indicates the problems of the students but there is no more ideas, why the students get problems in this topic. So I want to indicate the problems as well as the reason and its solutions. Also, this study will be support for teacher to understand about weakness of students, and ideas to encourage, also it will be reference further research in similar areas. This study was focus on the following question.

- What are the difficulties in solving algebraic word problem in secondary level students?

- Why do the students feel difficulty in solving algebraic word problem?

Objectives of the Study

The objectives of this study were follows.

- To explore students' difficulties in learning algebraic word problem at grade X.

- To analyze the causes of difficulties in learning algebraic word problem at grade X.

Significance of the Study

Mathematics is an essential part of life so there is not any field which can run without mathematics. It is a compulsory subject in school level. Furthermore algebra is one important and essential branch of mathematics. Although, algebra has been given an important place in the curriculum of school level of education, but most of the students are found having more difficulties in solving algebraic word problem. So most of the students dislike algebra as well as mathematics subject and afraid of it. It means to shows, there is frustrating situation in solving algebraic word problems. The main objective of this study is to finding difficulties and causes of difficulties in solving algebraic word problem of algebra at secondary level.

This present study was done in the hope that the results of the study could provide teachers with a better knowledge about how students are able or unable to solve algebra word problems, and understand the factors that make algebra word problems difficult for beginning algebra students. This may in turn enable teachers to assist students with learning to solve algebra word problems. In addition, the results from this present study would help teachers to choose and adapt algebra word problems wisely from instructional materials. Thus, following are the significance of the study:

- This study would help to provide learning experiences that students can use to develop understanding of important algebra concepts, teachers must learn what students understand, and they must be sensitive to possible difficulties held by the students.

- This study would help mathematics teacher to determine the weakness of students and use appropriate teaching learning strategies and materials.

- This study would help curriculum designer to design curriculum by considering the effect of knowledge gap in students as well as impact of poor arrangements of contents.

- This study would reference to researchers for further research in similar areas.

Delimitation of the Study

This study was limited in the following boundaries:

- The study was concerned with only exploring difficulties and analyzing the causes of difficulties in learning algebraic word problems.

- The study was limited to three public school of Kirtipur municipality which take about three months.

- The study was based on the sample three school, 150 students of grade ten and three mathematics teachers.

- The data of this study was generated through the achievement test and interview guidelines.

- The study was carried out in three school of kirtipur, so its finding cannot be generalized among all students.

Operational Definition of Terminology

An operational definition is how we (the researcher) decide to measure variables in our study. So, the following definition of terms refers only for this study.

Students. In this study, students refer to those selected students whose are studying in grade ten of Kirtipur, Kathmandu.

Difficulties. Difficulties in this study refers to the students who are unable to understand terms and condition in solving algebraic word problems.

Learning difficulty. Learning difficulties means the difficulties face by students in the different components of solving algebraic word problem such as understanding.

Word problem. The word problem refers that problems using mathematical language to describe real-life contexts which are used to achievement test for the data collection tool in my study.

Chapter II

Review of Related Literature

This chapter provides an overall picture of what is known about algebra and algebra word problems, students' successes and difficulties in solving algebra word problems, and solution strategies students' use to solve algebra word problems. The main aim of this study was to review major documents related to 'learning difficulties in mathematics'. The major purpose of this review was to find what works have done in the area of research problem under study and what has not been done in the field of the research study being under taken. The review of related literature helped to make concept clear for the study. So I have reviewed the related documents as follows:

Empirical Literature Review

I reviewed the first journal prepared by Ferryansyah et al. (2010) entitled "The analysis of students' difficulty in learning linear algebra". This study based on mixed method design (qualitative and quantitative) and Conducted the essay test, questionnaires and interview to strengthen the analysis of learning difficulty in linear algebra that obtained from instrument essay test of linear algebra for the propose of this to analyzes the students difficulties in learning linear algebra. For the study 85 students were chosen to data collection from mathematics education department. And this study showed that 88.63% students were not able to represent the symbol or notation, 88.11% students had difficulty in using the symbol or notation or ideas of mathematics and logical reasoning, 88.38% students had difficulty in comprehending the symbol or notation used by using logical reasoning, 91.77% students were difficult to check whether the symbol or notation or ideas of mathematics used has been applied correctly or not and use logical reasoning so that students' difficulties in

learning linear algebra was very high. I think it seems to like students' understanding of the material and solving linear algebra problems is quite slow compared to other materials. Lecturers are also not optimal enough in the use of media and learning methods in learning linear algebra in the classroom.

I have reviewed second document of Tambychik et al. (2010) studied "Students' Difficulties in Mathematics Problem-Solving". This study was design in mixed method approach and using purposive sampling. The main finding of this research was the students are unable to connection the sub-skills in information skills such as making connections, manipulating information, stating mathematical sentence and determining formula to be used. Manipulating information and stating mathematical sentence were found to be the major sub skill of information skill that influenced the difficulties in problem-solving. Also they were concluded that the students in school level they were lack in understanding the language skill. These lacking caused obstacles in understanding the objective of the problem that affected the ability to solve the problem.

Similarly, the "Investigation into Challenges Faced by Secondary School Teachers and Pupils in Algebraic Linear Equations" was done by Samuel et al. (2016). This study involved 80 students of grade 10 and 15 mathematics teachers selected from 4 secondary school in Mufulira district, Zambia in Central Africa. It was based on descriptive survey method and data was interpreted by means of an assessment test for pupils on algebraic linear equations as well as separate interviews for both teachers and pupils. They concluded that the most of the children failure to grouping like terms, manipulating the sings and symbols and their teachers explaining the concepts of algebraic expressions too fast. Also they found that the students have

lack of pre requisite knowledge such as simplification and manipulation of algebraic expressions and equations. Its shows that students have major difficulty in the basic concept about the solution of algebraic expression and their solution. Such basic as like terms, unlike terms and translate the word problem into algebraic equation, multiplication of two or more algebraic equations, manipulate the equations etc.

Moreover, another articles 'An Investigation of Students' Learning Difficulties in Mathematics at Secondary Level' conducted by Ijaz et al.(2017). The purpose of the study was to investigate the secondary level students' learning difficulties in mathematics in the areas of Geometry, Arithmetic and Algebra. The research was based on qualitative design and the researchers adapted two questionnaires with 21 items each, one for the students of public secondary schools of nine towns of Lahore and other for all the math teachers of that school. And the sample of 60 mathematics teachers and 300 students was selected through simple random sampling. Chi-square test was to use the data interpretation tool. And in general they found that students feel difficulty in learning Geometry concepts. Similarly, both the respondents (teachers and students) agreed that student feels difficulty in comprehending Arithmetic and student feels difficulty in learning the concepts of Algebra.

Similarly, another reviewed is Bhat (2017) research entitled "problem faced by students in learning Sets". It was a descriptive survey research design based on opponior and interview for data collection tool. This research conducted for the propose to find problems faced by students in learning the content set grade X and to compare problems faced by girls and boys in learning the content set at grade X. To meet this objectives the researcher selected 500 students with 250 boys and 250 girls

of 10 school of grade X of Baitadi district. He found that much of the students face difficulties in the sets words problems to conceptualize the problem and use formulas in different conditions and draw diagrams. Also he was concluded that the students faced problems by cause of the teaching activities because the teachers didn't check homework and provide feedback properly also the teacher does not explain the topics and problems connected in real life problems. And he does not found there any significant difference between problems face by boys and girls in learning set at grade X by using statistical z-test. It seems to like the main problem of the students in translations, manipulate and draw diagram phase. And the teacher should help the students in there every problems in the related topics.

I reviewed another research conducted by Bhandari (2017) entitled "difficulties in learning group theory" which is the master thesis of central department of mathematics education, Kirtipur. His research design is based on qualitative case study and five case students were selected by purposive sampling method form a school and questionnaire are the tool of data collection which are based on five cognitive domain. And he found that in first students feel difficulty is to understand the group theoretic concepts and is due to lack of link between pre-learned concepts and new perception towards group theory. Also reasoning is another difficulty for learning group theory, also the proving process of abstract ideas, moreover they were unable to use proper symbol as well as quantifiers. And most of the students have less interest to solve group theoretical problems because having less interested and motivation towards solving group theory problems. It shows that students have less pre-knowledge about related topic and they have lack of reasoning to linkage one to another steps of solving process also they have lack of interest to learning mathematics.

In addition, I reviewed another research conducted by Khanal (2018), entitled "Difficulties in Solving Word Problem in Algebra". The objectives of this study was to explore the difficulties and analyze the causes of difficulties in solving word problem in algebra. This study was based on qualitative design particularly case study design. Test and interview were used the tools of data collection. Researcher selected 20 students as the sample of the study. The major finding of the study was students unable to understanding the problem, students could not understand the meaning of problems, students unable to correct mathematics operation. The causes of solving difficulties are lack of pre knowledge, lack of understanding of mathematical terms, students always emphasis on product only rather than process and inability to identify target variables.

From the review of this study, this study focus only the difficulties related to reading, conceptual, comprehension and process. In my study, I focused the difficulties in learning algebraic word problems in different levels according to Bloom's taxonomy. Similarly, this study found the causes of difficulties lack of pre-knowledge and lack of understanding mathematical terms. But my study focused pre knowledge, teacher and students' interaction, students' labor at home and school and motivation are the causes of difficulties. This study was based on case study design and my study based on mixed method design.

In the conclusion the above description shows that many difficulties that children face in leaning mathematics in the lack of understanding of lower level concepts and lack of clarity about different rules that are often conflicting can lead to misconceptions and affect mathematical learning. Moreover, students were not able to using mathematical symbols, manipulate formulas in different situations, translation

in words problem to mathematical equations and solve them, visualization of geometrical figure and linkage in pre-knowledge appropriately. Most of the students feel mathematics subject is very hard so I think they should ignore that types of thinking at first and do hard labor in learning mathematics then they will get success. And their important role of teacher to make as a good perception of students about mathematics and mathematical concepts. Also teacher should responsible for each and every where they are unable to do.

Review of Theoretical Literature

In this research, I explain students' difficulties within the APOS framework. Dubinsky (1991) has developed an epistemological framework referred to as Action-Process-Object-Schema, or APOS. The framework considers the development of a mathematical concept as moving from an action to a process is a type of reflective abstraction. Schemas are constructed by coordinating processes and actions and can also be thematized into objects (Asiala et al., 1996). This framework results in descriptions of the mental constructions a student makes to come to understand a concept.

An action is a transformation of objects perceived by the individual as essentially external and as requiring, either explicitly or from memory, step-by-step instructions on how to perform the operation. Similarly, When an action is repeated and the individual reflects upon it, he or she can make an internal mental construction called a process which the individual can think of as performing the same kind of action, but no longer with the need of external stimuli. An individual can think of performing a process without actually doing it, and therefore can think about reversing it and composing it with other processes. Also, an object is constructed from

a process when the individual becomes aware of the process as a totality and realizes that transformations can act on it. Finally, a schema for a certain mathematical concept is an individual's collection of actions, processes, objects, and other schemas which are linked by some general principles to form a framework in the individual's mind that may be brought to bear upon a problem situation involving that concept. This framework must be coherent in the sense that it gives, explicitly or implicitly, means of determining which phenomena are in the scope of the schema and which are not. Because this theory considers that all mathematical entities can be represented in terms of actions, processes, objects, and schemas, the idea of schema is very similar to the concept image.

APOS theory arose out of an attempts to understand the mechanism of reflective abstraction, introduced by Piaget to describe the development of logical thinking in children, and extend to more advanced mathematical concepts. This theory begins with the hypothesis that mathematics knowledge consists in an individuals' tendency to deal with perceived mathematical problem situations by constructing mental actions, processes, and objects and organizing them in schemas to make a sense of the situation and solve the problems. (Dubinsky E., 1994) stated that as part of the examination, the APOS theoretical perspective involving the mental construction of processes and objects is presented. This theory shown how observing students' success in making or not making mental constructions proposed by the theory and using such observations to analyze data can organize our thinking about learning mathematical concepts, provide explanations of student difficulties and predict success or failure in understanding a mathematical concept. There is a wide range of mathematical concepts to which APOS Theory can and has been applied and this theory is used as a language for communication of ideas about learning.

In conclusion, APOS theory is usable for every area of mathematics. Its play significant role in learning mathematics but if we unable to use this theory then we get many difficulties in learning mathematics. The first level in APOS theory is that actions or a stage in the development of concept where a students can perform repeatable manipulations to transform an object into another object. Which is related to understanding level. These action need to interiorized process; this stage is attained when students can mentally link multiple inputs and out puts and they can think about the process think about the process without performing calculations. This process crystalize into objects when the students can combine and manipulate the processes and transform a process by some actions. The object becomes encapsulated into schema when they represent a coherent set of processes, objects and other schema that are thematized.

Learning disability theory. Learning disability is a classification that includes several areas of functioning in which a person has difficulty learning in a typical manner, usually caused by an unknown factor or factors. While learning disability, learning disorder and learning difficulty are often used interchangeably, they differ in many ways. Disorder refers to significant learning problems in an academic area. These problems, however, are not enough to warrant an official diagnosis. Types of learning disorders include reading, mathematics and writing.

The unknown factor is the disorder that affects the brain's ability to receive and process information. This disorder can make it problematic for a person to learn as quickly or in the same way as someone who is not affected by a learning disability. People with a learning disability have trouble performing specific types of skills or

completing tasks if left to figure things out by themselves or if taught in conventional ways.

Individuals with learning disabilities can face unique challenges that are often pervasive throughout the lifespan. Depending on the type and severity of the disability, interventions and current technologies may be used to help the individual learn strategies that will foster future success. Some interventions can be quite simplistic, while others are intricate and complex. Current technologies may require student training to be effective classroom supports. Teachers, parents and schools can create plans together that tailor intervention and accommodations to aid the individuals in successfully becoming independent learners. School psychologists and other qualified professionals quite often help design the intervention and coordinate the execution of the intervention with teachers and parents. Social support may improve the learning for students with learning disabilities.

Mathematics learning disabilities theory view from developmental perspective. Herbert P. Ginsburg (1994), developed this theory and this perspective suggests the use of sensitive research methods to examine the development of children's construction of knowledge in the context of schooling. Researchers should consider such factors as the adequacy of classroom instruction, the availability in children of informal knowledge, the role of motivation, the effects of specific interventions, the role and operation of different cognitive processes in constructing mathematical understanding, the adequacy of ordinary instruction, children's response to good teaching, children's motivation, the interaction between modes of thinking and educational context, and the development of children's thinking over time,

children's difficulties across different areas of mathematics, and the development of children's thinking throughout the school years.

It shows that learning disabilities not depends only in the area of reading, with the result being that little attention has been given to mathematics learning disabilities. It depends the school environments, teaching learning activities, students teacher relation, students' motivation, interaction with teacher etc.

Conceptual Framework

Conceptual framework is the basis of research problem. It brings clarity and focus, helping us to see and organize the research questions more clearly. Thus the students' difficulties in solving algebraic word problem at secondary level are considered as the main problems of mathematics. This study is mainly based on the already explained difficulties on algebra. The following theoretical understanding in prepared according to the theory which will proposed as a framework for this study.

Diffculties in Learning Algebraic Word Problem	Causes of Difficulties in Learning Algebric Word Problem
⇩	⇩
Understanding	Pre knowledge
⇩	⇩
Applying	Student labor at home
⇩	⇩
Solving Process	Teacher-Students Interaction
⇩	⇩
Generalization	Motivation
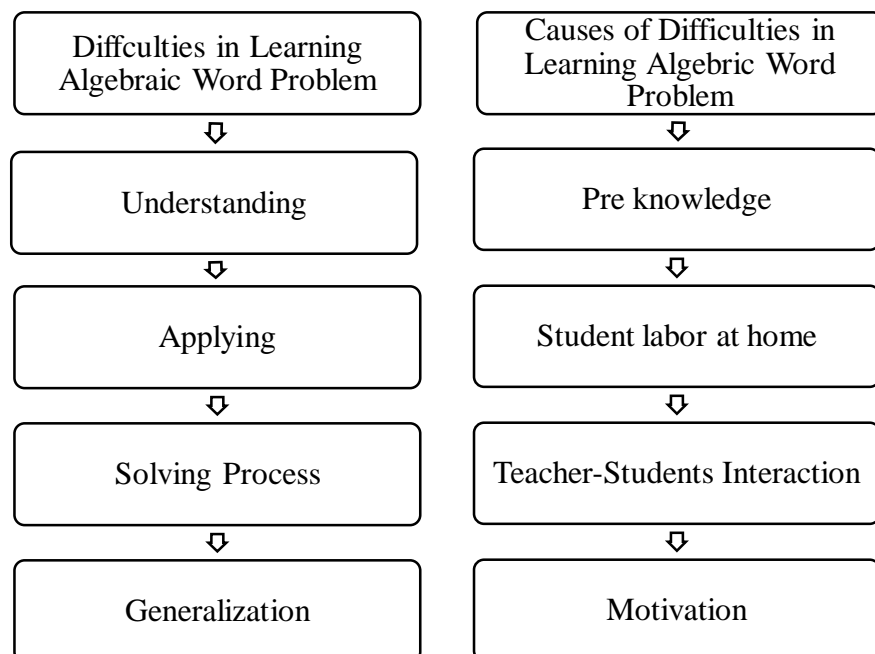
The above conceptual framework shows there are four dimension of learning difficulties in learning algebraic word problem and five dimension for causes of learning difficulties. This study will be based on above dimension of difficulties and causes. It will be known after checking the solution paper of achievement test and causes by conducting interview. The following were the difficulties of learning algebraic word problem at grade X.

Understanding the problem. The first difficulties is related to understanding the problem. Understand is construct meaning from instructional messages, including oral, written, and graphic communication, changing from one form of representation to another, Finding a specific example or illustration of a concept or principle Bloom (1956). This study focused firstly how students understand the given algebraic word problems. In this study understanding refers translation the verbal problem into algebraic expression is related on understanding the problem. The word problem into mathematical equation using appropriate symbols is also difficulties in algebraic word problem.

Applying. It is a third level of cognitive domain of Bloom taxonomy. The application category follows this rule in that to apply something requires "Comprehension" of the method, theory, principle, or abstraction applied. Teachers frequently say, "If a student really comprehends something, then he can apply it." Bloom (1956), after translating the word problem into equation then students are unable to apply. Applying, refers to using a learned procedure either in a familiar or new situation. It means applying refers a difficulties too.

Solving process. A difficulties in solving process is another obstacle that first abstract algebra students encounter. There is strong relationship between

understanding and solving process. Students should use variety of appropriate representations including number, symbols, picture, graphs, diagrams, and words. Also, in the calculation problem there are so many steps where students mistake in addition, subtraction of like terms, multiplication of sign, terms, etc. These are the problems related to solving process

Generalization. Generalization is the process of formulating general concept by abstraction common properties of instance. Hence the most fundamental task for learning algebra is to understand the basic concepts, axioms, properties, systems etc. Algebra is one of abstract subject so most of the students are failure to using concrete examples. It is a difficulties related to generalization.

Moreover, there is a strong relationship between reasoning and solving problem. Students should use various appropriate representations including numbers, symbols, pictures, graphs, diagram, words etc. Also students need to connection and the relationship between mathematical concepts and problem situations. Therefore, the algebraic problem are generally related to daily life problem so, students should be imagination and compare different situation for understanding the problem. It helps to generalizing the one problem in different situation. Hence this study will based on above four dimension of difficulties.

Also, this framework describes why students feel difficulties in solving algebraic word problems. There were so many causes according to above related theories which directly effects on the student achievements such as;

Pre-knowledge. Pre-knowledge it is an essential part basically mathematics because mathematical concepts are directly connected in previous knowledge. If the person does not have pre knowledge who unable to solve related mathematical

problems. So, pre knowledge plays vital role in learning algebraic problems of mathematics. Thus, it is an important cause of student achievement.

Students Labor at Home. Home is the first school of child so the basic knowledge were develop from their home. Also, parents are motivational factor of students learning. So, home environment also effect the students achievement because student does not success when they did not labor at home. It means the achievement of students is dependent in their labor at home. So, it becomes the difficulties in learning algebraic word problems.

Teacher-Students Interaction. Interaction is a social process it helps to develop the different knowledge in different situation. Teacher is the main person in teaching learning activities we learned a lot of subject matter from this teacher, and this teacher was likely very knowledgeable, but chances are that these are not the reasons why this teacher made such a difference. Chances are that this teacher's exceptionality lies with how he or she interacted with students. The fact is that a definite thread of similarity runs through teacher preparation programs; teachers generally enter the classroom with comparable training in content and pedagogy. The way that teachers interact with their students is a prominent factor in differentiating one from the next in terms of impact. Thus, the interaction between teacher and students is affected factor of students' achievement.

Motivation. Motivation and learning process have a deep connection. Motivation is the core for human being's aspirations and achievements. Thus, motivation is crucial to succeed in educational matters and without the fighting spirit nothing is possible not only in education but also in real life. The learning process is an endless life long process. In order to continuously achieve a high motivation is

crucial. Motivation is the force that encourages students to face all the tough and challenged circumstances. So, motivation is important fact in learning mathematics it directly effect in students achievement and becomes learning difficulties.

Chapter III

Methods and Procedures

This section, includes data collection process of this study to fulfill of research objectives such as research design, population and sample, data collection tool, data collection process and data analysis process.

Research Design

Khanal (2074 B.S) "a mixed method research design is a procedure of data collecting, analyzing and mixing both quantitative and qualitative methods in a single study or a series of studies to understand a research problem" (p. 199). In this study, at first I used qualitative methods particularly survey design to determine the difficulties. For the support of quantitative data and to determine the causes of difficulties I used qualitative methods by using narrative inquiry. Therefore, this study was explanatory sequential design of mix method.

Population of the Study

The students of grade X of academic years of 2075, in public schools of Kirtipur, Kathmandu district were the population of the study.

Sample of the Study

I selected three schools out of ten public schools of Kirtipur by random sampling and select all 150 students from different three school to conduct achievements test. From this population fifteen students were selected including five students from each schools and also select one/one mathematics teacher from each schools for the interview.

Data Collection Tools

The achievement test paper and the interview guidelines were the data collection tool of this study. According to Freeman (1956), a test of educational achievement is one designed to measure knowledge' understanding or skills in a specified subjects or a group of subject. The achievement test paper used to investigate the difficulties of students in learning algebraic word problems. The prepared test was set of questions made by researcher purposively on the basis of Bloom's taxonomy of objectives and according to the specification table of compulsory mathematics of class ten. Similarly, interview guidelines for students and teacher used to analyze the causes of students difficulties in learning algebraic word problems. The interview guidelines was design on the basis of output difficulties and the area of causes of difficulties.

Reliability and Validity of Tools

The reliability of achievement test paper were determined by pilot testing with five students of class ten selected from out of the research population. From that the researcher analyzed the reliability of test by using split half method found reliability coefficient is 0.92 (Appendix-B). It shows that the test questions (Appendix-A) were reliable. For validation of achievement test paper I used the specification table of class ten of compulsory maths and also consult with guidance teacher. Similarly, for the validation of interview guidelines (Appendix-C) consult with guidance teacher.

Data Collection Procedure

I contacted the principal of the school where the study took place, told them about the study and asked for permission to collect the data. After getting permission from school principal I met the students of class ten students and clarified the things

that students need to attempt the achievement test questions. Then I distributed the question paper to each students and asked them to complete and collect the answer sheet of students after completed the solution. Furthermore I thanked the students, teacher, and principal. Also requested with principal to help for conduct the interview with five low achiever students and related a mathematics teacher for next day. After getting permission I return from the school and carefully checking the answer paper of students and scoring. After that identified 15 lower achiever students five each from schools for interview. Again I went the schools then conducted interview with low achiever students and mathematics teacher also, sound recorded with permission.

Data Analysis Procedure

In this study the primary data were presented and analyzed. The collected data from primary source by achievements test and interview. Data from achievement were analyzed by using statistical tools and different theory. Mean Weightage was used to locate central score of students, also I tabulated frequency and percentage of students' performance in different level of question and analyzed by using related theory the difficulties of different domain according to conceptual formwork.

Similarly, I used to analyze qualitative data by thematic approach of Braun and Clarke's (2006) framework and apply it in a systematic manner to describe and analyzed the data. The recorded interview data were translate, coding and integrate similar coding and make a theme. Thus, in this study the data were analyze by thematic approach and using different theory.

Chapter IV

Analysis of Data and Interpretation of Results

This chapter presents the results of the study which aimed at investigating the student's difficulties in learning algebraic word problem at grade X students of public school of Kirtipur and identified why they are failure to solve algebraic word problem. The research findings are interpreted, explained and presented with regards to the objectives specified for the study.

The data were collected from 150 students by using achievement test, interview with 15 students including 5 students of each schools and interview with three teachers of different schools. After carefully checking the solution paper and calculate their obtained marks and determined the mean marks of students is very low that is 10.63 out of 36. This average marks shows the difficulties level of students is very high. The obtained data were calculated and analyzed according to the objectives of this study. To analyze and interpret the data using statistical tools mean and percentage. Thus, the obtained data were analyzed and interpreted under the following heading;

- Difficulties in learning algebraic word problems
- Causes of difficulties in learning algebraic word problems

Difficulties in Learning Algebraic Word Problem

The first objective of this study is related to learning difficulties. So, the researcher to meet this objective the achievement test were conduct and carefully checked and categorized the students on the basis of who attempt the solution of question. The first objective fulfills by the helps of the achievement test paper and analyzes the difficulties under the following domains:

- Difficulties in understanding

- Difficulties in applying

- Difficulties in solving process

- Difficulties in generalization

Difficulties in Understanding. The category of understanding is the second level of the Bloom's taxonomy pyramid. Understanding is described in terms of the way information is represented and structured in the memory. A mathematical idea or procedure or fact is understood if it is a part of an internal network, and the degree of understanding is determined by the number and the strength of the connections between ideas. In this study understanding refers translation of verbal problem into algebraic expression by representing appropriate symbol, notation, language etc.

To determine learning difficulties in understanding level four questions were asked among 12 questions and all of these questions were only related to translate verbal problem into algebraic expressions. The following table shows the performance of students;

Students Performance	No. of students	Percentage
Correct translation of all questions	3	2%
Correct translation of only three question	22	14.67%
Correct translation of only two questions	39	26%
Correct translation of only one questions	41	27.33%
Not correct attempt of any one questions	35	23.33%
Not attempt any one questions	10	6.67%

The above table shows few number of students were able to solve all questions. It means, there is great difficulty for students to understand the questions. And other students have solved only one, two and three questions of this level. Some students unable to write correct expression of any question of this level, they were failure to choose appropriate sign and symbol. The question of number 3 was, if present age of two people are x and y then what will be the age of them after 'a' years later? The correct solution of this question is, the age people of 'x' and 'y' after 'a' year later will be sum of 'x' and 'a' and sum of 'y' and 'a' respectively.

Similarly, question number 4 was there were 'm' boys and 'n' girls in a group. Each person carried 2 balloons. Write the expressions which represents the total number of balloons that were carried in the group? The solution of this question is, the number of balloons carried by 'm' boys and 'n' girls is 'm' multiply by 2 and 'n' multiply by 2. Then total number of balloons in this group is sum of number of balloons carried by each person. Similarly, the question number 5 was Ram earned a monthly income 'x' thousand. And he spend y thousand in a year then how much money did he save in a year? Correct solution of this question is, the total income of Ram in one year is '12x' thousand and expenditure of a year is 'y' thousand then the money saving in a year is '12x minus y'.

Furthermore, the last question of this level was to write the expression if the sum of square of three positive consecutive integers is 29. Correct answer of this question is, let the three consecutive positive integer are 'x', 'x plus 2' and 'x plus 4' then according to question, sum of square of these positive integer 'is equal to' 29. But some students not correct attempt any question of this level. The mistake of students show the following representative picture.

The above solution of Q. No. 3 there were no need to use multiplication sign between 'x plus a' and 'y plus a' and equality sign it is an age of two peoples. Here most of the students got confusion. Also the solutions of Q. No. 4 there not able to use correct sign in correct place. Similarly, the solutions of other two questions it seems to not understand the question what does question means and not correct representation the question by using symbol and notations. And some student who were not any ideas to start any question. They said that "we do not understand the questions and don't know how to do it".

The above discussion shows that most of the students failure to represent the proper symbol, notation, using appropriate sign, language. It means they unable to connect new concepts are linked with previous or pre-learned concepts. Thus lack of pre-knowledge is one problem to understand algebraic word problem. This claim derived from the literature, within the APOS framework, introducing students to algebraic word problem concepts through packaged abstract definition inverts the way they are practiced to learning mathematical concepts. Students generally learn concepts through a steady growth of knowledge from action to schema but the definition of algebraic terms immediately presents students with a combination of

three schema sign, symbol and axioms of algebra that concise the underlying action, process and objects.

Much of the satisfaction inherence in learning is that of understanding: making connections, relating the symbols of mathematics to real situations, finding out how things fit together, and articulating the patterns and relationships which are fundamental to our number system and number operations. It implies that to search for interrelationship between algebraic objects and their symbolic representation are very important for understanding algebraic word problem.

Difficulties in Applying. The category of application is the third level of the Bloom's taxonomy pyramid. Applying is using strategies, concepts, principles and theories in new situations. According to Bloom application level is where the student moves beyond basic comprehension in order to begin to apply what they have learned. Students are expected to use concepts or tools they have learned in new situations in order to show that they can use what they have learned in increasingly complex ways. To study the student's difficulties in applying I used four questions in this domain. The performance of students in this domain is also poor which shows the following table;

Students performance	No. of students	Percentage
Correct attempt all questions	11	7.33%
Correct attempt only three questions	24	16%
Correct attempt only two questions	18	12%
Correct attempt only one question	36	24%
Not correct attempt any one questions	48	32%
Not attempt any one questions	13	8.67%

The above table shows that the student's solution of applying level questions is very poor. There were few students attempt all questions without any error, other

students attempt only one, two, three questions. While observing the answer paper of these students, some students try to solve remaining question and some students not try to solve. The solution paper of these students, it seems to like maximum students were not understand the remaining questions. So, they were wrong and some students were not any idea to solve questions. It seems to like student's difficulties in applying level is very high. The answer paper shows maximum number of students was not understand the questions and didn't apply correctly. For example the question number 9 was, the present age of mother and his son are 37 and 8 years respectively. How many years ago was the product of their age 96 years. The correct solution of this question is, let the required year is 'a'. Then the age of 'a' years ago of mother and son can find 'a' is subtracted from 37 and 8. The correct application according by question is multiply of the 'a' year ago age of mother and son 'is equal to' 96. But the most of the students were not correctly expression and applying. The following representative picture shows the most of the students' mistakes;

The above picture shows that student's does not understand the question and do not apply it correctly according to question there were student get confuse because

s/he wrote 'x' plus 37 'is equal to' 8 and 'x' minus 96 'is equal to' 37. It seems to like student got confusion in understand the question and applying stage too.

Similarly, the student understands the question but s/he mistaken in applying stage for example the question number 7 was, if the length and breadth of rectangle are two consecutive odd number then find the area of rectangle. The correct solution is; if we suppose the length and breadth of rectangle are two consecutive odd number be 'x' and 'x plus2'. Then the area of rectangle is multiply of length and breadth i.e. multiply of 'x' and 'x plus 2'. But students' solution as follows;

This solution paper shows that, the students couldn't apply correctly. There is apply addition operation between length and breadth, because in calculation area of rectangle we should apply the multiplication operation. It seems that student's difficulties in applying stage. It represents the students' failure in understanding level as well as applying level.

Thus, above discussion shows students got mistake in understand the question. If understand the question then students failure to applying also. According to Bloom (1956), student is unable to solve application problems may result from a number of causes besides the one that the student has failed to learn to apply. Failure on a problem may result from incorrect comprehension of the problem abstraction,

choosing the wrong abstraction, incorrectly using the abstraction in the situation, or incorrectly interpreting the results of using the abstraction in the situation.

It is concluded that, most of the students were failure in application problems to understand the problem. Still, in many application problems, students have to go through the formulation step of the mathematical modelling process that often requires choosing/constructing a formula or setting up a function for further investigation. Normally the information given in an application problem includes some numbers, expressions, and stories. This is the stage where many students have difficulties in translating the word problem into the mathematical formula and then deciding which mathematics they should use.

Difficulties in Solving Process. It is an another important step of solution students who understand the problem and applying ideas in correct situation after then students try to get correct solution. In this steps students made various mistake such as; related to addition, subtraction of like terms, multiplication in different algebraic terms, signs, dividing any number in equality, balancing the equations, arithmetic operation, etc. By carefully checking students answer paper of four questions of applying level it knows that students were also failure to solving process. The following table shows the students difficulties in solving process;

Students did mistake in solving process of	No. of student who correct at least first two stage	No. of student who mistake in solving process	Percentage
First question	40	6	15%
Second question	85	10	11.76%
Third question	69	18	26.1%
Fourth question	60	8	13.33%

In the above table, second column represents the number of students who succeed to at least understanding and applying of each questions and third column shows the number students who failure after complete the understanding and applying of questions. It means to shows that students also failure in solving process like manipulate the sign, symbol, addition, subtraction, multiplication etc. The following representative picture shows students understand the problem also applying correctly but mistake in calculation of sign.

The correct solution of this question number 9 is already described above and the question number 10 was, if 5 is subtracted from the half of the square of positive number the result is 35. Find the number? The solution is; let positive number be 'x' and according to question x^2 divided by 2 'minus' 15 'is equal to' 35 then after taking L.C.M 2 on left side and cross multiply L.H.S and R.H.S we get x^2 'minus' 30 'is equal to' 70 then adding 30 on both sides we get x^2 'is equal to' 100 and taking square root on both sides then we get the value of 'x' is 10. But the solution of students as follows;

In the above solution it shows that the students understand and correct applying in both questions but there are mistakes in calculation. In first question there is mistake in multiplication of signs and in the second question mistake to take L.C.M. It means that solving process is also difficulties of students in solving algebraic word problem. Polya (1945), also found that students had significant difficulties in transferring their problem solving skills from verbal representation to graphical and functional representations. Moreover, there was still an increase in difficulties in quantities, formulae, values and calculations. Thus, it is concluded that solving process is another difficulties of students in learning algebraic word problem. There is students' failure to calculation like, addition, subtraction of like terms, multiplication, taking L.C.M. etc.

Difficulties in Generalization. The process of taking a skill learned in one setting and applying it in other settings. It may also be used to define the process of taking one skill and applying it in a different way (Fouse & Wheeler, 1997). In this study generalization means looking for broader patterns and relationship and making connection in different levels of mathematical thinking, also finding algebraic formula. Two questions were kept in this domain. And these questions were creating level of Bloom's Taxonomy. The following table shows the performance of students;

Students performance	Number of students	Percentage
Correct attempt all questions	0	0
Correct attempt only one question	21	14%
Not correct attempt any questions	65	43.33%
Not attempt any one questions	64	42.67%

The above table shows there was no one student attempt all without any error. Few number of students were solve only one question without any error. Some

students were partially correct but not completely correct. By carefully checking the answer paper of students it seems to like they were no any idea to further process that are able to partially correct the process and some were wrong at the beginning of solution. And some students were not attempt any questions of these level, they were no any idea to start the solutions of these questions. The following representative picture shows maximum students who correctly starting but after some steps they were no ideas to follow correct way of solution. The question was, Show that the solution of quadratic equation $ax^2 + bx + c = 0$ is $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$. The correct process of the solution is first divide 'a' on both side of the given quadratic equation. Then, make in left side perfect square of 'x' plus 'b divide by 2a'. After that taking square root on both sides and then we get required answer after some steps. But the student's solution as below;

In this paper the student starts the problem correctly because there is 'a' divide on both sides and then s/he didn't able choose best way to solve further process. It seems to like that maximum students had no idea to choose best way to get correct solution. Hence, after observing the performance of students in the questions of generalization domain, there is very poor performance even one student could not correct solution of both questions. Therefore, generalization is also strong difficulties of learning algebraic word problem.

The reason that it should be used systematically is; trying to reach to the main aims of concepts that is taught by using special examples with process of derivation in polynomials from linear to more degrees such as; 2nd, 3rd and 4th, the plan is made that refers to form the formula of derivation for polynomials of degree n. Forming formula is the generalization that use symbols to enter to the next stage. So formed formula is specialized by drawing diagrams, constructing tables, making symbols and organization.

Thus, I find out students' difficulties in learning algebraic word problem was very high. This is because all the aspects were on very high level of difficulty, representing the symbol or notation, using the symbol or notation or ideas of mathematics which are relevant and logical reasoning, and redefining symbol or notation that is used by using the logic of the logical necessity were very high. Students' understanding of the question, applying knowledge in different situation, generalization of problem and solving process of algebraic word problems is quite slow.

Causes of Difficulties

The second objective of the study is related to the causes of difficulties in learning algebraic word problem. According to Ginsburg (2016), the environmental conditions influenced for the learning of mathematics. Indeed, one might say that children are educationally at risk-at the mercy of a culture that devalues mathematics, inhospitable schools, teachers who teach badly, and textbooks that often make little sense. And of course, the risk is greater if the child is poor or from an underprivileged minority. Therefore, so many difficulties of learning which were create from different factors.

Thus, the difficulties in learning algebraic word problems which are come from internal and external facture of students. So, I'm try to identify the cases in the following area with the help of achievement test paper and interview with teacher and students of different three school;

- Pre knowledge

- Student labor at home

- Students-Teacher Interaction

- Motivation

Pre-knowledge. According to Sodeman (2007), build pre-knowledge is important role to learning such as students need an understanding of vocabulary terms in order to conceptualize and connect new learning to previous learning for long term memory retrieval. It means students do not have pre-knowledge about some topic then they unable to understand the question what to do and cannot solve the problem. It shows that lack of pre-knowledge is one important cause of learning difficulties in mathematics.

In this study I made two questions which are pre-knowledge for the solving algebraic word problem. By carefully observing the achievement test paper of participant students they were poor perform of that questions. This shows following table;

Students performance	No. of students	Percentage
Correct attempt both questions	8	5.33%
Correct attempt only one question	26	17.33%
Partially correct attempt of at least one question	29	19.33%
Not correct attempt at least one question	25	16.67%
Not attempt any one questions	62	41.33%

This table shows very poor performance in the knowledge level question. There is few students' give correct answer of all question without any error. And some students give partially correct answer some were not trying to solve any questions. It means the pre knowledge of students to solve algebraic word problems were very low level.

To be able to solve various types of algebraic expressions, one needs to first work on strengthening his/her fundamentals concepts in basic mathematics like arithmetic and number theory. We need to have a clear understanding of how basic maths works in order to solve problems needing the use of more complex mathematical concepts. Lack of primary knowledge leads to committing various silly errors in the course of arriving at the conclusion.

Bruner theme of that learning is an active process which learners construct new ideas or concepts based upon their pre knowledge. The learner selects and transforms information. So, Cognitive structure (schema, mental models) provides meaning and organization experiences and allows the individual to "go beyond the information given".

Thus, it is concluded that students' pre knowledge plays a most important role to good achievement in algebra. So, the causes behind the difficulties in learning algebraic word problem is poor pre knowledge. Due to the poor pre knowledge, basic knowledge of students in algebra; teacher has also faced problem to teach algebraic word problems.

Student Labor at Home. It is an important factor of student achievement. Mathematics need practice which has different theory and several formulas. So learning of mathematics, students should manage extra time for practice. Generally mathematics achievements determine students' labor in present situation; students are not laborious in mathematics learning. Consequently, mathematics achievement of students was decreasing this result show in mathematics. Another factor is most of the parents were uneducated. Uneducated and illiterate parents could not feel the nature of education, as it should be which eventually resulted in high rate of failure and dropout. Home is regarded as the first school to all child but most of the students were not help from their parents. So, they feel difficulties in learning mathematics. Thus home environment plays vital role in learning. But the views of students and teachers;

> "Parents provide enough time to practice at home but we are not doing
>
> better in learning specially mathematics because we forget at home
>
> what we had learned at school and there is no one to teach us at home.
>
> So, we fail to learn mathematics". (Views of student)

> "Sometimes we do not complete homework of mathematics because it
>
> takes long time to solve and most of the time we spend in school. Also,
>
> we have homework of other subjects' except mathematics and have to

help for the daily work of house so it is difficult to manage time".

(Views of student)

The above view shows that students were not studying sufficient at home because they have individual problems. Some student did not manage their time to attempt homework, forgot at home and no guidance for mathematics at home. If student do not repeat at home what is learned at school then students do not get interest in learning mathematics which result as failure students in respective subject. Some of the students have domestic problems as they have not enough time to study mathematics and other subjects too. They have the stress of homework of all subject and the work have to do at home. So, they were not managing their time for study and homework which is a great problem of some students to learn and achieve more results in mathematics. By the views of the interviewed students, their friends may have same kinds of problems so they were always failure in learning. Moreover, teacher said that;

"In presents situation some students are far from home and they have to do all personal work as living in room. Some of them are from low economic family and they work as child labor after school and before school time. Students of high economic family have many facilities like mobile, laptop, T.V., internet etc. which spends their more time. So, they are not responsible in their study. Also, in class time they are busy in side talk, making noise and a few number of students are only interested in learning. So, I think they do not open book regularly at home, and never attempt their homework". (Views of Teacher)

It shows, some students were not together with their parents so they were not able to manage their time to learn and other work of home and some were together with parents but not study at home regularly. Some students have to work and income themselves for their study. And most of the time of students of higher family spends in mobile, T.V, laptop, internet, etc. it shows that some of the children have their personal conditions that they most depends on study in school only. Most of the parents didn't guide and encourage the students in learning they keep them happy by providing unnecessary facilities demand by their children. As the results, they spend most of the time in unproductive field at home and fully depends in their study in school. So, they were failure to learning mathematics.

Thus, the difficulty in learning algebraic word problem is causes by lack of practice of students at home. According to learning disability theory teacher and parents will be part of the intervention in terms of how students get individual aid for the different successful practice. But the students are not fully guided by the parents and teachers. It became difficulty in learning mathematics.

Student-teacher interaction. Interaction is the most important part of human relationship. It is necessary to make the human activities effective simple and to achieve the goals. Interaction is the transfer and understanding of meaning. How the cell and the capillaries are important in human body likewise interaction is most important part of learning for the students and teachers. Also, it is the social process and may be within persons or in groups. Personal interaction refers to the mental activities with his/her mind and soul. It depends upon the personal intellectual capacity. Individual interaction refers to sharing, co-operation an adjustment between two or more persons. And it brings the maturity in learning. The following are the

words of the students and teachers how they interact with their mathematics teacher in classroom and school, how the mathematics teachers interact with the students respectively.

> "The teaching method of our mathematics teacher is very fast so we cannot completely understand even the simple problem which solved by teacher on the board because we do not have time to copy and understand. So, we are unable to talk with teacher about problems". (Views of student)

> "Our mathematics teacher says these problems are difficult to understand for you so we do not lose the time to solve these types of problems. And teacher solved some problems on board then leave remaining problems for homework. So, we do not seriously interact with teacher in this topic". (Views of student)

From above views of the students we can guess that some mathematics teachers, who is not familiar with child psychology and teaching methods. As some students are slow learner but the teachers did not interact properly with them. Only few problems of lengthy exercise are solve by the teachers saying that the remaining you can't understand and it is not necessary too. There is so big gap between some students and teacher it means there were not enough interaction between students and teacher. Also, some students were failure by the teacher's perception about the algebraic word problems as teacher already said that you are not able to solve that type of problems, it is very difficult to understand. This type of views of teacher effects negatively to the students' psychology, thinking about the word problem. So,

students are never interested and being success in that type of problems. Moreover, students and teacher said that;

> "Our mathematics teacher is very strict in discipline, so we are afraid of our teacher. So that, we do not ask any question of this topic with mathematics teacher. So we are very weak in this type of problems".
> (Views of student)

> "Students are not interested to learn this topic, they says that sir we are unable to start the solution of this type of problem and students does not regular, don't attempt their homework seriously and not ask any question with me. So, maximum students' are failure to get good achievement". (Views of teacher)

> "Some students are never serious to learn they always make noise from the back side, not attempt class regularly. There is also large number of students at a class, and we have to complete the course in time so sometime I'm unable to listen the students' interest and give feedback to their homework because in large number it takes long time". (Views of teacher)

From above views there is lack of interaction between students and teacher due to teachers' behavior as the teachers wants to keep the students in well discipline. Maximum student said that we are not understand this type of question so we are not interested to learn, and teacher also says that students are not interested to learn and solve this type of problem because their mentality about verbal problems are, very difficult to understand. So, they are not interested to interact with teacher about this problem. Also students were afraid from the behavior of teacher. Hence there was no

practice of proper interaction between students and teacher in classroom. That becomes students' difficulties in learning algebraic word problems.

An essential feature of learning is that it awakens a variety of internal developmental processes that are able to operate only when the child is in the action of interacting with the peers (Vigotsky, 1978). It shows that learning is the process which obtain from interaction with peers, teacher, other persons. But the above discussion shows, there were lack of interaction between teacher and students so, it becomes the difficulties in learning algebraic word problems.

It is concluded that there was lack of interaction between the teacher an students, teacher did not responds regularly and students were not regular in mathematics class, did not attempt homework regularly, passive to learn mathematics, and not interested to interact with teacher about their problems. So, students feel difficult in learning algebraic word problems.

Motivation. According to Ginsburg (2016), Children develop mathematics because they find it useful (practical utility) or because they are curious about the world (intrinsic motivation). The child wants more food, rather than less; therefore, figuring out what makes more and how to get it is useful. So, motivation is the essential part of learning and it effects the student achievement. Specially, in teaching learning activities teacher role of motivation is important for students' achievement. If the teacher connected the every content of mathematics to real life, to clear where it is used, also to clarify important of mathematics then they are automatically motivated to learn because students are always curious in the topics which are related in human daily life.

Moreover, teacher is that persons who can develop the students' behavior and encourage the students to develop the skill in their interested field. So, the students' achievement is also affected by the motivational part of teachers. I asked with students how your teacher motivated to learn algebraic word problems in classroom and the response of students are as follows:

"Our mathematics teacher enter in classroom and start to teach, he does not give any type of motivational speech even the importance of mathematics. He directly solves some problems of that exercise and says other problems are homework for you". (Views of student)

"Our mathematics teacher says this types of problems you cannot understand so we do not loss our time to solve this types of problems. And we also feel so difficult to solve these types of problems then always failure to get success". (Views of student)

Form this views there is no motivational and enjoyable teaching learning activities in classroom. The teachers is not serious to the students wants, teachers is only focused in course, only wants to solves some problems and wants to complete course only. There is no any students centered methods for the motivation of students and the students have not understand the importance of mathematics in real life. It seems only teacher is active in class room but the students were passive. So, it is teacher centered activities and its result is not well for students achievements. In addition;

"Sometime our teacher motivated us to learn by giving different example but in this of type of topic teacher do not say anything, only he solve the problem on board and describe the solving process".

(Views of student)

From this views there is no motivational ideas from the teacher in this proper topic and the students are not clear in the basic concept of algebraic word problems finally it became the cause of failure of the students. Similarly, the views of teachers' were common, which is as follows;

"Language problems are very difficult to understand is the earlier concept of the students. So students are not interested to learn this topic and never motivated to learn these types of problem while we try to motivate them". (Views of teacher)

From the above views of mathematics teachers the students have no any concept in previous class about the topics and the students feel algebraic problems are most difficult to understand and solve. It shows that students were not interested to solve word problems and the teachers were not successful to motivate the students as they tried many ideas many times. This indicates there is lack of right motivational ideas to the students to learning algebraic word problems. So, students were not able to get good achievement in algebraic verbal problems.

Ginsburg (2016), also concludes that Children usually appear to enjoy learning and to engage in it with enthusiasm. If the students are not regular in class and they are unable to learn mathematics properly. By the above views there is no any right type of motivational activities related to the psychology and previous knowledge of the students which can make students to actively participate in learning. The teacher only presents actively were the students are passive and the method is not child centered. So, it becomes the problems for good results of mathematics. Hence, it is concluded that motivation is one of the most important effective factor for student achievement. Not well practice of correct motivational methods became the causes of learning difficulties.

Chapter-V

Summary, Finding, Conclusion and Recommendations

This section contains a summary and discussion of the main findings and also presents implications for learning and instruction, recommendations for future research.

Summary and Findings

In mathematics students encountered difficult experiences while solving different problem of mathematics. This study was totally based in student difficulties and effected factor to create that difficulties in learning algebraic word problems at grade ten. The specific objectives of the study of the study were, to explore the student's difficulties in learning algebraic word problem and to analyze the causes of difficulties.

This study was based on both quantitative and qualitative method. I conduct achievement test and interview with students and teacher as the data collection tool. The respondents were select from different three public school of Kirtipur. The collected data were carefully checking and calculate the mean and percentage for interpretation also used thematic approach to analysis the recorded data of interview with students and teacher.

From the analysis the data of students' achievement and views of students and teachers, it was found that students had been facing difficulties in learning algebraic word problems at grade X. Based on analysis and interpretation of data, the findings of this study are presented in hierarchical order as follows;

- Most of the students have not good results in algebraic word problem. They are failure in understand the word problem questions.

- Students have lack of choose appropriate language to represents their answer also used sign in correct situation, used symbol and notation.

- Students were difficult to check whether the symbol or notation or ideas of mathematics used has been applied correctly or not and use logical reasoning.

- Most of the students were failure to apply the formula, not exact procedures. Also some students had not good hand writing.

- Students were not good performance in calculation problems, they were mistaken in addition, subtraction of like terms, multiplication of sign, terms, also in different in numerically.

- Students have lack of chosen different procedure to calculation problem of algebraic word problems. Because, they have lack of pre knowledge about related concept.

- Students have not followed the sequential order of the solution in algebraic word problems, that's why they were failure in solving process. They mismatched the steps between making final solution of any solution of any problems which makes organization difficulties of students in algebraic word problem.

- Students have lack of ideas to identification of a useful pattern by the students was a significant factor in their successful symbolic generalization. The students generally avoided verbalizing their generalizations. Students with a weaker background in algebra, so that they had more difficulties generalizing.

- Students' misconceptions of over generalization and/or inability to generalize mathematical rules to remove a term from the equation, students subtract and dividing it from both sides of the equation.

- Students have not requires pre knowledge about solving algebraic word problems. So, it becomes the difficulties to learn.

- There were difficulties in learning algebraic word problems due to lack of good concept about word problems to students and bad feelings towards learn this topic.

- The students difficulties in learning algebraic word problems were due to less participate in classroom activities and availability of mathematical laboratory and instructional activities.

- Students didn't participate internally in learning algebraic word problem because they were not motivated by teachers and parents. Then they feel word problem is difficult for learning.

- Most of students irregular and dropped out in between the academic year which becomes difficulties to learn.

- There were no proper interaction between students and mathematics teacher that become students had felt difficult to learning algebraic word problems.

Conclusion

From the above finding of study, it is concluded that learning algebraic word problems is not satisfactory at grade 10 students. Among the four different categories describes as above, it was found that there were symbolization problems, notational problems, problems of using appropriate language, calculation problem, formula manipulating problems and problems in identification of pattern and generalize.

Which becomes from due to lack of basic knowledge and pre knowledge, teacher-students interaction, lack of motivational role of teacher and parents to learn, lack of students labor in learning algebraic word problem, negative thinking about the word problems, also large number of students is the causes of difficulties in learning algebraic word problems.

Recommendation for Educational Implication

The preceding discussion of the study's main findings provided a number of implications for mathematics instruction regarding teaching and learning mathematics and curriculum development such as;

- First, the results from this study show that solving algebra word problems is difficult for many students. This suggests that teachers need to find a way that could help students minimize their difficulties and find a way to encourage students to think.

- The results from this study show that some students had systematic errors in solving equations. This happened because students did not understand the concept of equality. So, teachers might emphasize the concepts of equality, and also other properties of numbers.

- Another error that was often found with the students in this study was operations with polynomials and fractions. Teachers should check their students' work and help student's overcome this problem. Teacher can use algebra tiles to help student learn to add polynomials and fractions.

- The results from this study show that difficulties made by lack of pre knowledge of students of related topic. So that teachers should build

knowledge from what students already know and put more variety of activities in the classroom.

- The results from this study indicate that students' performance of teachers who mostly directed the students to solve algebra word problems improved little after instruction. In contrast, students' performance of the teacher who used questions to initiate students' thinking improved much after instruction. Thus, it would be interesting to conduct a study about teachers' encouragement of students to think through more the process of solving word problems rather than directing them.

- The results from this study indicate that all three teachers rarely emphasized the checking process, it would be interesting to conduct study that if teachers emphasized checking the process of solving word problems more and checking the accuracy of an answer, would student's errors in calculations or copying errors decrease.

- The interview with some of the students from the low achieving class gave value information. The students said, "I don't understand in class because the teacher always told us what to do. If the teacher let us think by ourselves, it would be better. "Thus, it is interesting to see if teachers encouraged the low achieving students to think more through the process of solving word problems rather than directed them.

Recommendation for Future Study

The preceding discussion of this study provides a number of recommendations for future research in mathematics education and teacher education such as;

- First, the results from this study show that some students had difficulties in solving word problems because they could not represent verbal situations into equations. Thus, future studies should focus on student's representation of verbal information into symbolic representations.

- The results from this study suggest that students who had difficulty in solving algebra word problems might have difficulties making the transition from arithmetic to algebra. Thus, it would be important for future research to study the connection between arithmetic and algebra in order to help students build a bridge from arithmetic to algebra.

- The results from this study indicate possible relationships between teachers' beliefs about students' learning and their decisions in instruction, thus, educators must understand the nature of teachers' beliefs about students' learning and the roles these beliefs play in the decisions teachers make as they present the material to their students. Thus, more research on teachers' beliefs about students' learning should be done.

- Student's errors in algebra should be investigated. In addition, future study might also focus on students' misconceptions in algebra.

Finally, the results from this study and from previous research show that translating words into equations is difficult. However, few research studies have investigated ways to help students to learn better and to solve word problems, since solving word problems is important. Word problems provide students a first glimpse into how mathematics is used in the real word.

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Appendix-A

Problems of Pretest and Post Test

Group-A [2×1=2]

1. Define the quadratic equation with example.
2. Define consecutive even number with example.

Group-B [4×2=8]

3. If present age of two people are x and y then what will be the age of them after 'a'years later.
4. There were m boys and n girls in a group. Each person carried 2 balloons. Write the expressions which represents the total number of balloons that were carried in the group?
5. Ram earned a monthly income x thousand. And he spend y thousand in a year then how much money did he save in a year?
6. Write the expression if the sum of square of three positive consecutive integer is 29.

Group-C [4×4=16]

7. Let the length and breadth of rectangle are two consecutive odd number then find the area of rectangle.
8. The area of a rectangle is 56 cm.^{2}its breadth is 7 cm. What is the ratio of its length to its perimeter?
9. The present age of mother and his son are 37 and 8 years respectively. How many years ago was the product of their age 96 years.
10. If 5 is subtracted from the half of the square of positive number the result is 35. Find the number.

Group-D [2×5=10]

11. Show that the solution of quadratic equation $ax^2 + bx + c = 0$ is $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
12. Find the rule of the pattern of consecutive odd number start from five (i.e. 5,7,9,11…..) and five the 50th number?

Interpretation the results of Pilot Test

The following table shows the students marks obtain of pretest.

Students number	1	2	3	4	5
Marks obtained in odd questions (X)	4	2	2	3	6
Marks obtained in even questions (Y)	4	5	5	5	12

To calculate correlation coefficient of above students marks by using following formula;

$$r_{oe} = \frac{N\Sigma XY - \Sigma X \Sigma Y}{\sqrt{N\Sigma X^2 - (\Sigma X)^2}\sqrt{N\Sigma Y^2 - (\Sigma Y)^2}}$$

$$r_{oe} = 0.85$$

This correlation coefficient shows the half of the reliability of test items. So, for the reliability of whole items I used Spearman-Brown correlation coefficient formula as below:

$$r_t = \frac{2r_{oe}}{1 + r_{oe}}$$

Where; r_t = is reliability coefficient of whole items.

r_{oe} = the reliability between marks of odd and even items.

Now, $r_t = \frac{2 \times 0.85}{1 + 0.85} = 0.92$

According to Garrett (Garret, 2008, p. 176), the interpretation of reliability coefficients as following table:

Coefficient	Nature
0.0 to ± 0.20	Negligible
± 0.20 to ± 0.40	Present but slight
± 0.40 to ± 0.70	Substantial
± 0.70 to ± 1	High to very high

Appendix-C

Interview Guideline with teacher

- School environments for learning

- Teaching strategies

- Problems on teaching algebraic word problems

- Problems of students in learning algebraic word problems

- Causes of students difficulties in learning mathematics

- Encouragement provided to the students learning

- Relation with students.

Interview Guideline with students

- On the basis of their solution test paper

- Personal interest

- Reading opportunity at home

- Discussion with teacher

- School environment for learning

- Learning activities

- Homework and class work

- Difficulties and cause in learning algebraic word problem

- Expectation with teacher, parents and school