# STUDENT'S DIFFICULTIES IN SOLVING ALGEBRAIC WORD PROBLEMS

A

THESIS

BY

KHAGENDRA KAFLE

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR MASTER DEGREE OF MATHEMATICS EDUCATION

SUBMITTED

TO

DEPARTMENT OF MATHEMATICS EDUCATION

CENTERAL DEPARTMENT OF EDUCATION

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2019

त्रिभुवनविश्वविद्यालय

शिक्षाशास्त्र केन्द्रीय संकाय

# गणितशिक्षाविभाग
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### Letter of Certificate

This is to certify to Khagendra Kafle a student of academic year 2072 / 073 with campus Roll No. 124 Exam Roll No. 7228306, thesis number 1482 and T.U. Regd. No. 9-2-29-561-2012 has completed his thesis under supervision of Mr. Abatar Subedi during the period prescribed by the rule and regulation of Tribhuvan University, Nepal. The thesis entitled "**Student's Difficulties in Solving Algebraic Word Problems**" has been prepared based on results of his investigation. I, here by recommended and forward that his thesis be submitted for evaluation as the partial requirements to the award degree of Master of Mathematics Education.

………………………………..

Assoc. Prof. Laxmi Narayan Yadav

Head

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**Letter of Approval**

This thesis entitled "**Student's Difficulties in Solving Algebraic Word Problems"** submitted by Mr. Khagendra Kafle in partial fulfillment of the requirement for the Master's Degree in Mathematics Education has been approved.

| **Viva Voice** | **Signature** |
|---|---|
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| 2. Prof. Uma Nath Pandey | ………………. |
| (External) | |
| 3. Mr. Abatar Subedi | ………………. |
| (Supervisor) | |

December, 2019

Poush, 2076

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### Recommendation for Acceptance

This is to certify that Mr. Khagendra Kafle has completed his M. Ed. thesis

entitled entitled "**Student's Difficulties in Solving Algebraic Word Problems**"

under my supervision during the period prescribed the rules and regulations of

Tribhuvan University, Kirtipur, Kathmandu, Nepal. I recommend and forward his

thesis to the Department of Mathematics Education to organize final viva-voice.

…….……………

Mr. Abatar Subedi

December, 2019

Supervisor

2019

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By

Khagendra Kafle

Defensed Date: 19/12/2019

**Dedication**

Honestly dedicated

To

My parents

**Khadga Prasad Upadhyay and Tara Upadhyay**

**Declaration**

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

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December, 2019                                                     Khagendra Kafle

**Acknowledgment**

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December, 2019                                                                Khagendra Kafle

**Abstract**

This is a mixed method research in titled "Student's difficulties in solving algebraic word problems". This research was conducted to identify student's difficulties and to analyze the major causes of difficulties' in solving algebraic word problems. One mathematics teacher was selected by using purposive sampling method also six students selected for purpose of interview. The data was collected from achievement test and interview guidelines. The collected qualitative and quantitative data were analyzed and interpreted by using general inductive approach.

The study was based on student difficulties in reading and language, comprehension, conceptual, transformation, solving process. While doing achievement test most of the student's raise their voice and question about understanding question and its translation to mathematical term. Lack of prior knowledge was mostly notable things. Through the deep analysis and interpretation it was found that the conceptual and comprehension difficulties were mostly noticeable difficulties. Also student make mistake to translate world to symbol and mathematical term. Student who have knowledge of transforming make mistake on solving process. These types of problems were caused by lack of pre- knowledge, less practice of algebraic problems, teaching strategies, methods and less and lack of interaction between student and teachers.

## Acronyms

| | | |
|---|---|---|
| CRA | : | Concrete to Representational to Abstract |
| FGD | : | Focus Group Discussion |
| NCTM | : | National Council of Teachers of Mathematics |

# Contents

## Chapter I

## Introduction

**Background of the Study**

Algebra for everyone is buzz word in the land mark of mathematics education. Mathematics is recognized as the "science of patterns" and patterns is the heart of algebra it shows that the unparalleled role of algebra in mathematics. Algebra is method of thinking and presented the position that thought, thinking processes and the ability to appreciate mental a spiritual accomplishments are looked upon today as the rightful possession of every individual. Algebra is critical discriminator of student future.

Algebra is more than memorizing ruled for manipulating symbols and solving symbols and solving prescribed types of problems, it is the part of reasoning process and a key to thinking mathematically and to communications with mathematics. Algebra can be conceived differently algebra as generalized arithmetic, as a study of producers for solving certain kind of problems, study of relationships among quantities as the study of structures.

The branch of mathematics that deals with general statement of relation, utilizing letters and symbols to represent specific set of numbers, values vectors etc. are called algebra. Algebra is branch of mathematics that uses numbers and letters that represent number (Merrian-Webster, 1828). The history of algebra began in ancient Egypt and Babylon, where people learned to solve linear and quadratic equation as well as indeterminate equations such as $x^2 + y^2 = z^2$, where by several unknowns are involved . The word algebra is derived from the Arabic word Al-Jabra, and this comes from the treatise written in the year 830 by medieval Persian mathematician.

Mathematicians seek and use patterns to formulate new conjectures they resolve the truth or falsity of conjectures by mathematical proof. When mathematical structures are good models of real phenomena, then mathematical reasoning can provide insight or predictions about nature. Through the use of abstraction and logic, mathematics developed from counting and the other things as calculation, measurement, and the systematic study of the shapes and motions of physical objects ( Wikipedia, The free encyclopedia, 2019).

Algebra has been characterized as the most important "gate keeper" in mathematics. It is widely accepted that to achieve the goal of "algebra for all" students in elementary should have experiences that prepare them for the formal study of algebra in later grades (NCTM, 2000). However, curriculum developer, educational researchers, and policy marker are just beginning to explore the kinds of mathematical experience. Elementary students need to prepare them for the formal study of algebra of the later grades.

**Statement of the Problem**

Understanding of algebra in school mathematics is one of the most important goals for mathematics education. On the other hand, algebra has been an obstacle and a challenge for many students. Yet we know that many students fail it in the basic level, Not only are these students unprepared for algebra, they also come to fear and dislike it (have a negative attitude towards mathematics), translation problem, Carelessness, difficulties stemming from a lack of basic concept and unfamiliar words and to think of themselves as mathematically weak. Algebra is frequently taught as though it is unrelated to any prior mathematics that students have experienced. The major reason for students either continuing in mathematics or avoiding mathematics was their own perception about how good they are at mathematics.

Algebra is a strand to mathematics in which variables are used to express rules about number and relationship and part mathematics that deals with generalization another parts of mathematics: Word problem are the parts of mathematics curriculum and connection between mathematics and clear, critical thinking any subject. Word problem defined within study as presenting a problem statement consisting of one or more sentence having some known or unknown values and relationship between the values. Word problems are an integral part of algebra and instruction and improvement of student ability to solve algebraic word problem is a critical concern.

When I reviewed the many literatures related to difficulties in solving word problems in algebra then I have found that students difficulties in comprehending mathematical problems affecting the process of problem solving. Many research showed that there are many causes of difficulties in solving word problem like: understanding the language mentioned in problem in mathematics, lack of teaching translating phase into mathematical symbols, solving process involved the reading comprehension, lack of appropriate formula, process of operation, inability to target variables and establish relationship between variables and students always emphasis on product only rather  process and I had also same difficulties to solve the word problem in mathematics. It was very difficult to solve those types of problem when i was in basic and secondary level. Therefore, I would like to study on "Student's difficulties in solving word problem in algebra." In this study I want to identify the actual causes of difficulties on solving word problem.

The concerned of this study is about difficulties on solving word problem of basic level students in algebra. So it is appropriate to discuss about learning difficulties faced by basic level students and to improve the condition of student. This study has focuses on the following questions.

- What are the difficulties in solving algebraic word problems?

- Why students feel difficulties in solving algebra word problems?

**Objectives of the Study**

The objectives of this study were:

- To explore the difficulties in solving word problems in algebra at basic level.

- To analyze the major causes of difficulties in solving algebraic word problem.

**Significance of the Study**

Learning of mathematics starts from when we being to learn how to count. Then, we use mathematics in our everyday lives, sometimes without even realizing. The important role that algebra plays is acknowledged by most educators and educationists, but it is a fact that the inherent nature of algebra concepts is quite complex. For many years teachers have been seeking answers of why students have difficulties and what they can do to help them to develop mathematically correct conceptions. In order to provide learning experiences students have to develop the understanding of importance to algebra concepts, Teacher must learn what students understand, and they must be sensitive to possible difficulties faced by the students. The learning experiences should allow student to confront their difficulties and build upon knowledge they have already understood. If students are unfamiliar with vocabulary', symbols, representations or materials, the meaning students gain might differ significantly from what the teacher intends. Since students actively construct knowledge, teachers must actively help them get out of their difficulties. Hence, this study has following significances:

- This study helps teacher to find out the student's difficulties in solving algebra and helps on choosing appropriate teaching methods and strategies to improve students understanding and learning skills.

- This study helps students to dig out own mistakes and helps to minimize mistakes in dealing with algebraic expression, in solving equations, in solving word problems etc.

- This study supports for policy makers, educators, curriculum planners, textbook writers, and related persons in finding students difficulties in solving algebra and notify them to selected content in the basis of students' knowledge.

**Delimitation of the Study**

The study was limited in the following boundaries:

- The study was conducted only one school of Kathmandu district in Kirtipur.

- The data collection tools of this study generated through the achievements test and interview guidelines.

- This study was delimited to eighty nine students on achievements test. And six students and the mathematics teacher were selected for interview guidelines.

- The study was delimited to find out difficulties of students in solving algebraic word problems at grade VIII.

**Operational Definition of Related Terms**

Here some terms are given which are more significant for this research work. These terms are those words which reflect the whole research and give particular meaning aspect. These terms should be defined clearly to make easy understanding of the problem and avoid ambiguous meaning of terms which can be otherwise interpreted in different ways.

**Difficulty.** In this study difficulty is defined as the thing or situations that cause problems faced by students solving word problem in learning algebra.

**Reading and language difficulties.** The difficulties related to the reading of the given word problem and students ability to read symbols, mathematical term and sentences used to explain problem and the more important of language in learning mathematics specially word problem. Language problem refers to those problems caused by lack of language skills and confusion by the inherently difficulty terminology and vocabulary of mathematics.

**Conceptual difficulties.** A mathematical concept is a collection of meaning that one associates with word used in mathematics. In algebra word problem, students are able to understanding and what to find these problems has no conceptual difficulties.

**Comprehension difficulties.** The difficulties related to the act of understanding the meaning of the problem. In his study comprehension refers ability to understand to get the meaning of problem own words and ability to understand the mathematical term and their relation that are used in problem.

**Transformation difficulties.** The transformation of problem is hardest thing about doing word problem is using the parts where need to take the one language translate them into mathematical. The transformation refers to student's ability to translate word problem into correct mathematical form.

**Solving process difficulties.** Solving process may include mathematical or systematic operation and can be a measure of an individual's critical thinking skills. The solving process refers to the ability to do correct the mathematical operation and student ability to do choosing correct answer from appropriative mathematical operation.

**Teaching learning strategies.** Teaching strategies refer to methods used to help students solve the problem and be able to develop achievable goals in the

contents. Teaching strategies identify different available learning methods to enable them to develop the right strategy to deal target identified.

      **Word problems.** The word problem in this research refers to the problem which presented as text rather than in mathematical notation and terms.

## Chapter II
## Review of Related Literature

This study deals with the reviewed of the related literature. The review of literature is an essential aspect to undertaken for documenting the research findings done by the different researcher related to present study. Theoretical literature describes learning theories in mathematics which helps has help to construct the framework to achieve the objectives of the study. This section also deals with the review of other related literature about facing problems concerning with curriculum, activities, observation and disabled students characteristics etc. this chapter describe the empirical and theoretical literature. This chapter also describes the conceptual framework of this study.

**Empirical Literature**

Khanal, (2018) studies on "Difficulties in solving word problems in algebra content at grade IX students". The objectives of research was to explore the difficulties in solving word problems of learning algebra at secondary level and to analyze the major cause of difficulties in word problem learning algebra. Through this research he wanted to know difficulties in solving word problem of algebra. He used (Silver & Weber) social constructivist learning theories, learning disability theory and Mathematics learning disability theory.

His research design was qualitative design in nature so that the researcher collected the information only by the primary sources and analyzed with the help of literatures. In his study the following tools were used: test, interview, and reliability and validity tools with split half method and accuracy of an instrument. The researcher find five levels of difficulties they are reading and language difficulties, conceptual difficulties, comprehension difficulties, transformation difficulties and solving process difficulties.

Limbu, (2018) has done a research thesis on the topic "students' difficulties in learning algebra at grade VIII". His objectives were to explore the student difficulties in learning algebra at grade VIII and to find causes of difficulties in learning algebra at grade VIII. Through this research he wants to know difficulties of algebra. He use Vygotsky's social constructivist learning theories, learning disability theory, mathematics learning disability theory.

His research design was mixed method design with sequential explanatory design. Interview and class observation was done in his research. He has selected two school of Kathmandu district using convenience sapling methods. Data were collected through written test, observation and interview as primary and various educational data bases, previously conducted research and government's papers as secondary data. He maintained his research validity and reliability through split half method and by subject export. Data were analyzed and interpreted by using simple statistical tools and mean. His findings are based on two categories student as low performer and high performer. They do mistake in constant and variable, simplification. Student of grade 8 has faced the problem in mathematical operation and dealing with algebraic expression. There is huge misunderstanding in equation solving method, most often student were confused due to technical word, language and vocabulary. He focuses to make interpersonal relation between student and teacher also for the sufficient practice of mathematics at home.

Shrestha, (2018) has completed research thesis on this topic "To explore the development level of algebraic skills and the cause of low skills in basic level students". The objectives of the study were to find out of the development level of algebraic skill of basic level students' and to explore the cause of low algebraic skills in basic level students. Through this research he wanted to know develop and cause of

low algebraic skills in basic level students. Researcher (Radford, 2008) used the theory of knowledge of objectification and Vygotsky's Social Constructivist Theory.

His research design was mixed method design with qualitative and quantitative elements. The main tools for the data collection in his research were algebraic assessment, Interview and FGDs. He has selected two school of Gorkha district using convenience sampling methods. Data were collected through written test, observation and interview as primary and various educational data bases, previously conducted research and government's papers as secondary data. He has maintained his research validity and reliability through split half method and by subject export. Data were analyzed and interpreted by using simple satirical tools and mean.

His study suggested that lack of the study, pedagogical barriers , students personal perception of algebraic and succession,  personal barriers, lack of the undefined mathematics teaching strategy, unbraiding algebra to real life situation , disconnected transition from arithmetic to algebra are the main causes of low algebraic skills.

Jupri, (2016) "Student difficulties in mathematizing word problem in algebra" investigated student difficulties in solving word problems in algebra. This study carried out a teaching experiment involving 51 Indonesian students (12/13 year-old) by using a digital mathematics environment. The findings were backed up by an interview study, in which eighteen students (13/14 year-old) were involved. The learning arrangement that the study designed consisted of students activates including digital tasks within applets embedded in a digital environment, intermediate formative paper and pencil assessment tasks, a final written test and a teacher guided.

This study suggested that the main difficulties in student's written work after the algebra lesson concern the solution processes and to a lesser extent, checking solutions. These finding of study that the main obstacle concerns vertical mathematization and the mathematical problem solving and reflection subcategories in particular and students' written work at the end of the cover-up strategy lesson concern understanding words, phrases or sentences and formulating equations, schemas or diagrams, lack of ability in horizontal mathematization and understanding problems and formulating mathematical models in particular.

Cruz & Rose, (2014) studied on "Students difficulties in translating word problems into mathematical symbols". This study sought to identify the difficulties encountered by students in translating worded problems into mathematical equations in a private sectarian school in Manila. It examined the student's difficulties and level of performance in translating worded problems into mathematical symbols.

The study used both quantitative and qualitative methods. The Data of the study was obtained through a research made test. In this study, the student's ability in solving word problems depended on how they translate phrases in to mathematical symbols. Problem solving was a difficult task as it involves a lot of steps. Students hurdle the challenge from one step to another although the steps might not necessarily have to be taken in sequential manner. Some of the processes in solving word problems involve reading comprehension and how students make a plan. This study found that the student's difficulties to translate word problem in the mathematical concept were due to misinterpretation, unable to visualization of problems, lack of the comprehension of the problem posed, incorrect use of operation, carelessness of the problem, interchanging the value and unfamiliar words.

Witzel, Mercer, & Miller, ( 2003) studied on "Teaching algebra to students with learning difficulties: An investigation of explicit instruction model." In this study approximately 358 sixth and seventh grade students in instruction and 10 teachers in a Southeastern United States urban country were participated in this research. Four teachers individually taught a total of eight mathematics classes for sixth graders and two sets of teacher teams taught a total of eight mathematics classes for seventh graders. Every class included students with and without disabilities. One sixth-grade teacher was certified to teach students with learning disabilities and one other sixth-grade teacher had taken courses on students with learning disabilities. The researcher, in this study divided students into two group: treatment group 34 students with disability or risk for algebra difficulties and the treatment group were matched with 34 students with similar characteristics across the same teacher classes in the comparison group.

In this study researcher developed the test instrument and comparison of an explicit Concrete to Representational to Abstract (CRA) sequence model of instruction for teaching algebra transformation equations. Students in both the treatment and the comparison groups received the same assessment instruments throughout the study. The finding of this study were that the effectiveness of CRA sequence of instruction for algebra learning among students with mathematics difficulties brings continued insight into the effectiveness of hands on manipulative objects and pictorial representations for complex mathematics, committed fewer errors with negative numbers and with transformations of equations before solving for variables, students with disabilities have not always been effective for students with identified disabilities and those at risk for math difficulties in a setting with normally achieving peers.

Reviewed of above theses, my topic was based on the students' difficulties in solving algebraic words. The problems show that solving difficulties and faced by the students are particularly related to language aspects of algebra confusion about terminology, solving process involve the reading compression and how students make a plan to solve, conceptual understanding of the problems, difficulties lack of pre-knowledge of basic algebra and covered on previous lesson, carelessness, lack of comprehension , interchanging values and on familiar words are some of the common difficulties encountered by the respondents in translating words problems. Similarly, it was due to the negative feelings of the students towards algebraic word problems. Thus, it is concluded that students feel easily to solving algebraic if above maintained aspects are addressed.

**Conceptual Framework**

This study attempted to identify the learning difficulties of students in solving algebraic word problem. The things which are describe in different empirical reviews, the purpose of the conceptual framework is to identify learning difficulties of students in solving algebraic word problem. In order to move ahead of my study, I have use (Khanal, 2018) conceptual framework. This study report has the similar problem on the difficulties in algebra world problem.

Figure: Conceptual Framework
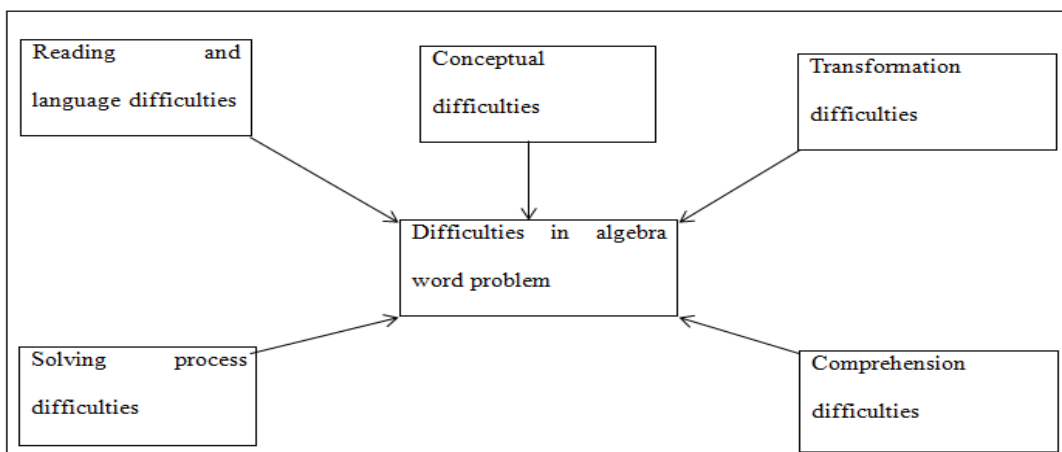
**Reading difficulties.** Word problem in mathematics often pose a challenge because they requires the students read the problems and comprehend them. A reading refers to student reading ability of symbols, mathematical term and sentences those in the problems. If students are able to read mathematical symbol and term, there will not be reading difficulties otherwise reading difficulties.

**Language difficulties.** Language plays vital role in learning mathematics specially word problem, Language problem refers to those problems caused by lack of language skills. It means students do not understand the given problems of the algebra. For some, algebra is difficult because of language used in the problems. Students understand mathematical ideas by making connection between language, symbols, picture and real- life situation. In algebra, language problem is confounded by the inherently difficulty, terminology. It uses a number technical of words that are not usually met or used by school students outside mathematics lessons. For example: Multiplication.

**Conceptual difficulties.** Mathematics emphasizes the need to build a deep understanding of concepts. This involves making connection among mathematical ideas, facts, skills and reflection, upon refining one understands. In algebra, it is necessary to understand word problem first or these concepts then have to make plane to solve them. If students are able to understanding and what to find these problems has no conceptual difficulties they are able to solve conceptual problems.

**Comprehension difficulties.** Comprehension is the ability to understand and get meaning from spoken and written language skills (National Institute for Literacy, 2001). Successfully solving word problems requires both metal representation skills and reading comprehension skills. The successful word problem appears to employ such a problem solving strategy drawing on their mental

representation skills and reading comprehension skills appear to be more important in overcoming such textual complexities than being able to use one's mental representation skills. Can the student understand the meaning of question? If students are able to understand the meaning of problem it will be considered as a no difficulties at comprehension level.

**Transformation difficulties.** Transformations word problem nowadays is one of the most difficulties for especially basic level and secondary level students too. The hardest thing about doing word problem is using the parts where need to take the one language translate them into mathematics students are able to translate word problem into mathematical form and select mathematical operations or procedures, it is considered as no difficult at transformation level. If students unable to translate the word problem into correct mathematical form is was considered as the transformation difficulties.

**Solving process difficulties.** Process is more important for problem solving skills. Can student perform the mathematical calculation? If students are able to correct mathematical operation it will be as no process skills difficulties. If students are able to do correct mathematical operation, it will be consider as process skill difficulties.

To fulfill second objectives of this study, researcher mentions the following categories:

**Pre- knowledge.** Prior knowledge acts as a lens through which we view and absorb new knowledge. Students learn and remember new information best when it is linked to relevant prior knowledge. Teacher who link classroom activities and instruction to prior knowledge and build on their students background knowledge they understand the lesson easily.

A common problem faced by instructor in education is that students lack important prior knowledge and skills needed when they enter the more courses in their subjects. Students who had a more integrated prior knowledge base and were able to operate on higher levels of procedural prior knowledge at the beginning of the course were more likely to be successful.

**Participation in learning.** Different aspects are interrelated in learning. Social status, educational background of family learning environment, qualification of teacher etc are the different factors which affect the learning. If the students participate and show interest in learning, they progress in learning. Students are participation can be defined through the factor, irregular in school and class, extra classes and tuition classes in addition to class by peer groups and teacher.

**Teaching learning strategies.** Effective teachers are always on the prowl for new and exciting teaching strategies that would keep their students motivated and engaged. They follow methods or strategies such as cooperative learning, inquiry based learning, different instrument use graphic organizer, utilizing technology in classroom.

Mathematics is not limited to learning from a textbook, lessons or testing strategies. Students have different learning styles and need to have lessons that help improve all styles to learning to get the best results. When the teacher teach to moving beyond the simple concepts to abstract and in corporate time to test that review the previous class or several classes.

**Teacher-students relation.** Instruction is social activity; interaction may be within person or in group. Personal instruction refers to the mental activity her/his mind and soul. It depends upon the person's intellectual capacity. Inter- individual interaction refers to the sharing, adjustment and co-operation. Interaction brings

maturity in learning. The students are away from teacher because they do not have time to talk to them-as they are hurry to go to another school or class. They also did not want to interact with their teacher. So, this is cause for difficulties in learning algebra.

# Chapter III
## Methods and Procedure

Research methodology is the most important aspect of research work; it is a bridge to achieve the objectives of the study in systematic way. Simply it means way to gather information. Authenticity and reliability of any research depends upon the tools and methods used for data collection. Hence, the primary purpose of this chapter is to discuss and design the framework for the research.

### Research Design

A mixed (both quantitative and qualitative) method is used for data collecting, analyzing process of this study. Achievement test and interview guidelines are the methods for data collection. Achievement test paper helps to find out what type of questions are difficult for student and interview support to researcher that how and why types of questions. So, at first I determined the difficulties by achievement test and then determined the causes of difficulties. Therefore, this study was explanatory sequential design of mixed method.

### Population of the Study

The students of grade VIII of academic year of (2075/076), in public schools of Kirtipur, Kathmandu district were the population of the study.

### Sample of the Study

I selected a public school of Kirtipur by random sampling from total school and select all eighty nine students from grade VIII at basic level from the same school to conduct achievement test. From this sample six students and also one mathematics teacher selected for interview as data collection process.

**Data Collection Tools**

Since study was based on explanatory sequential design. The main tool for data collection was achievement test and interview guidelines. The tools were made by the researcher through the help of subject exports and thesis supervisor.

**Achievement test.** According to Freeman, (1956) test of educational achievement is one designed to measure knowledge understanding or skills in a specified or a group of subject. The achievement test paper used to investigate the difficulties of student in solving algebraic word problem. The prepared test was set of questions made by researcher purposively on the basis of bloom's taxonomy of objectives. The achievement test paper is presented in Appendix- A.

**Interview guidelines.** After findings the difficulties of student and teacher interview guidelines is used to analyze the causes of difficulties in solving algebraic word problems. The researcher took the interview on basis of the objectives. The interview guideline was design on the basis of reading and difficulties, conceptual difficulties, comprehension difficulties, transformations difficulties and solving process difficulties. The researcher took interview with highly difficulties in an achievements test with selected six students and mathematics teacher. The interview guideline for students is given in Appendix-D, for teacher Appendix-E.

**Reliability and Validity of Tools**

The reliability of achievement test paper was determined by pilot testing with four students of class VIII selected from out of the research populations. From that researcher analyzes the reliability of the test by using split half method found reliability coefficient in pilot test is 0.83 Appendix-B and also in achievement test paper  is 0.80 Appendix-C. It shows that the achievement test paper Appendix-A were reliable. For validation of achievements test paper, I used the specification table of

class VIII of compulsory mathematics and also consult with guidance teacher. Similarly, for the validation of interview guideline Appendix-E consult with guidance teacher.

**Data Collection Procedure**

Data is the foundation of any research. Therefore data collection is the essential part of research. For the study, I visited the principal of the school where the study took place, and told them about the study and asked for permission to collect the data. After that getting permission from school principal I met the student of class eight students and clarified the matters that students need to attempt the achievement test questions. Then I distributed the answer sheet and questions paper to each student and asked them to complete and collect the answer sheet of students after completed the solution. Furthermore I thanked the students, teacher and principal to help for conduct the interview with six low achiever students and related a mathematics teacher for next day. Then getting permission I return from the school and carefully checking the answer paper of student and scoring. Again the researcher marked each students answer sheet and found out different difficulties (reading and language difficulties, conceptual difficulties, comprehension difficulties, transformation difficulties and solving process difficulties). After that the selected six students achieved high difficulty in interview by the achievement test. Researcher conducted the face to face interview with the selected students related the highly difficulties problem and also interview with mathematics teacher related with the same problem.

**Data Analysis Procedure**

Data analysis is described as a systematic search for meaning such that the qualitative or quantitative data observed may be communicated to others in understandable ways. Analyzing qualitative data requires understanding make sense

of text and images so that can form answers to your research questions (Creswell, 2014). This research qualitative research is mostly associated with words, language and experience rather than statistics. In this study primary data were presented and analyzed. The primary sources of data were the achievements test and interview.

In this study, researcher used the achievements test and interview with mathematics students to find out the different difficulties levels. While the collected the data student was provided with achievements test to find out the difficulties in their answer sheets. Interview was conducted with selected each student who done in maximum difficulties in achievements test and interview was conducted with mathematics teacher to know the view or experience about difficulties about made by his students. There are three purpose of using inductive approach are; condense raw textual data into a brief, summary format, establish clear links between the evaluation or research objectives and the summary findings, developing framework from raw data (Thomas, 2006).

The collected data was classified into: reading and language difficulties, conceptual difficulties, comprehension difficulties, transformation difficulties and solving difficulties. The researcher has categorized the answer sheet on the basic of difficulties. The collected data from selected students and mathematics teacher was analyzed first, these all interview from information transcribe and transcribe these information are coding and build description upon themes. These themes were considered as a code and similar code version of respondents' student were collected together and explained in their perspectives. At last the main themes were analyzed with the help of the above reviewing literatures and the findings of the study.

**Chapter IV**

**Analysis of Data and Interpretation of Result**

Different themes are developed in the process of data analysis with reference to learning difficulties problem in algebraic. Learning in Algebraic world problem has seen an obstacle and a challenge for many students. Students could not grasp the language used in the problems. It seems that they just try to make equation and other mathematical representation without thorough reading and understanding. This indicates that due to understanding in verbal problems in algebra students are not able to solve and are poor in algebra word problem as well as learning and achieving high grades in mathematics. The final themes are reading and language difficulties, difficulties in conceptual understanding, comprehension difficulties, transformation difficulties and solving process difficulties. The analysis and interpretation of data based on those themes which are presented in the chapter. Many students could not understand the conceptual meaning of the problem. Some students were careless in their study and examination. It algebra word problem, the researcher found so many difficult areas: reading and language difficulties, conceptual difficulties, comprehension difficulties, transformation difficulties and solving process difficulties.

The data were collected from eighty nine students of grade VIII by achievement test, interview with six students of same school and also one mathematics teacher. After carefully checking the answers sheets and calculate their obtained marks and determinant the mean marks of the student is very low that is almost out of eighty nine. This average marks shows the difficulties level of student is high to very high. The obtained data were calculated and analyzed according to the objectives of this study. To analyze and interpret the data using statistical tool

correlation coefficient shows the split- half of the reliability of test item is 0.80. Thus, the obtained data were analyzed and interpreted under the following heading;

**Difficulties in Solving Algebra Word Problems of Grade VIII Students'**

The word Algebra has been an obstacle and challenges for many students. Lack of many mathematical skills caused difficulties is solving word problem. Yet we know that many students have failed in the mathematics since the past decades. In this research, researcher found that the students were poor in algebraic word problems in solving mathematics.
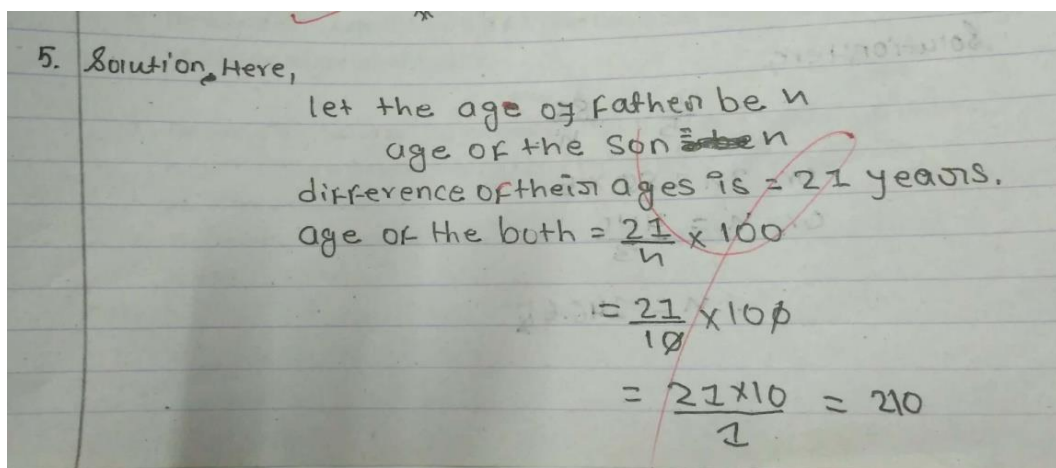
Many students did not understand the conceptual meaning of the problems. Some students were careless in their study and examination. In algebra word problem, the researcher found the problems on the basis of reading and language difficulties, conceptual difficulties, comprehension difficulties, transformation difficulties and solving process difficulties. So, researcher had described about these above difficulty areas:

**Reading and language difficulties.** Reading refers the ability to identify and understand the symbols, mathematical terms and sentences used in a problem. The process of solving an algebra word problem begins with reading and then students make attempts to make coherent sense out of the several sentences. Reading skills in mathematics are regarded as a fundamental fact to mathematics learning as they help learners to make meaning of various concepts that define school mathematics. The reading difficulty is linked with difficulty in reading text to direct their own learning, vocabulary of math, trouble learning or recalling abstract etc. In this study, students who are not able to reorganize the words and symbols are categorized as reading level difficulties. Based on an algebraic problem having seven words assigned to every one of the students, it was noticed that respondents recited the symbol, mathematical

terms and sentence correctly that were used in the posed problems. From this the researcher came to decide that there is no difficulty in reciting level. Because researcher has mentioned the difficulties as "Whether the students can or cannot read all symbols or mathematical terms". Students read all the symbol, mathematical term and sentence in clear and loud speech.

Students were able to recite the problem, their understanding was challenging. Most of the students were confused about terminology, which resulted difficulty with explanation as well as harder in preparing plan for the solving problem. As a result, language difficulty especially in reading result ability in understanding word problems. In language difficulties category, the researcher also noticed the problems having ratio were also difficult to comprehend. Its consequence can be linked with Cruz and Mine (2014) that misinterpretation and unfamiliar word as difficulties in solving word problem.

The problem presented of this level is mentioned as the ages of father is double than that of his son. The difference of their ages is 21 years. Find their ages. The answer sheet of a student is given below;



In solving this problem many students faced such type of difficulties. The answer sheet of a student is given above for example. The solution shows that the

students did not understand the term or language of this question because student wrote the symbol of ages of the father and son are x and x. One of the reasons for doing this is misconception of the languages and students were confused about the relation between ages of father and son. In fact they have to solve this problem by supposing the x of the age of son and 2 x of his father, then their differences of ages is 21 years. That means, 2 x - x =21.

After the researcher took face to face interview with students then they replied,

*"It was found that the present age of son is X and father is also X. By analyzing the answer of the students, they understood the first condition easily but they are in language confusion in the second condition, the third one is the differences between their age is 21 years that replied by learners that we could not understand the problem".*

Again, Researcher conducted the face to face interview with mathematics teacher. In order to look the phenomenon of language reading difficulty, the response of the teacher narrated as given herewith.

*"Algebraic word problem is one of the difficulties problem, its vocabulary terms, and language is not learnt too easily. Many students are unable to understand difficult terms in algebra word problem".*

This is referential to state that understanding problem is one of the major learning difficulties among students with reference to language ability and ability to meaning making with mathematical terms and symbols. The languages used in word problems are the first steps to understand the problem. The main concern of teaching word problems in algebra is to make meaning from the problem. In short, without developing language ability, the learning algebraic word problem is seen almost

impossible. Mathematics teachers need to focus on making students learn language in order to be proficient in solving algebraic word problems. This can be linked with the study of Gooding, (2009) that student unable to understand the words and symbols such as the reading level difficulties, the difficulties related to the reading of the given problem and students ability to read the symbols, mathematical term and sentences that use in problem.

This problem can be addressed with the solutions of Cruz and Mine, (2014) that the cause of language difficulties with explanation and weak word skill, the student have difficulty in understanding written or verbal direction or explanations and find out word problem especially difficulty to translate. It was also found that students had mathematical vocabulary problems and also forgetting very fast. In language problem in algebra, teacher could encourage students to put problems into own words. Teach students to read for meaning when trying to identify the operation to use for solving problem.

In the second problem, presented of this level is mentioned as the ratio of present age of A and B are the ratio 4:7. After 3 years ratio of their ages will be 5:8, find the present ages of A and B. In this problem many more students committed such type of difficulties. The answer sheet of a student is given below;

In solving this problem many students faced such type of difficulties. The answer sheet of a student is given above for example. The solution shows that the students did not understand the terms or language of this question because student wrote the ratio of ages of the A and B is 4/7. Second step after 3 years student wrote the ratio of ages 5/8. And third step wrote present ages of A and B = 4/7 + 5/8. It was not the correct steps. In fact, students have to do by supposing the X ratio between A and B that is 4:7 then after three years the ratio will be come between A and B is 5:8 it means, 4 x+ 3/7 x + 3 = 5/8.  The reasons are the misconception of the ratio and the relation between ages of A and B. To the point, in this problem students were unable to understand the languages of this problem.

Researcher conducted face to face interview with the students asked the question to read the question correctly, the question was the ratio of present age of A and B is 4:7. After three years, the ratio of their age will be 5:8. Find the present age of A and B. Then the students replied,

"*Due to the question was long and did not understand the relation age of ratio between A and B.*"

Again, researcher conducted the face to face interview with mathematics teacher. In order to look the phenomenon of language reading difficulty, researcher asked "Why do students feel the language difficulty?" to the mathematics teacher at the respective school. The response of the teacher is narrated as given herewith. The teacher replied,

 "*Algebra word problem is one which is created the number of difficulties in vocabulary terms, and language is not learnt too easily. Many students are unable to understand difficult terms in algebra word problem they will not learn word problem easily.*"

This is referential to state that understanding problem is one of the major learning difficulties among students with reference to language ability and ability to meaning making with mathematical terms and symbols. The languages used in word problems are the first steps to understand the problem. The main concern of teaching word problems in algebra is to make meaning from the problem. In short, without developing language ability, the learning algebraic word problem is seen almost impossible. Mathematics teachers need to focus on making students learn language in order to be proficient in solving algebraic word problems. This can be linked with the study of (Gooding, 2009) that student unable to understand the words and symbols such as the reading level difficulties, the difficulties related to the reading of the given problem and students ability to read the symbols, mathematical term and sentences that use in problem.

This problem can be addressed with the solutions of Cruz and Mine (2014) that the cause of language difficulties with explanation and weak word skill, the student have difficulty in understanding written or verbal direction or explanations and find out word problem especially difficulty to translate. It was also found that students had mathematical vocabulary problems and also forgetting very fast. In language problem in algebra, teacher could encourage students to put problems into own words. Teach students to read for meaning when trying to identify the operation to use for solving problem.

**Conceptual understanding difficulties.** A mathematical concept is a construct in mind that has collection of meanings and is associated with a set of words used in mathematics. Cangelosi, (1996) states that a concept is a category student's mentally construct by creating a class of specifics possessing a common set of characteristics. The process, by which creation qualities of actual objects or events are

internalized as concepts while other qualities are ignored, is called abstraction. Thus a concept can be described as an abstract meaning, mental picture or idea that an individual has about something. Conceptual knowledge consists of connected relationships between idea and concepts internalized by individuals. Researchers analyzed the conceptual level difficulties on the basis of two categories. First, if the students can understand the problem their own it is considered as no conceptual difficulties. Second, if the students are unable to what they are trying to find out it is considered as conceptual difficulties.

The problem a number is 5 more than twice the other number and their sum is 44. Write a linear equation to represent the given statement and solve it to find the number. In this problem, many students face this type of difficulties. The answer sheet of a student is given below:



Above solution shows the conceptual difficulty level of students based on their work and talking about the process, it is the level of students that they did not try to make meaning of the problem. The meaning making process is hindered by the conceptual terms used in the questions: such as relation; a number, other number and 5 more than twice the other number etc. They started to solve without understanding the question. This indicates that students attempt to solve the problem without

understanding the question. Students assume that the first number be x and second number be x + 5. This first step was correct and second was incorrect there should be 2 x.  But student unable to understand what are trying to find out, meaning of  terms of number and other number. And what are unknowns. Students have directly started to solve the problem in this step, the particular student could only write 2 x + 5 is equal to 44. Thus this problem is related with conceptual difficulties. As mentioned by Cruz and Mine (2014) research the conceptual level difficulties are describe as the above mentioned problem. In their research also the same condition was found, so we can categories it as the student's conceptual difficulties. In this problem student had read the question correctly to the interviewer, the following dialogue took place.

In the interview mentioned above with, the researcher conducted a face to face interview and responded replied,

*"I understand the word problem but I cannot find the, main ideas what is given the problem and what to do find out. I don't have any ideas to solve this problem. How to make further process."*

It was reflected that the student has difficulties in conceptual because student unable to understand problem and unfamiliar words and lack of vocabulary. Cruz & Mine (2014) shows that when students unable to understand the meaning of the problem and unable to relation among the mathematical words.

After that, researcher interviewed with mathematics teacher relating to this problem. He replied,

*"Many students are lacking of pre-knowledge of algebra, lack of the vocabulary and unknown variables."*

Researcher asked, how can it be done to teach students so that they can understand easily? Responded replied,

*"First, teacher should teach based on the previous knowledge, teacher will explain what the question said and teacher will also explain that what to find out."*

Cruz & Mine (2014) has also mentioned if students are unable to understand the problem it is considered as conceptual difficulties level. This research shows that the main causes of difficulty was conceptual difficulties as students lack previous knowledge of algebra. It is not difficulty in reading the problem, unfamiliar words and vocabulary. It was found that the students has conceptual difficulties because of lack of students' mathematical vocabulary and terminology; students are poor to perform the connection among the mathematical symbol and operation, general pre-knowledge of algebra, carelessness in the mathematics class and lack of knowledge of mathematical term and inability to use relation in the problem.

In another problem student's solution was analyzed through their answer sheets. The problem in this level was the also linked with conceptual understanding. The problem reflects a number is 3/5 times another number. If their sum is 88, find the numbers? In this problem, many more students faced such type of difficulties. The sample answer of a student is given below;



Above this solution shows the conceptual difficulties level of students. In this problem, student assumes the numbers 3 x + 5 x. This was incorrect. Student directly

started to solve the problem by writing 3 x added by 5 x. It is also incorrect. Students solved the problem without understanding. Student was unable to understand the real problem. If the two numbers is given, the times need to be assumed correctly otherwise they cannot solve the problem. The student could not assume correctly which is in the above example. Assuming was important in solving real problem but student was unable to understand, the meaning of difference between two numbers. In this problem, students could write x be the first number then second number is 3 x/5 because the number of times x and 3 x/5 because it is give in the question. The sums of two numbers are 88 and then solve it. Thus this problem is related to conceptual difficulty level.

Moreover, for clear justification of student conceptual level difficulties in this problem, face to face interview was taken by researcher and student replied,

"*I don't know and understand process what to do and how to do*."

After that, Researcher interviewed with mathematics teacher relating to this problem. He replied,

*"Student was confused the word difference because of their carelessness in class and lack of basic mathematical vocabulary."*

Responded again added,

*"Teacher should teach this problem through group discussion and while teaching mathematical term and vocabulary of these meaning and teacher should follow the problem solving method and based on students' pre-knowledge and also by associating with verbal knowledge."*

In the same line, Cruz and Mine (2014) also shows that when the students cannot understand the concept of problem and unable to making the connection among mathematical ideas, facts and reflection upon refining one's own

understanding such as the conceptual difficulties. In above interview and written solution, the causes of conceptual difficulties are student could not understand the relation of terms in the problem unable to understand the word difference and execute the solution process. Therefore, it shows the difficulty of student lack of mathematical vocabulary and terminology, pre-knowledge of arithmetic and algebra and inability to use the relation.

**Comprehension difficulties.** Comprehension is the ability to understand the text and to get the meaning of the problem. A student requires both mental representation skills and reading comprehension skills in order to solve the word problems successfully. Comprehension difficulties are classified as reading the problem, comprehending its meaning and narrating meaning in own words. In this research context, students faced challenges with the meaning making process and seen unable to grasp the meaning of the words. As a result, they were unable to proceed along with an appropriate solving process. Comprehension difficulties are related with the student's inability to get idea that the question asks to solve and its process for solving problem. Researcher analyzed comprehension difficulties on the basis of two categories. First, if the students can understand the meaning of the problem it is considered as no comprehension difficulties. Second, if the students are unable to understanding the meaning of the problem it is considered as comprehension difficulties.

The problem in this level was the sum of two consecutive numbers is 67. Find the numbers? This problem requires an ability to understand the problem and others. In this problem many more students faced such types of difficulties. The answer sheet of a student is given below:

Let the first number be $x$
Let the second number be $x+2$

$$x+x+2 = 67$$
$$or, \quad 2x+2 = 67$$
$$or, \quad 2x+2 = 67$$
$$or, \quad 2x = 67-2$$
$$or, \quad 2x = 65$$
$$or, \quad x = \frac{65}{2}$$
$$or, \quad x = 32.5$$

∴ first number is 32.5
and the second number $x+2$
$$34.5 \quad Ans$$

The solution shows the comprehensions are one of the difficulties of students. The students tried to solve the problem without understanding the meaning of the problem. In this problem, student assumed that the two number x and x + 2. This was incorrect. It is conceptual meaning. Instead of The students has to solve the problem of x and x + 1 then he has to follow the next process to solve the problem summing by the consecutive numbers. Therefore, there is conceptual difficulty in this question. Student was unable to understand the meaning of two consecutive numbers. This shows that the student seems confusion in the consecutive numbers. This type of the difficulties is comprehension difficulties level. Thus, the student was unable to understand the actual meaning of the problem. This level of difficulties matches with the definition of the comprehension difficulties mentioned by the researcher Gooding (2009). That is when these answers describe we came to decide that through understand the problems but lack of comprehension in the meaning of the mathematical terms and could not understand the relation of the mathematical terms. Thus, it is confirmed that students have comprehension difficulties.

Moreover, the justification of student's comprehension difficulties in this problem, the researcher took face to face interview with the students. In this respect the respondent stated,

*"I can read the question but exactly do not know the meaning of the term*

*'consecutive. Therefore, could not able to find out two consecutive number.''*

In this problem student was not reading and conceptualize difficulties. From this fact of the interview we came to know that students have comprehension level difficulties in this problem. After that, researcher interviewed with mathematics teacher relating to this problem. Researcher asked the mathematics teacher and replied,

*"What happens in the class is that my students do not give attention to the teaching at the time of dictating the meaning of mathematical terms and symbols. So, they could not understand. Furthermore, students focus only on nonverbal problems, and they have low practice in algebraic word problem."*

Gooding, (2009) shows that, students face difficulties in the comprehension level because students are unable to understand the meaning of the problem, lack of comprehension in the meaning of mathematical terms, lack of skills to write in the number sentence. In this problem students are able to only read the problem but not understand the actual meaning of the problem. The study concluded that the comprehension difficulties is determined if the students are unable to understand the meaning, lack of the teachers' explanation, students are unable to connect between mathematical term and symbol therefore students failed to solve the problem correctly.

The second problem was the perimeter of rectangular book is 100 cm. If the length of book is 8 cm more than its breadth. , the answer of this question is provided wrong ways by many of the students. The answer sheet of a student is given below:

From the above result the understanding level and comprehension level of the learners is not good. In this problem, Student was assumed that the length of the rectangular is 8 cm, perimeter was 100 cm and the breadth =? It was the incorrect process of the given problem. Instead of, student need to understand the question and its comprehensive level by supposing its breadth of the book is X cm then its length is (x + 8) cm. More than they have to solve this problem proceeding such way. In the next step, they have to follow perimeter of rectangular book (p) = 2 (l + b). Which was incorrect? Cruz & Mine, (2014) shows that especially students difficulties in solving word problem lack of knowledge of technical terms and symbols, pre-requisites knowledge and inability to use relation of term.

In order to conform the difficulties were seen in this level, researcher took the interviews with the students. In this matter another student opined,

*"After reading the given question I could not able to find out what should be found out and what is given there in the problem."*

After asking the cause behind this problem the teacher replied,

*"I think, lack of knowledge of mathematical term and inability to relate the problem, unable to trace out the connection between mathematical term and symbol and lack of pre-knowledge of algebra."*

Again, researcher asked, student can learn easily? How do you teach? Teacher told,

*"First, I will explain the meaning of the words given in the beginning and what the question will be given and what will be done, provided the pre- knowledge related to the question and step by step solution." The result out of interview and written solution shows the same fact. It is understood that the students have comprehension difficulties.*

Gooding S. (2009) research on the comprehension level difficulties is described as the mentioned. This study also supported the findings of the previous research studies. So it is the student's comprehension difficulties. The result that came out of interview and written solution shows that the same fact. After analyzing, we could conclude that students could not understand the meaning of the problem and understand the relation of the terms, lack of relation between word and mathematical symbol. The main reason of comprehension difficulties are student not able to understand the meaning of the problem, unable to connect mathematical term and symbol, unable to understand the own meaning of the problem.

**Transformation difficulties.** The transformation difficulties are those difficulties which student cannot translate the word problem into mathematical word or cannot select the appropriate mathematical operation. Researcher described the transformation difficulties in two categories. If the students are able to translate the word problem into appropriate mathematical operation, it is categorized as no transformation level difficulties. If the students are unable to translate the verbal

problem correctly to mathematical form, it is categorized as transformation difficulties.

The problem in this level was the perimeter of rectangular book is 100 cm. If the length of book is 8 cm more than its breadth. In this problem many more students have faced such type of the difficulties. The answer sheet of a student is given below;



Above the solution shows the transformation level difficulties of students. The student was assumed that the length of the rectangular is 8 cm, perimeter was 100 cm and the breadth =? It was the incorrect process of the given problem. There were the students mentioned the converting the given problem into mathematical form. This shows that the students had difficulties in converting word problem into correct mathematical symbol. Instead of, student need to understand the question and its transformation level by supposing its breadth of the book is X cm then its length is (X + 8) cm. More than they have to solve this problem proceeding such way. In the next step, they have to follow perimeter of rectangular book (p) = 2 (l+ b). This type of

difficulties can be considered as transformation level difficulties. Cruz & Mine (2014) shows that when the students cannot able to translate the word problem in correct mathematical form then such type of difficulties is known as transformation level difficulties.

Moreover, for clear justification of student transformation level difficulties in this problem, face to face interview was taken by researcher and student replied, *"I read the question and understand as well but could not convert the problem in mathematical form."*

In this problem students are easily able to read the question and to understand the problem but unable to transform the mathematical terms and word problem to mathematical form. Thus, there are no reading, conceptual and comprehension difficulties. But students unable to translate the world problem in correct mathematical form. Again, researcher asked mathematics teacher how the students make transformation difficulties. Teacher told,

*"Teacher teaches the word problem with some explanation and asks the general and regular question like, understood? Most of the question is answered in group, Yes sir but rarely do they think about concept of meaning. So, the student's student commits transformation difficulties make."*

Cruz and Mine, (2014) research shows that, Students difficulties to transformation word problem due to misinterpretation, unable to visualization of the problem and other describe as the above mentioned problem. The same condition was found in their research also, so we can categories it as the student's transformation difficulties. In the interview mentioned above it was found that the student has difficulties in transformation because the students could not convert the word problem into correct mathematical form. So, research concluded that the student's has

difficulties in this stage. The main reason for the emergence of difficulties in this problem was student's lack of practice to translate word problem into mathematical form, inability to choose method and misperception of the problem.

In second problem, the student written solution was analyzed through their answer sheet. The problem in level was the cost of 2 kg chicken and 1 kg mutton is Rs.1500. If 1 kg chicken and 2 kg mutton cost Rs.1950. What is the separate of per kg chicken and mutton? Solve it by making the pair of liner equations. In this problem many more students had such type of difficulties. A sample answer sheet solving by the students is incorrect which is given below.



Above solution shows that the difficulties is high in transformation because students were unable to transform the word problem into correct mathematical form and symbols. While solving the problem, students assumed that the cost of 2 kg chicken and the cost of 1 kg mutton is Rs.1500. And the second equation was the cost of 1 kg chicken and 2 kg mutton cost is Rs.1950. That the written equation form was correct but the students have less transformation level in mathematical forms and symbols. Then, students solved by 1 kg chicken = 1500 multiply 1500 = total sum likewise 2 kg mutton = 1950 multiply 1950 = total sum. It shows that the students could not solve the questions by mathematical forms and symbols. In this step student could not write $2x + y = 1500$ first equation and $x + 2y = 1950$ assume second

equation. It is seen that the student has not converted word problem into correct mathematical form and symbols. This shows that transformation level difficulties of students because it is mentioned in definition of researcher if students are unable to translate word problem into correct mathematical form such types of difficulties are known as transformation difficulties. Cruz & Mine (2014) shows that unable to convert the word problem into correct mathematical form is described as the transformation level difficulties.

In order to confirm the above solution conducted face to face interview with students. And student told,

*"I understood the problem and also made concept but could not convert in mathematical equation form. So, I could not solve this problem."*

Researcher asked the questions in face to face interview to mathematics teacher: "Why students commit the transformation difficulties?" The teacher replied that

*"Students commit the transformation difficulties because student focuses on only calculation part, lack of pre-requisite knowledge of their previous lesson."*

Again researcher asked "What are the main causes of transformation difficulties?" The teacher replied,

*"Because of lack of mathematical concept, skills and more emphasis on calculation part, unable to understand the connection between word and mathematical symbol, lack of meaning of the each mathematical term in difficulties read and unable to identify the correct operation to solve the problem."*

Cruz & Mine, (2014) research the transformation level difficulties are described as the above mentioned problem. The difficulties in transformation problem is due to lack of mathematical concept, could not visualization the problem, unable to

interchange the value and mathematical words. The result out of interview and written solution shows that the similar fact. Thus the main reason of transformation difficulties is students unable to allocate the correct mathematical term to solve the problem, lack of mathematical concept skills and more emphasis on calculation part of mathematics problem and student could not identify the correct operation to solve the problem.

**Solving process difficulties.** A solving process difficulty is defined as the carrying out difficulties such as using inappropriate method, inappropriate formula and calculation error in which students become unable to solve the problem correctly. The difficulty in solving process is a skill difficulty when a student's been able to identify the difficult operation but did not know the procedures to carry out these operations correctly. Looking at the solution researcher has analyzed that the students had identified the correct way of solving problem but failed to carry out the operation correctly.

In second problem, students' written solution was analyzed through their answer sheet. The problem 1 this level was the cost of 2 kg chicken and 1 kg mutton is Rs.1500. If 1 kg chicken and 2 kg mutton cost Rs.1950. What is the separate price of per kg chicken and mutton? Solve it by making the pair of liner equations. The problem in this level was to solve it by making a pair of liner equations. In this problem three students faced such type of difficulties. A sample answer sheet of a student is given below:

Analyzing the above way of student's solution shows that the student has no problem in reading, conceptual, comprehension as well as transformation levels but there is a difficulty at solving process. In this problem students assumed that the cost of chicken is x and cost of mutton is y and the student prepared the equation $2x + y = 1500$ as equation first and $x + 2y = 1950$ as equations second. Then the student shows that $1950 (2x + y) = 1500 (2y + x)$ was incorrect. After solving s/he got the value of $2400x = 1050y$ the student did not face any confusion up to the equation level but faced the difficulty in the solving process. In this problem, students was able to read the problem and understood what the question was asking also select an appropriate strategy but did not know process to carry out the problem correctly. Student didn't know about the concept of interchanging the value of equal sign and misplacing multiplication. So, it is considered as solving process difficulties. McCall (1999) shows that student able to convert the problem into correct mathematical form was not able to perform the correct mathematical operation such type of difficulties is solving process difficulties.

Moreover, for clear justification of student solving process difficulties in this problem, face to face interview was taken by researcher with the student asking the oral question to him stated as,

*"I understood the question and transformed into the mathematical equations but could not do operation."*

Again, researcher took face to face interview with the mathematics teacher related this problem. First, researcher asked "What are the main causes of solving process difficulties?" Then the teacher replied,

*"Students always focus that the product is more important than the process."*

Researcher asked, how do you teach to solve the type of problem? The teacher replied,

*"First, I clear explanation of the question and silent features of the question, I will provide the necessary pre-knowledge for the problem and problem solving method step by step solution with explain."*

McCall, (1999) also showed that is students are able to transform into mathematical form but could not attempt with an appropriate mathematical operation then that is known as solving process difficulties. The evidence shows that main reason of facing process difficulties is linked with student's inability to perform correct computational operation, lack of mathematical basic concept, lack of knowledge of variables multiplication and student unable to correct mathematical operation such difficulties lies on solving process level difficulties.

*"Students are careless in mathematics class, do not attend in learned and students do not practice at home."*

Researcher asked "Why the students make a process skill?" The teacher replied,

*"Because the students cannot present in regularity class, then teacher uses in method in the teaching learning activities while students used different method in mathematical problem."*

McCall, (1999) mentioned that student's difficulties related to solving process because of the computation difficulties, incorrect operation, regrouping difficulties, unaware format or patterns, lack of the mathematical basic concept. The difficulties in the problem can be liked with computation difficulties and incorrect operation. Interview with students and mathematics teacher relating to the problem found that the students difficulties in solving problem because of the students' inability to perform computational operation, lack of the knowledge of variables multiplication, lack of practice mathematics at home, irregularity in mathematics class and students focus on the product is not more important than the process.

## Chapter V
## Findings, Conclusions and Implications

This section deals with the summary, findings, conclusions and implications concerning the student difficulties in solving word problem in algebra of grade VIII. This chapter has divided into three sections: finding, conclusion and recommendations for the further study.

**Findings**

The main concern of this study was to explore the difficulties in solving word problems in algebra and causes behind those problems. In this study I included the five levels of difficulties (Reading and language difficulties, conceptual difficulties, comprehension difficulties, transformation difficulties and solving process difficulties). The findings of the study were listed as follows;

- Maximum students felt difficulty to understand the verbal problems due to that they took the meaning of the mathematical words misleadingly. So, they were unable to deal with the question. For example, to generalize mathematical rules, to remove an unrequired term from the equation and mathematical operations.

- In the context of the algebraic problem, they failed to conceptualize and cannot solve the word problem as per the demand of the question. Like consecutive numbers.

- Students were unable to do choice of correct language to represent their mathematical ideas.

- Sometimes, learners failed to understand the correct meaning and use of mathematical symbols, so they could not solve the problem. For example: The age of father is double than that of his son.

- In the process of following sequential order of the solving algebraic word problems by mismatching the proper steps they committed mistake.

- It was found that most of the learners felt difficulties in solving the algebraic word problem due to their less participation in the classroom activities.

- Students experience was failure to apply the correct formula and mathematical procedures. This was because they could not transform verbal language into mathematical forms and terms.

- It was also investigated that most of the students did not have the foundational knowledge in the algebraic word problems.

**Conclusion**

In this research the researcher has found the problem in solving algebraic word problem in grade VIII. In course of analysis and interpretation of data it is found that most of the students commit their mistakes at reading level. The difficulties are also found in giving meaning of mathematical terms properly due to the lack of pre-required background knowledge about directed numbers, fraction, use of signs, identifying the variables and their relationship. The students have focused only in product rather than process. In this study the researcher has also found that due to the lack of proper interaction between teacher and students, the problem has arisen moreover, the major cause is also found that of students less practice in mathematics.

The meaningful solution is such kind of problem as far as the researcher has found that the teachers are suggested to use symbolic mathematics notations, student's well practice and giving the ample opportunities in solving mathematical problems. The formulated equations are also important to get the valuable result in algebraic problem.

**Educational Implications**

- Teacher should teach word problem of algebra by applying the basic concepts.

- Before starting the chapter, the teacher has to give the fundamental knowledge about the topic. Conceptual teachings are most needed in basic level.

- Teacher should encourage his/her students to focus on process rather than product.

- The teacher should try to find out the reason about committing the difficulties.

- Teacher should be diagnostic test and most identify the area of difficulty and must use remedial teaching to avoid the difficulties.

- This type of study can be extended to privative school as well.

- The study area of this research should be extended like other development region and other parts of country.

- Due to lack of sufficient time, resources and economic problem I conducted only one government school. Therefore, further study can be carried out sampling various schools from different parts of Nepal.

- Similar kinds of research can be carried out in primary and secondary levels too.

- Further study can be done on "Low achievement of student's in algebra solving word problem."

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**Appendices**

**Appendix -A**

Achievement test

Dear all, Namaste

I am **Khagendra Kafle** student of central department of mathematics education from university campus T.U. Kritipur. This is a partial work of my master's thesis entitled "**Student's Difficulties in Solving Algebraic Word Problems**". I would be grateful by your appreciation of this question as an achievement test of my study. Please solve the given problems in your original manner.

Student's Demographic Information (not compulsory)

Student Name:                                              Roll No:

School Name:

Age:                          Gender:                          Time:

Questions:

<div align="center">Group "A"                          $6 \times 2=12$</div>

1.  A number is 5 more than twice the other and their sum is 44. Write a linear equation to represent the given statement and solve it to find the number.

2.  The sum of two consecutive numbers is 67. Find the number.

3.  A number is 3/5 times another number. If their sum is 88, find the number.

4.  One number is twice the other number. The sum of two numbers is 36. Find the numbers.

5.  The age of father is double than that of his son. The difference of their ages is 21 years. Find their ages.

6.  The ratio of present age of A and B is 4:7. After three years, the ratio of their age will be 5:8. Find the present age of A and B.

<div align="center">Group "B"                          $2 \times 4=8$</div>

7.  The cost of 2 kg chicken and 1 kg mutton is Rs.1500. If 1 kg chicken and 2 kg mutton cost is Rs.1950. What is the separate of per kg chicken and mutton? Solve it by making the pair of linear equations.

8.  The perimeter of rectangular book is 100 cm. If the length of book is 8 cm more than its breadth.

<div align="center">**Thank You**</div>

**Appendix-B**

Interpretation the results of Pilot Test

The following table shows the students obtain of pilot test.

| Students Number | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Marks Obtained in Odd Questions (X) | 2.5 | 3 | 3 | 0.5 |
| Marks Obtained in Even Questions (Y) | 3 | 2 | 3 | 1.5 |

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

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

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

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

Where, $r_t = \frac{2 \times 0.713}{1 + 0.713}$   Therefore, $r_t = 0.83$

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

| Coefficients | Nature |
|---|---|
| $0.0 \; to \pm 0.20$ | Negligible |
| $\pm 0.20 \; to \pm 0.40$ | Present but slight |
| $\pm 0.40 \; to \pm 0.70$ | Substantial |
| $\pm 0.70 \; to \pm 1$ | High to very high |

**Appendix-C**

Interpretation the results of Achievement Test

The following table shows the students obtained of Achievement test.

| S.N | Marks Obtained in Odd Questions(X) | Marks Obtained in Even Questions(Y) | S.N | Marks Obtained in Odd Questions(X) | Marks Obtained in Even Questions(Y) |
|---|---|---|---|---|---|
| 1 | 2 | 0 | 46 | 3.5 | 2.5 |
| 2 | 0 | 0 | 47 | 0.5 | 0 |
| 3 | 0.5 | 0 | 48 | 3.5 | 3.5 |
| 4 | 8 | 8 | 49 | 0 | 0 |
| 5 | 0.5 | 1.5 | 50 | 0 | 0.5 |
| 6 | 1.5 | 2 | 51 | 0.5 | 2 |
| 7 | 0 | 1 | 52 | 0.5 | 0.5 |
| 8 | 2.5 | 5.5 | 53 | 2.5 | 4 |
| 9 | 0.5 | 0.5 | 54 | 4 | 2 |
| 10 | 1 | 0 | 55 | 5 | 3.5 |
| 11 | 0 | 0.5 | 56 | 3 | 5 |
| 12 | 2 | 1 | 57 | 1 | 2 |
| 13 | 5 | 1.5 | 58 | 0.5 | 1.5 |
| 14 | 0 | 0.5 | 59 | 3.5 | 5 |
| 15 | 0.5 | 1.5 | 60 | 0 | 0.5 |
| 16 | 0 | 0 | 61 | 0 | 0 |
| 17 | 1 | 2 | 62 | 2 | 0 |
| 18 | 1.5 | 0.5 | 63 | 0 | 0 |
| 19 | 0.5 | 1 | 64 | 0 | 0.5 |
| 20 | 1.5 | 1.5 | 65 | 0 | 0 |
| 21 | 0.5 | 2 | 66 | 1.5 | 1 |
| 22 | 0.5 | 1.5 | 67 | 1.5 | 1 |
| 23 | 0 | 2 | 68 | 2 | 0.5 |
| 24 | 0 | 0 | 69 | 1 | 1 |
| 25 | 2 | 6 | 70 | 1 | 3.5 |
| 26 | 2.5 | 2 | 71 | 2.5 | 3 |
| 27 | 0.5 | 1 | 72 | 1 | 1 |
| 28 | 1 | 1 | 73 | 1.5 | 0 |
| 29 | 2 | 4 | 74 | 1 | 1 |
| 30 | 0.5 | 1.5 | 75 | 1 | 0 |
| 31 | 0.5 | 0 | 76 | 3.5 | 4.5 |
| 32 | 0 | 3.5 | 77 | 2.5 | 3 |
| 33 | 0.5 | 4.5 | 78 | 3.5 | 4.5 |
| 34 | 0 | 2.5 | 79 | 0 | 0 |
| 35 | 0 | 4.5 | 80 | 4 | 4 |
| 36 | 1 | 2 | 81 | 6 | 6 |

| 37 | 0 | 0 | 82 | 5 | 5 |
|----|-----|-----|----|-----|-----|
| 38 | 0.5 | 0.5 | 83 | 2.5 | 2.5 |
| 39 | 0.5 | 3.5 | 84 | 0.5 | 0.5 |
| 40 | 3 | 3.5 | 85 | 3 | 3 |
| 41 | 0 | 0 | 86 | 2 | 2 |
| 42 | 3 | 8 | 87 | 1.5 | 1.5 |
| 43 | 2 | 1.5 | 88 | 4 | 4 |
| 44 | 1 | 1.5 | 89 | 3.5 | 3.5 |
| 45 | 0.5 | 3.5 | | | |

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

$$r_{oe} = \frac{N\sum XY - \sum X \sum Y}{\sqrt{N\sum X^2 - (\sum X)^2}\sqrt{N\sum Y^2 - (\sum Y)^2}} = 0.67$$

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

This correlation coefficient shows the split-half of the reliability of test items. so, for

the reliability of whole items I used Spearman-Brown correlation coefficient formula

as below:

Where, $r_t = \frac{2 \times 0.67}{1+0.67}$    Therefore, $r_t = 0.80$

According to Garrett (Garret, 2008, p .176), the interpretation of the reliability

coefficients as following table:

| Coefficients | Nature |
|---|---|
| $0.0 \ to \pm 0.20$ | Negligible |
| $\pm 0.20 \ to \pm 0.40$ | Present but slight |
| $\pm 0.40 \ to \pm 0.70$ | Substantial |
| $\pm 0.70 \ to \pm 1$ | High to very high |

**Appendix-D**

Interview guideline with students

1. Reading and Conceptual Difficulties:

    ➢ Simple reorganization of word and symbols.

    ➢ Unfamiliar word ad Vocabulary.

    ➢ Understanding the problem.

    ➢ Identify the main ideas.

2. Compressions Difficulties:

    ➢ Understanding the meaning of problem and sentences.

    ➢ Sentence structure and syntax.

    ➢ Visual displays of information of the problem.

3. Transformation Difficulties:

    ➢ Interchanging the value and unfamiliar words.

    ➢ Mathematical Terminology.

    ➢ Connection between word and symbol.

4. Solving Process Difficulties:

    ➢ Knowledge for understanding representing problems.

    ➢ Strategic to approach problem solve take to the task.

    ➢ Correct mathematical operation or producers.

**Thank You**

**Appendix-E**

Interview guideline with mathematics teacher

a) Teaching method in algebr

- ➤ Using teaching materials

- ➤ Different teaching strategies


- ➤ Students are openly talking with teacher

- ➤ Students' opportunity for learning with teacher

- ➤ Ask any problem by students

c) Participation of students in the classroom

- ➤ Students are regular or irregular in school

- ➤ Student interest in mathematics

d) Encouragement of the students in learning algebra

- ➤ Reinforcement, feedback provided by mathematics teacher

e) School environment in learning algebra

- ➤ Physical facilities available in school

- ➤ Students' demography

f) Students pre knowledge in algebra

- ➤ Students have prerequisite knowledge for grade VIII

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