IMPACT OF CUISENAIRE-ROD STRATEGY ON REMEDIATING ERRORS IN ADDITION AND SUBTRACTION AMONG PRIMARY SCHOOL PUPILS, IN LERE LOCAL GOVERNMENT AREA KADUNA,NIGERIA.

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DECLARATION

I, Sabi'u Barwa, BALA declare that this work titled "impact of Cuisenaire rod strategy on remediating errors in addition and subtraction of numbers among primary school pupils,Lere local government Kaduna state Nigeria" was carried by me as a student of Science Education Department (Mathematics Education Section). Also, I declare that the information obtained from literature review has been duly acknowledged in the text and in the reference lists provided. Furthermore, no any part of this work was previously presented for the award of another degree or any other certificate at this or any other institution.

_____ _____

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CERTIFICATION

This dissertation titled "impact of Cuisenaire rod strategy on remediating errors in addition and subtraction of numbers among primary school pupils, Lere local government Kaduna state Nigeria" by Sabi'u Barwa, Bala meets the regulations and condition governing the award of Master Degree in Mathematics Education, Ahmadu Bello University, Zaria and is approved for its contribution to knowledge as well as literary presentation.

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DEDICATION

This work is dedicated to my late parents, may their soul rest in peace. Amin

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TABLE OF CONTENTS

Title	Page
Title page	i
Declaration	ii
Certification	iii
Dedication	iv
Acknowledgements	v
Table of Contents	vi
Abbreviations	vii
Operational Definitions of Terms	viii
List of T ables	ix
List of Figures	x
List of Appendices	xi
Abstract	xii
CHAPTER ONE: THE PROBLEM	
1.1 Introduction	1
1.2 Statement of the Problem	4
1.3 Objectives of the Study	6
1.4 Research Questions	6
1.5 Null hypotheses	7
1.6 Significance of the study	8
1.7 Basic Assumptions	9
1.8 Scope of the Study	9

CHAPTER TWO: REVIEW OF RELATED LITERATURE

2.01 Introduction 11

2.02 Conceptual Framework of the Study 11

2.03 Teaching Mathematics at Primary Schools in Nigeria 12

2.04 Concept of Cuisenaire Rod Strategy 12

2.05 Mathematics Teaching Methods 14

2.06 Cuisenaire Rods and Mathematics teaching 16

2.07 Convectional Method 19

2.08 Studies on Gender and Achievement in Mathematics 24

2.09 Overview of Related Studies 27

2.10 Implications of the Reviewed to the Study 27

CHAPTER THREE: METHODOLOGY

3.1 Introduction 29

3.2 Research Design 29

3.3 Population of the Study 30

3.4 Sample and Sampling Techniques 31

3.5 Instrumentation 32

3.6 Validation of the instrument 33

3.7 Pilot Testing 33

3.8 Reliability of the Instrument 33

3.9 Administration of the Treatment 36

3.10 Procedure for Data Collection 36

3.11 Procedure for Data Analysis 36

CHAPTER FOUR: DATAANALYSIS , RESULTS AND DISCUSSIONS

4.1 Introduction 39

4.2Data Analysis to Answer Research Questions 39

4.3 Testing the Null Hypotheses 41

4.3: Summary of Major Findings 44

4.4: Discussions of Results 44

CHAPTER FIVE:SUMMARY,CONCLUTIONS AND RECOMMENDATIONS

5.1 Introduction 48

5.2. Summary 48

5.3. Conclusions 49

5.4 Recommendations 49

5.5 Contributions to Knowledge 50

5.6 Suggestions for Further Studies 50

References 52

Appendices 61

LIST OF TABLES

Table	Title	Page
Table 1.2. Analysis of student's performance in JSSCE from 2010 – 2014		5
Table 3.1. Showed the summary of two class two pupils enrolment (boys and girls) Across the education district in Lere local government Kaduna State		29
Table 3.3 Below showed the sample selected for the study		30
Table 4.1 Descriptive statistics for impact of addition and subtraction of Cuisenaire Road on Academic performance of experimental and control group		37
Table 4.2 Descriptive Statistics for Academic performance of Male and female taught addition with Cuisenaire Rods Strategy		37
Table 4.3 Descriptive Statistics for Academic performance of Male and Female taught subtraction of whole number with Cuisenaire Roads Strategy		38
Table 4.4 Descriptive Statistic for Academic performance of student From urban and rural school taught addition and subtraction with CRS		38
Table 4.6 Summary of t-test analysis of the mean performance scores of the Experimental and control groups in post-test		39
Table 4.7 Summary of t-test analysis of the mean performance scores of The experimental and control group in Post-post-test		40
Table 4.8 Summary of one-way ANOVA of the mean performance of male and Female in the experimental and control groups in post-test (CRS)		40
Table 4.9 Summary of t-test analysis of the mean scores of experimental And control groups in Post-post-test		41

LIST OF FIGURES

Figure	Title	Page
Figure 3.1.	Research Design Illustration	28
Figure 3.4.	Flow chart of paired Cuisenaire Roads Strategy step adapt from Kurameh and Achor, (2008)	33

LIST OF APPENDICES

Appendix	Title	Page
A.	Manual for Experimental Group	57
B.	Manual for Control Group	118
C.	Cuisenaire Rod Model Errors Remediating Test	

OPERATIONAL DEFINITION OF TERMS

Cuisenaire Roads Strategy is manipulative and symbolic concrete representation of teaching concepts in Mathematics.

Remediating: the act or process of remediating something that is undesirable or deficient.

Errors: is deviation from accuracy or correctness.

Coeducational; Schools that comprises boys and girls.

ABBREVIATIONS

STAN: Science Teacher Association of Nigeria

TRCN: Teachers registration Council of Nigeria

PMPT: Primary Mathematics Errors Remediating Test

PCRS: Paired Cuisenaire Rods Strategy

SUBEB: State Universal Basic Education Board

NCTM: National Council of Teachers of Mathematics

ABSTRACT

This study investigated the impact of Cuisenaire rods strategy on remediating errors in addition and subtraction of numbers among primary school pupils in Kaduna State, Nigeria. Simple random sampling technique using "balloting method" was used in selecting two co-educational primary schools in Lere local government. One of the schools was also randomly selected as experimental group while the other as the control group. The same method was used in selecting intact classes for the study. A sample of ( ) primary II school pupils consisting of 1,271 males and 1,057females were used for the study. The experimental group was taught using Cuisenaire rod strategy (CRS) while the control group was taught using conventional method. A Quasi –experimental research design of pre-test, post-test was adopted by the researcher. The instrument used by the researcher was a primary mathematics errors remediating test(PMERT)which consist of 50 test items of multiples choice objective test and a paired Cuisenaire rod strategy(PCRS) was developed and validated by the expert in mathematics education and the data were collected. In this study, four (4) research questionsand four (4) null hypotheses were formulated and tested at 0.05 level of significance. The target population of the study was all the 2,328 class two pupils of the public primary schools in Lere local government area of Kaduna State. All the public primary schools selected were coeducational and have the same characteristics.. Thus the sample size was 227 pupils. The data collected were presented by using the descriptive statistic of mean and standard deviation. The date were analysed by using the independent sample t-test statistic at 0.05 level of significance.The treatment for the study involved exposing class two pupils addition and subtraction of numbers using a Cuisenaire rods strategy which consist of 74 rectangular rods in 10cm different length and 10 different colours for experimental group and the lecture method for the control group. Both the experimental and control group were taught for six weeks for one hour per week by the researcher. The Findings of the study showed that the pupils taught using Cuisenaire-rod strategycommitted less error than the pupils in the control group. It is recommended that mathematics teachers should be trained on how to implement Cuisenaire rods strategy on remediating errors in addition and subtraction of numbers among primary school pupils in their classrooms.

CHAPTER ONE

THE PROBLEM

1.1 Introduction

Mathematics is a study of pattern and relation, a science and way of thinking, an art that is characterized by order and internal consistency, a language used as tool for national development (National Council of Teacher of Mathematics, 1991). Agwagahs (2004) described mathematics as a pivot on which other sciences revalue and serves as a means of sharpening man's reasoning ability and developing his personality However, according to Salman (2005) mathematics is a precursor of scientific discoveries and inventions..

The general importance of mathematics cannot be over emphasized. Mathematics is an essential, subject for scientific and technological development of any nation. This is to say no nation can grow scientifically above her mathematics status. With this understanding, Nigeria made mathematics a compulsory subject in her primary and secondary school levels of education. The need to acquire knowledge of mathematics in the world over has become very obvious. Teaching and learning of mathematics will continue to generate interest among scholars. This is because of the importance of mathematics to humanity. In Nigeria today, there is much emphasis on the development of technology, as a result more emphasis is being placed on learning of the arts of humanities to science and technical subjects.

The teaching and learning of mathematics in primary schools is deteriorating. This is due to constant changes in the field of mathematics and also the new research work which is not often passed to the primary schools teachers. It is important a teacher should be able to test what he teaches and above all find suitable ways of assessing those areas of weakness and identify errors committed by pupils for analyzing later; this will enable him to assist his pupils in such area and to correct such errors.

Objective of teaching mathematics at primary schools contributes immensely. The pupils acquire understanding of numbers, numerations and develop the ability to perform the four basic mathematics operations. Moreover the knowledge will help pupils to develop the skills in measuring, approximation, estimation spatial concept and ability to use them. Learners will acquire the techniques of collection, interpreting data, and positive attitude toward mathematics and make good use of leisure time. Therefore, the study of mathematics in primary schools is essential in assisting pupils to develop skills of critical, and logical thinking, problem solving and deductive reasoning.

The problem associated with teaching of mathematics at primary schools most especially on addition and subtraction are renaming, renaming-unit to tens, renaming-tens to hundred, place value and word problems. These errors committed by the pupils were studied and classified according to one of the algorithm error where pupil applies the correct operation (formula, techniques) but makes errors in carrying through the necessary step. In other word the error occurs within the step, enumerate by Joseph (1990). The data were collected through scrutinizing the test scripts of the pupils with reference to the questions papers and marking schemes. For the error made each of the scripts was taken andthen analyzed to see why the pupils failed. The error(s) were later classified and summed up by errors type. Also the total numbers of errors in each error-type for the entire pupil in each school were calculated.

The study remediated the errors using Cuisenaire-rods strategy. Cuisenaire-rods are mathematics manipulation use for elementary level of learning. A pack of Cuisenaire-rods consist of 74 rectangular rods in 10cm different length and 10 different colors. Each colorcorresponding to different length. Cuisenaire-rods are good to be used in teaching mathematics. It entails the used of concrete, physical, observable and touchable objects like Cuisenaire-rods to teach abstract concept. There is therefore a need to have a tryout of an approach like the use of Cuisenaire-rods

The rods could be used as manipulative and symbolic concrete representation in teaching concepts in mathematics. Teacher explores whole numbers, fraction, measurements, ratio, perimeter, symmetry, congruency 3, dimensional geometry and function using Cuisenaire-rods (Thomson, 1994). Cuisenaire-rods approach is hand-on and mind-on manipulative activities field approach for teaching abstract concept in mathematics and science.This approach helps to develop key skills such as, classification, critical thinking, problems solving and logical reasoning (Rule and Hllaga, 2006). It is a valuable educational tool for modeling relationship between what is taught in school and what exists at home, making connection between what is taught in school and their everyday life activities (Elia et al 2007). It enables every pupil to work independently and in a group on meaningful mathematics contact while the teacher provides individual attention to other pupils (Van de Walle, 2007). Cuisenaire-rods are ready made, its approach minimize preparation and set up time both for the teacher and pupils. The study is necessary because it will help pupils grasp abstract concept in mathematics using colors card board strip of varying length called Cuisenaire-rods, with the intention to establish a firm foundation in mathematics in Nigeria. The primary school could be the right place to introduce such instructional materials. This study remediated the errors that pupils commit when

solving problem of addition and subtraction of numbers in primary school as well as to investigate teaching strategies to bring equity in gender performance in mathematics.

This study remediated the errors that pupils commit while solving problem of addition and subtraction of numbers among primary school pupils as well as to investigate especially with teaching strategies to bring equity in gender performance in mathematics. Also the study investigated the impact of gender.In view of Aiyedun, (2000) there I s no significant different in the performance of boys and girls in mathematics and that they both perform equally well. Ashafi and Areelu (2010) assert that in mathematics boys achieved significantly higher than girls as a result of retention rate. This conflicting result call for continuous investigation

1.2 Statement of the Problem.

The teaching/learning of mathematics at all level of education in Nigeria have grown and brought with it many instructional strategies. Yet, the pupils/pupils interest, attitude, performance and achievement towards mathematics at primary and secondary schools levels have remained a topic of concern (Adetula, 1987). Because there is massive cry from the society as to why there has been massive failure of mathematics in schools, and the need to evaluate primary school mathematics. This is because it is believed that a strong foundation is necessary at the grassroots in order to eradicate this failure problem, otherwise the system will one day collapse totally.

The situation of persistent failure could be attributed to several factors such factors include the abstracters of mathematical concept, the way the concepts are presented to the pupil and poor foundation, among others. As a way out, the use of practical and concrete representations in locking abstract concept for better understanding in mathematics. Also pupils always find it difficult to add and subtract number involving remaining these are the of discovery for teaching commutative and association additive property of primary school level (Adetula, 1989) most of the mathematics teachers in primary schools taught the subject by using traditional conventional teaching approach. Concept is expressed thereby confusing and confounding below average learners. Hence, the teacher`s in ability to concretize concept in classroom makes the learners to develop hatred against the subject. This attitude in variable may be the cause of poor performance in primary school examination for some years.

Kurumeh,(2004) maintained that the mathematics taught in schools in foreign, euro center in origin and build on the western cultural background making pupil learn by rote memorization in which the attendant result is consistent mass failure: hence pupils no longer home interest toward the study of the subject. Various factors responsible for pupil`s poor achievement in geometry and mathematics generally have been identified by researchers in mathematics education. These include lack of enough qualify teachers, instructional materials, large size and pupilpoor, background. However, other finding asseverated that most important factor is the use of poor teaching strategy in leaching materials. Such finding has agreed that under achievement is large due to in appropriate instructional strategy (Usman, 2004, Hassan, 2010 Obiom, 2011). However the study will investigatethe impact of Cuisenaire-rods strategy on remediating errors in addition and subtraction of number among the primary schools pupils inLere local government Kaduna state.

1.3 Objectives of the Study

The main objective of the study was to examine the impact of Cuisenaire-rods strategy on remediating errors in addition and subtraction of numbers among primary schools pupils in Lere local government Kaduna state.

Specifically, the research investigated:

1. the impact of Cuisenaire-rods strategy on remediating addition of numbers among primary schools' pupils inLere local government Kaduna state.
2. the impact of Cuisenaire-rods strategy on remediating subtraction of numbers among primary schools' pupils inLere local government Kaduna state.
3. the impact of Cuisenaire-rods strategy on remediating addition of numbers among male and female primary schools' pupils inLere local government Kaduna state
4. the impact of Cuisenaire-rods strategy on remediating subtraction of numbers among male and female primary schools' pupils inLere local government Kaduna state

1.4 Research Questions.

The following research questions were formulated and tested in this study:

1. In what way, would Cuisenaire-rods strategy affects remediationerror ofaddition of numbers among primary schools' pupils inLere local government Kaduna state?

2. To what extent would Cuisenaire-rods strategy affect remediation error of subtraction of numbers among primary schools' pupils inLere local government Kaduna state?
3. What are the impacts of Cuisenaire-rods strategy on remediation error ofaddition of numbers among male and female primary schools' pupils inLere local government Kaduna state?
4. What are the impacts of Cuisenaire-rods strategy on remediation error ofsubtraction of numbers among male and female primary schools pupils inLere local government Kaduna state?

1.5 Null Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significant.

HO_1: There is no significant difference in theremediation of errors between pupils taught addition of numbers with Cuisenaire-rods strategy and those taught using conventional method.

HO_2: There is no significant difference in the remediation of errorsbetween pupils taught subtraction of numbers with Cuisenaire-rods strategy and those taught using conventional method

HO_3: There is no significant difference in the remediation of errorsbetween males and females' pupils taught addition of numbers with Cuisenaire-rods strategy

HO_4: There is no significant difference in the remediation of errorsbetween males and females' pupils taught subtraction of numbers with Cuisenaire-rods strategy

1.6 Significance of the Study

The outcome of this study enriched the standard of teaching and learning in the following ways:

The study provides primary teachers, with relevant teaching strategy and resources materials that may be used to improve the teaching and learning of mathematics at primary level of education. The study will contribute and outline strategy teachers adopt to organize, design and direct problems solving activities for learners. This build their confidence and motivated them to use this method to promote academic achievement in addition and subtraction of numbers among learners.

The findings of the study were useful to science teachers association of Nigeria (STAN) in preparing workshops and conferences for science teachers on effective instructional method that will promote academic achievement addition and subtraction.

The findings of the study were useful to national registration council of Nigeria (NTRCN) in preparing an in-house training on teaching strategies for their members. The in-house training can be conference and seminars where experts on teachings strategies can be invited to present papers for impacts lesson delivery. The experience acquired in such interaction by teachers will aid in promoting academic achievement, addition and subtraction traits among the learners.

Text books publishers will find this work useful as it will assist them in selecting materials and practical questions based exercise to be incorporated in text that will promote academic achievement in addition and subtraction among the learners.

Curriculum planers can expand the curricula contents of teacher on training (NCE pupils) to include on use of Cuisenaire-rods strategy. Curriculum planers will also benefit by knowing that the use of general and rigid curriculum that is one size fits all will no longer meet the needs of other learners. The study will improve the weakness of a single – place lesson delivered through a singular instructional approach in its disregards to different learning style interest present in modern classrooms. This will assist in making good policies.

Fellow Researchers, findings of this study will add to the existing literature for the researchers to view for further studies in order to establish more evidence on the impact of Cuisenaire-rods strategy using learners learning style.

Educational administration, the curriculum in current educational system does not adequately adheres learners diversity therefore; the knowledge from this study would guide the school policy makers, educationist and administrators to encourage their teachers to use innovative strategies and methods of teaching that can effectively recognize the issue of diversity in learning abilities that pupils brought to the class room numbers.

1.7 Basic Assumptions

For the purpose of the research work, the following assumptions were made.

1. The subjects of the study (primary two pupils) have equal mathematics background.
2. The quality of teachers and facilities are evenly spread across the primary school in the area.

3. The schools under study are similar based on regulations, syllabus used.
4. The primary mathematics teachers are familiar with the use of Cuisenaire-rods strategy.

1.8 Scope /Delimitation of the Study

The main point of the study was to determine the impact of Cuisenaire-rods strategy on remediating errors in addition and subtraction of numbers among primary schools pupils inLere local Government Kaduna state.

Thus, the study was delimited to classtwo pupils of public primary schools. This class was particularly chosen, because it was considered as foundation to other level of mathematics teaching and learning, as primary one could be considered as transition from home to schools or transition from nursery (play class) to school. Therefore, a lot is hinged on addition and subtraction in this class.The mathematics curriculum for primary schools has a lot in terms of content on addition and subtraction of numbers; it covered addition and subtraction of two to three digits numbers.

Another scope of this study was that only one instrument and method were developed for the research;these are known as primary mathematics errorsremediating test (PMERT) and paired Cuisenaire-rods strategy(PCRS).

Also, the treatment for the study involved exposing class two pupils to addition and subtraction concept with the use of a pack of Cuisenaire-rods consisting of 74 rectangular rods in 10cm lengths and 10 different colors for experimental group. Thecontrol group was taught the same topics on addition and subtraction with lecture method only.

The remediation errors were determined through the inability of pupil to get the correct answer to the pre-and post-performance tests respectively. Both the experimental and control groups were taught for six weeks for one hour per week by the researcher.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.01 Introduction

The chapter contains a review of related literature on Cuisenaire-rods theories of teaching and learning mathematics drown from the past researchers on the subject matter under research. The literature review is organized in under the following sub-headings as explained below.

- Theoretical/Conceptual Framework of the Study
- Teaching Mathematics at Primary School in Nigeria
- Concept of Cuisenaire-rods Strategy
- Cuisenaire-rods Strategy and pupils Remediation of errorson Addition and subtraction
- Cuisenaire-rods and Gender related Issues to Mathematics
- Conventional Method
- Gender and performance in Mathematics
- Overview of Related Studies
- Implications of Literature Reviewed on the Study

2.02 Theoretical /Conceptual framework of the study

Mathematics teacher at all level generally agree that the teaching and learning of mathematics must;

I. Develop pupils' ability in problem handling and solving
II. Provide applicable mathematics knowledge, expertise and skills for future needs
III. Extend pupil way of thinking for pupil to do mathematics

Therefore, for pupil to do mathematics and not to just listen and watch mathematics being done, also for pupils to be excited doing mathematics, to understand mathematics, pass and continue schooling and to solve problem that they recognize as relevant to their lives. There has to be good teaching practice that would involve the pupils, make them active in the process and hence respect and enjoy mathematics, recognize its usefulness and appreciate it as a subject in its own right. These make instructional methods fundamental to any impassive

instruction. Teaching approach use by a teaching is very important to the success of learning process. As a result teachers employ varying teaching techniques, method or approaches to accomplish their educational objective. There has been a great deal of research concerning the teaching and learning and the use of manipulative to enhance conceptual understanding. As already highlighted, the intent of this research is to determine the effectiveness of Cuisenaire-rods strategy in remediating Addition and Subtraction in whole numbers among primary school pupils of mathematics in Kaduna state. Thus it is necessary to review literature on the basic concepts involved in the study which are:

2.03 Teaching Mathematics at Primary Schools in Nigeria.

Mathematics is a power tool for the development for any nation. However the teaching of this subject at all the school level in Nigeria has not been very impressive. For instance, at the foundation level, which is at primary school level, the bulk of teaching is on the number concept and basic operation (addition, subtraction, multiplication, and division). This expression is taught with strong emphases on drill and practice of number facts, which are often implemented as classroom chorus drills. Clearly such drills put emphases on repetition and fixation of procedures or algorithms to the extent of ignoring understanding (Adetula, 1987). The ability to add or subtracts develops later than many parents and teachers thinking. Many first graders (class one or six years old) are taught addition before they can understand it. This result into verbal or road learning, Piaget therefore advices teachers to pay attention to both the method of teaching and stages of development of children, if true understanding is to occur. It is against this background knowledge that this study is set to discover if the use of Cuisenaire methods may act as a new strategy for teaching mathematics in primary schools

2.04 Concept of Cuisenaire-rods Strategy

Cuisenaire-rods are a very versatile mathematical manipulative use for elementary school mathematics training as well as of other level of learning and even with adult. They are used to teach a wide variety of topic such as the four basic arithmetic operation, working with fraction areas and volume of figures, square roots, solving simple linear quadratic equation and systems of equation. In the system, there are 10 rods measuring 1 to10cm rods of equal length are assigned with same color. However, the pupils in primary schools, their programmed activities should emerge from within the context of their lived world. Also

Piaget said that for every stage in addition and subtraction of numbers, certain activities should precede and is prerequisites for such procedure. These include physical model with practical activities before the corresponding paper and pencil. This will help to avoid children interchanging addition rules for subtraction and vice versa or placing numerals incorrectly. It will also assist knowledge construction to the pupils. Also pupils should work together with peers in the social construction of personally significant meaning. Thus evaluation should be a personalized ongoing, share analysis.

The study in the use of human cognition has much specific application in educational practice and technology. The following are five general educational applications of constructive theory that should be considered when designing methods of instruction. The pupil's cognitive processes should be a major concern to educator. Pupils learning difficulties can often be attributed to ineffective or inappropriate cognitive process (Swanson, 1987). Second, educators must consider pupils level of cognitive development when planning topics and methods of instruction. For example, explanation based on concrete operational logic is unlikely to be effective ways of presenting ideas in a preoperational kindergarten. Concrete operational elementary school children have difficulties in understanding abstract ideas that do not tie in with their own experience. These pupils will learn more effectively if the same information is presented through familiar concrete experience prior to handling abstract material. Third, pupils organize the information they learn. Teachers can help pupils learn by presenting organized information and by helping pupil see how one thing relates to another. Four, new information is most likely acquired when people can associate it with what they have already acquired. Therefore, teachers should help pupils learn by showing them how new ideas relates to old ones. When pupils were unable to relate new ideas to anything which they are familiar with, learning is likely to be slow and ineffective. It is important to note that Cuisenaire-rods do not suggest particular pedagogy. In fact, it describes how learning should happen, regardless of whether learners are using their experiences to understand a lecture or attempting to design a model air plane. In both cases, the theory of constructivism suggests that learners construct knowledge. Cuisenaire-rods are often associated with pedagogic approach that promotes active learning by doing (Perry and Duffy, 1995). When designing method of instruction learners need other people (teachers) that will guide them in achieving their educational goals. Teacher will improvise the necessary teaching materials that will

facilitate understanding of the subject matter. The contribution of Piaget is very important in the history of mathematics education.

2.05 Cuisenaire-rod Strategy and Pupils Remediation of Errors on addition and subtraction

Cuisenaire Rods provide a basic model for the numbers 1 to 10. The white rod can stand for 1, andthe red rod can stand for 2, because the red rod has the same length as a "train" of two white rods. The rods from light green through orange are assigned values from 3 through 10, respectively. The orange and white rods provide a model for place value. A "train" of 4 orange rods ("tens") and 3 white rods ("ones") is 43 white rods long.

You can model addition for your students by placing rods in trains, and then finding their equivalence. For example, find 4 + 3 by first making a train with a purple rod (4) and a light green rod (3) and then find the single rod (black) whose length (7) is equal in length to the two-car train made up of purple and light green. This model corresponds to addition on a number line.

The rods can also be used for acting out subtraction as students search for a missing addend. For example, they can solve 7 – 3 by placing a light green rod (3) on top of a black rod (7). Students then look for the rod that, when placed next to the light green rod, makes a train equal in length to the black. The missing addend, a purple rod (4), is the solution to this subtraction problem. Once students have completed the *All Aboard!* Activity and have a basic understanding of the values and uses of the rod colors, you can move on to *Logging Company* and *RodCover-Up*. Both units offer practice in basic subtraction facts through the use of the rods. To challenge students' understanding of subtraction's inverse relationship to addition, move to *Rod Equations.* This unit gives children practice in looking at the rods and writing the math facts represented by each train.

2.06COMMON ERRORS AND MISCONCEPTIONS IN ADDITION OF TWO DIGIT NUMBERS

A. 5 4

\+ 3

8 4

Failure to understand the significance of the place value of digit 3

B. 4 2

\+ 9

4 1 1

Insertion of column which does not exist, lack of awareness of place value columns and that

11 = 10 + 1= 1 ten + 1 unit

C. 3 4

\+ 9

6 1

Reversal of the tens and 9 ones digit when carrying

D. 6 8

1 + 7 1

3 9

Failure to understand that the hundreds column exist even when no digit reside in it initially.

E. 6 8

\+ 3 4

1 9 2

Forgetting to add the carrying digit

F. 2 7

\+ 9 3

2 1 0

Reversal of hundred and tens digit in the answer

G. 7 0

\+ 1 5

8 0

Confusion between multiplication by 0 and addition of 0

H. 9 9

\+ 3 2

1 2 1 1

2.07 COMMON ERRORS AND MISCONCEPTION IN SUBTRACTION OF TWO DIGIT NUMBERS

A. 3 6

\- 4 2

1 4

Wrong positioning of two numbers when writing down. Frequently occurs when the problem is presented in words.

B.5 8

_ 9

5 1

Failure to appreciate that 8 – 9 ≠ 9 – 8 or confusion from being told '' start with the bigger number and subtract the smaller number''

6 0

_ 2 1

4 0

"Can't do 0 -1 so the answer must be o". Perception of the subtraction as 0 – 1 and 6 – 2 instead of 60 – 21.

C. 6 1

_ 2 3

3 2

Partial decomposition (due to mechanical knowledge of algorithm but without real understanding of decomposition of exchange 1ten for10 ones).

D. 6 1

_ 2 3

4 8

Partial decomposition (due to mechanical knowledge of algorithm but without real understanding of decomposition of exchange 1ten for10 ones).

E. 4 1

/5 9

_ 2 8

211

Decomposition when unnecessary (inadequate understanding of reasons for, and the process of decomposition)

F. 2 5

_ 1 8

113

Confusion between addition and subtraction algorithms (i.e. between decomposition and carrying both involve exchange between tens and ones).

There are also specific difficulties in using the decomposition algorithm which are course by the presence of zero digits in the first (top) number of the subtraction. The various types are shown overleaf.

2.08 SPECIFIC SUBTRACTION ERRORS OWING TO THE PRESENCE OF ZERO DIGITS

G. 5 0 5

_ 1 8 6

3 2 9

Decomposition from hundred to tens has been correctly applied but the subsequent decomposition from tens to ones has only been partially carried out since the ten digit has not been reduced by the one.

H. 5 0 5

_ 1 8 6

2 2 9

Decomposition of the hundred twice instead of hundred in to tens and ten in to ones.

I. 5 0 5

_ 1 8 6

4 1 9

Decomposition of tens is incorrect. The child's thinking is decomposing a ten leave 9 (one less than ten).failure to understand the notion of zero as a place – Holden is evident.

J. 5 0 5

_ 1 8 6

4 2 9

Decomposition without decreasing the size of the tens digit (which is zero). Thus, the decomposition of tens to ones has only been applied partially.

+

2.09 Cuisenaire-rods Strategy and Gender Related Issues to Mathematics

The studies using Cuisenaire-rods method of teaching mathematics have been few in number. The primary reason for this is probably the newness of the method, since the first book

describing the approach did not appear until December, 1952 many of this studies that have been reported were constructed in other countries. George Cuisenaire the originator of this method was a Belgian schoolmaster thus: the method began in that country and spread to other countries, finally reaching the North America continent and African continent in later part of the 1950's. Cuisenaire-rods were invented over 75 years ago by George Cuisenaire a Belgian mathematics teacher. He invented this unique system to help pupils grasp abstract concepts in mathematics using colored cardboard strips of varying lengths called Cuisenaire-rods. A pack of Cuisenaire-rods consists of 74 rectangular rods in 10 cm different lengths and 10 different colors. Each color corresponds to a different length. The content of the pack is thus: 22 white rods of 1 cm each, 12 red rods of 2 cm each, 10 light green rods of 3 cm each, 6 pink rods of 4 cm each, 4 yellow rods of 5 cm each, 4 dark red rods of 6cm each, 4 black rods of 7cm each, 4 brown rods of 8cm each, 4 blue rods of 9 cm each and 4 orange rods of 10 cm each. These rods could be used as manipulative and symbolic concrete representations in teaching concepts in mathematics.

Cuisenaire-rods are ready-made tools; its approach minimizes preparation and set up time both for the teacher and the pupils. It involves a lot of cooperatively and collaboratively working group (Butler et al., 2003). In a Cuisenaire-rods' approach classroom, the lesson begins with pupils shared into groups of threes or fours and a park of Cuisenaire-rods given to each group. They are acquainted with the content of the park and what each color stands for. The teacher explains to the pupils what is expected from them, the objectives of the lesson and the type of cooperation needed. Here the teacher is only a resource person, an instructor and a guide to the experiment. It begins with the exploration of the learner's immediate environment and ends with the application of the lesson learnt to his immediate environment. Learner's past experience forms the basis of the teaching and learning. This means relating classroom activities to learner's life experience which enables him to see the relationship between what is taught in school and what is done at home thereby facilitating transfer of teach (Case et al., 2003). There is group discussions among members of the groups, inter group discussion, teacher pupil discussion which leads to effective interaction and daily assignments. This discussion forum warms up and sparks off pupils' interest from the beginning to the end of each lesson.

It as well sustains the interest of learners for a longer period because it is learning by doing which is at the heart of mathematics knowledge (Weiss glass, 1977). The newness, practical, result – oriented and explorative nature excites the learners so much that they begin to emulate the work of their teachers resulting in frequent practice at home even without being given home exercise in and outside the classroom. Those who learnt, begin to teach the younger ones. The use of concrete material for practical takes away the abstractness seen in mathematics concepts (NCTM, 2000).As the learner progress from one manipulative representation to the other, they learn and understand important mathematics concepts and develop abstract logical thinking. Endless opportunities are presented to investigate and reinforce key mathematics topics and ask questions freely without fear. This lesson involves cooperation, collaboration and individual works (Moyer, 2001).This approach helps the learner to learn from others and be able to ask questions when he does not understand or when in a fix as opposed in today's mathematics classroom. It requires minimal preparation by the teacher. The fun involved in this approach makes pupils absorbed in the varieties of the activities (Butler et al., 2003). Studies carried out on this approach revealed that pupils taught using this approach rapidly acquired problem solving skills, maintained these skills over a two month period and transferred these skills to a paper and pencil problem solving format (Case et al., 2003). Its problem solving ability leads to discovery which is aesthetic.

This method favors both sexes thereby encouraging male and female pupils(Weiss glass, 1977). The use of manipulative in teaching mathematics has become as almost common place as the use of textbook. Manipulative not only allow pupils to construct their own cognitive model for abstract mathematical idea and processes. It also provides a common language with which to communicate these models to the teacher and other pupils. In addition to the ability of manipulative to aid directly in the cognitive process, manipulative have the additional advantage of engaging pupils and increasing both interest in and enjoyment of mathematics. Pupils, who are presented with the opportunity to use manipulative, report that they are more interested in mathematics. And, long term interest in mathematics translation to increase mathematical ability (Sultan and Krueger, 2002).

Manipulative are concrete objects that can be viewed and physically handled by pupils in order to demonstrate or model abstract mathematical objects including tan grams, cubes and base ten blocks. The use of manipulative materials in teaching mathematics has a long history. In the 19th century, influential Swiss educator Johann Pestalozzi (1746-1827). In the early part

of 20th century, Montessori (1870-1952) founded schools acquired a host of followers that believed in and stress the importance of concrete, authentic learning experience. Advocated the use of various manipulative, such as blocks, to help children acquire abstract concept, such as number sense, through concrete means (settler, 1970). It was her belief that children actualized their innate desire to learn through self-directed exploration of developmentally appropriate manipulative (ward, 1971).

2.10Conventional Method

It important to note that the tradition or teacher- centered orientation could be regarded as the hitherto existing conventional method of instruction in the normal classroom setting. There exist several of such conventional methods instructions which have permeated our educational system over the years. Among such conventional methods of instruction are; lecture, demonstration, activity, discussion, inquiry, role-play, rote-learning method, discovery, project, storytelling, dramatization, excursion/field trips and experimentation/ laboratory work among other. Accordingly, any of the teaching style can lead to success learning if properly planned. What makes a specific teaching method pupil-centered strategy is the ability to involve pupils actively in the teaching process.

According to McMahon (1997) and Wertsch (1997) individual method should take a large place in the teaching of mathematics, especially in infant classes. The backgrounds of the children in all classes were varied. Some will have learned to recite number from parent, other brothers and sisters they will have idea of the meaning of name of the values. On the other hand there were children who have been a nursery school and done elementary work. And there were those who have had little help toward schoolwork of any kind. In general the children will have been used to doing things on their own rather than large groups. For individual work, individual apparatus is needed and children learn from the activities planned for them. For example, individual work, individual apparatus is needed and children work at their own rate and memories the fact from the activities planned for them. For example if the children have been taught the symbols for the number 0 to 5 the kind of apparatus could be an egg box seed with numbers 1, 2, 3, 4, 5 painted in holes. The pupils can convert the apparatus number of seeds in the right place and asset of card to form puzzle. The pupils using these will

match the symbol to the number of dots. If they get them correct the piece will fit. Group learning also facilitate team work and understanding of the learning experience.

The traditional teaching method pays more attention on teachers which in turn help to decrease pupils' learning interest to a greater extent. The conventional strategy of teaching is often boring for pupilsbecause their job in classroom is to pensively sit and watch the teacher work mathematics problem on the board and then copy what the teacher did. Few teachers often use instructional materials to teach mathematics. A more fatalistic shortcoming of traditional teaching strategy is that it gradually makes the pupil to feel that mathematics is pointless and has little value to them in real life. It becomes a subject they are force to study, but not useful in real life. Another disadvantage of the strategy is that it provides no way for the pupilsto practice generic skills such as communication and teamwork which facilitate learning. To brown et al (1989) this term is used to describe two different ideas. The stage and the rate of progress of pupils will vary. Some work can be taught more successfully if the class is divided in two groups, rather being taught as a whole. The teacher using these methods will explain a new step in their work to one group while the other works at set activities. The number of group will depend very much on the particular class. Two or three group may be sufficient to ensure that every child is doing work of a suitable standard for particular needs. In some classes dividing children into small groups of six to eight were the most effective way. It is important that each child knows what he is expected to do and has the necessary apparatus to get on with it on his own. For example, variety of activities can be prepared for the class and the pupils grouped to take turns in using the different set of apparatus. In this way the children are able to gain from a wider variety of activities than if they are all doing the same thing at the same time.

To Beneze (2005) when new work is introduced to pupils it must be done in such a way that they can understand what they are learning. Activities should be organized to help to think out result for them. For example in the infant classes, children must be learning the place value figures. If the pupils tie match sticks together, it will help their understanding. If they replace ten counters from unit rod an abacus with one on the ten rods the pupils will learn and remember the comparative values older pupils, topics such weight, capacity, area and volume should tie apparatus practically it must be realized that individuals pupils should take part in the practical activities. Pupils may not know, even if they have success ideas and an urge to

change, how to alter their thinking. They may lack skills necessary to share their ideas. They may not know how to think about their own ideas, how to learn new ones, or how to decide what to believe. Therefore as with conceptual change, pupils need other (often teachers) to introduce the new ideas. Pupils cannot change their thinking own their own, even if they want to; they lack the understanding of the lows, theories and invention are available to them. For pupils to learn therefore experience alone is not enough, they need to learn the different lows and theories, which guide their ideas. Teacher must therefore take purposeful step to get pupils to see things in new ways. Knowledge is becoming communally based, moreover, learning need access to the knowledge of different communities. Learning should be not being so conservatives as to ignore the knowledge and ways of different races, cultures and societies. Learning must be pluralist rather than conformist. For example, according to Beneze while a teacher can show to pupils on a background the various atoms can be rearrange to make new molecules in a chemical change, pupils often needs to try the new ideas, skills etc. teacher must therefore, take purposeful step to get pupils or pupils to see things in the new ways. For example it would be about getting pupils to "see" particular images in the black and white photograph. It is also getting pupils to know the formula of a circle and how it can be applied to solve related problems on area of circle. Learners need first-hand information to help them in their experience. According Beneze (2006) pupils need to use and test ideas, skills through relevant activities. This is a concrete experience of the abstract ideas that have been presented to the learners. Finally learners does not mean receiving and remembering transmitted messages instead educational research must offer compelling evidence that pupilslearn mathematics well only when they have constructed their own understanding. Assessment is very important in all learning experience.

. Where the sequencing of matter is concerned it is the constructivist viewpoint that the foundation of any subject may be taught to anybody at any stage in same form (Duffy and Janssen, 1992). The feedback created by the assessment process serves as a direct foundation for further development. The structure of the learning experiences help in conceptual understanding. Savery (1994) contends that more structure learning environment, the holders it is for the learner to construct meaning based on their conceptual understanding. According to Holt and Willard-Holt (2000) emphasis the concept of dynamic assessment, which is a way of assessing the true potential of learners that must differs significantly from conventional

test. Here the assessorial interactive nature of learning is extended to the process of assessment. Rather viewing assessment as a process carried out by one person, such as an instructor, it is seen as a two way process involving interaction between both instructor and learner. The role of the assessor becomes one of the entering into dialogue with the person being assessed to find out the current level of performance on any task and sharing with them possible way in which that performance might be improved on a subsequent occasion. Thus, assessment and learning as seen as inextricably linked and not separate processes. According to this viewpoint instruction should see assessment as a continuous and interactive process that measures the achievement of the learner, the quality of the learning experience and courseware A facilitator should structure the learning experience just enough to make sure that the pupilsget clear guidance and parameter within which to achieve the learning objectives. Yet the learning experience should be open and free enough to allow for the learners to discover, enjoy, interact and arrive at their own, socially verified version of truth. This means that instructor should first introduce the basic ideas that gives life and form to any topic or subject areas, and then revisit and build upon these repeatedly.

Thus, the learning experience becomes a shared enterprise, emotion and life context of those involved in the learning, the goal of the learner is central in considering what is learned. (Brown et al, 1989 and Ackerman, 1996). This notion has been extensively used in curricula. It is important for instructor to realize that although a curricular may be set down for them, it inevitably become shaped by them in something personal which reflect their own belief system, their thought and feelings about both the content of their instruction and their learner (Rhode and Bellamy, 1999). It is important to achieve the right balance between the degree of structure and flexibility that is built into the learning process. A constructivist learning intervention is thus an intervention where contextualized activities (task) are used to provide learners with an opportunity to discover and collaborate construct meaning as the intervention unfold. Learners are unique, individual, and instructor act as facilitator rather than as teacher. Motivation for learning emphasizes the important of the learner being more active.

Von Glasserfed (1989) urged that the responsibility of learning should reside increasingly with the learners. Social constructivism thus emphasizes the importance of the learners being actively involved in the learning process, unlike previous educational viewpoint where the responsibly rested with the instructor to teach and where the learner

played a passive, receptive role. Von Glasserfed emphasizes that learners construct their own understanding and they do not simply mirror and reflect what they read. Learners look for meaning and will try to find regularity and in order in event for the world even in the absence of full or complete information.

This link up with vygotsky's "zone of proximal development" (vygotsky, 1978) where learners are challenged within class proximal to, yet slight above, thus current level of development by experiencing the successful completion of challenging task, learners gain confidence and motivation to embark on more complex challenges.Another crucial assumption regarding the nature the learner concerns the level and source of motivation. According to Von Glasserfed, sustaining motivation to learn is strongly dependent on the learner's confidence in his or her potential for learning. These feelings of competence and belief in potential to solve new problems and derived from first-hand experience of mastery of problems in the past one are much more powerful than any external acknowledgement and motivation (Prawet and Floden, 1994). Learning principle propels learning process (Baser feld, 1995). The role of the instructor is very important in learning process. According to the social constructivist approach, instructor has to adapt to the role of the facilitator and not teachers. Where a teacher gives a didactic lecture which covers the subject matter, a facilitator helps the learners to get to his or her own understanding of the content. In the former scenario the learners plays a passive role and in the late scenario the learners plays an active role in learning process. A teacher tells, a facilitator asking a teacher lecture from the front, a facilitator provides guidelines and creates the environment for the learners to arrive at his or her own conclusion; a teacher mostly give a monologue, a facilitator is in continuous dialogue with the learners (Rhode and Bellamy, 1999). The emphasis thus turns away from the instructor and the content, and toward the learner. This dramatic change of the role implies that a facilitator needs to displays a totaling different set of skills than a teacher (Brown stein, 2001). A facilitator should be able to adapt the learning experience, 'in mid-air' by using his or her own initiative in order to steer the learning experience to where the learners want to create value. The basic principle that underlines effective learning from researches conducted from different disciplines is as follows:

1. Pupils' prior knowledge can help or hinder learning; pupils come into courses with knowledge, beliefs and attitudes gained in the other courses and through daily life. As

pupils bring this knowledge to bear in our classrooms, it influences how they filter and interpreted what they are learning. If pupils' prior knowledge is robust and accurate and activated at the appropriate time, it provides a strong foundation for building new knowledge. However, when knowledge is inert, insufficient or the task, activated or incorrect, it can interfere with or impede new learning.

2. How pupils organize knowledge influence how they learn and apply what they know; Pupils' naturally make connection between pieces of knowledge. When these connection form knowledge structures that are accurately and meaningfully organized, pupils' are better able to retrieve and apply the knowledge effectively and efficiently. In contrast, when knowledge connected inaccurate or random ways, pupils can fail to retrieve or apply it appropriately.

3. Pupils motivation determines, directs and sustain what they do to learn; As pupils enter college and gain greater autonomy over what, when and how they study and learn how motivation plays a critical role in guiding the direction, intensity, persistence, and quality of behaviors in which they engage. When pupils find positive value in a learning goal or activity, expect to successfully achieve a desired learning outcome, and perceive support from their environment they are likely to be strongly motivated to learn.

4. To develop mastery pupils must acquire component skills and knowledge necessary to perform complex tasks, they must also practice combining and integrating them to develop greater fluency and automaticity.

5. Finally, pupils must learn when and how to apply the skills and knowledge they learn. As instructors, it is important that we develop conscious awareness of these elements of mastery so as to help our pupil learn more effectively.

6. Goal directed practiced coupled with targeted feedback enhance the quality of pupils' learning; learning and performance are best fostered when engage in practice that focuses on a specific goal or criterion targets and appropriate level of challenge and is of sufficient quality and frequency to meet the performance criteria. Practice must be coupled with feedback that explicitly communicate about some aspect(s) of pupil's performance relative to specific target

criteria, provide information to help pupil progress in meeting those criteria, and is giving at a time and frequency that allows it to be useful.

7. To Pupilscurrent level of development interacts with the social emotional and intellectual climate of the course to impact learning. Pupil is not only intellectual but also social and emotional being and they are still developing the full range of intellectual, social and emotional skill. While we cannot control the developmental process, we can shape the intellectual, social, emotional and physical aspect of classroom climate in developmentally appropriate ways.

8. Infect, many studies have shown that the climate we create has implication sin our pupils. A negative climate may impede learning and performance, but a positive climate can energize pupils' learning.

9. To be sets directed, pupils must learn to monitor and adjust their approaches to learning; learner may engage in a variety of meta cognitive process to monitor and control their, accessing the task at hand, evaluating their own strengths and weaknesses, planning their approach, applying and monitoring various strategies and reflecting on the degree to which they can't approach in working. Unfortunately, pupils tend not to engage in this process naturally. When pupil develops the skill to engage this process, they give intellectual habit that not only improves their performance but also their effectiveness as learners.

2.11 Gender and Performance in Numbers

The females' under-representation in formal education can be seen as an ancient problem which was with the common belief that females are considered equally talented as males for working in mathematics (Fennema, 1980). Although Fennema's finding was relative to a certain population, it could be extrapolated to a broader population since there is a worldwide convention that girls are not interested in participating in mathematics and its related fields. Though, this aspect is of extreme importance and hence it is recognized that a strong mathematical background is prerequisite to many career and job opportunities. Therefore, the aim of this study is to explore possible gender based differences in pupils' attitude toward mathematics.

Although, Forgasz and Leder (1996) noted that the relative literature reveals inconsistent finding, other researcher such asFennema (1985) and Kimball (1989) Peterson and found that general development of gender differences in mathematics are related to teacher behavior and classroom climate.Bali, (1989) in a study of pupils' performance in mathematics essay and objective types question found that there was no significant difference between the performance of boys and girls in both essay questions. This study is an attempt to explore further areas of primary mathematics, which can be tutored by means of construct method. And, in addition Fennema et al. (1990), stated that one component of the external influences, which may affect the development of gender related differences in mathematics would be the teacher influence on both pupils' internal motivational beliefs and on pupils' participation in classroom learning activities. On one hand, (1990a) stated that the overall impression conveyed by the data from her study career out in Australia, suggested that boys and girls were treated differently in mathematics lessons. In fact there have been other studies (e.g.,Koehler, 1990 andLeder,1990b), Leder, 1993; Leder, 1996; Cassy, 2002 indicating that males and females are not treated equally in the mathematics classroom, with females being disadvantaged, as mathematics teacher interact more with boys than with girls. Thus, compared with females, males have been found to receive more assistance and have their work monitored more often. The same authors underlined the evidence that teachers have interact more frequently with boys than with girls. However, other authors, (Peterson and Fennema, 1985Peterson and forgasz, 1990; and Fennema et al, 1990), claim that the impacts in the way teacher interacts with their pupils, and therefore its influence on pupils' participation inFennema and Hart, (1994) argued that in USA the gender-differences in mathematics may be decreasing and that an intervention is a need for achieving equity in mathematics education. Meanwhile, classroom should be one of the components of the external influences which contribute to the development of gender differences in the learning of mathematics and in attitude towards mathematics. Therefore, in view of relevant research report regarding the affective variables, several authors such as Midgley, Feldlsufer and Eccles (1989), Leder (1990a), Relich (1996), Middleton and spanias (1999) noted that the pupils' decline in positive attitudes towards mathematics could be explained in part as a function of teacher supportiveness and the classroom environment. This role of the mathematics teacher was widely examined in their studies (Fennma and Hart, 1994; Fennema, 1996; and Middleton and spanias, 1999), and most of the result lead to the conclusion that

pupil a tend to attribute their reaction to bad experiences for which they blame teachers. In fact in a study by Forgaszs (1995) examining the link between pupils' attitudes to mathematics and their perceptions of classroom environmental factors in co-educational school found that teachers' variables were stronger indicators of mathematics attitude for males than females.

2.12 Overview of Related Studies

The chapter has provided some detailed information on the theoretical and practical studies of similar studies conducted. It has specifically looked at conceptual framework of the study, impacts of other teaching strategies, and gender achievements in the teaching of mathematics and Cuisenaire-rod and the impacts of teaching strategies on the pupils' retention abilities. This is with the solid aim of making Cuisenaire-rods contributions and recommendations on the teaching strategy that should be used in teaching primary school mathematics. Thus from the foregone, it is evident that there were still some mixed feelings on the magnitude of gender difference in learning mathematics in school almost as a general problem.

Luke (2012), conducted the study to ascertain the impact of manipulative on the accurate completion of money word problems. Three populations were included: adults who struggle with numeracy (n = 20), children with a learning disability (n =20), and children who are typically developing (n = 23). Participants were administered a measure of 10 money word problems and were asked to solve them without the use of manipulative. Participants were then randomly assigned to one of two groups: perceptually rich and perceptually bland manipulative. Results indicate that none of the participants performed better with manipulative than they performed without manipulative. There was an interaction of Condition x Type of participant with the participants with a learning disability in the bland condition performing significantly worse than the other participants. More research is

warranted to understand the impact of manipulative use in mathematics instruction for adults who struggle with numeracy, children with a learning disability, and children who are typically developing.

Trudge (2016), conducted the study and determine the effectiveness of using Cuisenaire-rods to Develop the Concept of Equivalence with Year 1 Children. The results of the study showed that the rods can promote an awareness of equivalence through the process of selecting and moving them. The rods gave the children a model for visualizing and understanding abstract concepts such as the deeper structures and rules of equivalence. When the children were given opportunities to "free write" what they had learnt with the rods, with no constraints on what or how to record, they demonstrated they were capable of mastery of a much deeper understanding of what the equals sign means and wrote complex equations of equivalence involving brackets, all four operations and fractions as an operator. Children's knowledge of the mastery of deeper structures when using the rods can become really powerful when they can move fluently between different representations of equivalence; moving from manipulation of the rods to writing abstract equations using the algebra of letter names for the rods and their composition.

Pager (2013), conducted the study on the impacts of a Grouping by Tens Manipulative on Children's Strategy Use, Base Ten Understanding and Mathematical Knowledge. Children in the Transformation group used a manipulative that transformed from a unitized to a continuous model, while children in the Unitized group used a manipulative that remained discrete. Researchers recorded children's strategy use and accuracy when determining how many objects appeared on the screen, and the data were examined micro genetically. Children's counting on abilities, base ten understanding, and number sense were tested at post-test to examine group differences. The results showed that using the transforming

manipulative significantly improved children's ability to count on at posttest. The math software also improved girls' base ten understanding at post-test. Children who used the math software in both conditions improved in their advanced strategy use and accuracy over time. These findings suggest that virtual manipulative have the potential to improve children's strategy use and base ten understanding in ways that physical manipulative may not. An important reason why children, especially in non-Asian countries, may struggle with base ten understanding is because of difficulties posed by language. Research shows that children in English-speaking countries struggle to understand place value even when they can enumerate and count to high numbers, especially compared to children in Asian countries.

Mix (2010) delineates four mechanisms through which manipulative may aid children's learning: by *generating actions*, acting as *conceptual metaphors*, *offloading intelligence*, and *focusing attention*. Mix's notion of "generating action," or providing children with something to act upon, is supported by research on embodied cognition and physically distributed learning, which highlight the iterative, co-evolving relationship between actions, thinking, and memory on the impacts of using toy manipulative to act out story events. Second graders in their study who used toys or imagined using toys to enact what they read showed significantly better inference skills and memory of the stories compared to children who were not instructed with manipulative. Mix (2010) distinguishes between two types of conceptual metaphors, which both may be responsible for why children learn from manipulative. *Grounding metaphors* emerge, often spontaneously, from direct experience with objects, for instance, when one learns about the concept of containment or subsets through playing with various types of containers and objects (Mix, 2010). Working with base ten manipulative may offer children a new grounding metaphor for the compositional nature of numbers (i.e. 10 ones blocks are the same size as 1 tens rod). This metaphor could have

important impacts on children's ability to learn about place value. *Linking metaphors* emerge through formal instruction and are used to bridge different domains together. For instance, teachers may help children see that proportional base ten blocks offer insight into the relationship between numbers and space. Finally, Mix (2010) argues that manipulative may promote learning because of their ability to offload intelligence and focus attention.

Martin & Schwartz (2005) studied the ways that actions impact conceptual understanding in the realm of mathematics. They found that fourth grade students who were given the opportunity to move around pie pieces and tiles gained better understanding of fraction concepts than those who were only able to look at these pieces. Importantly, they note that the process of moving the pieces around itself, and not an initial understanding of fractions, led children to gain insight into the underlying concepts (Martin & Schwartz, 2005). Taken together, these studies suggest that action, real or imagined, is effective in encouraging children's conceptual learning and thinking. Because manipulative provide material for children to act upon mathematical ideas, they are potentially useful tools to support mathematics learning. The supposition that manipulative offload intelligence is based in literature on situated cognition, which stresses the important function of the environment in cognitive tasks. Manipulative can ease the cognitive demands of a task for children, by providing scaffolds and making goals more attainable. For example, a base ten 100's block allows children to perceive "100" without requiring children to count out 100 unit blocks, an extremely laborious, error prone task.

In view of the implications, it showed that their findings are inconclusive. Therefore, it is the interest of this study to use the Cuisenaire-rods techniques to find the effectiveness of Cuisenaire-rods strategy on remediating errors in addition and subtraction of numbers among primary school pupils', Kaduna state.

2.13 Implications of LiteratureReviewed on the Study

Fennema (1972) summarized research on the use of Cuisenaire-rods to teach arithmetic's compared to more traditional approaches. She found that research generally supported the use of the manipulative for the first-grades, but that the value of the rods for second and third-graders was less conclusive. The use of manipulation in teaching mathematics has become as almost common place as the use of textbooks. And with good reason, as both so well (1989) Ruzic and O'Connell (2001) found that the long-term use of manipulative has a positive impacts on pupil achievement by allowing pupils to use concrete objects to observe, model, and internalize abstract concepts. Manipulative not only allow pupils to construct their own cognitive models for abstract mathematical and processes. It also provides a common language with which to communication these models to the teacher and other pupils. Much research in to the use of manipulative and their benefits to children has been conducted over the years. Although some researchers have questioned the value of manipulative in teaching mathematics (e.g., Friedman, 1978: Raphael and wahlstrom, 1988). Research has demonstrated that manipulative generally have positive impacts on pupils achievement and mathematical learning compared to more traditional instructional methods that place a heavy emphasis on the use of worksheets and computational fluency.

Fennema concluded. "There is some indication that children learn better when the learning environment includes a predominance of experiences with models suited to the children's level of cognitive development." Her recommendations were that teachers use manipulative to teach math's in the early grades and then gradually decrease their use as pupils are able to grasp concepts more symbolically. Parham (1983) analyzed 64 research studies in to the use of manipulation at the elementary level. Generally, she found that there were significant positive differences in achievement of pupil who had used manipulation as part of their math instruction compared to those who had not. Marsh and Cooke (1996) analyzed the impacts of using manipulative (Cuisenaire-rods) in teaching third grade learning disabilities pupils to identify the correct operations to use when solving math word problems. After using the manipulative, pupils showed statistically significant improvements in the ability to identify and use the correct operations to solve the problems

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The chapter explains the methodology used in the investigation of the study. It is organized according to the following sub-headings.

- Research Design
- Population of the Study
- Sample and Sampling Techniques
- Instrumentation
- Validation of the Instrument
- Pilot Testing
- Reliability of the Instrument
- Administration of the Treatment
- Procedure for Data Collection

3.2 Research Design

The quasi experimental research method was applied in carrying out the research, the study employed pretest, posttest control design. The choice of this design was based on the fact that it controls researcher's biasness inrandomization of groups, since there was need for randomization of the subject into groups (Usman&Nwoye, 2010). In thisstudy, two (2) intact classes were involved in the design. One class was randomly assigned to the experimental group while the other class was assigned as control group. Before instruction started, both groups took a pre-test in order to establish whether the entry level of the subjects in both groupsdiffers or not. The addition and subtraction topics were taught to the experimental group using Cuisenaire-rods and the control groups were taught the same lesson usingtraditional lecture method. A day after the last lesson for the two groups, a post-test was taken by both groups and measured their level of errors performance, due to the type of instruction received. In order to control the extraneous variable like teaching quality deference, regular mathematics teachers of the classes and the researcher involved in the study, the researcher himself marked the examination scripts of the various classes. In this study, the independent variables are; teaching method and gender, while the dependent variable was pupils errors performance.

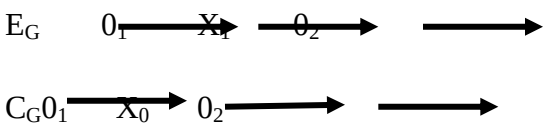


Figure 3.1 Research Design Illustrations.

KEYS:

E_G = Experimental Group

C_G = Control Group

0_1 = Pre-test

0_2 = Post-test

X_0 = No treatment (Using Conventional Lecture Method)

X_1 = Treatment (using Cuisenaire-rods)

3.3 Population of the Study

The target population of the study comprises of 2,328 class two pupils of the public primary schools within the total number of 296 public primary schools inLere local governments Kaduna State. All the public primary schools are coeducational. However 1,271 are boys and 1,057 are girls and there are 80 public primary schools within the two educational districts.

Table 3.2 showed the distribution of schools and the total enrolment of both male and female pupils.

S/N	Location	No.ofSchools	Male	Female	Total
1	Saminaka	35	621	539	1160
2	Lere	45	650	518	1168
	Total	80	1,271	1,057	2,328

Source:(SUBEB,Lere educational Authority)

3.4 Sample and Sampling Techniques

Simple random sampling techniques using balloting method was used in selecting two coeducational primary schools within the two (2) educational districts in Lere local government. One of the schools was also randomly selected as the experimental groupwhile the other as the control group. A sample size of 220 primary school two (2) pupils consisting of (124) males and (96) females were used for the study. The experimental group was taught using Cuisenaire-rods strategy (C R S) while the control group was taught using conventional lecture method.

Two intact classes were randomly selected for the study. After shaking the 2 papers very well in a container, a paper was picked for each school. This result was used to place the classes into either experimental group (Cuisenaire-rods) or control group (traditional lecture method). Thus, the total sample for the study were220primary two pupilsand were viable for the study based on the suggestions that if parametric tests are to be employed 30-500 subjects would be the necessary sample size(Ross,2004).

Table 3.3 Summary of the sample selected for the study

S/N	Group	Male	Female	Total
1	Experimental	68	56	124
2	Control	56	40	96
	Total	124	96	220

3.5 Instrumentation

One instrument and one method of teachingwere used for the study(one instrument for data collection and onefor teaching the subject) as follows:

i. Primary Mathematics Errors Remediating Test(PMERT)
ii. Paired Cuisenaire-rod Strategy (PCRS)

3.5.1 Primary Mathematics Performance Test (PMPT)

A draft of 50 test items for pilot testing was developed by the researcher out of which 25 items emphasize subtraction and the other 25 items emphasize addition were selected from the primary mathematics errors performance test (PMEPT). The test covered the behavioral objective of the research topics extracted from the mathematics curriculum for the study. The test is a multiple choice objective with four alternatives for each question (See Appendix C)

3.5.2 Paired Cuisenaire-rods Strategy (PCRS)

Paired Cuisenaire-rod strategy (PCRS) adapted from Kurumeh and Anchor (2008) for this study. In this Cuisenaire-rods teaching strategy, the teacher explained a concept for a short period of time, and then pose a problem for the class to solve. Pupil was required to solve the problem individually and discuss similarities and differences in groups. Explain below are the step involved in this method and it is also shown diagrammatically in figure 3.4.

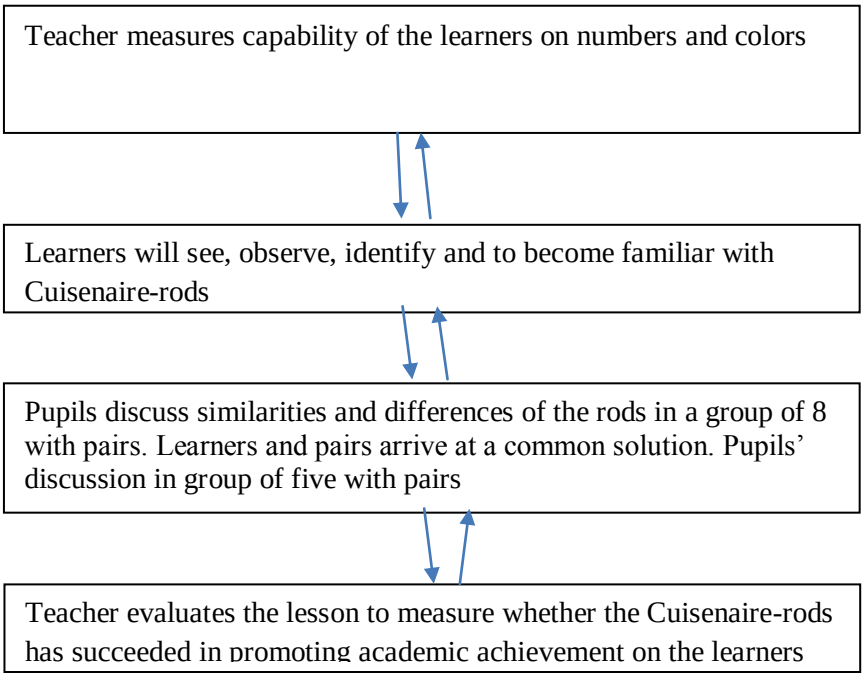


Figure3.4: Flow chart of paired Cuisenaire-rods Strategy step adapt from Kurumeh and Anchor, (2008).

Step 1: the teacher introduced the lesson by asking the pupils question relevant to the concepts were taught. The step measured the capability of the learners on numbers and colors.

Step 2: the teacher introduced the pack of Cuisenaire-rods to pupils and gives brief explanation on the concept. The objective of this step is to make pupils see, observe the concept and to become familiar with Cuisenaire-rods

Step 3: pupils were presented with the rods of varying length with different colorandwere asked to sort out the rods according to colors and size. Pupils will discuss similarities and differences of the rods with a partner sitting next to him / her. The objective of this step is to encourage all members that are involved in the study to participate actively in class activities. It will also encourage them to accept the view of others while doing group work.

Step 4: teacher will evaluate the lesson by asking pupils questions and concludes the lesson by revising the main points of the lesson. The objective of this step is to measure whether the Cuisenaire-rods have succeeded in promoting academic achievement on the learners. It will also assist the learner to listen to the view of other for a valid and reliable conclusion.

The treatment for the study involve exposing class six pupil addition and subtraction concept using Cuisenaire-rods strategy for experimental group and the lecture method for the control group respectively. The experimental group was taught for six weeks of one hour per week by the researcher. The topic taught was: addition of two digits number, subtraction of two digits numbers, word problem and place value while the control group were taught the same topic using lecture method for six weeks and two hours per week by the researcher. At the end of treatment the study subject both experimental and control group will be subjected to post test and later the scripts were mark and the mean score were subjected to statistical analysis.

3.6 Validation of the Instrument

The contents validity of the instrument was given two experience and qualified mathematics experts from Science Education Department ABU Zaria with minimum rank of Professor and Ph.D. This involves looking into the consistency between the test and content of the study topic. Copy of draft was given to each of them, who rated the questions and ensure their appropriateness for the class, age, level and simplicity of language expression for the pupils. The corrections were made leading to the final acceptance of the instruments.

3.7 Pilot Testing

The instruments were pilot-tested at school different from the school where the main research were conducted but have equivalent characteristics with the sample schools to test for the reliability

of instrument that were used for the study. Thirty (30) mathematics pupils participated in the pilot study, which were not part of the study sample but part of population of the study. Cuisenaire-rods mathematics achievement test instrument was administered twice using test-retest method, with two weeks interval as recommended by Tuckman (1975). Data obtained after the test, was analyzed using Pearson product moment correlation statistics. Data obtained after the pilot-test was used to determine; reliability coefficient of the instruments.

3.8 Reliability of the Instrument

The reliability of the instrument is the degree to which a test on repeated yields almost the same result when administered to subjects of similar characteristic (Nwargu, 1990 & Sambo, 2005) to determine the reliability of instrument PMERT test retest method was employed. The instrument was administered twice with interval of two weeks as proposed by Tuckman, (1975). Pearson Product-Moment Correlation Statistics was used for analysis. The reliability of Cuisenaire-rods mathematics errors performance test (PMERT) was found to be 0.72.

3.9 Procedure for Data Collection

The classroom teaching was for 6 weeks for all the classes involved. It was done by the research himself and the instructional timehour per week. The topics for the instruction are extracted from the syllabus for the primary school class two at the time of the study. The data for this study were collected using Cuisenaire-rods mathematics achievement test for the experimental group and lecture method for the control group respectively. The pre -test was done in order to determine the capability of the two groups in their ability level, addition and subtraction of numbers before the treatment administration. Experimental group were taught with the Cuisenaire-rods strategy while the control group were taught the same topic using conventional lecture method. At the end of the treatment a post test was administered to the experimental and control groups to determine whether the treatment has succeeded in promoting academic achievement in the subjects. The data was collected after marking the pupil's scripts and scores were recorded accordingly. The scores were divided in to two that of experimental group and control group. Also the scores were further divided base on urban and rural primary schools and gender that is males and females. After sorting out, the data were subjected to statistical analysis.

3.10 Procedure for Data Analysis

The data were collected from the instruments for the study. The four research questions were organized using descriptive statisticsof mean and standard deviations and the four null hypotheses were analyzedusing an independent t-test statistic. The pre-test and post-test scores of the control group were used as control measures to the post-test of the experimental group. Experiment levels of all the research hypotheses of the study were tested at 0.05 levels of significance.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND DISCUSSIONS

4.1: INTRODUCTION

In this chapter, the result obtained from data collected by using the instruments (PMERT and PCRS) administered as pre-test and post-testtest were presented, analyzed and discussed. This was done according to the raised research questions and the formulated hypotheses in chapter one. Mean and standard deviation were used and organized the research questions. In testing the hypotheses of the study, $\alpha = 0.05$ was adopted as level of significance and formed the basis for rejection or retaining all the null hypotheses. The t-test statistic was used to test all the hypotheses (H_{01}, H_{02}, H_{03} and H_{04}). The chapter was presented under the following sub-headings:

4.2 Data Presentation

4.3 Data analysis

4.4 Summary of the major findings

4.5 Discussions

4.2 DATA PRESENTATION

The data collected for this study were presented by usind the descriptive statistics of mean and standard deviation.

4.2.1 Research Questions

1. In what way, would Cuisenaire-rods strategy affects remediation errors of addition of numbers among primary schools' pupils in Lere local government, Kaduna state.The result was presented in Table 4.3

Table 4.3: Summary of the mean and standard deviation on remediation of errorsbythe Experimental and Control Groups on Addition.

GROUPS	N	Mean(m)	SD	Mean Difference
EXPERIMENTAL	84	68.48	16.24	23.86
CONTROL	54	45.62	14.72	

The result in Table 4.3,showed that the experimental group(m=69.48, S.D=16.24)while the control group(m=45.62, S.D=14.72) taught addition.This indicated that there was a statistically significance

difference in errors remediating between the experimental group and the control group.The mean difference between the experimental and the control group was 23.86.

2. To what extent would Cuisenaire-rods strategy affect remediation errors of subtraction of numbers among primary schools' pupils inLere local government area of Kaduna state?

To answer this question, mean and standard were used. The result was shown in Table 4.4

Table 4.4: Summary of the mean and standard deviation on remediation of errorsbytheExperimental and Control Groups on Subtraction.

Group	N	Mean(m) $\left(\overline{X}\right)$	SD	Mean Difference
EXPERIMENTAL	40	61.93	19.27	-2.35
CONTROL	42	64.28	19.19	

The result in Table 4.3, showed that the experimental group (m=61.93, S.D=19.27) while the control group(m=64.28, S.D=19.19) taught subtraction of numbers.This indicated that there was a statistically significance difference in errors remediating between the experimental group and the control group.The mean difference between the experimental and the control group taught subtraction -2.35.

3. What are the impacts of Cuisenaire-rods strategy on remediation errors of addition of number among male and female primary schools' pupils inLere local government area, Kaduna state?

.The result was shown in Table 4.5

Table 4.5:Summary of the mean and standard deviation on remediation of errorsbyMale and Female Pupils on the experimental group taught Addition of numbers.

GENDER	N	MEAN	SD	MEAN DIFFERENCE
MALE	43	66.35	17.52	-5.45
FEMALE	41	71.80	15.99	

Table 4.5, showed that the male(m=66.35, S.D=17.52) and female (71.80, SD=15.99) taught using Cuisenaire-rods Strategy(CRS).This indicated that Female in the experimental group had higher

meanwhen compared to their counterparts in the experimental group.The mean difference between the male and female pupils taught addition of numbers using Cuisenaire-rods Strategy (CRS) was -5.45.

4. What is the impact of Cuisenaire-rods strategy on remediation error of subtraction of numbers among male and female primary schools pupils inLere local government area of Kaduna state?

The result is shown in Table 4.6

Table 4.6:Summary of the mean and standard deviation on remediation of errorsbyMale and Female Pupils on the experimentaltaught Subtraction of numbers.

GENDER	N	MEAN $(\overline{X})$	SD	MEAN DIFFERENCE
MALE	43	60.53	13.52	-1.47
FEMALE	41	61.18	14.99	

Table 4.6, showed that the male(m=60.53, S.D=13.52) and female (m=61.18, SD=14.99) taught subtraction of numbers using Cuisenaire-rods Strategy(CRS).This indicated that Female in the experimental group had higher mean when compared to their counterparts in the experimental group. The mean difference between the male and female pupilstaught subtraction usingCuisenaire-rods Strategy(CRS) was -1.47.

RESULT ANALYSIS

The Result obtained from Cuisenaire-rods Strategy(CRS)was subjected to statistical analysis in order to retain or reject the null hypotheses.

All four (4) hypotheses formulated in this study were tested at 0.05 level of significant. The result were analyzed and presented below.

ANALYSIS OF PRE-TEST RESULT

Cuisenaire-rods Strategy(CRS) was administered to both experimental and control group before the commencement of the experiment to establish the equivalence of the two groups. The result was analyzed using t-test Statistics and tested at 0.05 level of significance and was presented in Table 4.7.

4.3: HYPOTHESES TESTING

The four hypotheses for the study were re-stated and tested at 0.05% level of significance as follows.

H_{01}: There is no significant difference in the remediation of errorsbetweenpupils taught addition of numbers with Cuisenaire-rods strategy and those taught using conventional method.

The summary of t-test was analyzed in table 4.5.

Table 4.5:Summary oft-test analysis of the mean Remediation of Errors scoresbythe experimental and control groups onaddition.

Group	N	Mean	SD	Df	t-value	p-value	Decision
Experimental	84	68.48	16. 24	225	10.99	0.00	Reject H_O
Control	54	45.62	14.72				

Significant at α=0.05

The result in table 4.5 showed the difference in the test scores between the experimental (N=84, M=68.48, SD=16.24) and the control group (N=54, M=45.62, SD=14.72) t=10.99, p=0.00 taught addition of numbers were statistical significant. This indicated that there was statistically significance difference in errors remediating between experimental group and the control group.

H_{o2}: There is no significant difference in the mean remediation of errors scoresbetweenpupils taught subtraction of numbers with Cuisenaire-rods strategy and those taught using conventional method

The summary of t-test was analyzed in table 4.6

Table 4.6:Summary of t-test analysis of the mean remediation of Errors scores by the experimental and control groups on subtraction.

Group	N	Mean	SD	Df	t-value	p-value	Decision
Experimental	40	61.93	19. 27	143	-0.73	0.47	Retain

Control	42	64.28	19.19				H_O

Significant at α=0.05

The result in table 4.6 showed the difference in the test scores between the experimental (N=84, M=61.93,SD=19.27) and the control group (N=54, M=64.28, SD=19.19) t= -0.73, p=0.47 taught subtraction of numbers were statistical significant. This indicated that there was statistically significance difference in errors remediating between experimental group and the control group.

H_{o3}: There is no significant difference in the remediation of errorsbetween males and females' pupils taught addition of numbers withCuisenaire-rods strategy

The summary of the t-test was analyzed in table 4.7

Table 4.7:Summary oft-test analysis of the mean remediation of Errors scores by the male and female pupilson addition.

GENDER	N	Mean	SD	Df	t-value	p-value	Decision
Male	43	66.35	17.52	143	-1.94	0.055	Retain H_O
Female	41	71.80	15.99				

Significant at α=0.05

The result in table 4.6 showed the difference in the test scores between the experimental male (N=43, M=66.35, SD=17.52) and experimental group female (N=41, M=71.80, SD=15.99) t= -1.94, p=0.06 taught addition of numbers were statistical significant. This indicated that there was statistically significance difference in errors remediating between experimental group and the control group.

H_{o4}: There is no significant difference in the mean remediation of errors scoresbetween males and females' pupils taught subtraction of numbers with Cuisenaire-rods strategy

The summary of t-test was analyzed in table 4.8

Table 4.8:Summary of t-test analysis of the mean Remediation of Errors scores by the male and female pupils on subtraction.

GENDER	N	Mean	SD	Df	t-value	p-value	Decision
Male	25	60.53	13.52	38	-0.12	0.45	Retain

Female	15	61.18	14.35		H_O

Significant at α=0.05

The result in table 4.8 showed the difference in the test scores between the experimental male (N=43, M=60.33, SD=17.513.52) and the experimental group female (N=41, M=61.18, SD=14.35) t= -0.12, p=0.45 taught subtraction of numbers were statistical significant. This indicated that there was statistically significance difference in errors remediating between experimental group and the control group.

4.4: SUMMARY OF THE MAJOR FINDINGS

Based on the data analyzed in the study, the following were the major findings:

1. Pupils taught Additionusing Cuisenaire-rods strategy committed fewer errors significantly betterthan the pupils taught using conventional method. The result revealed that the experimental group committed less error than the control group.
2. Pupils taught Subtraction using Cuisenaire-rods strategy committed fewer errors significantly better than the pupils taught using conventional method. The result revealed that the experimental group committed less error than the control group.
3. Female pupils exposed to Cuisenaire-rods strategy have committed less error than the males taught addition of numbers.
4. Furthermore, finding from the study revealed that, Female pupils taught subtraction using conventional methodshave committed less errors than the males taught same Subtraction of numbers.

4.5: DISCUSSIONS

The study indicated the existence of significant difference between the errorsremediation of pupils taught using Cuisenaire-rod strategy and those taught using conventional lecture method in favor of those exposed to Cuisenaire-rod strategy as shown in the Table 4.5. This implies that Cuisenaire-rod strategy was more effective than the conventional method of teaching mathematics. This resultfurther supports that Cuisenaire-rod strategy could help to enhance pupils'understanding of Cuisenaire-rod strategy in mathematics more than the conventional lecture method.

As the learners progress from one manipulative representation to the others, they learn and understand important mathematics concept and develop abstract and logical thinking. Endless opportunities are presented to investigation and reinforce key mathematics topics and ask question free without fair. Those lesson involved cooperation, collaboration and individual work (Moyers, 2001). Studies carried out on the approach revealed pupils taught using this approach rapidly acquired problem solving skills, over a two month period and transferred these skills to a paper and pencil solving format (Case et.al. 2003).

The result of the study Table (4.7) revealed that there was difference in the test scores between experimental group male andexperimental group female's pupils exposed to CRS.However, (Fennema and Hart, 1994) argued that in USA the genders difference in Mathematics may be decreasing and that an intervention is a need for achieving equality in Mathematics education. Meanwhile, other authors (Forgasz, 1995, Fennema and Peterson, 1985), claim that the impacts in the way teachers interact with their pupils, and therefore its influence on pupils participating in classroom should be one of the component of external influence which contributes to the development of gender difference in learning Mathematics and in attitude toward Mathematics.

The result of the study Table (4.8) revealed that there was difference in the test scores between experimental group male and experimental group female pupils taught subtraction using CRS.

ToBebeze (2005) when new work is introduced to pupils it must be done in such a way that they will understand what they are learning. Activities should be organized to help think not result for them. According to Beneze (2006) Pupils need use and test idea, skills though relevant activities. This is a concrete experience of abstract idea that has been presented to the learners. Finally, learners do not mean receiving and remembering transmitted message instead educational research must offer compelling evidence that pupils learn Mathematics will only when they have constructed their own understanding. Assessment is very important in all learning experience.

According to Holt and Willard Holt (2000) emphasize the concept of dynamic assessment, this is a way of assessing the true potential of learners that most differ significantly from conventional test. Here the assessorial interactive nature of learning is extended to the process of assessment. Rather viewing assessment as a process carried out by one person, such as instructor, it is seen as a two way process involving interaction between both instructor and learner.

In addition, Fennema et.al,(1990) stated that one component of the external influence which may affect the development of gender related difference in Mathematics would be the teacher influence on both pupil's internal motivation belief and on pupil participation in classroom learning activities

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

The main objective of this study is to determine the impact of Cuisenaire-rod strategy on performance and way of remediating error in addition and subtraction of numbers among primary school pupils inLere local government Kaduna State. The chapter contains the summary, conclusions as well as recommendations based on the findings of the study. It also highlighted contribution of the studies to knowledge. Finally, suggestions for further studies were made.

5.2. SUMMARY OF THE STUDY

The goal of the study is to determine the impact of Cuisenaire-rods strategy on remediating errors in addition and subtraction of numbers among primary school pupils inLere local government Kaduna State, Nigeria. The independent variable in the study was teaching method while the dependent variables were errors performance and gender was an intervening variable in the study.

1. The result of the study revealed that experimental group taught Addition committedfewer errors than the control group.
2. The result of the study revealed that experimental group taught subtraction committed fewer errors than the control group.
3. Female pupils have committed fewer errors than the males taught addition of numbers.
4. Female pupils taught subtraction committed less errors than the males taught same

5.3. CONCLUSIONS

1. Thefavoredpupils taught by Cuisenaire-rods Strategy committed less error than those taught by conventional method, therefore it was concluded that Cuisenaire-rods Strategy haveeffectively enhanced and improvedpupils' academic performance in addition and subtraction of numbers.
2. Cuisenaire-rods Strategy proved to be more effectivein remediating errors on addition and subtraction of numbers than the convectional lecture method. This is based on the findings that experimental group committed less errors scores than the control group.

3. Cuisenaire-rods strategy could be employed to reduce the errors committed byfemale's pupils in addition and subtraction of numbers, so as to bridge the gap in mathematics performance between boys and girls. This is based on the findings that gender was a factor in learning Cuisenaire-rods Strategy.

5.4 RECOMMENDATIONS

In order to improve academic performance using Cuisenaire-rods Strategy, the following measures were recommended.

1. Mathematics teachers should be trained on effective procedure for implementing Cuisenaire-rods Strategy in their class rooms. This will reduce the errors committed by pupil in addition and subtraction of numbers.
2. Mathematics educators, professional associations in mathematics as well as mathematics text books developers should incorporate Cuisenaire-rods Strategy in their future publications for enhanced pupils' academic performance and retention of mathematic concept.
3. Mathematics teachers at primary school level should be using Cuisenaire-rods Strategy in their lesson. This will help to close the existing gap in mathematics errors between boys and girls and even make girls better achievers in mathematics.
4. Suitable environment for effective implementation of Cuisenaire-rods Strategy should be provided in primary schools. This can be inform of provision of special class rooms procurements of class room furniture suitable for group work and provision of group reward materials.

5.5 CONTRIBUTIONS TO KNOWLEDGE

Mathematics generally and Cuisenaire-rods Strategy in particular is perceived by pupils as a difficult area, leading to poor performance. This is because teachers use ineffective methods which encourage rote learning. This study has proved that when Cuisenaire-rods Strategy are presented to pupil, their understanding of mathematical concept can be enhance which in turn could lead to a positive change in the pupils' performance and perception of Cuisenaire-rods Strategy.

Moreover, pupils turn out to be in confusion when they discover they could not recall what they were taught before. Ability to recall past experience use the recalled experience to reconstruct new knowledge is needed in any meaningful learning. This study has proved that pupils could be helped to

retain Cuisenaire-rods Strategy concept. They removing confusion pupils find themselves due to poor retention of learnt concept. This in turn could make mathematics teaching easier for the teachers since pupils can recall learnt material to solve other novel problems independently.

Furthermore, the gap between males and females in mathematics errors performance has remained a source of concern among mathematics educators. The gap has gone to the extent that females regard mathematics an exclusive area for males only. This study helps in providing the use of Cuisenaire-rods Strategy in mathematics leading to the fact that female can even perform better than the males when mathematics teachers use Cuisenaire-rods Strategy.

5.6 SUGGESTIONS FOR FURTHER STUDIES

1. Studies in which Cuisenaire-rods Strategywere used for a longer duration should be conducted to determine whether pupil'scommit fewer errorswith additional experience using the strategy (C R S).
2. Further studies should focus on comparing between Cuisenaire-rods Strategy and other learning strategies in order to determine whether other learning strategy can equally enhance pupil's to commit fewer errors in addition and subtraction of numbers.
3. Similar studies should be carried out using lager sample than the sample size used in the study.
4. Similar studies should be carried out at other part of Kaduna state and other states.

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APPENDIX A

LESSON PLAN FOR EXPERIMENTAL GROUP

Sequential lesson plans were developed by the researcher for the use by the regular mathematics teachers who are the research assistants for uniformity. The lesson plan for each objective is prepared and the research assistant matches them to their respective instructional guide. The topics are broken down into achievable behavioral objective. Table 3.5 provides this information. The lesson plans are given to two mathematics inspectors and two experience classroom teachers for validation. They are required to examine the following aspects.

1. Clarity and appropriateness of the lesson objective for the pupils.
2. Conformity of the instructional method and appropriateness of the lesson
3. Relevance of the pupil's activities and evaluation question for the instructional materials.

Their comments and correction were used to modify the lesson plans. These are in appendix?

LESSON ONE

Group: Experimental group

Class: Primary five (5)

Number of pupils: 40

Subject: Mathematics

Topic: questionnaire rods pack

Time: 40 minutes

Description of the Cuisenaire rods according to colour and length

are as follows:

White Rod  Represent 1

Red Rods  Represent 2

Light green Rods  Represent 3

Pink Rods  Represent 4

Yellow Rods epresent 5

Dark Red Rods epresent 6

Black Rods resent 7

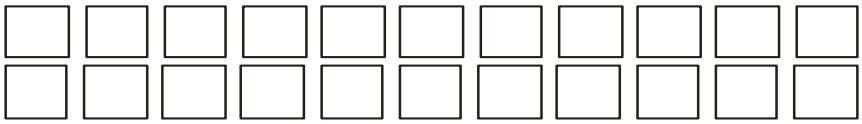
Brown Rods esent 8

Blue Rods esent 9

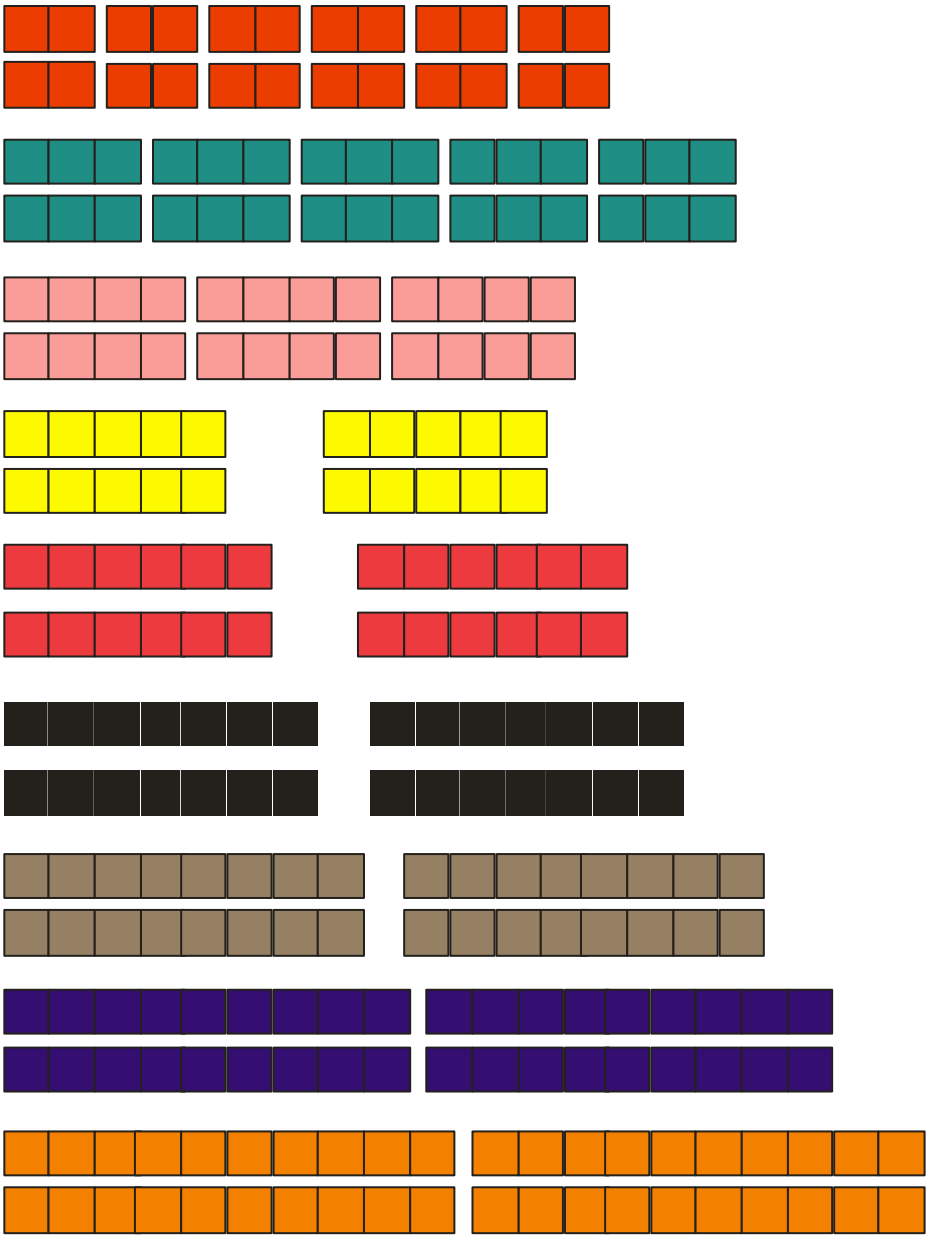
Orange Rods esent 10

Step 5: The pupils will be given some problems to solve;

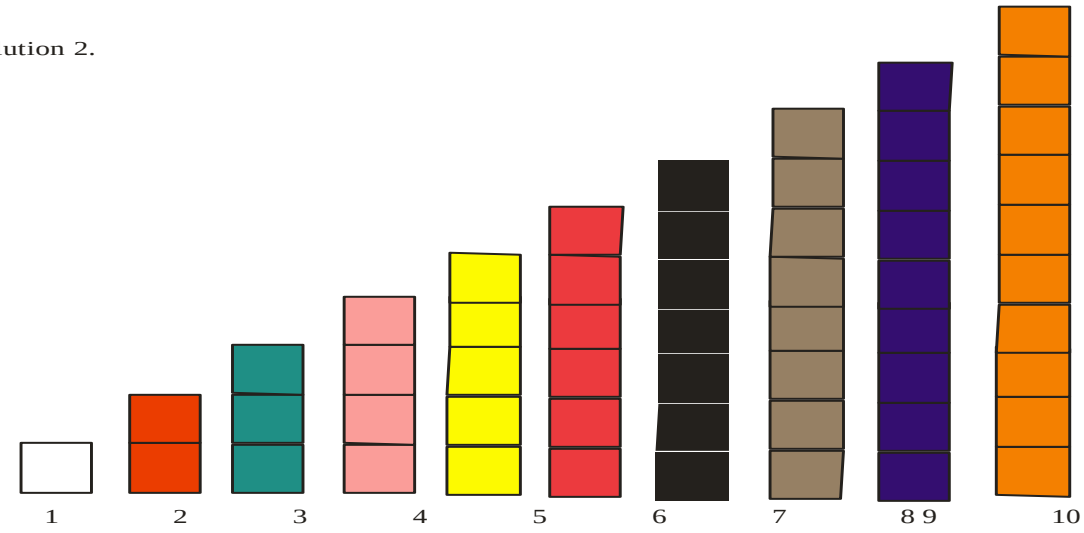
1. Sort the rods according to their color.
2. classify the rods according to their size.
3. What each group of the rods represents.

Solution1. 

White Rod



Solution 2.



White Rod — Represent 1

Red Rods — Represent 2

Light green Rods — Represent 3

Pink Rods — Represent 4

Yellow Rods — Represent 5

Dark Red Rods — Represent 6

Black Rods — Represent 7

Brown Rods — Represent 8

Blue Rods — Represent 9

Orange Rods — Represent 10

Evaluation: The teacher evaluates the by asking the pupils questions

i. How many rods are there in the pack?

ii. How many color of the rods are there in the pack?

Iii. Who can tell what each rods represent?

Iv. Who can sort the rods into groups?

Conclusion: The teacher conclude the lesson by revising the main points of the lesson.

LESSON TWO

Group: experimental group
Class: Primary five (5)
Number of pupils 40
Subject: mathematics
Topic: Cuisenaire rods pack
Time: 40 minutes
Instructional materials: Cuisenaire rods pack of varying lengths and with different colors
Behavioural objectives: At the end of the lesson pupils should be able to:

I. Identify the number of rods in the groups
II. Read the number according to the rods colors

Previous knowledge: pupils have an idea of the rods
Introduction: The teacher introduce the lesson by asking questions

I. What is Cuisenaire rods?
II. How many colors are there in the pack of Cuisenair e

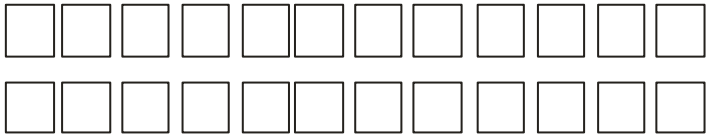
Solution: i. Cuisenaire rods is an excellent representation which is concrete, physical objects, which one can see, touch, manipulate in the class.

Ii. Cuisenaire rods pack consist of 10 different colors.

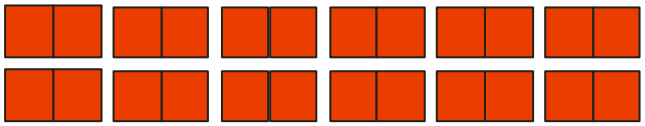
Presentation:

step I: The teacher would show to the pupils the various groups of rods and the number they represents.

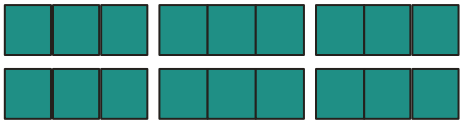
Twenty two (22) white rods



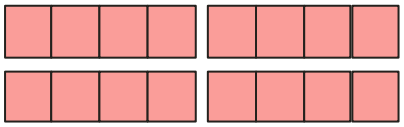
Twelve (12) red rods



Six (6) light green rods



Four (4) pink rods

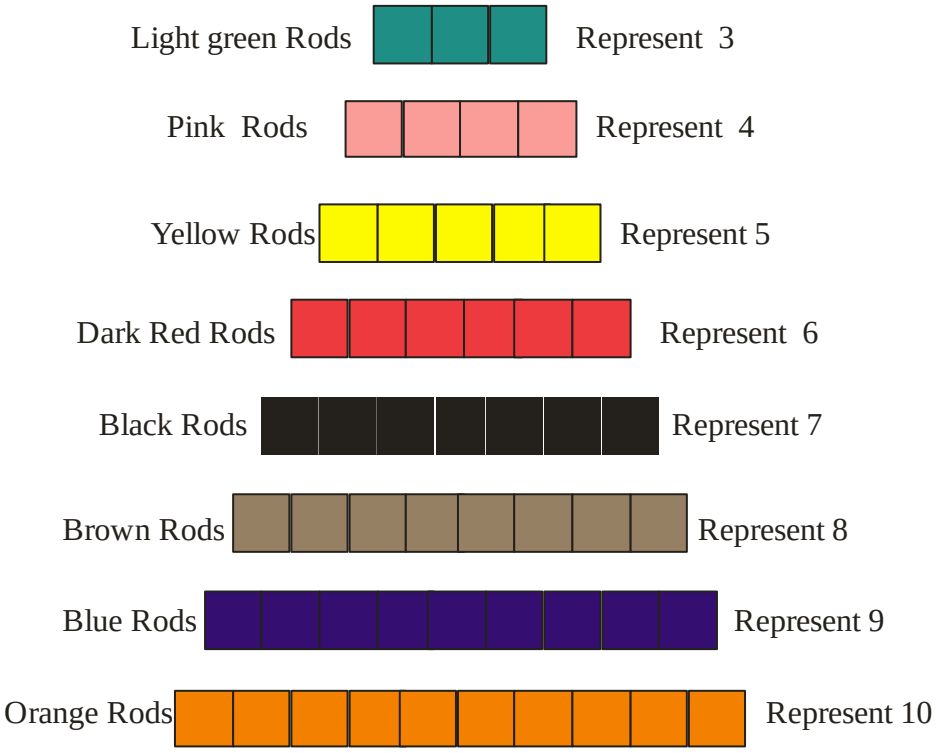




Step II :Teacher would read the number each rods represents according to their colors

White Rod  Represent 1

Red Rods  Represent 2



Evaluation : The teacher evaluations the lesson by asking the pupils questions

I. white rods represent which number?

II. Who can identify the number of rods in each group?

III. How many orange rods are there in the Cuisenaire pack ?

Conclusion: The teacher conclude the lesson by rivising the main points of the lesson.

LESSON THREE

Group: Experimental group

Class: Primary five (5)

Number of pupils: 40

Subject:: Mathematics

Topic: Addition of single digit numbers using rods

Time : 40 minutes

Instructional materials: Cardboard, Paints, Colors and Cuisenaire rods pack of varying length and with different colors

.Behavioural objectives : At the end of the lesson pupils should be able to :

I. Add single digit number (using rods)

II. Add rods of the same color

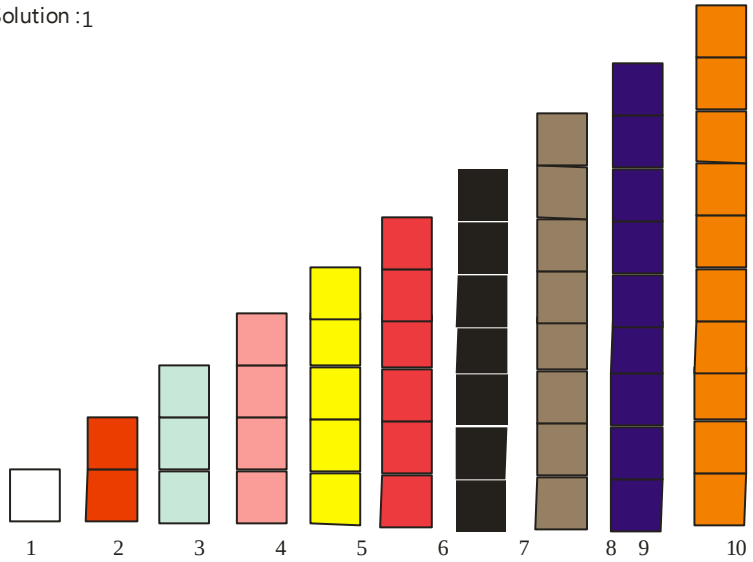
III. Add rods of different color

Previous knowledge : pupils have learnt about rods size and their colors

Introduction : The teacher introduce the lesson by asking pupils question

1. Who can read the rods number according to their col ors.

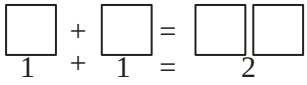
Solution :1

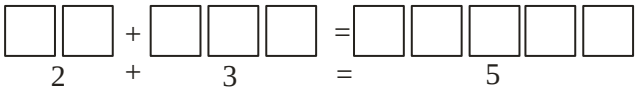


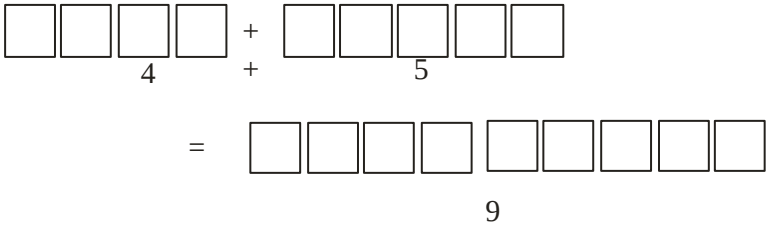
Presentation:

Step I: The teacher would show rods of varying lengths and different color and what each color or rods represent. The teacher would explain further in details about addition of rods.

Step II: The teacher will guides the pupils how to add rods of the same color.

1. 

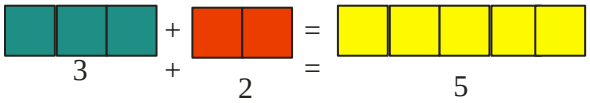
2. 

3. 

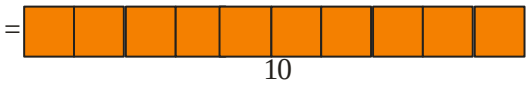
Step III: The teacher will guides the pupils to add rods of different colors.

1 

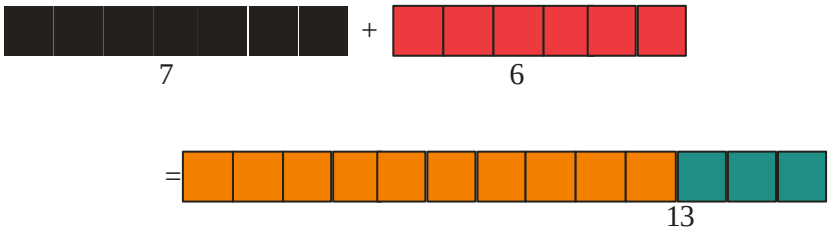


2 

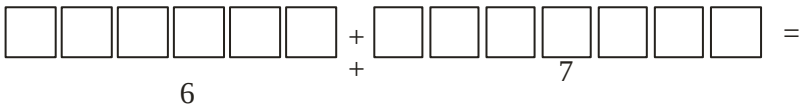
3 



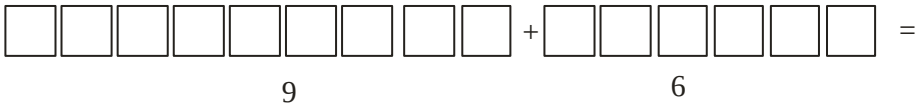
4



Evaluation : The teacher evaluates the lesson by given some problems to solve in the cla ss

.1. 

2. 

3. 

4. 

Conclusion : The teacher conclude the lesson by summarizing the main points of the lesson .

LESSON FOUR

Group : Experimental group

Class : Primary five (5)

Number of pupils: 40

Subject : mathematics

Topic : Addition of two digit numbers using rods

Time : 40 minutes

Instructional materials: Cardboard, paint colors and Cuisenaire rods of varying lengths with different colors

Behavioural objectives : At the end of the lesson pupils should be able to:

I. Add rods of different color

II. Add rods of the same color

III. Add two digit number using rods strateg

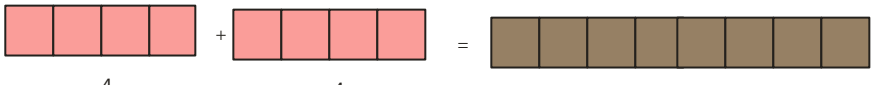
Previous knowledge : Pupils have already learnt about addition of single digit number using rods.

Introduction : The teacher introduce the lesson by asking the following questions.

1. Who can add rods of the same color to gives single digit number.

II. Who can add rods of different color to gives single digit number.

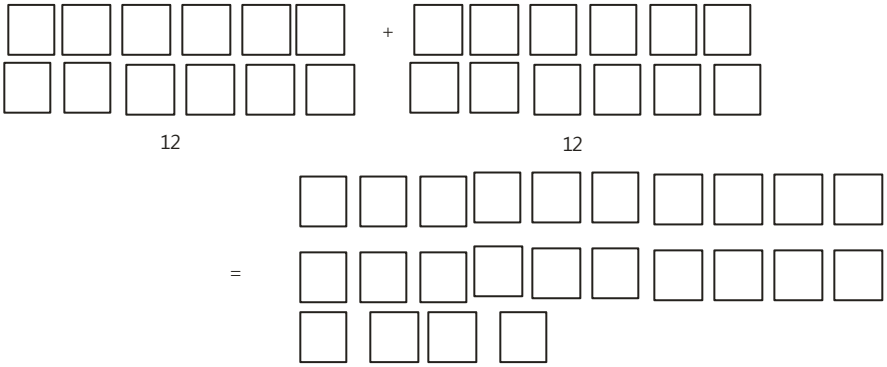
Solution 1:

1. 

2. 

Presentation :

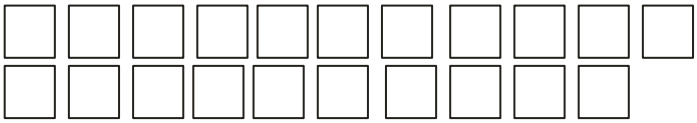
Step I: The teacher would guides the pupils how to add rods of the same color .

1. 

12  = 1 0

\+ +

 = 1 1

=  = 2 1

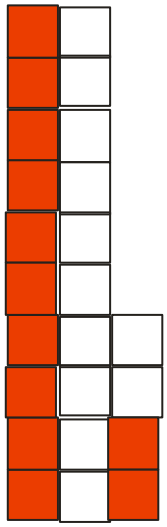
Step II : Teacher lead the pupils to add rods of different colors.

1. 

\+ 1 2

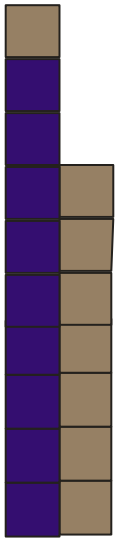


1 2

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2 4

2.



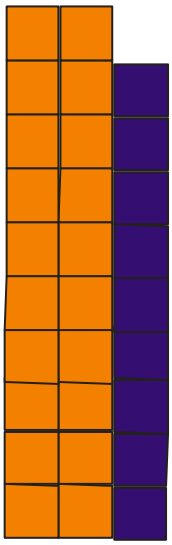
1 7

+



1 2

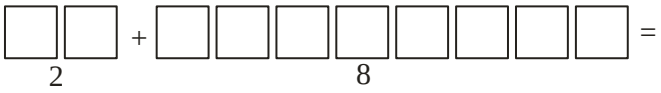
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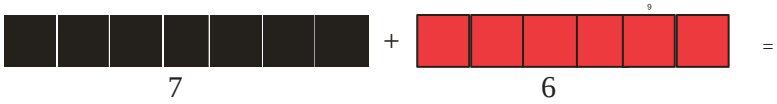


2 9

Evaluation : The teacher evaluates the lesson by given some problems to solve in the class

Add the following rods ;

1. 

2. 

3. 

Conclusion : Teacher conclude the lesson by revising the main points of the lesson.

LESSON FIVE

Group : Experimental group
Class : Primary five (5)
Number of pupils: 40
Subject : Mathematics
Topic : Addition of two digit number that involve reminder
Time : 40 minutes

Instructional materials: Cardboard, Paint, Colors and Cuisenaire rods pack of varying length and with different colors

Behavioural objectives: At the end of the lesson pupils should be able to :

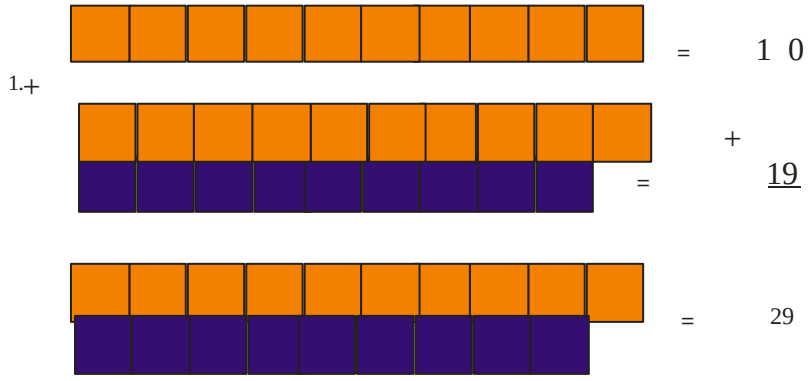
I. Add two digit number that involve renaming.

Previous knowledge: Pupils have already learnt about addition of two digit number without renaming

Introduction : The teacher introduce the lesson by asking pupils the following questions

1. Which rod will you add to give two digit number?

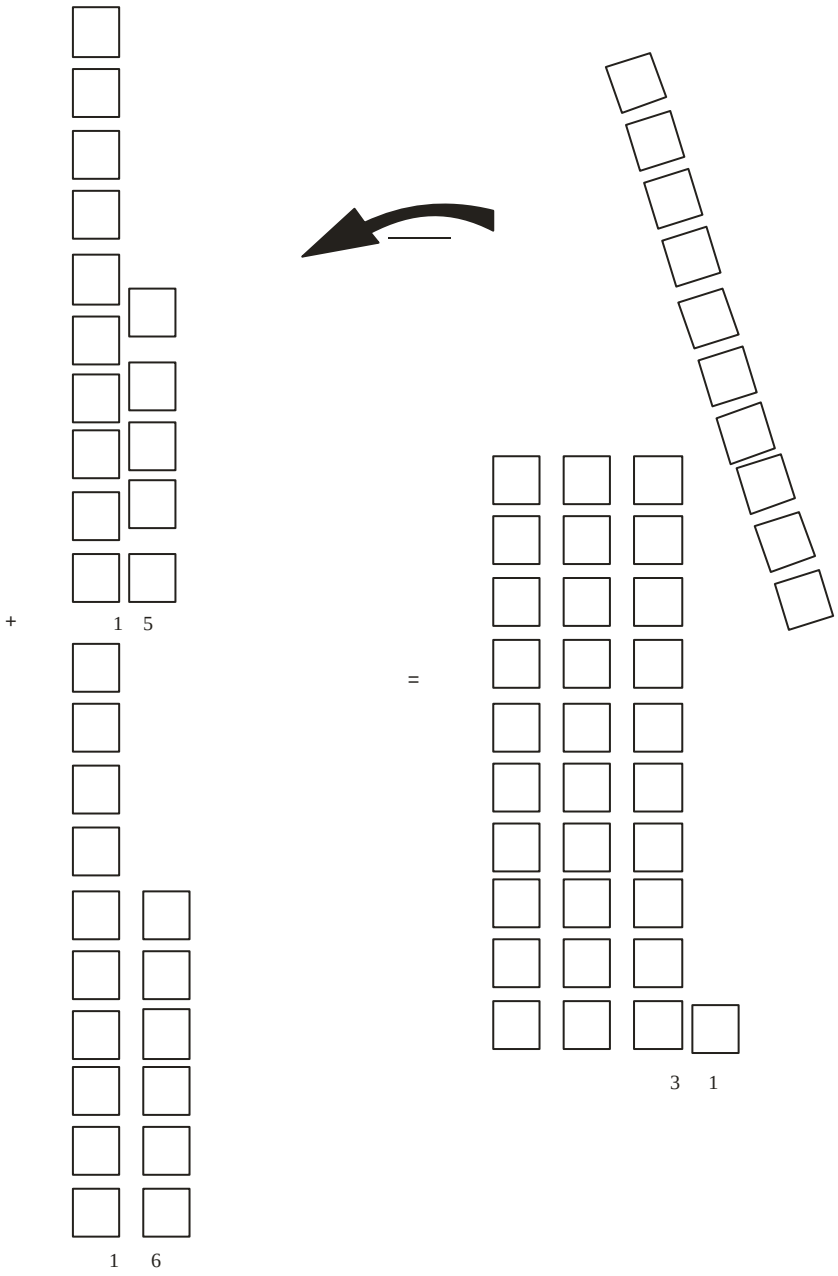
Solution :



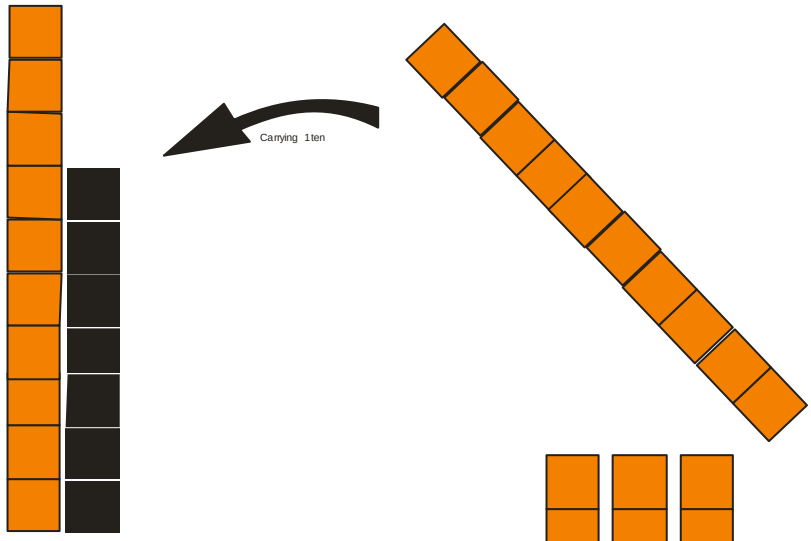
Presentation :

Step I : The pupils will be presented with different rods of varying length and with different colors, that they will be required to used the rods to add two digit number that involve renaming.

1.

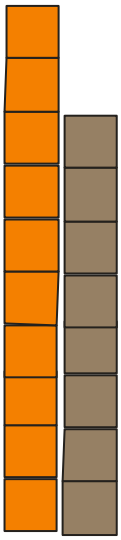


2.



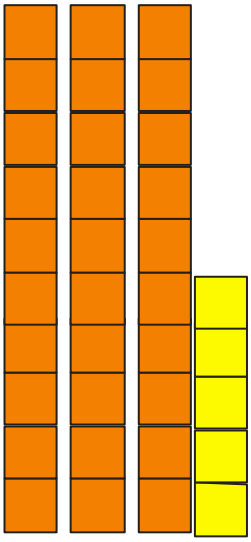
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1 8

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3 5

Step II: The teacher lead the pupils to add rods that involve renaming

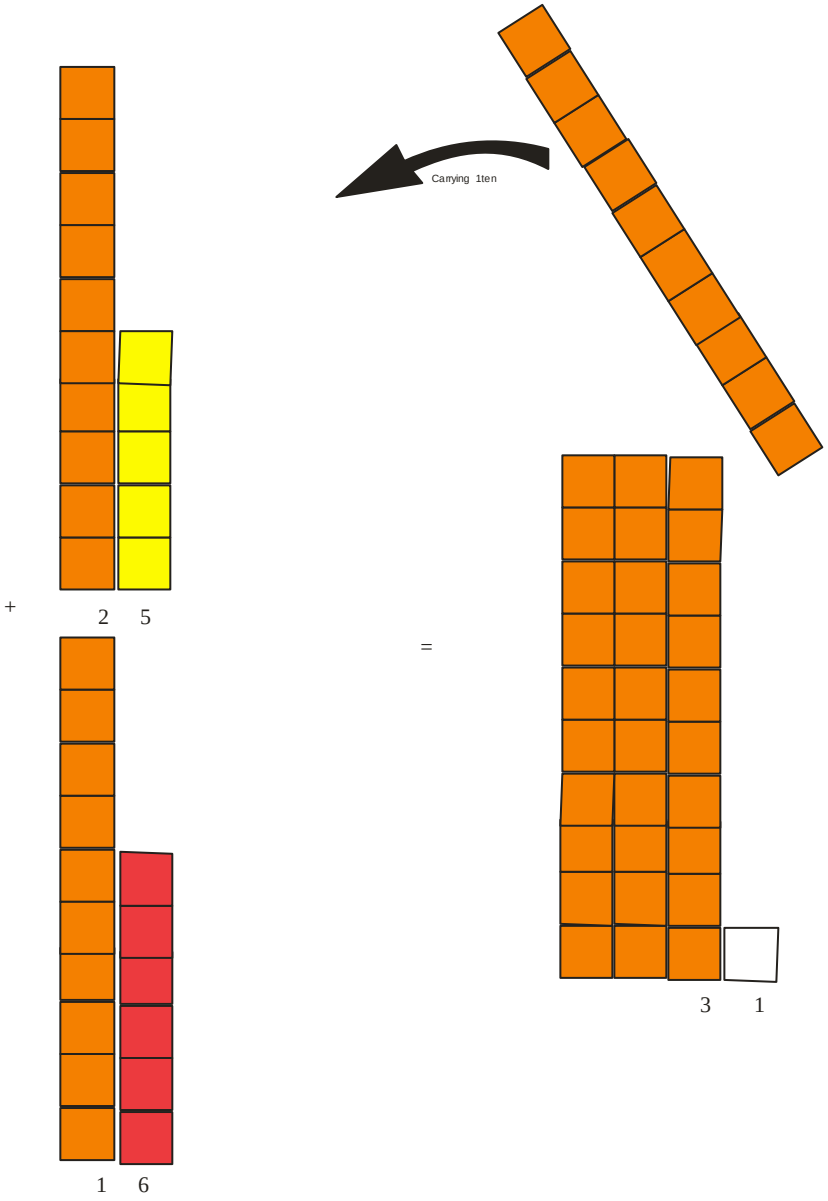
Activity : The pupils would be provided with ;

one orange rod, one yellow rod to add with one orange rod, one dark red rod that is

one orange rod =10, one dark red rod =6 and one yellow rod =5

Solution :

1.

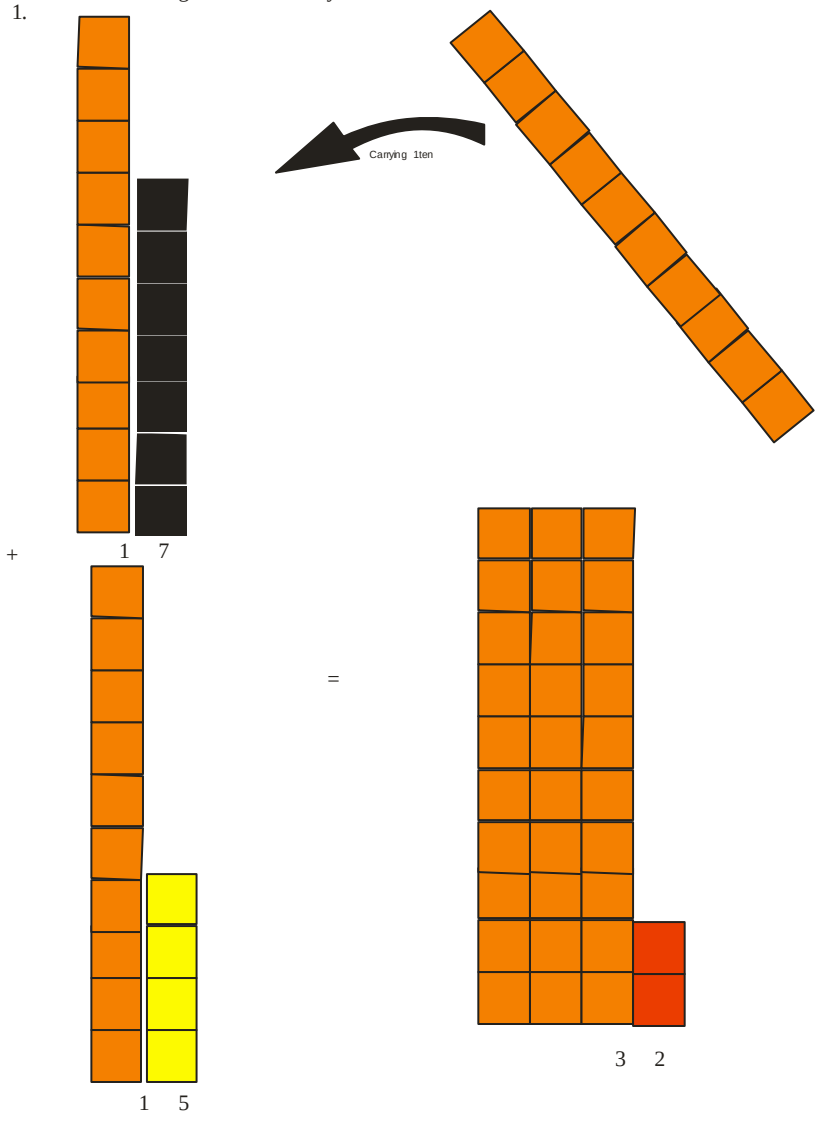


The teacher willbe going round the groups to monitor how the group are progressing. And give assist ance without giving direct answer. The teacher will also help the groups to complete the task.

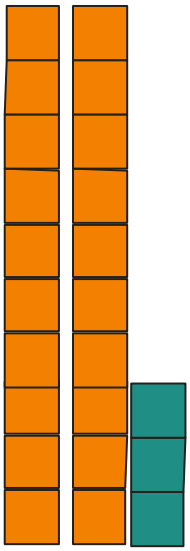
Step III : The pupils would be given some problems in the group and compare their answers with the rest of the group at the end of the lesson. Each group would be given the question which includes:

Add the following rods horizontally

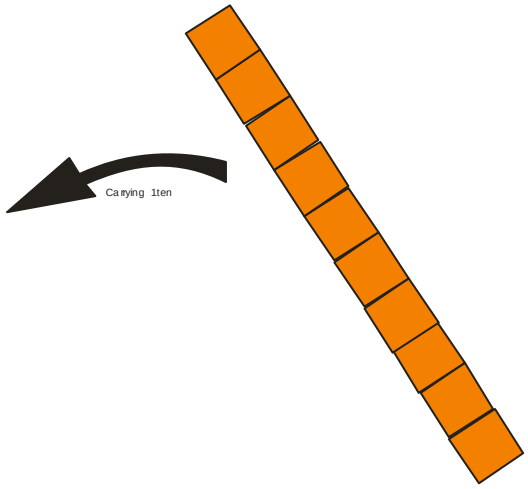
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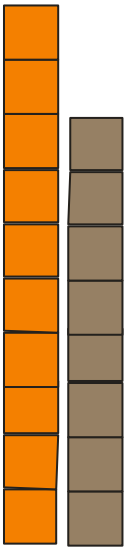
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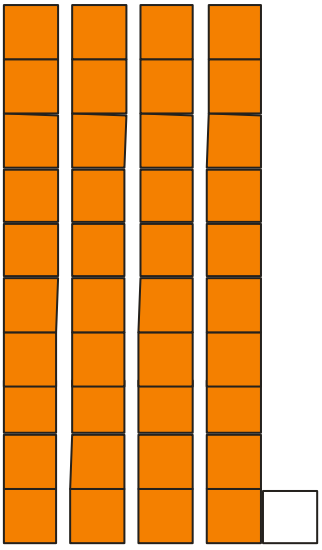


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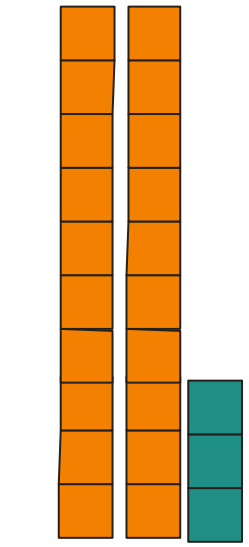
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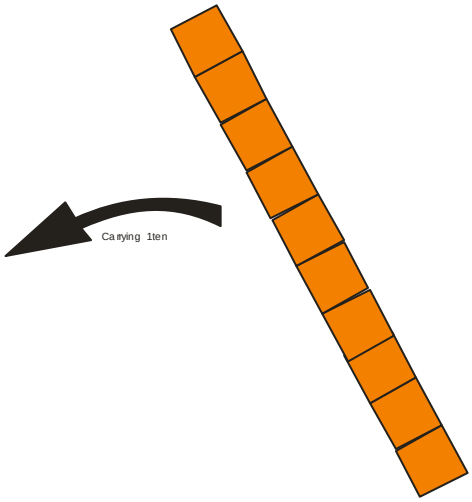


4 1

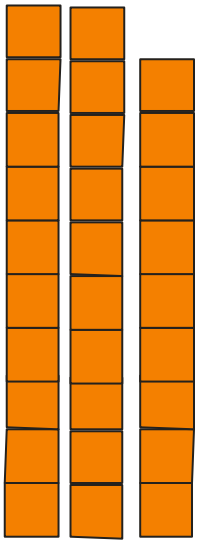
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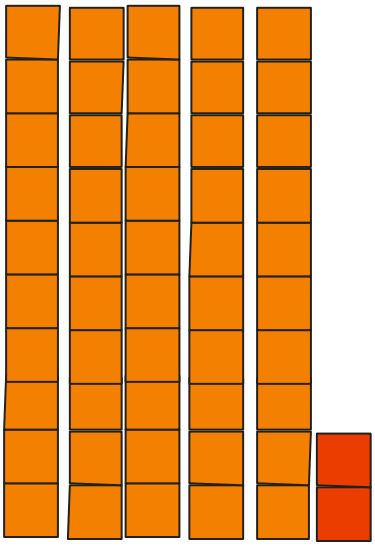


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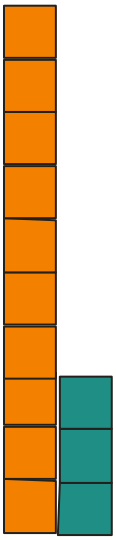
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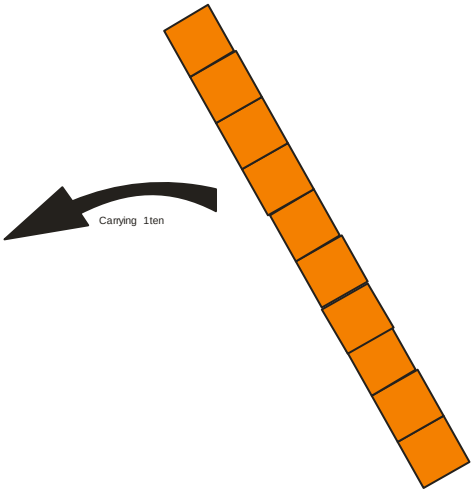
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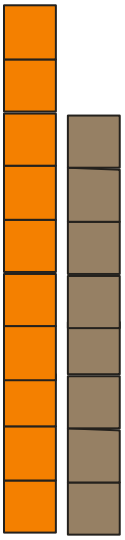
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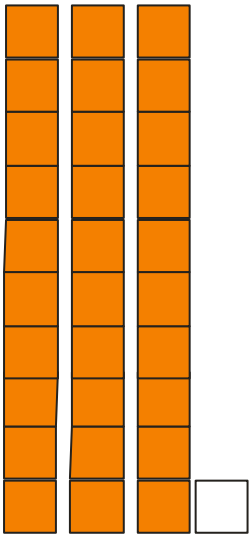


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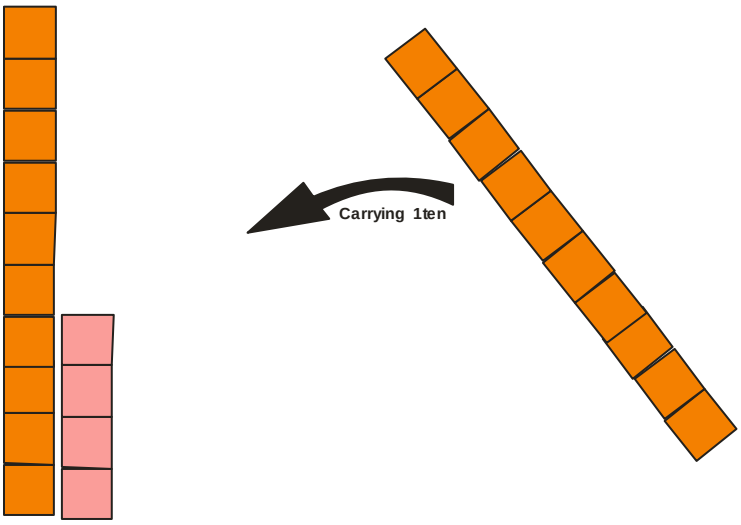
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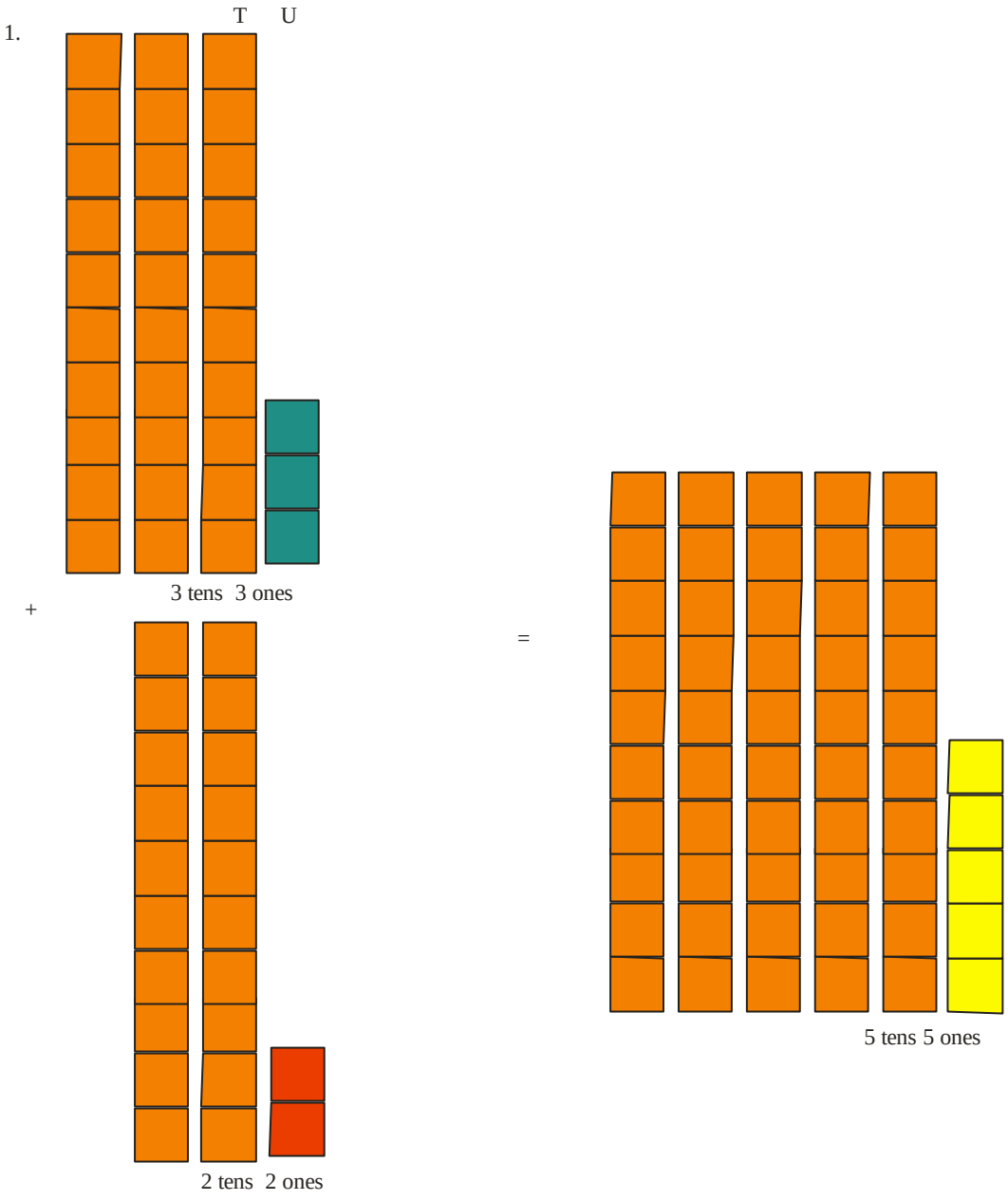
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Evaluation : The teacher evaluates the lesson by checking the extent of learning by individual as well as group success. Also check the result on each group's team work.

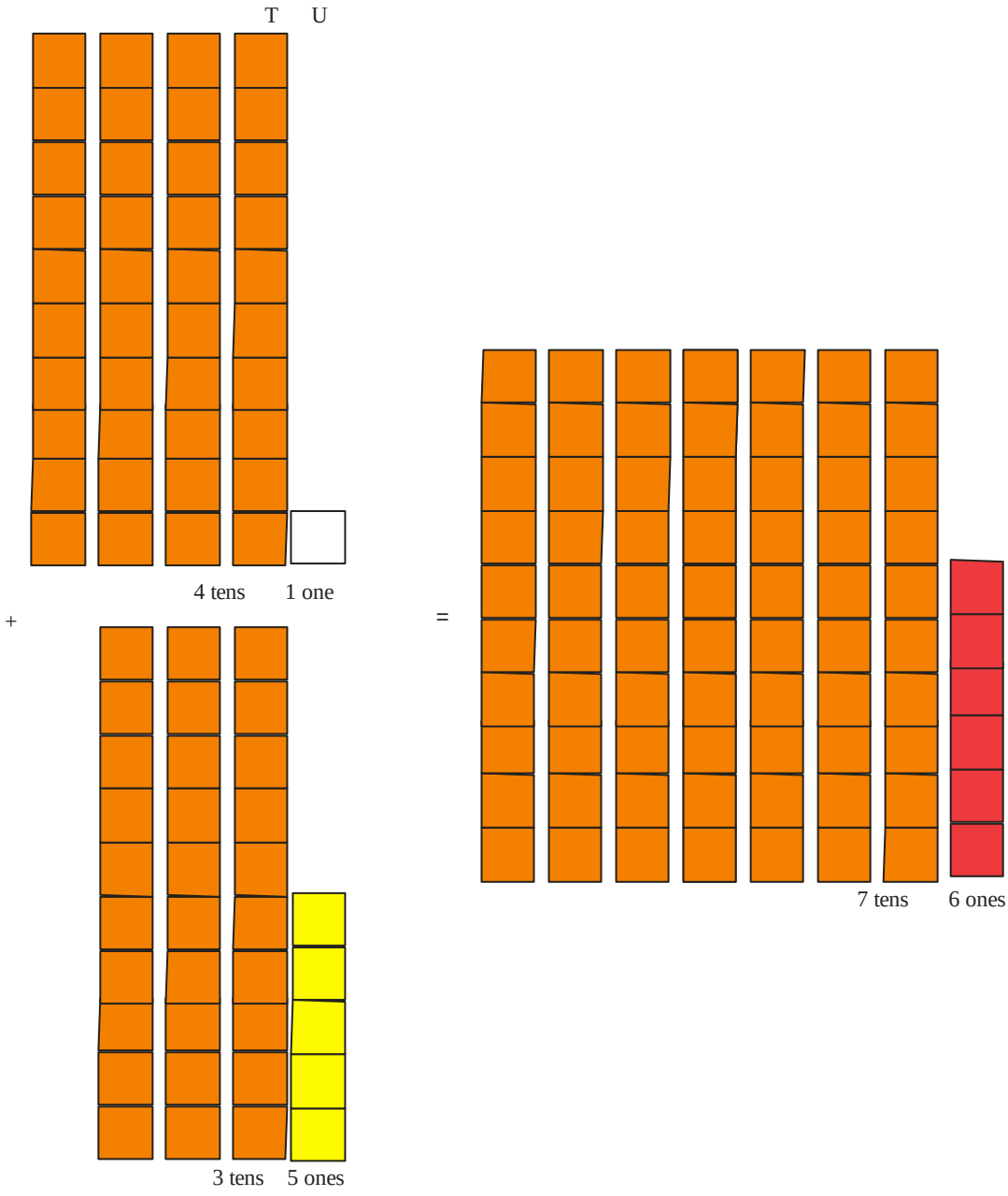
Conclusion : The teacher concludes the lesson by comparing the result from the groups finding.

(5) Three (3) orange rods, one yellow rod to add with one o range rod.

1.

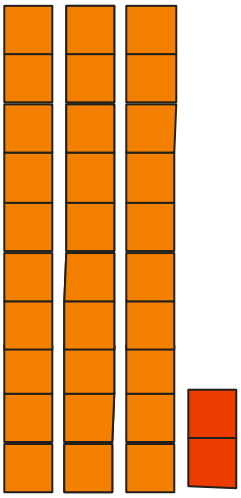


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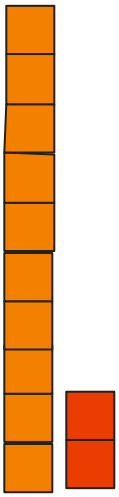
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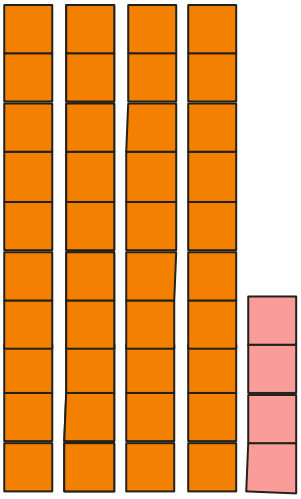
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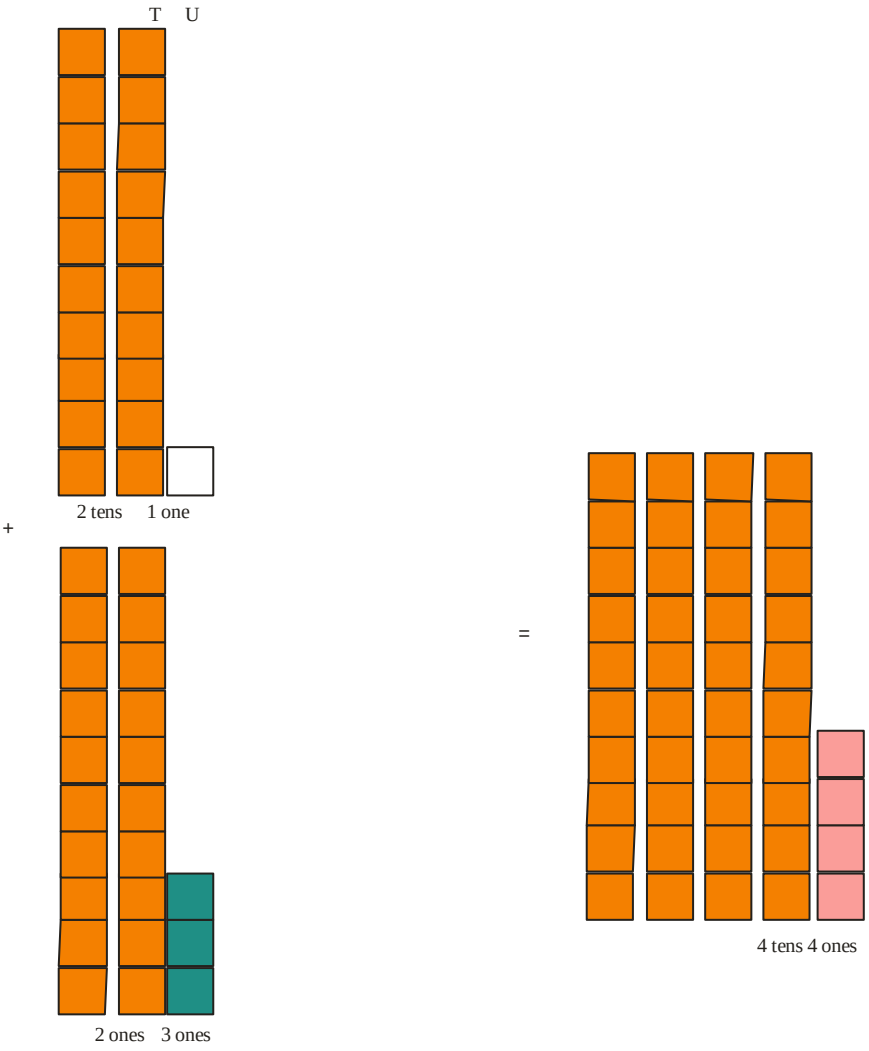
1 tens 2 ones

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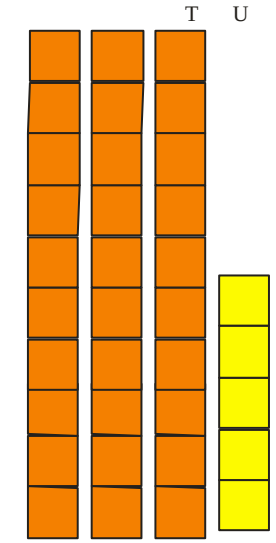


4 tens 4 one

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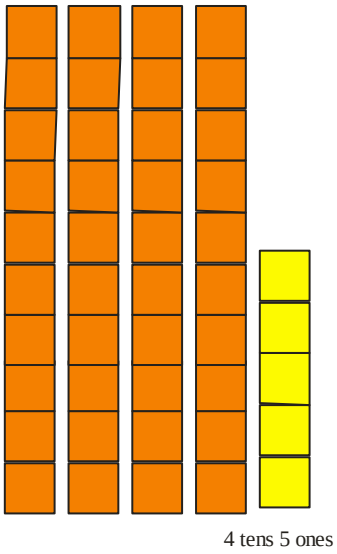
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Step II: The teacher will be going round the group to monitor how the groups are progessing.
And give assistance without giving direct answers. The teacher will also check the group to complete the task.

Evaluation : The teacher evaluates the lesson by checking the extent of learning by the groups and also
And alsocheck the result on each group's team work.

Conclusion : The teacher conclude the lesson by comparing the result from the groups finding.

LESSON SIX

Group : Experimental group
Class : Primary five (5)
Number of pupils: 40
Subject : Mathematics
Topic : Additive commutative property
Time : 40 minutes

Instructional materials: Cardboard, Paint, Colors and Cuisenaire rods of varying length and with different colors

Behavioural objectives: At the end of the lesson pupil s should be able to :

1. Demonstrate the commutative property of addition
2. Add commutative numbers using rods

Previous knowledge: Pupils have learnt about addition of whole numbers involving tens and units.

Introduction : The teacher introduce the lesson by asking pupils the following questio ns

1. Whocan show rod that equal to 10
2. Whocan show two rods that are equal to 10

Solution :

1. The rod that equal to 10 is orange rod
2. The two rods that are equal to 10 can be;
   i. Brown rod + red rod
   ii. Ligth green rod + black rod
   iii. Yellow rod + yellow rod
   iv. Dark red rod + pink

Presentation :

Step I: The teacher would explain the meaning of commutative property as; in mathematic can operands is commutative if changing the order of the operands does not change the end result.

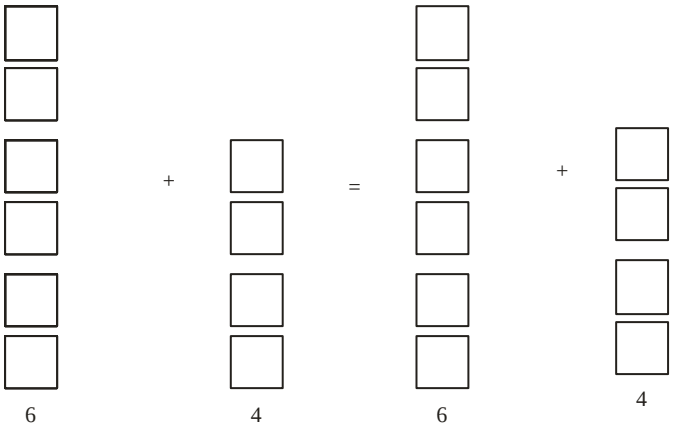
Step II. The teacher guides the pupils to add commutative number (rods)

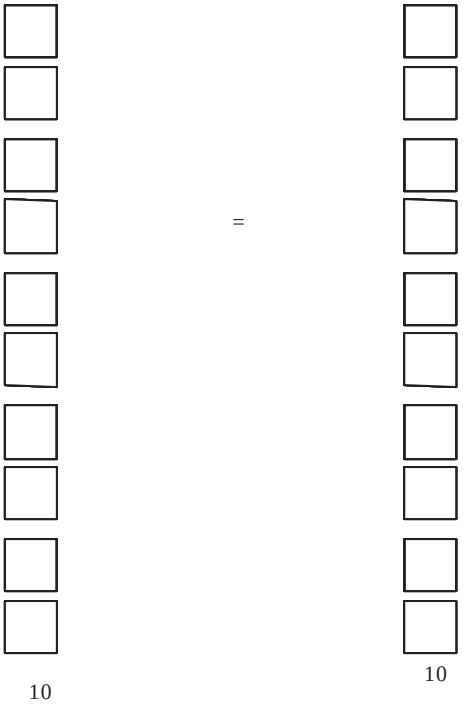
Activity :

The pupils would be provided with the following rods to add

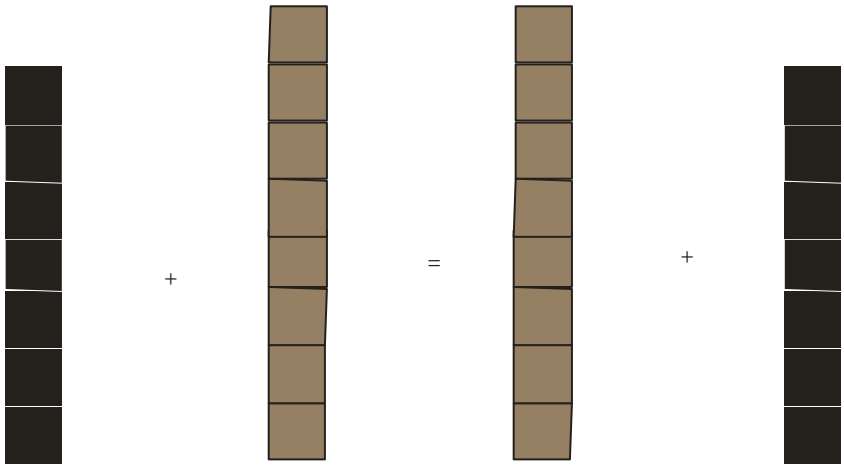
1. Four (4) white rods + six (6) white rods = six white rods + four white rods
2. One dark red rod + one blue rod = one blue rod + one dark rod

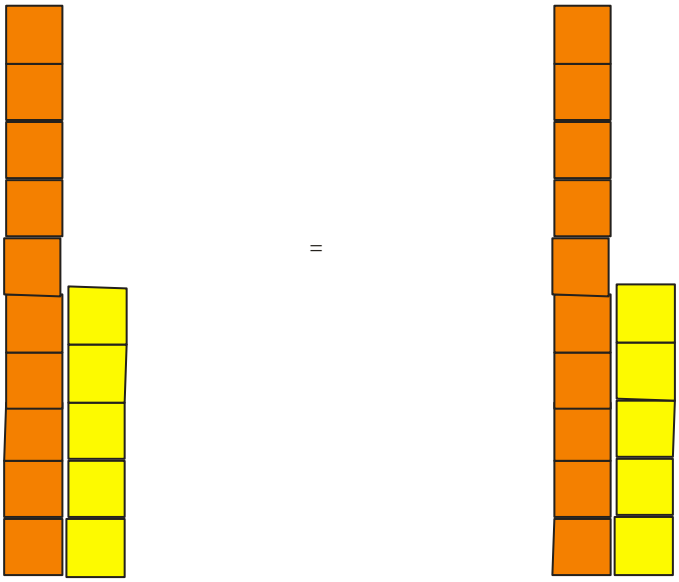
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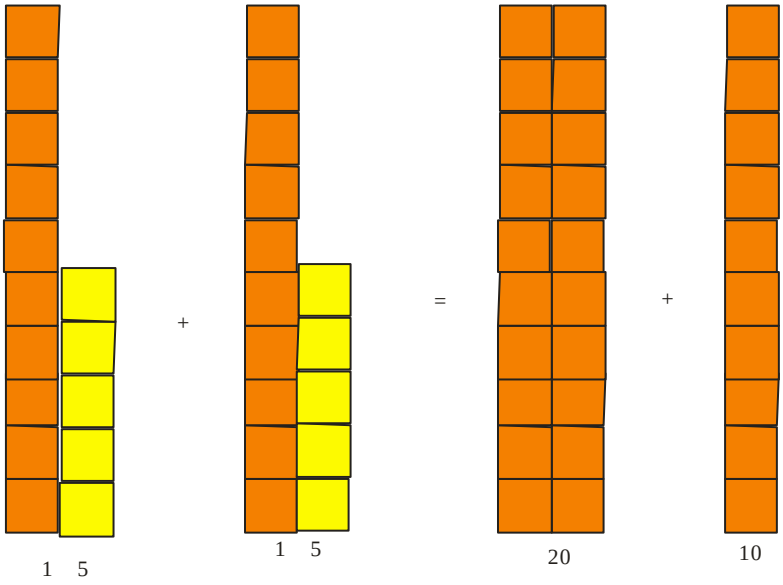
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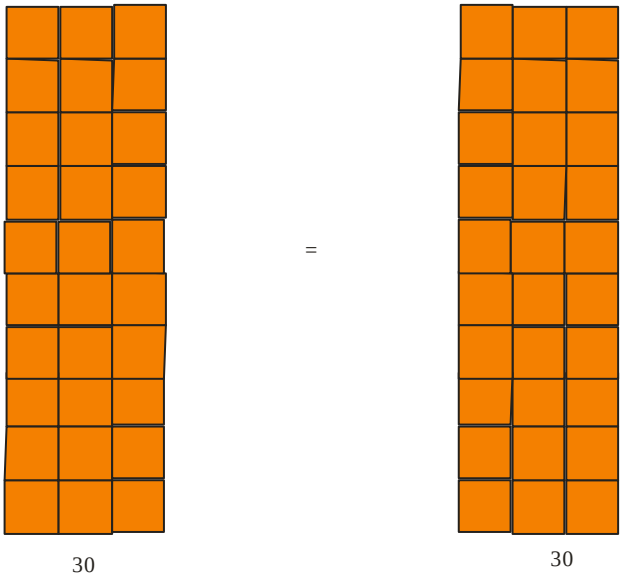




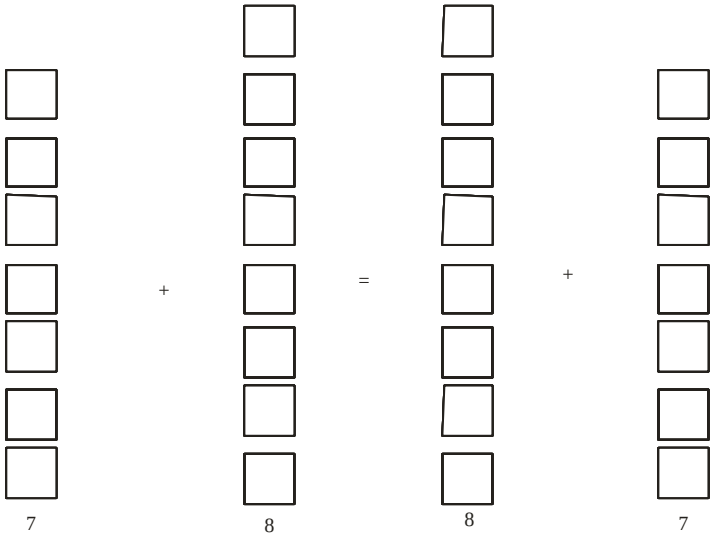
Evaluation : The teacher evaluates the lesson by giving pupils some problems to solve in the cla

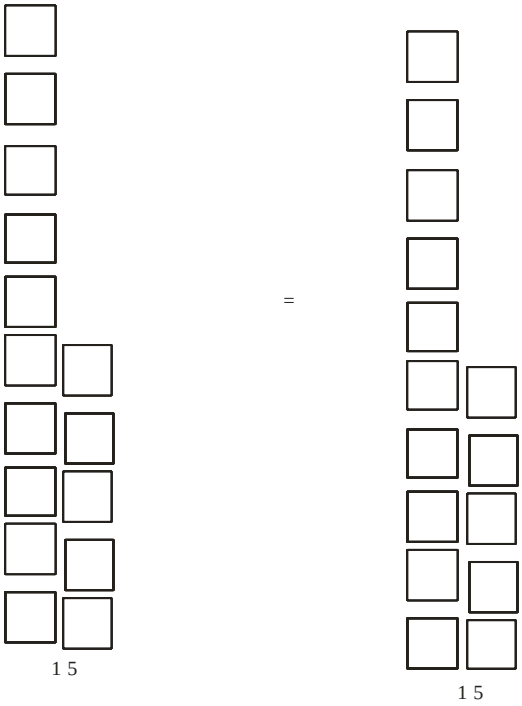
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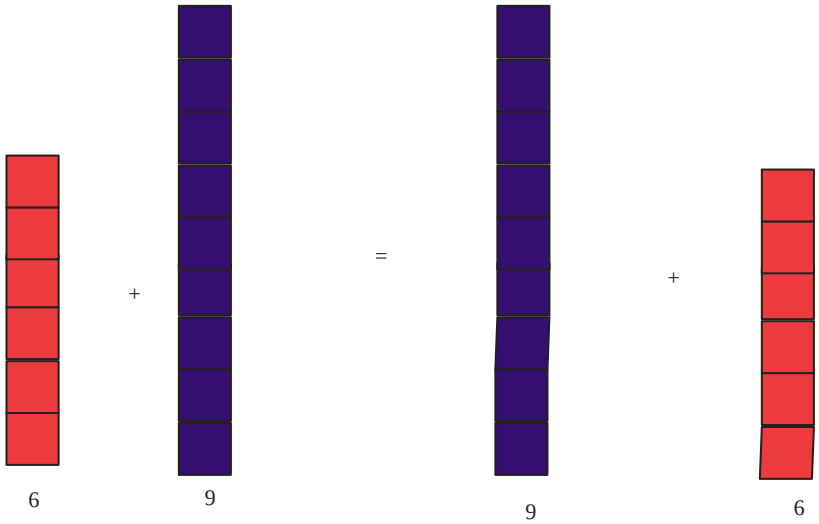


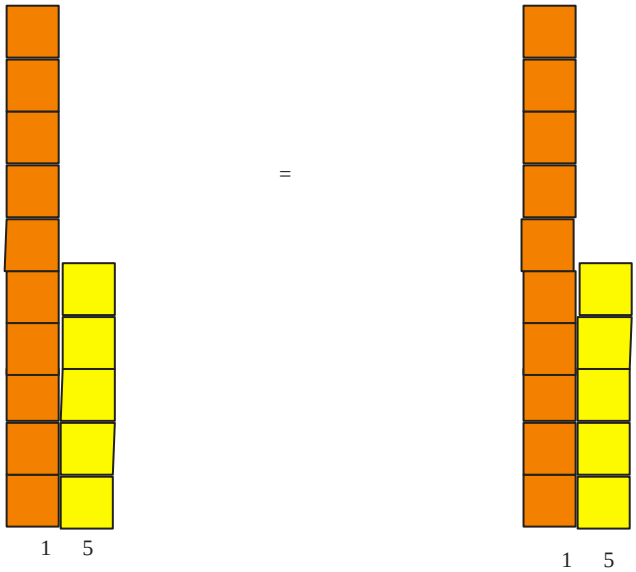
2.





3.





Conclusion : The teacher concludes the lesson by revising the main points of the lesson.

LESSON SEVEN

Group : Experimental group
Class : Primary five (5)
Number of pupils: 40
Subject : Mathematics
Topic : Additive associative property using rods
Time : 40 minutes

Instructional materials: Cardboard, Paint, Colors and Cuisenaire rods pack of varying length and wi th different colors

Behavioural objectives: At the end of the lesson pupils should be able to :

I. Demonstrate the associative property of addition
II. Add three different rods

Previous knowledge: Pupils have already learnt about addition of commutative numbers using rods

Introduction : The teacher introduce the lesson by asking the pupils question

I. What is commutative

Solution :

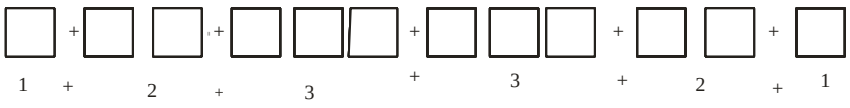
, I. In mathematics an operands is commutative, if changing onder of the operands does not change the end result.

Presentation :

Step I : The teacher would explain the meaning of associative property as ; The asociative will involve 3 or more numbers, or is a mathematical property that kes it easy to find the sum or product of numbers by grouping.

Step II : The teacher would explain further the importance of "Bracket" through working example that bracket or parenthesis indicates the terms that are considered on

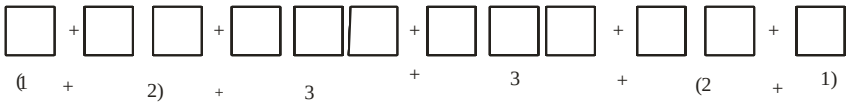
Step III : The teacher guides the pupils to add three different rods.

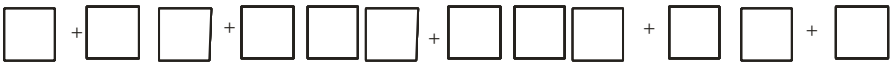
(1) 

Note that:

we can add any two above of the terms at a time.

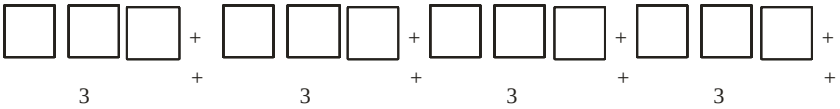
Then





(1 + 2) + 3 + 3 + (2 + 1)

The bracket indicates the terms that are considered one



3 + 3 + 3 + 3



6 = 6

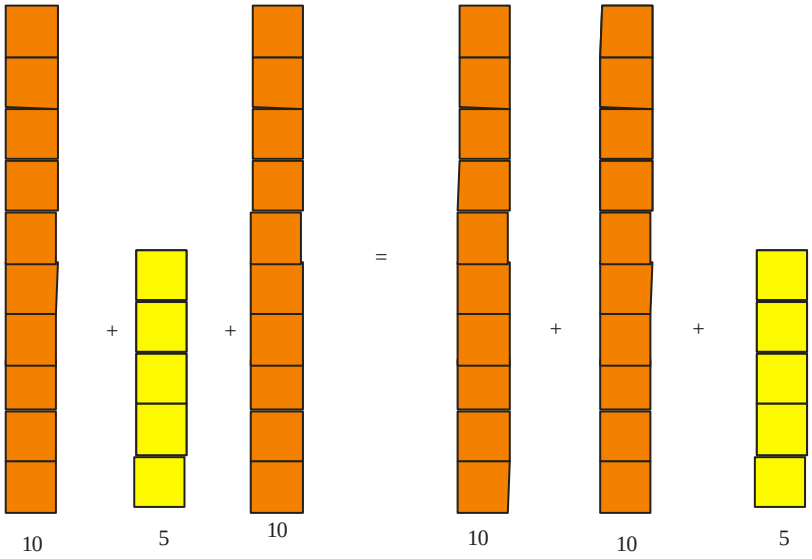
1 + 2 + 3 = 3 + 2 + 1

(1+ 2 + 3 = 3 + (2+1)

3 + 3 = 3 + 3

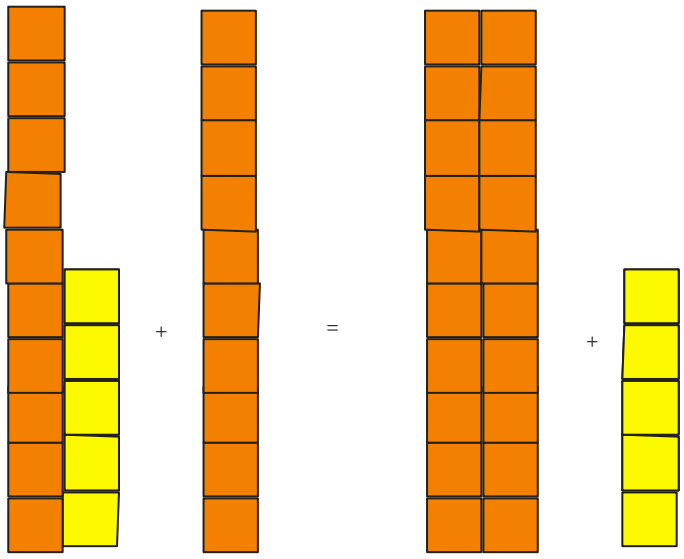
6 = 6

(2)

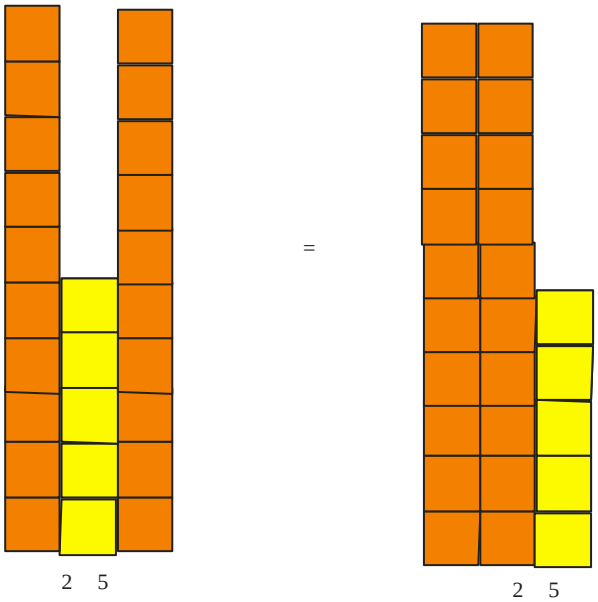


10 + 5 + 10 = 10 + 10 + 5

(3)



1 5 + 10 = 2 0 + 5

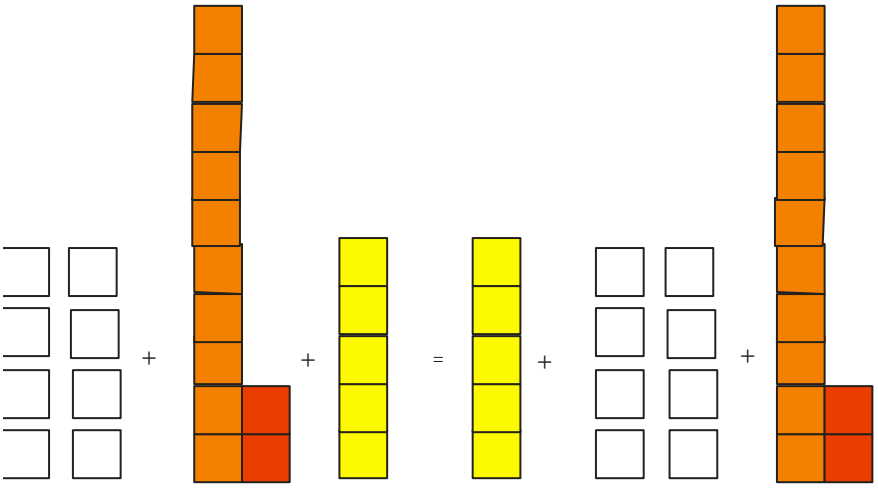


2 5 = 2 5

(10 + 5) + 10 = (10 + 10) + 5

15 + 10 = 20 5+

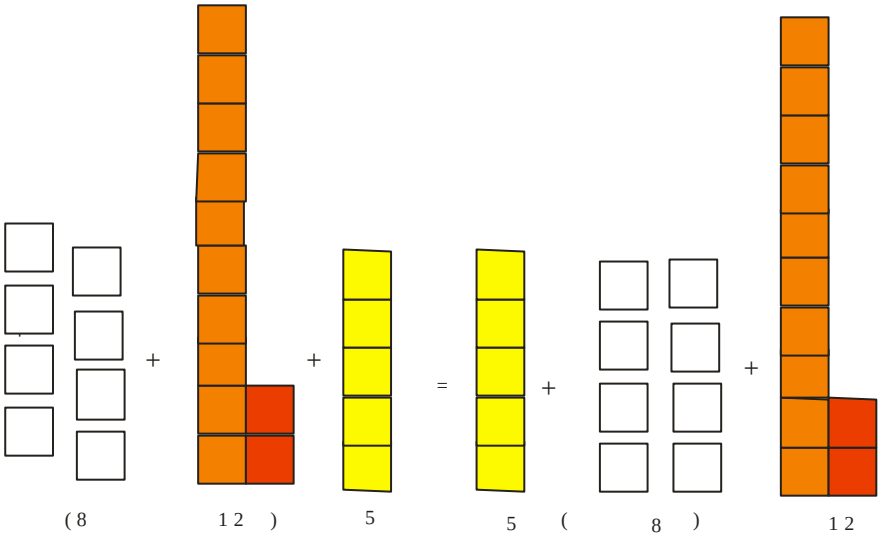
25 = 25



Note that:

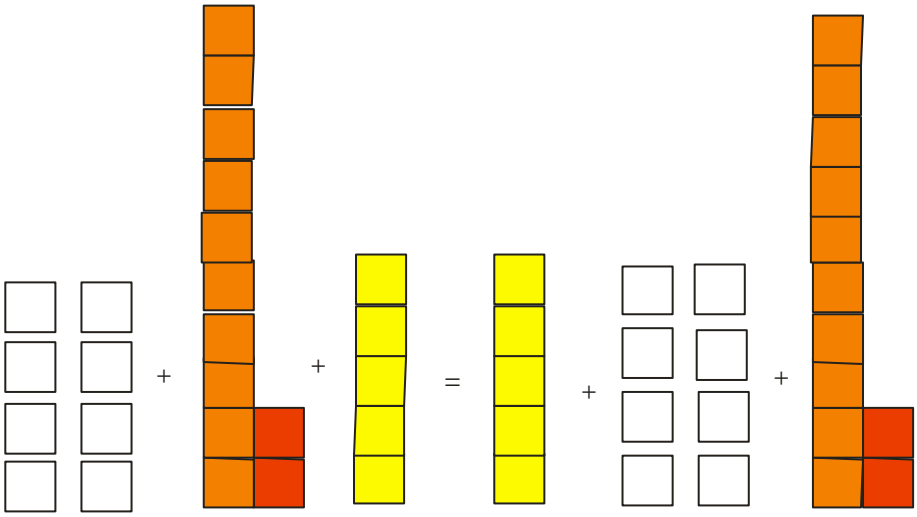
we can add any two above of the terms at a time

Then.

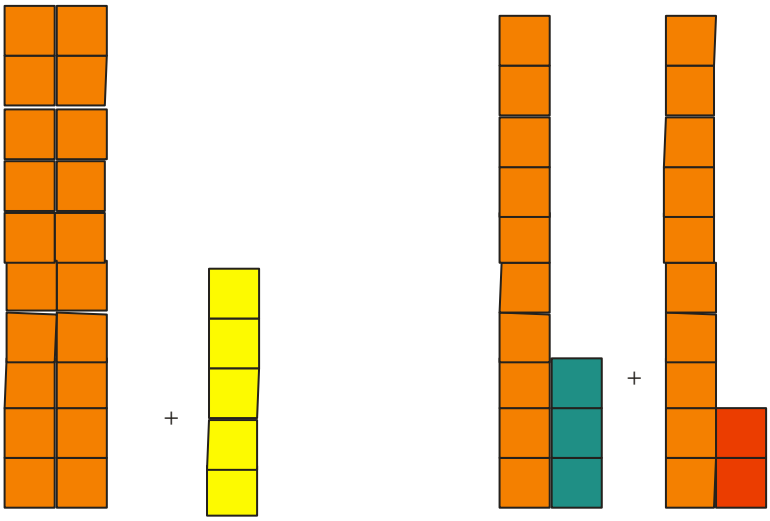


Note that:

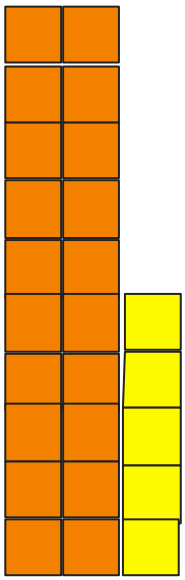
The bracket indicates that the terms that are considered one



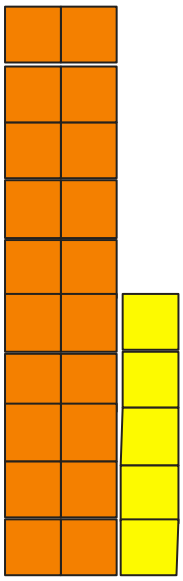
(8 1 2) 5 5 (8) 1 2



20 5 13 1 2

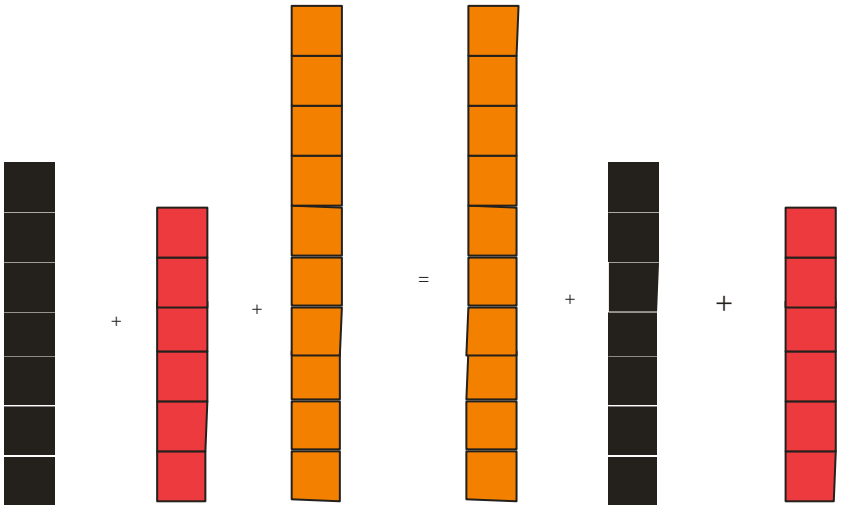


25



25

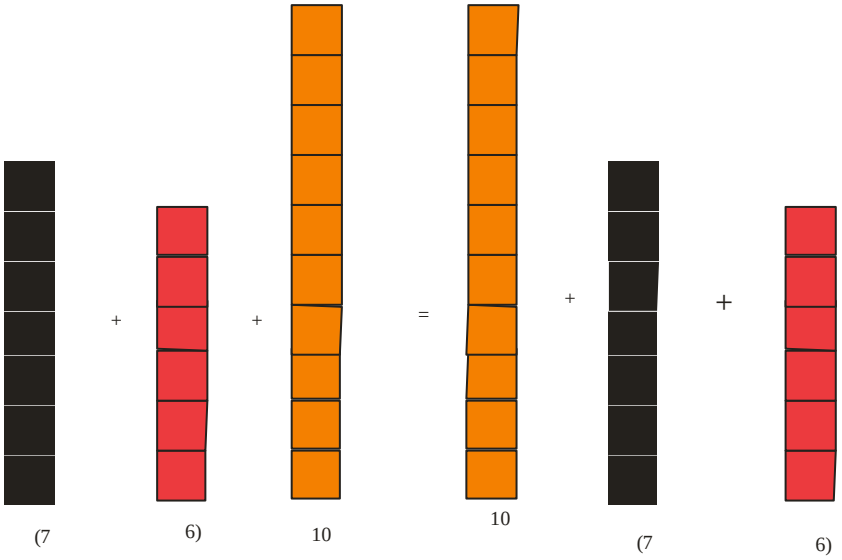
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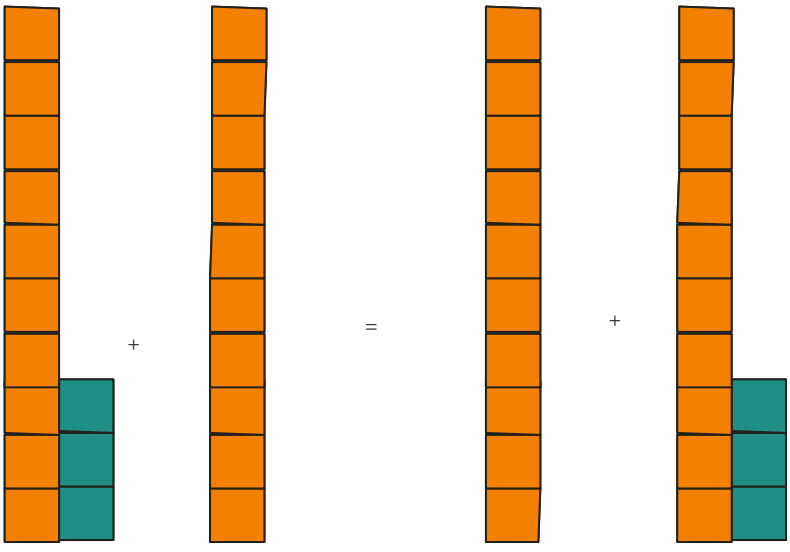
Note that :

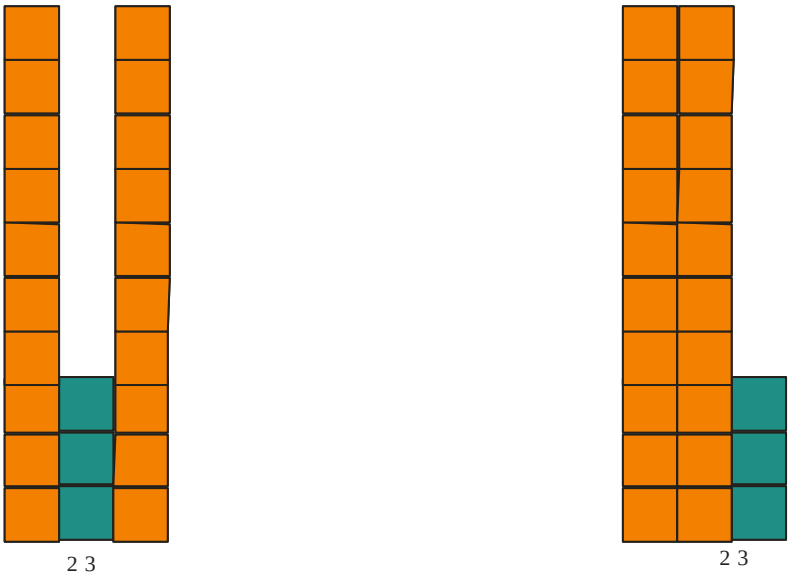
we can add two of the terms above at a time.

Then :



The bracket indicates the terms that are considered one





Conclusion :The teacher concludes the lesson by revising the main points of the lesson.

LESSON EIGHT

Group : Experimental group
Class : Primary five (5)
Number of pupils: 40
Subject : Mathematics
Topic : Subtraction of single digit number using rods
Time : 40 minutes

Instructional materials: Cardboard, paint, colors and Cuisenaire rods of varying length and with different colors.

Behavioural objectives: At the end of th e lesson pupils should be able to:

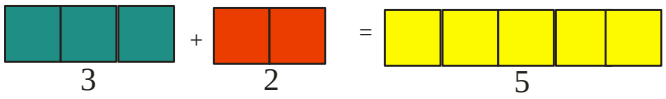
I. Add single rod with another rod
II. Add rod of the same color
III. Add rod of different color

Previous knowledge: pupils have already learnt about addition of single digits number

Introduction : The teacher introduce the lesson by asking the pupils question

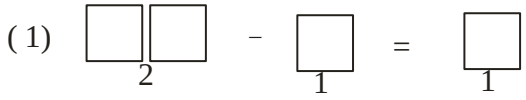
1. Who can add light green rod with red rod?

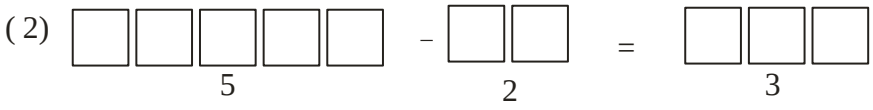
Solution :

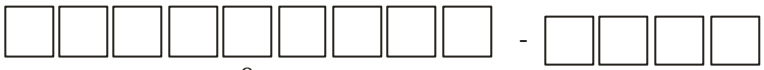
1. 

Presentation :

Step I : The teacher would lead the pupils to add single rod with another rod





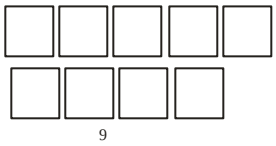
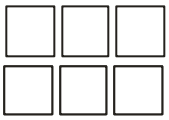
(3)  -

9 4

= 

5

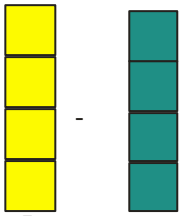
StepII : The teacher would be given some problems to solve in the group and compare answers with the rest of the group at end of the lesson. Each group would be given the question which includes;

1.  -  =

9 6

2.  -  =

7 5

3.  - =

5 - 4 =

4.  -  =

8 3

5.  - 

10 2

Evaluation : The teacher evaluates the lesson by checking the extent of learninh by the group succe ss also check the result or answers on each group's team work.

Conclusion : The teacher concludes the lesson by comparing the result from the groups finding.

APPENDIX B

LESSON PLAN FOR CONTROL GROUP

LESSON ONE

Group: Control group

Class: Primary five (5)

Number of Pupils : 40

Subject: Mathematics

Topic: Addition of single digits numbers

Time: 40 minutes

Instructional materials: MAN primary school mathematics 6 based on modules, Chalk, and dusters

Behavioural Objectives: At the end of the lesson pupils should be able to:

1. Add simple digits numbers

Previous knowledge: Pupils have already learnt about counting of numbers

Introduction: The teacher introduces the lesson by asking the pupils the following questions .

1. Who can count the number (1-100)
2. Who can count the number (1-50)

Solution :

1. 1 2 3 4 5 6 7 8 9 10 11 - 100
2. 1 2 3 4 5 6 7 8 9 10 11 - 50

Presentation:

Step I: The teacher writes some problems and solve on the board

(1) 3+2 = 5 (2) 9+8 = 17 (3) 7+6= 13 (4) 5+4=9

Step II The teacher writes some probems and sole on the board together wit the pupils

(1) 9+3= 12 (2) 8+2 =10 (3) 7+8 = 15

Evaluation: The teacher evaluate the lesson by giving some problems to solve in the class.

LESSON TWO

Group: Control group

Class : Primary five (5)

Number of pupils :40

Subject: Mathematics

Topic : Addition of two digit numbers that involve renaming

Time : 40minutes

Instructional materials: MAN primary school mathematics 6 based on modules, chalk and dusters

Behavioural objectives : At the end of the lesson pupils should be able to:

Previous knowledge : Pupils have learnt about

Introduction : The teacher introduce the lesson by asking pupils the following question.

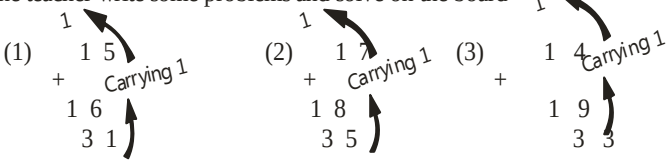
1. Who can add 1 2
+
5 7

Solution :

(1) 1 2
+
5 7
6 9

Presentation :

Step: The teacher write some problems and solve on the board



Step II: The pupils would be given some problems to solve in the class individually. The teacher will be going round to monitor how the pupils are progressing. And give assistance without giving direct answers. The teacher will also help the individuals to complete the task..

(1) 2 6
+
1 6
4 2

(2) 5 9
+
2 2
8 1

(3) 46
+
7 6
1 4 0

Evaluation : The teacher evalutes the lesson by checking the extent of learning by individuals aswell as comments on each indidvidual's work.

Conclusion : The teacher concludes the lesson by comparing the result from the individual finding

LESSON THREE

Group: Control group

Class : Primary five (5)

Number of pupils :40

Subject: Mathematics

Topic : Addition of whole numbers involving tens and units

Time : 40minutes

Instructional materials: MAN primary school mathematics 6 based on modules, chalk and dusters

Behavioural objectives : At the end of the lesson pupils should be able to:

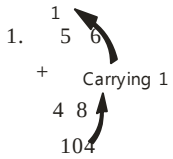
1. Add whole numbers involving tens and units

Previous knowledge : Pupils have learnt about addition of two digit numbers that involve renaming

Introduction : The teacher introduce the lesson by asking pupils the following question

1. Who can add 56 + 48

solution



Presentation :

Step I: The teacher write some problems and solve on the board.

(1)

	T	U
+	3	3
	2	2
	5	5

	T	U
+	4	1
	3	4
	7	5

	T	U
+	3	2
	1	2
	4	4

Step II: The teacher write some problems and solve on the board together with the pupils

(1)

	T	U
+	3	8
	2	1
	5	9

	T	U
+	5	0
	1	1
	6	1

	T	U
+	4	0
	1	5
	5	5

Evaluation: The teacher evaluates the lesson by given some problems to solve in the class.

(1)

	T	U
+	2	1
	2	3

	T	U
+	3	1
	1	0

	T	U
+	4	4
	5	2

Conclusion : The Teacher concludes the lesson by revising the main points of the lesson.

LESSON FOUR

Group: Control group
Class : primary five (5)
Number of pupils :40
Subject: Mathematics
Topic : Additive commutative property
Time : 40minutes
Instructional materials: MAN primary school mathematics 6 based on modules, chalk and dusters
Behavioural objectives : At the end of the lesson pupils should be able to:

I. Demonstrate the commutative property of addition
II. Add commutative numbers.

Previous knowledge : Pupils have already learnt about addition of whole number involving tens and units.

Introduction : The teacher introduce the lesson by asking pupils the following question.

Who can add 1 + 0
who can add 0 + 1

solution:

1. 1 + 0 =1
2. 0 + 1 = 1

Presentation :

Step I: The teacher would explain the meaning of commutative to thepupils as ; in mathematics an operands is commutative, if changing the order of the operands does not change the end result.

Step II: The teacher write some problems and solve on the board.

(1) 4 + 6 = 6 + 4
10 = 10

(1) 7 + 8 = 8 + 7
15 = 15

(3) 6 + 9 = 9 + 6
15 = 15

Step III : The teacher write some problems and solve on the board together with the pupils.

(1) 10 +5 = 5 + 10
15 = 15

(2) 15 + 15 = 20 + 10
30 = 30

Evaluation : The teacher evaluates the by given some problems to solve in the class.

(1) 8 + 9 = 9 + 8

(2) 30 + 10 = 10 + 30

Conclusion : The teacher concludes the lesson by summarising the main points of the lesson.

LESSON FIVE

Group: Control group

Class : Primary five (5)

Number of pupils :40

Subject: Mathematics

Topic : Additive association property

Time : 40minutes

Instructional materials: MAN primary school mathematics 6 based on modules, chalk and duster

Behavioural objectives : At the end of the lesson pupils should be able to:

1. Demonstrates associative property of addition
2. Add whole numbers involving three (3) terms

Previous knowledge : Pupils have already learnt about commutative property of addition

Introduction : The teacher introduce the lesson by asking pupils the following question

. 1. What is commutative?

Solution :

1. In mathematics an operands is commutative, if changing the order of the operands does not change the end result.

Presentation :

Step : The teacher would explain the meaning of associative property as ; the associative property involve three (3) or more numbers or is a mathematical property that makes it easy to find the sum or product of numbers by grouping.

Step II: The teacher would explain the importance of "Bracket" through working example, that bracket or parenthesis indicates the terms that are considered one.

Step III : The teacher write some problems and solve on the board

(1) $1 + 2 + 3 = 3 + 2 + 1$

Note that:

We can add any two above of the terms at a time then

$$(1 + 2) + 3 = 3 + (2 + 1)$$

The brackets indicates the terms that are considered one

$$3 + 3 = 3 + 3$$
$$6 = 6$$

2. 10 + 15 + 10 = 10 + 10 +15

Note that :

we can add any two above of the terms at a time

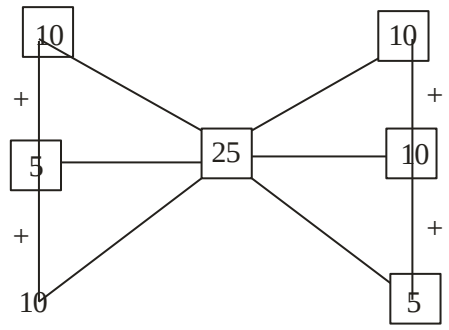
then; .

10 + (15 + 10) = (10 + 10) +15

bracket indicates the terms that are considered one

10 + 25 = 20 + 15
35 = 35

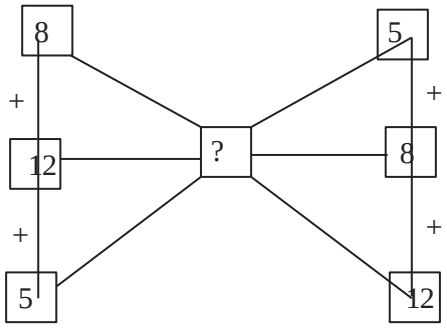
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Evaluation : The teacher evaluates the lesson by given some problems to solve in the class.

(1) 10 + 20 +30 = 20 + 30 +10 (2) 7 + 6 + 10 = 6 + 10 +7

(3)



Conclusion : The teacher concludes the lesson by revising the main points of the lesson.

LESSON SIX

Group: Control group

Class : Primary five (5)

Number of pupils :40

Subject: Mathematics

Topic : Subtraction of single digit numbers

Time : 40minutes

Instructional materials: MAN primary school mathematics 6 based on modules, chalk and duster

Behavioural objectives : At the end of the lesson pupils should be able to:

1. Subtraction of single digit numbers

Previous knowledge : Pupils have learnt about Addition of single digit numbers

Introduction : The teacher introduce the lesson by asking pupils the following question.

1. What is the sum of 3 and 2

Solution:

(1) 3 + 2 = 5

Presentation:

Step I : The teacher write some problems and solve on the board.

(1) 5 - 2 = 5 (2) 9 - 5 = 4 (3) 7 - 5 = 2

Step II: The teacher write some problems and solve on the board together with the pupils

(1) 8 - 2 = 6 (2) 9 - 1 = 8 (3) 9 - 9 = 0

Evaluation : The teacher evaluates the lesson by given some problems to solve in the class

(1) 6 - 3 = 3 (2) 9 - 8 = 1 (3) 7 - 2 = 5

Conclusion : The teacher concludes the lesson by revising the main points of the lesson.

LESSON SEVEN

Group: Control group

Class : Primary five (5)

Number of pupils :40

Subject: Mathematics

Topic : Addition of two digit number

Time : 40minutes

Instructional materials: MAN primary school mathematics 6 based on modules, chalk and duster S

Behavioural objectives : At the end of the lesson pupils should be able to:

I. Subtract two digit numbers

Previous knowledge : Pupils have learnt about subtraction of single digit numbers

Introduction : The teacher introduce the lesson by asking pupils the following question.

I. Who can give example of single digit number

II. Who can give example of two digit numbers

Solution :

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

II. 10 12 13 14 15 16 17 e t c

presentation :

Step I. The teacher write some problems and solve on the board

(1) 1 1 (2) 1 2 (3) 1 5

_ - -

1 0 1 2 1 3

0 0 0 2

Step II. The teacher write some problems and some together with the pupils.

(1) 1 5 (2) 1 4

\- -

1 0 7

5 7

Evaluation : The teacher evaluates the lesson by given some problems to solve in the lesson

(1) 2 9 (2) 1 9

\- -

8 1 1

Conclusion : The teacher concludes the lesson by summarizing the main points of the lesson.

LESSON EIGHT

Group: Control group

Class : Primary five (5)

Number of pupils :40

Subject: Mathematics

Topic : Subtraction of two digit numbers that involve exchanging

Time : 40minutes

Instructional materials: MAN primary school mathematics 6 based on modules, chalk and duste

Behavioural objectives : At the end of the lesson pupils should be able to:

1. Subtract two digit number that involve exchanging.

Previous knowledge : pupils have learnt about addition of two digit numbers

Introduction : The teacher introduce the lesson by asking question

1. What is exchange?

Solution:

1. Exchanging means borrowing or given something and receive something of the same kind in return

presentation :

Step I: The teacher write some problems and solve on the board

(1) Borrowing 1

$$\begin{array}{r} 1 \\ 2\ 0 \\ -\ 1\ 9 \\ \hline 1 \end{array}$$

(2) Borrowing 1

$$\begin{array}{r} 3\ 7 \\ -\ 2\ 9 \\ \hline 8 \end{array}$$

(3) Borrowing 1

$$\begin{array}{r} 4\ 7 \\ -\ 1\ 8 \\ \hline 2\ 9 \end{array}$$

Step II: The teacher write some problems and solve on the Board together with the pupils.

(1) Borrowing 1

$$\begin{array}{r} 3\ 5 \\ -\ 2\ 6 \\ \hline 9 \end{array}$$

Evaluation : The teacher evaluates the lesson by given some problems to solve in the class.

(1) $\begin{array}{r} 4\ 3 \\ -\ 2\ 5 \end{array}$ (2) $\begin{array}{r} 4\ 6 \\ -\ 3\ 9 \end{array}$

Conclusion :The teacher concludes the lesson by revising the main points of the lesson.

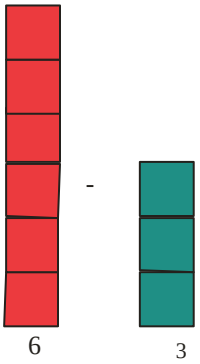
CUSENAIRE RODS MODELS FOR ACHIEVEMENT TEST

ON EXPERIMENTAL GROUP

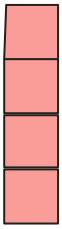
Time Allowed: 1hour.

Instruction: Answer all Questions by Circling the correct option.

Q1.



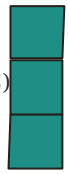
(A).



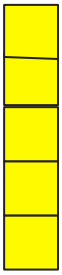
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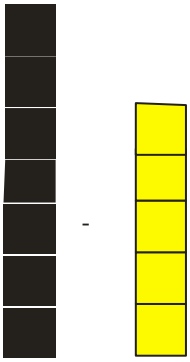
(C)



(D)



Q2.



7 - 5

(A).



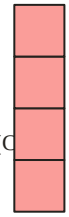
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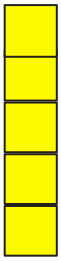


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(C

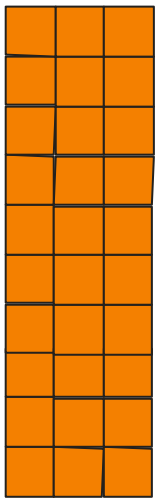


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Q 3.



30

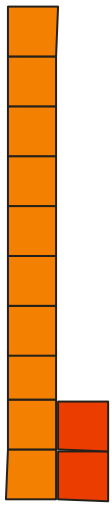
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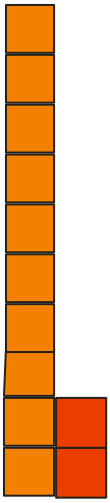
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Q 4.



12

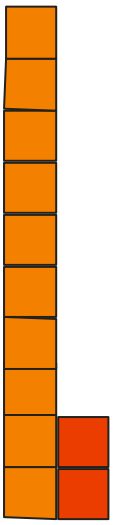
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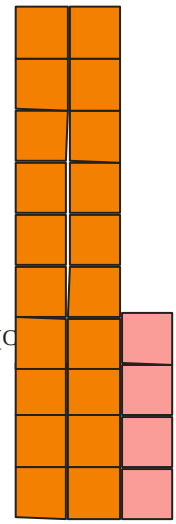
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See options in the next page

(A). 0

(B) 

12

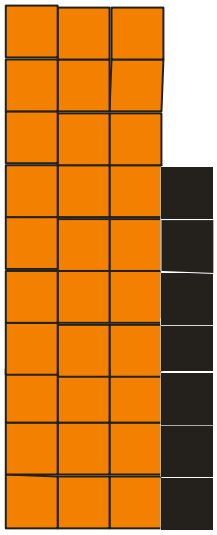
(C 

2 4

(D) 

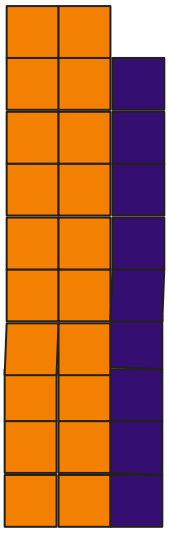
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Q 5.



37

-



29

See options in the next page

(A). 

7

(B) 

6

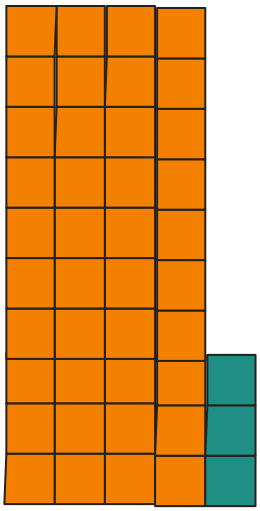
(C) 

8

(D) 

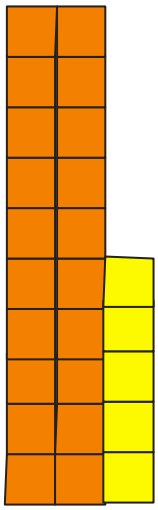
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Q 6.



4 3

-



2 5

See options in the next page

(A)



9

(B)



7

(C)



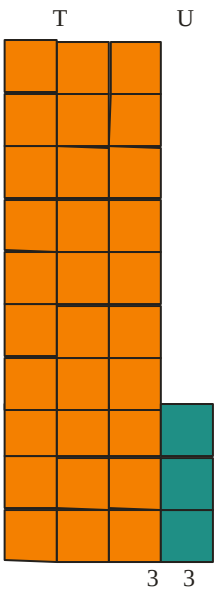
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(D)

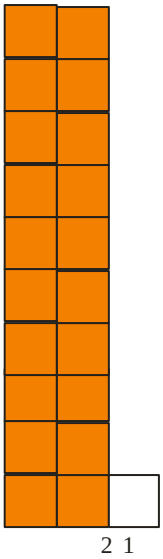


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Q 7.

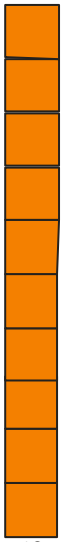


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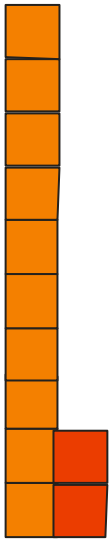
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(A).



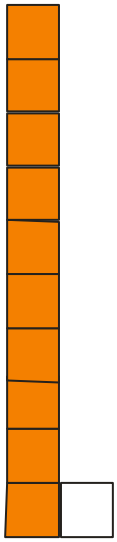
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(B)



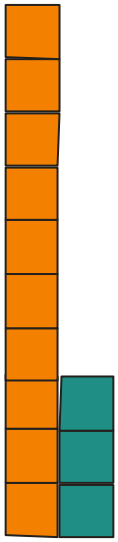
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(C)



11

(D)



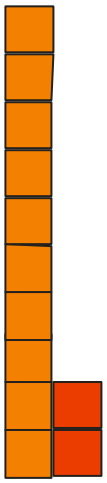
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Q 8.



18

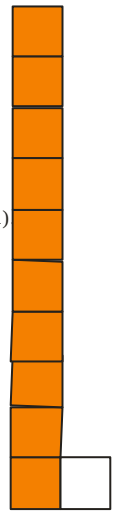
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12

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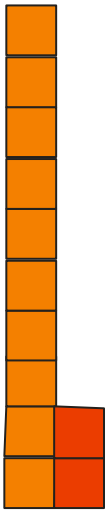
Q 9. There are 22 white rods in one box, 12 white sods were taking away

(A) 

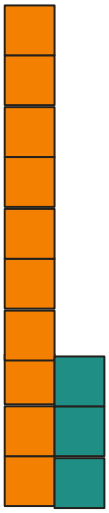
11

(B) 

10

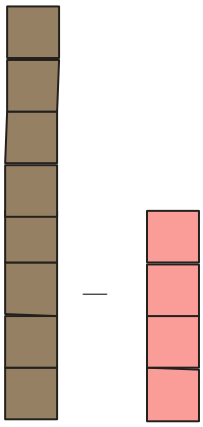
(C) 

12

(D) 

13

Q10.



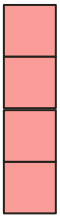
(A).



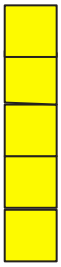
(B)



(C)

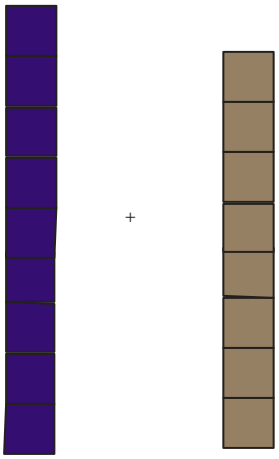


(D)



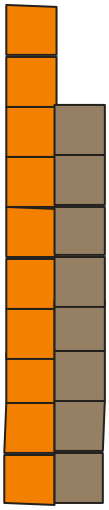
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Q 11.



9 + 8

(A).



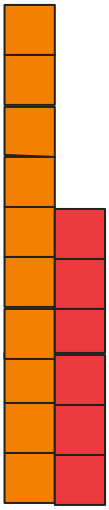
1 8

(B)



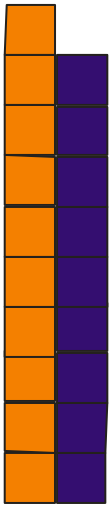
17

(C)



16

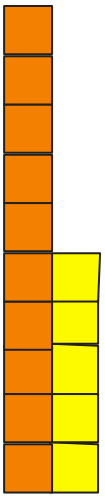
(D)



1 9

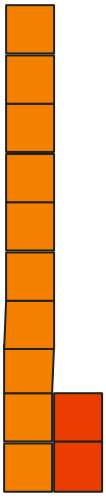
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Q12



1 5.

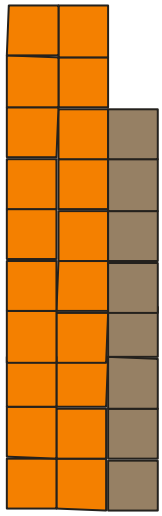
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1 2

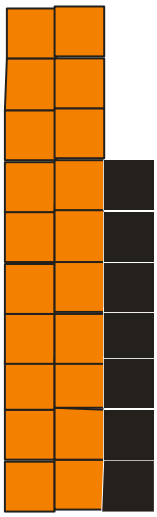
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(A)



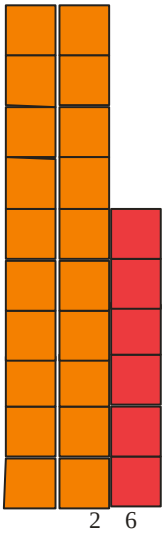
2 8

(B)



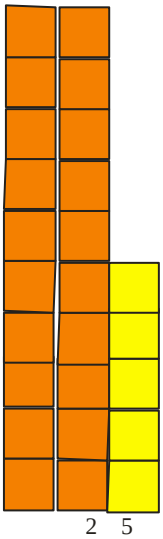
2 7

(C)



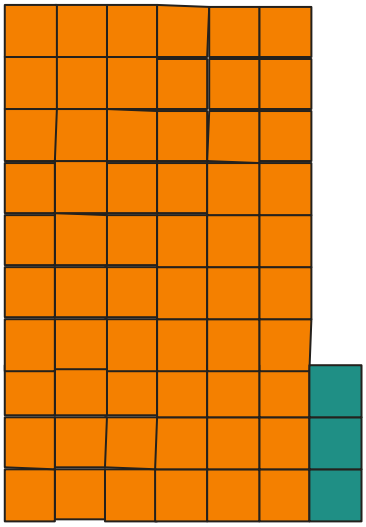
2 6

(D)



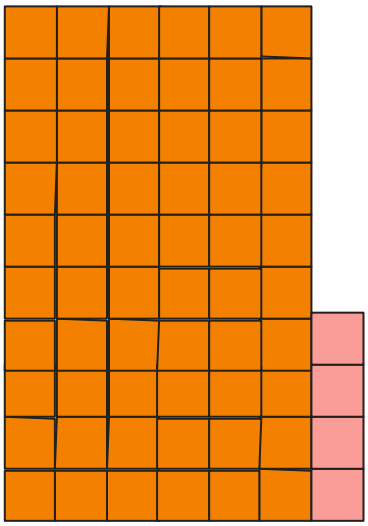
2 5

Q 1 3.



6 3

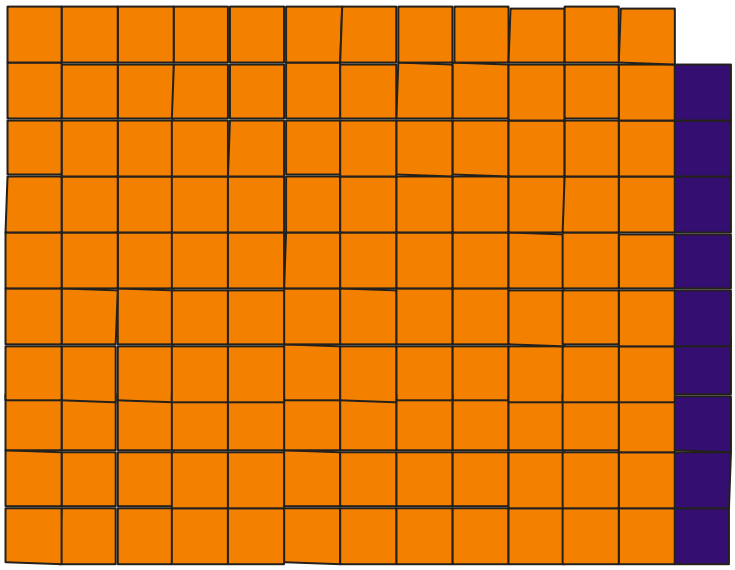
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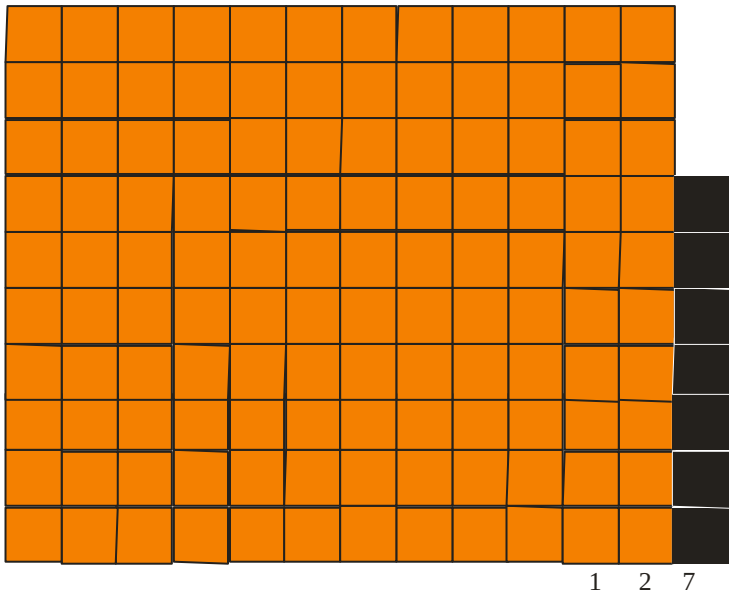
6 4

See options in the next page

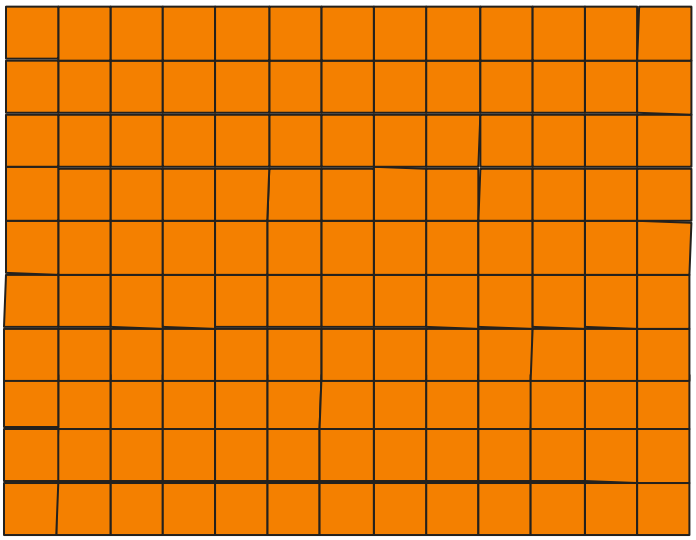
(A)



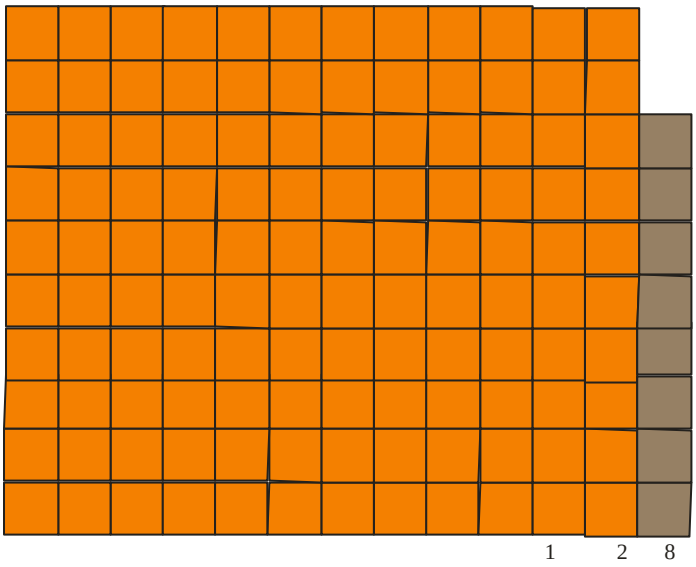
(B)



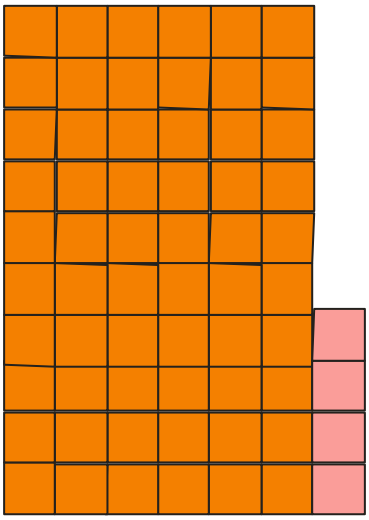
(C)



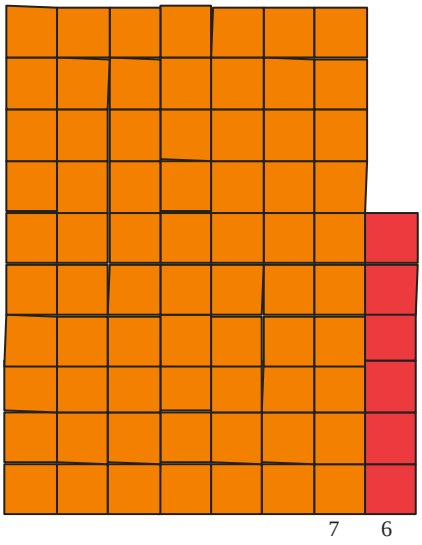
(D)



Q 4.

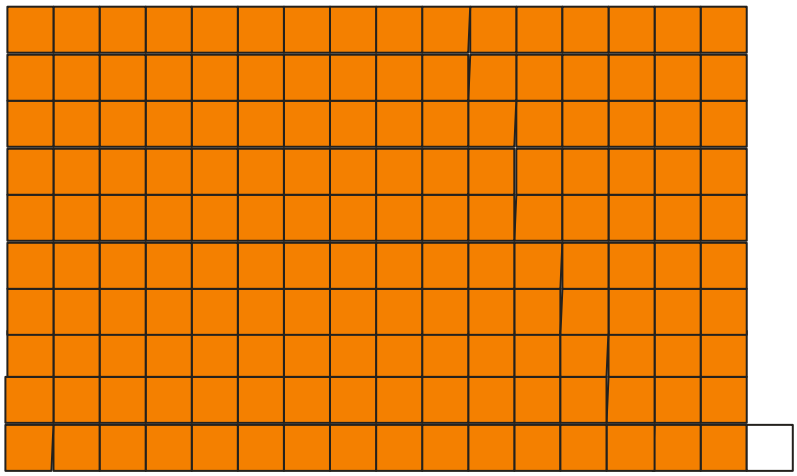


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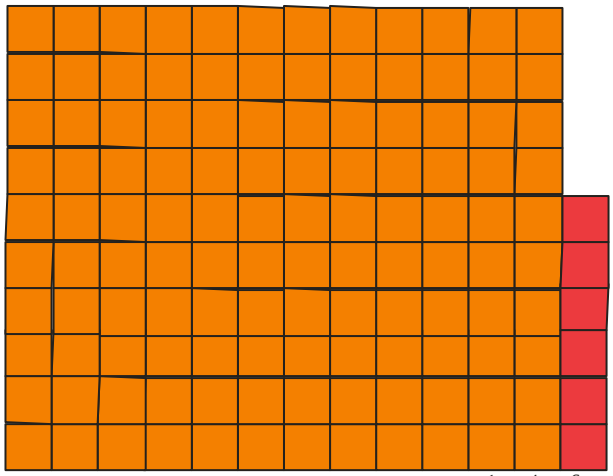
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(A)



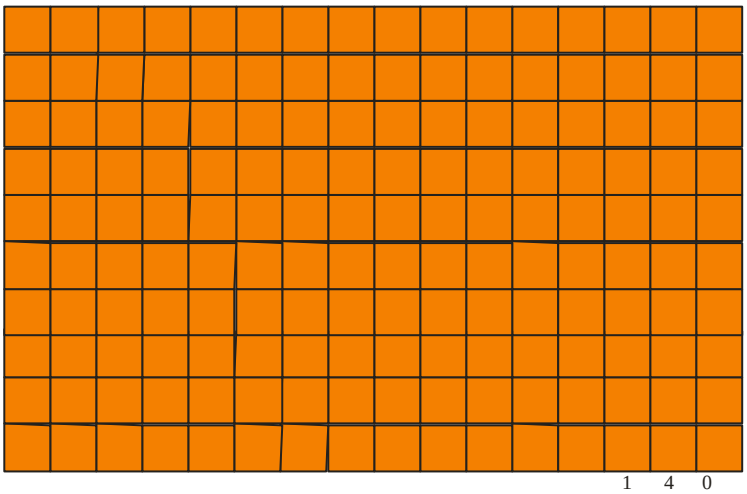
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(B)

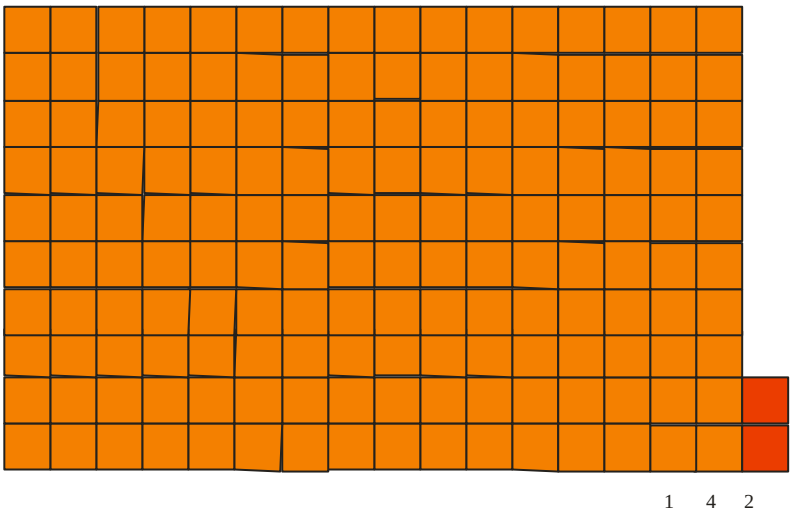


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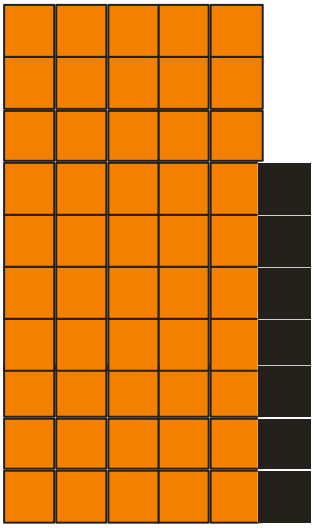
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(D)

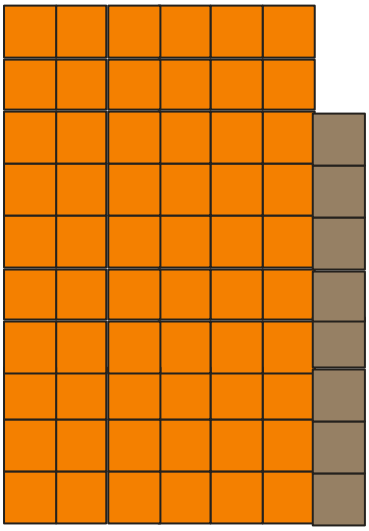


Q 15.



5 7

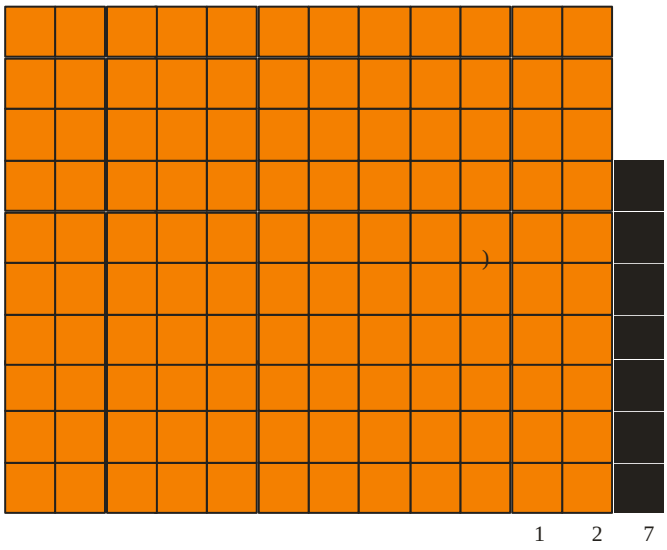
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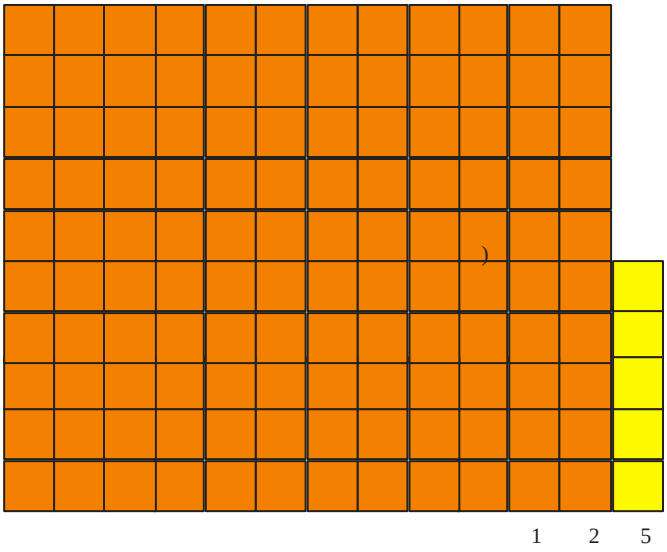
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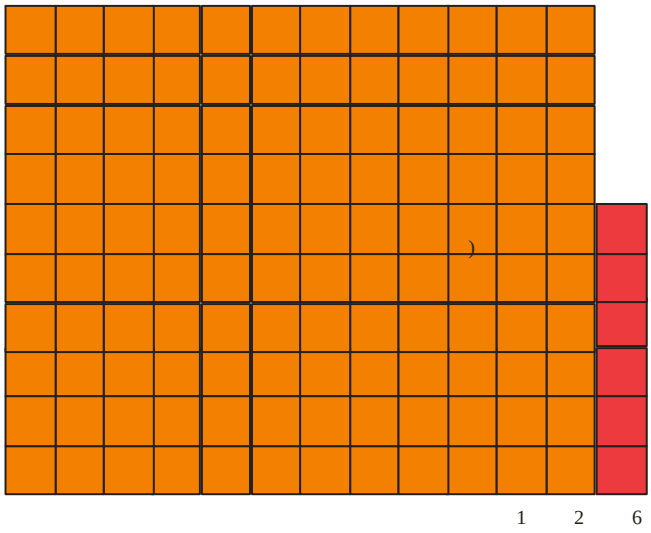
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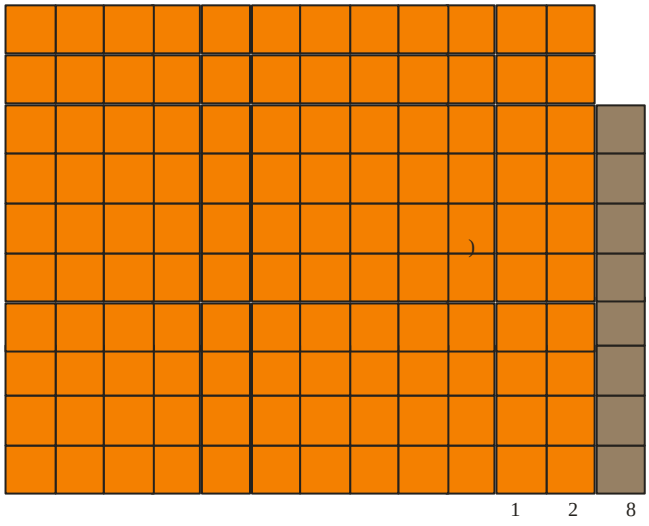
(B)



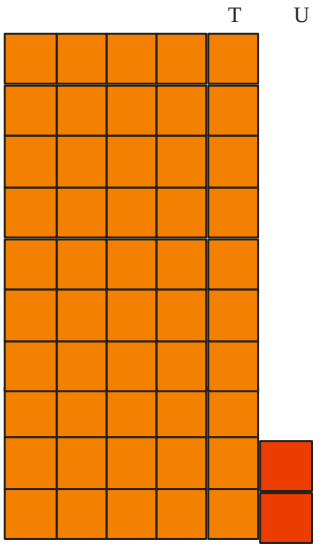
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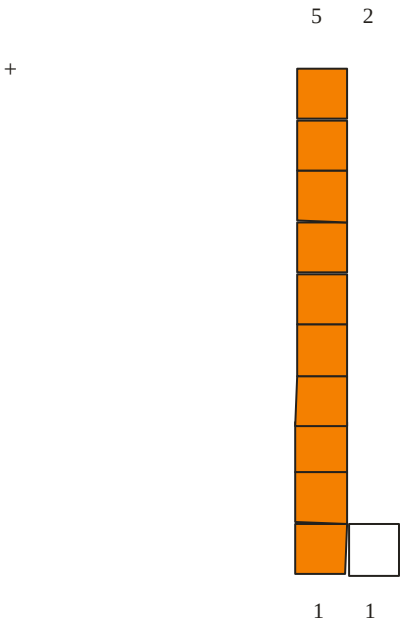


(D)



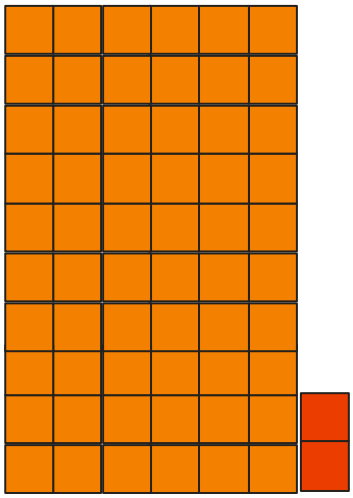
Q 16.



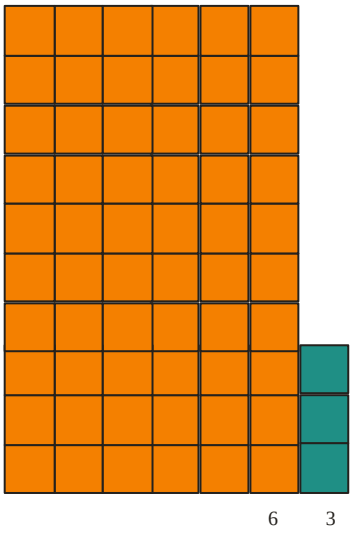


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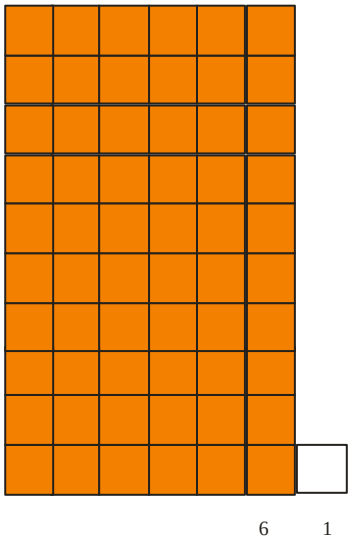
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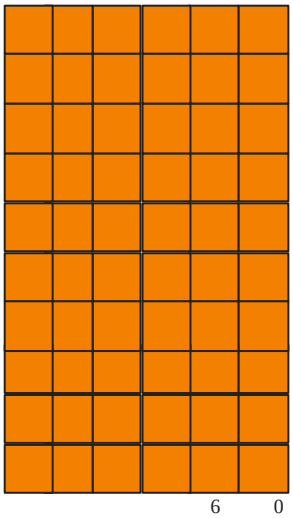
(B)



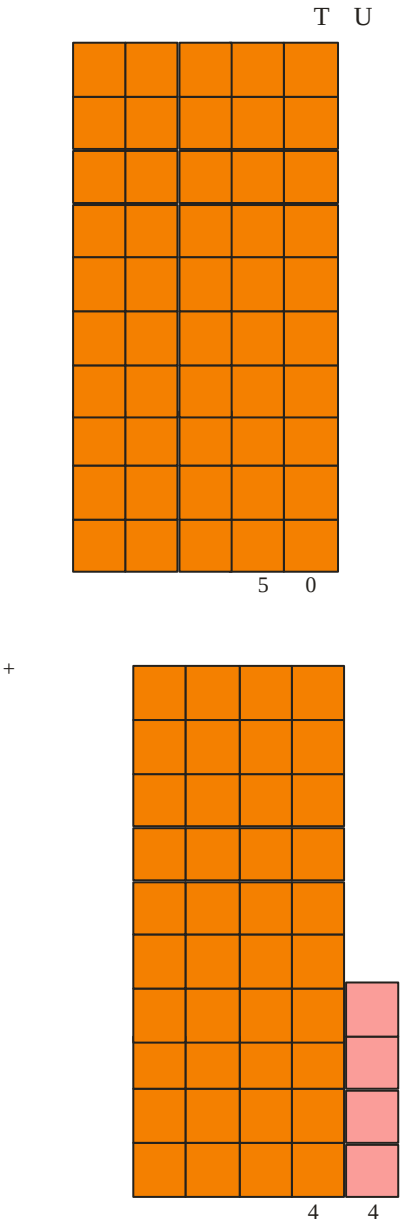
(C)



(D)

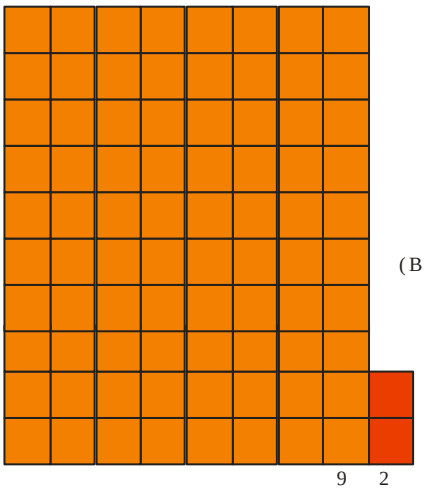


Q 1 7 .

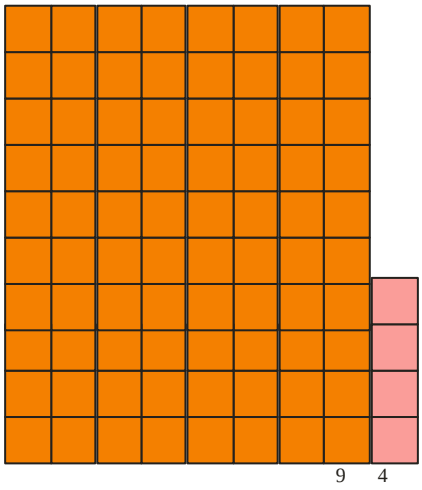


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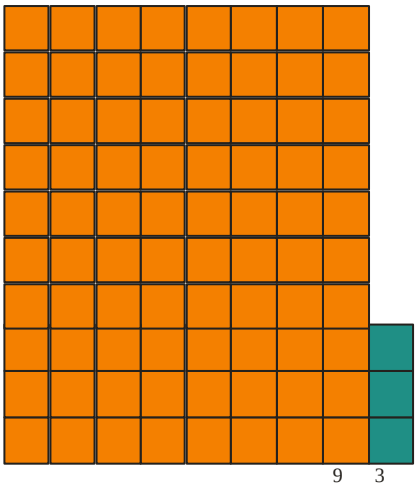
(A)



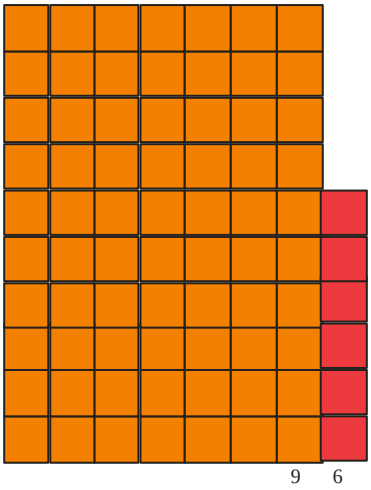
(B)



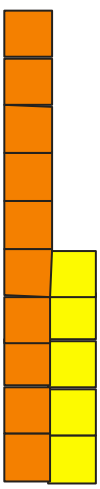
(C)



(D)

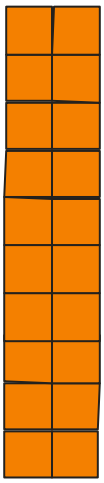


Q 18.



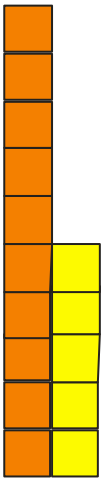
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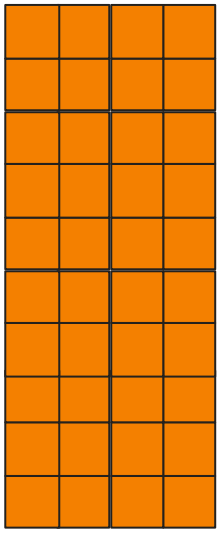
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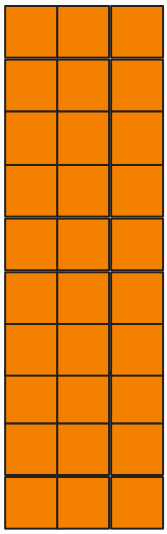
See options in the next page

(A)



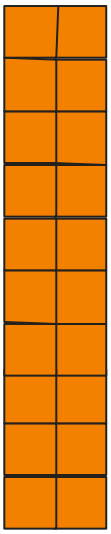
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(B)



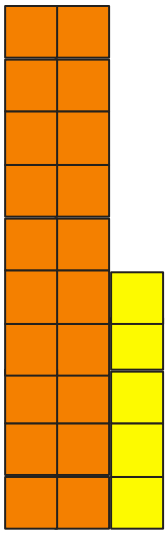
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(C)



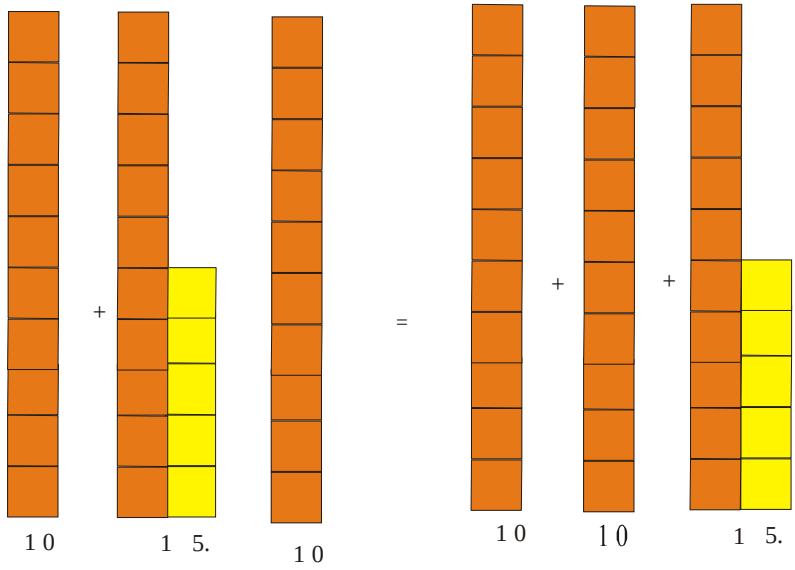
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(D)



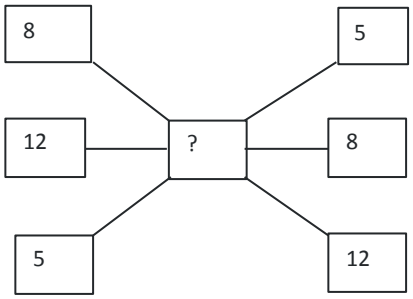
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Q19.

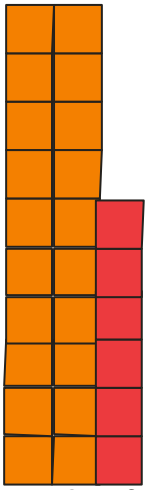


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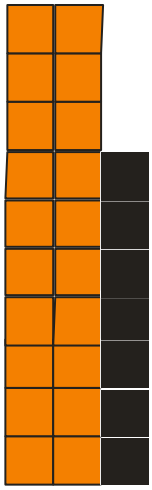
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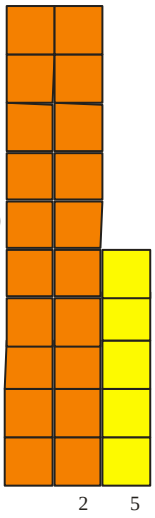
(A)



(B)



(C)



(D)

