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Effect of Short-term Course in Mathematics on Pedagogical Practices in Upper Primary Schools of M.P. and C.G.

PAC Code 16.16

(2017-18)

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PREFACE

To teach Mathematics is a very challenging task. Teachers need to develop their knowledge on the pedagogical techniques. The teacher should keep him/her self abreast with the recent development in this subject to make it joyful and interesting. A good teacher can create the right environment for learning mathematics. It should be imparted through skillful techniques where the learners can fully participate and learn Mathematical concepts or rules in a spontaneous manner. The teachers should adopt such strategies that would make the subject interesting, meaningful and applicable in real life situations.

The study was undertaken with three objectives. The first objectives was to study the performance level of students in mathematics , second was to analyze the type of mathematical errors students commit and the third was to find out the reasons that are responsible for such mistakes. On the basis of these objectives this study was conducted on the selected sample of upper primary school children in Madhya Pradesh and Chhattisgarh.

It is hoped that findings of the study will offer possible solutions which will prove useful to upper primary teachers as well as teacher educators and help them in improving students' performance in mathematics at upper primary level.. Suggestions which will improve future research in this direction are welcome.

Bhopal,

Dated: 26/03/18

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It is hoped that the research report will have a positive impact on teaching and learning of mathematics at upper primary level in the western states as well as in other part of the country.

Bhopal, Dated: 26/03/18

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Executive Summary

Looking to the difficulties in learning mathematics felt by the learners, learning gaps and guidelines of NCF (2005), in the year 2016-17, a 12 weeks short-term course was conducted for teachers/teacher educators in a split model comprising of three phases. In the first phase, a two week face-to-face training programme was organized to provide training to KRPs on the developed course material (2015-16). In the second phase, KRPs visited schools to undertake the practical assignments in the real classroom situations and a report based on their assignment was submitted. A team of resource persons of the short-term course analyzed and assessed the assignments of KRPs. The third phase consisted of two weeks programme which was organized in face-to-face mode wherein KRPs discussed and shared their experience gained in 1st and 2nd phases. This program was an attempt to solve the practical problems faced in teaching of mathematics through the short term in-service course. In the short-term course 28 teachers from MP and 07 from CG (Total 35) were trained which belonged to 35 schools (One Teacher from each school).

After the successful conduct of the course it was felt necessary to know its effectiveness and changes in the teaching-learning of mathematics at elementary level in these states. Therefore, it was decided to undertake a research study on the “Effect of Short Term Course on Pedagogy of Mathematics at Elementary stage”. The study was undertaken in selected schools of M.P. and CG states. Objectives of this study were: (1) To identify the critical parameters of pedagogical practices of the Short Term Course on Pedagogy of Mathematics, and (2) To assess the effectiveness of the short-term course against identified parameters.

Sample of the study is consisting of five schools each from MP and 07 schools from CG States with at least one school from rural area in each state where the teachers had undergone the designated course and who has also implemented the rigors of the training programme in his/her day-to-day teaching. In all the randomly selected school teaching in all the three i.e, 6, 7 and 8 classes were included in the study. The self-constructed observation schedules, focused group discussion schedule and interview schedules were constructed and used as the standardized scales.

Seven parameters of pedagogical practices finally arrived under objective one and Parameter wise inferences are:

1. **Learners' participation in Teaching – learning:** The classroom were child-centered and there was a great extent of involvement of learners in teaching-learner process in both the states under investigation..
2. **Use of verities of Teaching – learning strategies:** Variety of teaching learning strategies are used such as black board-work, group work, different activities in and outside classrooms besides employing other than the traditional teaching methods.
3. **Assessment and feedback during Teaching – learning:** The variety of ways of assessment are used in both the states, they are unit tests, home assignments etc. The assessment also includes both assessment of process as well as speed of learning.
4. **Joyful learning:** The various measures undertaken by teachers in teaching-learning process enhanced the students' joy and pleasure in mathematics teaching-learning and mathematics becomes a subject of students' interest and enjoyment.
5. **Use of laboratory activities:** At present mathematics laboratories are not in existence but there is a good use of locally available material for teaching of mathematics in and outside classrooms. Raw materials like clay, wood,

stone etc. in teaching-learning of mathematics were frequently used in both the states under consideration.

6. **ICT Integration in Teaching – learning:** Use of ICT is on increase in teaching of mathematics in MP and CG states. However, the CG is comparatively better in use of ICT for teaching of mathematics.
7. **Problem solving using Action Research:** Though teachers are aware of the concept and use of action research for problem solving but the use of this parameter is not so frequent.

The conclusions of the study revealed that teachers of mathematics are well aware of the concepts and importance of training inputs and use them but because of availability of less time at their disposal, they normally do not undertake problem solving through action research. This need to be emphasized in various pedagogy-based training programmes. There is also need to establishing mathematics laboratories in all the schools of MP and CG.

Chapter: One

Introduction

1.01 Overview:

Education plays a pivotal role in development of a nation and its people. According to Delor's report on education, through education, one learns to know, learns to do, learns to be and learns to live together. This paves way to acquisition of knowledge, skills and values to form habits and beliefs. Education aims at reflecting the current needs and aspirations of the society and its values. The immediate concern of a community is to build a cohesive society with commitment to practice and demonstrate values which are based on reasoning and understanding of the school going children. The Directive Principles of the Constitution of India envisage provision of free and compulsory elementary education to all children up to the age of 14 years.

Historically, in contemporary education system, elementary mathematics was the integral part of the education since the ancient civilization because of applicability of mathematical concepts in the life of humans on day-to-day basis. The basic numeracy skills such as counting numbers, counting money and observations of time are essential in one's life. Thus, mathematics in its most basic form has been man's faithful companion and helper right from the beginning of human existence on this earth. When man first wanted to answer the questions like: "How many? How much? How big? etc." Thus, mathematics was born. Later, Algebra devised to simplify arithmetical components and geometry came in for measurement and forms or shapes. Trigonometry came into existence when man wanted to find the position of high mountains and stars. With these facts, we must consider that if we remove mathematics from our daily life then the civilization as a whole will crumble down. It plays crucial role not only in the advancement of civilization but also

in the development process of the country. Mathematics helps in problem-solving and decision-making through its applications to real life situations in familiar as well as non-familiar contexts.

It not only helps in our day-to-day situations, but also develops logical reasoning, abstract thinking and imagination. It enriches life and provides new dimensions to thinking. Learning mathematics is not only about remembering solutions or methods but is a skill to solve problems. Mathematical skills are therefore indispensable in one's day-to-day life and planning. Right from the most ordinary to the most extraordinary citizen, everyone has mathematics in his/her life. It has helped us in reaching the moon and paved way for solving mysteries of nature. The entire galaxy is surcharged with the inevitable power of Mathematics.

So, mathematics has been regarded as the most international of all curriculum subjects and it is regarded as an un-dispensable tool of practical utility and also as essential element of intellectual equipment of every cultured person. Mathematical understanding influences decision making in all areas of life—private, social and civil. The mathematical principles of deductive, inductive, equations, proofs and problem solving apply nearly in all the subjects. It is merged so deeply with business subjects that a separate branch has emerged in the name of commercial mathematics. Statistics a division of mathematics is studied in all the subjects and disciplines. Trigonometry a branch of mathematics is widely applied in calculation of heights and distances in geography. Thus, physical, biological or social sciences including the business subjects depend on mathematics for their analysis and interpretation. That's why the mathematics is a compulsory subject of general education up-to the secondary level.

1.02: Teaching-learning of mathematics - The Indian Scenario

Teaching is a simple term, it referred as either an occupation or profession of a group of peoples known as teacher or an activity to help an individual to learn or acquire some knowledge, skills, attitudes or interests. However, the meaning or concept is not so simple. Some educationists defined teaching as:

‘An interactive process, primarily involve in classroom talk, which takes place between teachers and pupils and occurs during certain definable activities.’

E. Amidon (1967).

‘Teaching is a form of interpersonal influence aimed to change the behaviour potential of another person.

N. L. Gage (1962)

‘Teaching is a system of actions intends to produce learning.’

B. O. Smith (1960).

Thus, “Teaching is a triadic relation and tri-polar process involving the source of teaching, student and a set of activities and manipulation to bring changes in the behavior of the students”. ‘Effective teaching’ demands various integrated activities in teaching-learning system. There is no single, universal approach that suits all situations therefore effective teachers use an array of teaching strategies according to the needs. Different strategies are used in different combinations with different groups of students to improve their learning outcomes. Some teaching strategies are better suited to teaching certain skills and fields of knowledge than are others. Some strategies are better suited to certain student backgrounds, learning styles and abilities. The profession teaching standards represent the teaching profession’s consensus on the critical aspects of the art and science of teaching (pedagogy) that characterizes accomplished teachers in various fields.

‘Pedagogy’ is the art and as well as science of teaching. It is a master-plan that includes a detailed analysis of what is to be done by a teacher. Pedagogy,

incorporating an array of teaching strategies that support intellectual engagement, connectedness to the wider world, supportive classroom environments and recognition of difference, should be implemented across all key learning, and subject areas. Pedagogical practice promotes the wellbeing of students, teachers and the school community - it improves students' and teachers' confidence and contributes to their sense of purpose for being at school; it builds community confidence in the quality of learning and teaching in schools. Cast in terms of actions that teachers take to advance student outcomes, these standards also incorporate the essential pedagogical knowledge, skills, dispositions, and commitments that allow teachers to practice at a high level.

Teachers develop their pedagogical knowledge in mathematics from different sources. Like in-service training and organized professional activities and teachers' own teaching experience and reflection, and their daily exchanges with colleagues, are the most important sources of knowledge. Teachers' previous experiences as students, their pre-service training and their reading of professional literature have less influence on their professional knowledge.

Mathematics is engrained in the Indian history from the discovery of zero to modern mathematics. The Journey of education of mathematics starts from pre-nursery stage. Every child in school study mathematics to develop mathematical skills required throughout their life. Teaching learning of mathematics as a subject in school system is the foundation of children. Mathematics education is a key to increasing the post-school and citizenship opportunities of young people, but today, as in the past, many students struggle with mathematics and become disaffected as they continually encounter obstacles to engagement. It is imperative, therefore, that we understand what effective mathematics teaching looks like—and what teachers can do to break this pattern.

To achieve the constitutional mandate, Government of India took several steps after independence for improving mathematics education especially at elementary level. Further, in 1990s many committees and commissions were set up and programmes were implemented in the country to focus on elementary education for improving access and quality of elementary education under Sarva Shiksha Abhiyan for 'Universalisation of Elementary Education (UEE)'. To achieve the target of UEE, major identified indicators included access, enrolment, retention, achievement and quality aspects in education. It may be noted that there are two prominent National Policies on Education which were implemented in 1968 and in 1986 (revised in 1992). All these concerted efforts led the country to witness the substantial results on access, enrolment and retention fronts in Elementary Education but the achievement or more appropriately the quality aspect of it remained still mooching. The quality concern not only lies in the poor level of children's achievement but also in the gaps in their achievements across the caste, sex and geographical location which continued to widen further. This gap is widely visible across the states and regions, even in schools at different levels in achieving the same objectives and with the similar facilities.

1.03 Teaching-learning of Mathematics in NCF 2005:

The national focus group on teacher education formed during NCF-2005 strongly recommended redesigning of teaching education programme to respond to the current changes in the school curriculum in the state and regional context. The key departure of pedagogical courses (including mathematics) from conventional teacher education programmes shifted the focus from pure disciplinary knowledge and methodology to learner and his context. Now, a pedagogy course of mathematics would focus on understanding the nature of children's mathematical thinking as much through theory as through direct

observation of children's thinking and learning process, the language of mathematics and engagement with children's learning in specific areas. One can state the nature of mathematics as having Abstraction, Symbolic methods, Conditional reasoning, Rigour, High (and even unexpected) applicability to the real world and extremely long historical development. The proposed pedagogical shift will help the children to understand and appreciate his nature of mathematics in a better way.

Teacher and student engagement is critical in a classroom. Children are natural learners and knowledge is the outcome of their own activities. They draw upon and construct their own knowledge and develop their capacities in relation to the physical and social environment. Knowledge needs to be distinguished from information and teaching needs to be seen as a professional activity. Pedagogic efforts in classrooms depend on professional planning of teachers. It should aim at enhancing children's natural desire and strategies to learn at the age of adolescence. So opportunities to try out, manipulate, make mistakes and correct one-self are to be provided by the teacher and child-centered pedagogy has to be adopted in classrooms in which children's experiences, voices and active participation are necessary and teacher has to plan activities keeping in view the children's psychological development and interests. In the critical period of development of self-identity and psychological changes, responsible handling with the issues like independence, intimacy and peer group dependence etc. and appropriate support is necessary and specifically for girls. Here, re-enforcement of norms of positive behaviour is necessary.

What children learn out of school and bring to school is important to further enhance the learning process by the teacher. This is all the more true for children from underprivileged background, especially girls, as the world they inhabit and their realities are under-represented in school knowledge. Participatory teaching and learning, emotions and experience need to have definite and important place in classroom.

1.04 Current Problems in Teaching and Learning of Mathematics:

The nature of mathematics teaching significantly affects the nature and outcomes of student learning. This highlights the huge responsibility teachers have for their students' mathematical well-being. The main goal of mathematics education in schools is to stimulate analytical thinking process of the children. Clarity of thoughts and pursuing assumptions to logical conclusions is central to the mathematical enterprise. Teaching of mathematics in the class is not only concerned with the computational knowledge of the subject but is also concerned with the selection of the mathematical content and communication leading to its understanding and application. So while teaching mathematics one should use the teaching methods, strategies and pedagogic resources that are much more fruitful in gaining adequate responses from the students than we have ever had in the past. The teaching and learning of mathematics is a complex activity and many factors determine the success of this activity. The nature and quality of instructional material, the presentation of content, the pedagogic skills of the teacher, the learning environment, the motivation of the students are all important and must be kept in view in any effort to ensure quality in teaching-learning of mathematics. One of the major objectives of teaching mathematics is to enable children to keep both speed and accuracy in mathematical operations. The numerical and spatial problems which they encounter at home, in the school and in the community can be used as examples to inculcate practical concepts. Mathematics should help children in developing understanding of key mathematical concepts at each level through appropriate exercises with things from the physical world and environment. It should help children develop an understanding from the concrete to the abstract, from the specific to the general.

Any analysis of mathematics education in our schools, tend to encounter a range of problems. Developing children's abilities for mathematical skills is the main

goal of mathematics education. The narrow aim of school mathematics is to develop 'useful' capabilities, particularly those relating to numeracy-numbers, number operations, measurements, decimals and percentage. The higher aim is to develop the child's resources to think and reason mathematically, to pursue assumptions to their logical conclusion and to handle abstraction. It includes a way of doing things and the ability and the attitude to formulate and solve problems. But how far these are achieved is a great question? It is imperative, therefore, that we understand what effective mathematics teaching looks like- and what teachers can do to break this pattern.

The following four problems are the core areas of concern in teaching and learning of mathematics:

- A sense of fear and failure in mathematics among majority of children.
- A curriculum that disappoints both a talented minority as well as the non-participating majority at the same time,
- Crude methods of assessment that encourage perception of mathematics as mechanical computation, and
- Lack of teacher preparation and support in the teaching of mathematics.

Thus, mathematics is one of the significant subjects in the school curriculum at elementary and secondary level. In light of the NCF (2005) directions and the problems felt in the mathematics teaching-learning in classrooms comes the issue of quality teaching of mathematics, the most important component, for which quality professional teachers are to be prepared or trained through in-service course.

With this aim, the short term course for elementary school mathematics teachers (classes 6 to 8) was conducted with major objective to orient the teachers/teacher educators in a split model, comprised of three phases. In the

first phase, a two week face-to-face training programme was organized to provide training to KRPs on the developed course material (2015-16). In the **second phase**, KRPs visited schools to undertake the practical assignments in the real classroom situations and a report based on their assignment was submitted. A team of resource persons of the short-term course analyzed and assessed the assignments of KRPs. The **third phase** consisted of two weeks programme which was organized in face-to-face mode wherein KRPs discussed and shared their experience gained in 1st and 2nd phases. This program was an attempt to solve the practical problems faced in teaching of mathematics through the short term in-service course.

1.05 Need and importance of the Study:

In the year 2016-17, the 12 weeks short-term course was conducted for teachers/teacher educators in a split model comprising of the above three phases. Teachers and teacher educators from Madhya Pradesh and Chhattisgarh participated in the programme. After the successful conduct of the course it was felt necessary to know its effectiveness and changes in the teaching-learning of mathematics at elementary level in these states. Therefore, it was decided to undertake a research study on the “**Effect of Short Term Course on Pedagogy of Mathematics at Elementary stage**”. The study was undertaken in selected schools of M.P. and CG states. The study also seeks to suggest interventions for the improvement in training strategies and training materials.

1.06 Objectives of the study: The major objectives of this study are:

1. To identify the critical parameters of pedagogical practices of the Short Term Course on Pedagogy of Mathematics.
2. To assess the effectiveness of the short-term course against identified parameters.

1.07 Research Questions: The following research questions were formulated for this study-

- What are the critical parameters of pedagogical practices of the mathematics short term course?
- How effective is the mathematics short term course in pedagogical practices?
- What is the extent of the effectiveness of the mathematics short term course?

1.08 Delimitations of the Study: The limitations of the study are as follows:

- The study is limited to observations made on teachers of M.P. and C.G who had taken the three months short term course in Mathematics on pedagogical practices
- Under this study, teachers were included only of the first batch of the short term course (Year 2016-17).

In this chapter the rationale and need of the investigation were discussed in light of the need felt by the investigator. Next chapter reviews the related literature of the problem under study.

1.08 Chapterization of the study: The report of the study is distributed in five chapters. Chapter one contains the introductory part of the study, the chapter two is regarding different commissions and review of past studies with respect to mathematics education, chapter three is related to the methodology of the study. Under methodology, the details of research design regarding this study are documented. Chapter four, deals with the presentation of data and its interpretation. The last chapter i.e. fifth, contains the conclusion and discussion about the findings. The executive summary of the research study is given in the beginning of the report.

Chapter: Two

Review of Literature

2.01 Introduction:

The literature of any field forms a foundation on which the structure of the current investigation will have to be built. In absence of this foundation the work is likely to be shallow and it becomes an isolated entity bearing only accidental relevance to what has gone before. When studies are based on past literature, one can hope for cohesive and integrated approach to the problem. Review of the literature involves locating and evaluating reports on researches conducted in the field of the investigation in hand or reviewing the research work in related areas. Review helps researcher to delimit and define his problem. It helps in problem selection, depth of the problem, utility of problem, research design, tool and statistics to be used in research. Review of literature suggests proper direction to new study. Earlier findings help to give proper shape to new research. Research planning depends upon review of related literature with another factor also. In the following pages an attempt has been made to narrate researches that were carried out relating to the area of study along with the educational scenario and opinion of different commissions with respect to the mathematics education. .

2.02 Opinion of different Commissions with respect to mathematics

education: Universalization of elementary education has been the central theme of educational planning in India as a prerequisite of the 45th article of the directive principles of our constitution. These direct the state to provide free and compulsory education to all children, till the completion of fourteen years of age. In view of the constitutional commitments, Elementary schools were opened, teachers were appointed and enrollment drives were organized under

the five year plans. However, complete realization of the goal of universalization of Elementary Education could not be achieved due to the problems of access, illiteracy, uninteresting teaching and learning process and explosion of population etc.

To achieve this constitutional mandate, Government of India has taken several steps in the past to universalize Primary/Elementary Education. Many committees and commissions were constituted and programmes were implemented in the country after independence to achieve the target of universalisation of Elementary Education, taking account of the major indicators like access, enrolment, retention, dropout, achievement and quality aspects. Two National Policies on Education have been in place – one in 1968 and another in 1986 (revised in 1992). Due to all these concerted efforts, the country witnessed substantial results on access, enrolment and retention fronts in Elementary Education but the achievement or more appropriately the quality aspect of it remained still mooching. The quality concern not only lies in the poor level of children's achievement but also in the gaps in their achievements across the caste, creed, sex and location which continue to widen further. This achievement gap is so varied that what to talk of states and regions, even schools are found at different levels for the same objectives and with the similar facilities.

The poor level of education and gaps in achievement lead to an urgency to standardize it. The educationists and policy-makers were highly concerned for this since long. The Secondary Education Commission (1952-53) and the Education Commission (1964-66) both laid emphasis on the quality aspect of education as well as on the national development. The Kothari Commission (1964-66) went deeper into the issue and strongly recommended for setting of some standards for achievement and to ensure that no school remains below that standard. The 1968 Education Policy also enumerated the same. Consequently,

NCERT in collaboration with the states undertook a UNICEF assisted project in the year 1978, with the focus on Elementary Education Curriculum Renewal (EECR). Under this project, a Minimum Learning Continuum (MLC) was developed. However, this was a localized effort and did not seep much into the entire system. Hence, the National Policy on Education (NPE 1986, revised in 1992) emphasized again the need of universalizing quality elementary education and eradication of illiteracy more emphatically and categorically. It envisaged a child-centered approach to promote universal enrolment and universal retention of children up to 14 years of age and substantial improvement in the quality of education in the school (POA, P.77).

The National Policy document has also recommended identifying competencies and values which are to be nurtured at different stages of school education (NCF 05, P.4). In pursuance of this, the National Curriculum Framework for School Education (1988) focused more on making school education comparable across the country and ensuring national integration without compromising on the country's pluralistic character. This concern of comparable school education continued to emerge further in the National Curriculum Framework of School Education (NCFSE 2000).

Indian education commission (1964-66) has pointed out, "We cannot overstress the importance of mathematics in relation to science education and research. This has always been so, but at no time has the significance of mathematics been greater than today". The Kothari Commission has envisaged a course of compulsory mathematics in primary and junior secondary course. Diversification of course has been recommended at higher secondary level with the result that mathematics at this stage is an optional subject and is meant only for those who want to study higher mathematics or to take up vocations and professions requiring specialist knowledge of the subject.

2.03 Review of past studies: There are many studies conducted on achievement, but only those which relating to school going children are cited below-

Desai (1973) studied the attitude towards Mathematics of high school students of Saurashtra. Objective of this study was to construct an attitude scale to measure the attitude towards Mathematics of the high school ,Pupils of Saurashtra , in order to know if the students varied in their attitude with respect to sex, grade and area they lived in. The sample of 3584 pupils constituted of 2280 boys and 1225 girls. 1821 from rural and 1684 from urban areas, for analyzing data Mean and S.D. were calculated and significance test was applied.

It was found that the pupils with favorable attitude to Mathematics preferred to offer it at S.S.C. Exam. The attitude of boys and in general became more favorable as they moved from grade VIII to grade IX ; their attitude was less favorable in grade X than in grade IX, while the trend reversed in case of girls. The boys and girls of X had more or less similar attitude. Boys in general, did not differ from girls in their attitude towards Mathematics. **Urban children in general had more favorable attitude to Mathematics than rural children.**

Lalithamma, K. N. (1975) conducted a study on some factors affecting achievements of secondary schools pupils in Mathematics with the objectives to find out the general nature of pupil's interest, study habits and performance in Mathematics, to carry out differential studies on interests, achievements and intelligence based on sex locality etc. and to find out relationship of study socio-economic factors intelligence and interest with achievement in Mathematics. The sample consists of 732 students of class IX. The study used standardized achievement test in Mathematics, a study habit inventory, an interest inventory, a socio-economic status scale and Raven's standard progressive matrices. The study concluded that the average performance of pupils in mathematics was 23-

14 with S.D. 8-20 and the distribution was negatively skewed. There was significant difference in the performance of boys and girls in mathematics, the difference being in favor of boys. The urban pupils were superior to rural pupils in Mathematics. Intelligence and interest in Mathematics were higher in boys and urban pupils than in their respective counterparts. An achievement in Mathematics is positively related to intelligence interest in mathematics, study habit and socioeconomic status. Studying lessons daily, studying Mathematics by writing, repetition in learning, spaced learning, over learning, etc. influenced the achievement in Mathematics positively. Private tuitions, electric light facilities, radio, equipments for study etc. influenced the achievement in Mathematics.

Zecharia T. (1977) conducted a study on impact of attitude and interest on achievement of secondary school pupils in social studies, Ph.D. (education) Kerala University, 1977 with the objectives to find out the general nature of pupils achievements, attitude and interest in Social studies for the total sample, to find out the effect of attitude and interest on the Social studies achievement for the whole sample and sub-sample classified on the basis of intelligence, sex, age and socio-economic status a sample of 800 students of class X. The study used standardized achievement test in Social studies for class X attitude scale interest inventory and standard progressive Matrices were used for the collection of data. It was found that there was a high positive correlation between secondary school students' achievement in Social studies and their attitude. The students' interest in Social studies was closely related to their achievement in the subject at all levels. The students' intelligence was not a prominent factor in influencing their attitude and interest in Social studies.

Mishra (1978) studied the attitude towards Mathematics of secondary school students. To find out the relationship between attitude score and parent's qualification, parent's profession, parent's income, family size, type of school

attended by students and reading facility. The objective was to develop a Likert scale to measure attitude towards Mathematics. On the basis of opinion from a sample of 500 students of secondary schools, seventy attitude statements were prepared of which thirty were finally accepted for the scale. A stratified random sample of 505 students (345 boys, 160 girls) was selected from the population of class X and XI students of Patna Municipal area. Analysis of variance and t-test were employed for the treatment of data. It was found that the boys whose parents were qualified and in prestigious profession had more favorable towards Mathematics than others but this was not true in the case of girls. Boys and girls from rich families had more favorable attitude towards Mathematics than those from poor house. The types of institution attend earlier had no impact on attitude than others.

Singh (1986) studied some possible contributing factors to high and low achievement in mathematics of high school student of Orissa: To study the relationship between achievement in Mathematics and some possible contributing factor. To study the significant difference between high and low achiever group in Mathematics with respect to variables in the above objectives .The sample consisted 370 students of class XI from central, western and Southern Zone Orissa. Achievement test developed by investigator Cattell's culture Fair intelligence test , scale 3 (from A + form B) Samal's vocational Interest inventory and survey of study habits and attitude (form H) were used for data collection .The data were analyzed with the help of correlation and multiple regression analysis. It was find out achievements in Mathematics was significant positively related with intelligence, SES and study attitudes. Regression analysis revealed that study habits and interest in agriculture are significantly correlated with achievement in Mathematics. High achievers scored high in the study of attitudes survey while low achievers scored low,

high achievers were more intelligent than the low achievers, and high achievers in general were of higher SES than low achievers.

Nagailaiankmi (1988), conducted an investigation into the attitude and study habits related to achievements in Mathematics in Shillong. To find out difference in attitude to-wards Mathematics of students with high, average and low mathematics achievements. To find out difference in study habits of students with high, average and low Mathematics achievements. All the students of class IX of ten high schools in Shillong selected randomly provided the sample of 326 students for the study. The tool used were Likert type attitude scale mean to measure the attitude of student to-wards Mathematics and achievements test for Mathematics, of class IX students and Rao's study habits inventory , Descriptive statistics and analysis of variance were used to treat the data. It was found that there is no significant difference in attitude to-wards Mathematics of student grouped high, average and low on Mathematics achievements. Significant differences were found among the study habit scores of high, average and low achievers in Mathematics. Male and Female students belonging to high, average and low scores on Mathematics achievements did not show significant difference in their attitudes as well as higher achievements scores on Mathematics but did not show significant difference in their study habit scores as compare to the tribal student .Studies related to achievement in Mathematics .

Pal (1989) had conducted a critical study of some affective out of the students as predictors of their Mathematical ability. To find out their relation to students achievement in Mathematics sex –wise, stratum –wise. The objective was to fit a regression equation so that prediction of achievements in Mathematics. Self-construct and standardized four tests on self –concept, anxiety, attitude towards Mathematics and a questionnaire on academic motivation were used. 16schools

(6 urban, 5 semi-urban, 5 rural) and 600 students took the various test. The tools were used a test on self-concept in attitude Mathematics a test of anxiety towards Mathematics and a questionnaire on academic motivation. It was found that boys showed higher self-concept than girls. There existed significant correlation between Mathematics and self-concept and between anxiety and Mathematics and motivation.

Gusamy, S.(1990) conducted a diagnostic study of the errors committed by students of standard IX in solving problems in geometry. The objectives of the study were (1) To identify and categories the errors committed by the students of standard IX in solving problems of geometry (2) To design some suitable remedial teaching programmes (3) To implement the remedial teaching programmes with the students of standard IX in order to minimize these errors in solving problems of geometry. Major findings were (1) It was found that the students mean achievement score were increased and the errors were considerably reduced in the post test. (2) The level of performance of the students in the post test was found to be high after the implementation of the remedial programme.

Subramaniam and Singh (1996) examined different type of mistakes committed by students of Grade II and III in mathematics and its remedial measures using. The finding revealed that (1) The students committed six types of mistakes in addition, eight types of mistakes in subtractions, ten types of mistakes in multiplication and six types of mistakes in division (2) During interview most of the students felt that paucity of time to solve the test items, un-comfortability with subtraction, multiplication and division, carrying over problems, copying habits, presentation of test items in different mode, problems of remembering tables etc., were the possible reasons of their poor performance in the test (3) Some of the students felt that due to confusion between

multiplication and addition signs, forgetfulness of the procedures, lack of opportunity to write on the notebook, etc., they committed mistakes in the test (4) Poor concept of carrying over poor concept of zero, poor concept of multiplication, introvert behavior, lack of writing skills etc., were observed as possible causes of mistakes committed by students (5) The teachers of schools had cited home environment, SES, physical facilities in the school, extra work load on teaches, lack of interest, motivation and discipline, large size of class, general promotion policy etc. as responsible for the poor performance of children in the test.

K.K. Iyer (1997) conducted a study on some factors related to under achievements in Mathematics of secondary school students with the objective to identify factors related to under achievement in Mathematics a sample of 862 students of class IX. The study used a verbal group test of intelligence and standardized test of Mathematics were administered. Out of the 14 personality variables selected, ten variables were most effective in discriminating between all achievement pairs. The variable which was the least effective in discriminating was anti-social tendencies. The non-personality variables i.e., sex age caste, parental profession and parental education were associated with all the three achievement levels. There was significantly greater number of high achievers among high intelligence group than among the low intelligence group.

Maria L. Blanton, Sarah B. Berenson and Karen S. Norwood (2001) conducted a study on exploring pedagogy for the supervision on prospective mathematics teachers. The investigation explored pedagogy for supervision through a case study of one prospective middle school mathematics teacher during her student teaching semester. Classroom observations by the university supervisor, teaching episode interviews between the supervisor and student teacher, and focused journal reflections by the student teacher were coordinated

to challenge the student teacher's existing models of teaching. The emerging pedagogy of the teaching episodes, a central focus of this study, was characterized by (a) the use of open-ended questions that centered the student teacher in the process of sense making; (b) a shift away from the supervisor's direct, authoritative evaluations of the student teacher's practice; (c) a sustained focus throughout supervision derived from the student teacher's classroom experiences; and (d) an effort to maintain sensitivity to the student teacher's zone of proximal development. The nature of the teaching episodes seemed to open the student teacher's zone of proximal development so that her practice of teaching could be mediated with the assistance of a more knowing other.

Garg A. K. (2007) conducted a study on, "Analysis of Causes of Unsatisfactory performance of Students in Mathematics at Primary level in the North East Region" The major objectives of study were (1) To study the level of performance of students in Mathematics at Primary level (2) To find out the causes for unsatisfactory performance of students in Mathematics at primary level and suggest possible solutions. The data were collected through self developed tools. Two types of tools were developed-first, class wise learners' achievement test and second, classroom observation and school related information schedule. This study was conducted in Meghalaya and Assam states on 592 class 1 to 5 students. On the bases of learners achievement, classroom observation, analysis of mathematics books and training module and teachers discussion researcher following reference drawn to causes of unsatisfactory performance of students in mathematics at primary level in the North-East region-

- Due to language problem students do not understand the question.
- During classroom teaching teachers do not use mathematics related teaching learning materials. During classroom observation some schools (about 25%)

there was teaching learning materials in the classrooms but teachers do not use during classroom teaching.

- Both states do not have separate mathematics teachers in the schools. One teacher teaches one class and all subjects.
- Both states do not organize any separate mathematics teachers training. During in-service teacher training both states gave some emphases to mathematics training, but content and process was not sufficient.
- During classroom teaching teachers do not give sufficient emphasis on each learner.
- Teachers do not give sufficient time to CCE and students practices during classroom teaching.
- Both states mathematics books have not sufficient exercise.

Melissa Joan McAninch (2015) conducted a qualitative study of secondary mathematics teachers' questioning, responses, and perceived influences. The purpose of this study was to examine secondary mathematics teachers' questioning, responses, and perceived influences upon their instructional decisions regarding questioning and response to students' ideas. This study was designed to examine the following questions: (1) what similarities and differences exist in questioning patterns between novice and experienced teachers when guiding a classroom mathematical discussion? (2) What similarities and differences exist in responses to students during pivotal teaching moments between novice and experienced teachers when guiding a classroom mathematical discussion? (3) What perceived factors impact the responses teachers give to students' ideas, and how are these factors of influence different among novice and experienced teachers? This study employed a multiple case study research design to compare the questioning practices and responses of three beginning teachers and three experienced teachers. Multiple sources of data were collected, including two interviews (i.e., initial interview and follow-

up interview) for each teacher, five days of classroom video footage for each teacher, and field v notes by the researcher for each interview and observation. The data was analyzed mainly using the constant comparative method to identify regularities and patterns emerging from the data. Results showed differences among the beginning and experienced teacher participants in the frequency and variety of questions asked. The results found through this qualitative study suggest benefits for practicing teachers to expand the types of questions they use in the classroom, making particular efforts to include those areas that teachers from this study showed to be most lacking: semantic tapestry questions that help students build a coherent mental framework related to a mathematical concept, and framing questions that help frame a problem and structure the discussion that follows. The comparison between beginning and experienced teachers also shed light on important practices for teacher education. The beginning teacher participants from this study had no trouble noticing pivotal teaching moments in their lessons but were less developed in their responses to them.

Garg A. K. (2016) conducted a study on common mistakes in mathematics committed by students of upper primary level in the M.P. and Chhattisgarh states. The major objectives of the study were (1) to set a criteria of diagnostic analysis of questionnaire,(2) to analyze the questionnaire based on the above objective, (3) to classify different types of errors/mistakes and (4) to diagnose causes of the mistakes.

The data were collected through self developed tools. Two types of tools were developed-first, . class wise (Class 6, 7, and 8) learners' achievement test, second classroom observation and third school related information and data information schedule. This study was conducted in Madhya Pradesh and Chhattisgarh states 1138 class 6 to 8 students and observed 27 mathematics

classes in both states. On the bases of learners' achievement, classroom observation and teachers discussion researcher following reference drawn to common mistakes in mathematics committed by students of upper primary level in the M.P. and Chhattisgarh states-

The mean score of achievement in Mathematics of students belonging to different classes differ significantly at 0.01 level. It is evident that 't' value for class 6 and class 8 is 3.51 which is significant at 0.01 level $df = 763$. It reflects that the means scores of achievement in Mathematics of students studying in class 6 and class 8 differ significantly. Further the mean score of achievement in Mathematics of students studying in class 6 is 38.57 which is significantly lower than those of class 8 whose mean score of achievement in Mathematics of students is 43.01. Therefore, it can be said that students studying in class 8 have better achievement in Mathematics than those of class 6. Similarly 't' value for class 7 and class 8 is 3.06 which is significant at 0.01 level $df = 789$. It reflects that the means scores of achievement in Mathematics of students studying in class 7 and class 8 differ significant but the means scores of achievement in Mathematics of students studying in class 6 and class 7 do not differ significantly.

The mean score of achievement in Mathematics of students belonging to different districts differ significant at 0.05 level. The t-value for Jhabua and Mahasamund districts is 2.00 which is significant at 0.05 level $df = 560$. It reflects that the means scores of achievement in Mathematics of students studying in Jhabua and Mahasamund differ significantly. Further the mean score of achievement in Mathematics of students studying in Jhabua is 41.56 which is significantly higher than those of studying Mahasamund district whose mean score of achievement in Mathematics of students 38.52. Therefore, it can be said that student studying in Jhabua has significanty better achievement in

Mathematics than those are Mahasamund. In case of difficult questions, more rural children were able to solve it in comparison to urban children. Similarly, girls were able to solve more difficult questions in comparison to boys.

Due to language problem students do not understand the questions. During classroom teaching teachers do not use mathematics related teaching learning materials. During classroom observation, teaching learning materials were found in the classrooms of some schools (about 25%) but teachers did not use them during classroom teaching. In both states there are no separate mathematics teachers in the schools. One teacher teaches mostly all subjects in the class. During classroom teaching, teachers do not give sufficient emphasis on each learner.

2.04: Basis for the study:

The studies in the field are very few and they are not directly related to the investigation. From some of the above researches it has been clarified that the impact of the training programme can be estimated through the observation schedule on the classroom interactions and can be triangulated through interviews /discussions with the stakeholders.

After having gained insight from the related literature, the rationale and need of the study as well as methodology and empirical design have been delineated. All these aspects are discussed the next chapter.

Chapter: Three

Methodology of the Study

3.01 Introduction:

Research is a systematic attempt to achieve the objectives and obtain the answers of meaningful research questions about a phenomenon or event through application of scientific techniques and procedures. Every research is directed towards solution of a problem characterized by systematic and logical enquiry aimed to develop generalizations, principles or theories helpful in predicting future occurrences. Research strives to be objective, un-biased and logical. Therefore, every step of research work must be well planned and designed carefully so that the researcher proceeds ahead without getting ahead confused at the subsequent set-up of investigation. Research design helps to define detailed plan of an investigation. It gives clear understanding of what is to be done? What tools are to be employed? What types of data are to be needed? And how the data are to be statistically analyzed and interpreted? It gives the crucial steps in the investigation process and the research is to be carried out as per the research design formulated. It is objectively executed to bring empirical evidences, by doing so; the observations on inferences become valid to reply the research questions and achieve the objectives.

This chapter deals with the methodology employed to achieve the objectives of the study and answer the research questions mentioned in the chapter one. Keeping in view the nature and objectives of the study appropriate sample was selected from the population and appropriate tools were developed. In this chapter tools and techniques of data collection and procedure followed to conduct the study are discussed. They include sampling procedure, tools used for data collection, procedure of administering and scoring of the test and statistical techniques employed for analyzing the data.

3.02 Research Design:

Research design is the actual blue print of the procedure for completion of various investigatory steps to reach the valid conclusions. The present study is a descriptive research, will employ survey method and will be both qualitative and quantitative in nature. Tools and techniques used for data collection under this study will be observation schedule, focused group discussion and interviews with different stakeholders, such as teachers, students and headmasters /principals. The tools were validated with the experts and where ever needed the data collected through different tools/techniques will be triangulated for establishing its reliability and validity in the given context.

3.02.01 Population and Sample:

In the short-term course on pedagogy of mathematics teaching and learning 28 teachers from MP and 07 from CG (Total 35) were trained which belonged to 35 schools(One Teacher from each school).

Studying the entire population to arrive at generalization is not viable in many ways and the process of sampling makes it possible to draw valid inferences on the basis of careful observation of variables within a relatively small proportion of population and therefore sampling was done to represent the universe or population of the trained teachers.

Sample of the study is consisting of five schools each from MP and CG States with at least one school from rural area in each state where the teachers had undergone the designated 3 months training course and who has also implemented the rigors of the training programme in his/her day-to-day teaching. In all the randomly selected school teaching in all the three i.e, 6, 7 and 8 classes were included in the study. Following table depicts the actual sample of the study:

No. of School		
Madhya Pradesh	Chhattisgarh	Total
05	07	12

3.02.02 Tools Used:

Tools are the instruments with the help of which the data are gathered from the respondents for fulfillment of the research objectives. The tools must be appropriate and well constructed to achieve the research objectives. Before preparing and finalizing the research tools, an in-depth study of the training components and their delivery techniques were studied. In present investigation the self-constructed observation schedules, focused group discussion schedule and interview schedule were constructed and used as the standardized scales on the aspects were not available. The details of tools used in the study are given below-

Mathematics pedagogical practices observation schedule: An observation schedule with 35 statements covering the 7 parameters of the mathematics pedagogical practices. All the statements desired observations on implementation of the pedagogical aspects of the training on two modes, to 'a great extent' or 'to some extent'. The statements were arranged in the schedule in a haphazard manner to have cross validation of the situations. After initial development of the schedule it was validated with the experts of the area for its correctness. This observation schedule was used for observation of pedagogical practices in mathematics teaching classroom. The observation schedule is given in appendix.

Focused group discussion Schedule with the students: A focused group discussion with the students of the class was constructed by the researcher to triangulate the information recorded in the observation schedules. Total 5 central issues / points were identified for the focused group discussion with the students. This schedule was used by the researcher to collect data. The format is given in appendix

Interview schedule for teachers and Head teachers: An interview schedule was constructed to facilitate conduction of interview with teachers and head teachers. Total 16 and 12 central pedagogical practices were identified for the interview with the teachers and headmasters, respectively. Based on this schedule, the researcher/project fellow conducted interviews on the changes of the training with the concerned teachers and their headmasters to triangulate the observations. The schedules are given in appendices.

3.02.03 Method of data collection:

After selection of sample districts and schools, the investigator contacted the school authorities through correspondence explaining them the objective and scope of the study and the time. After getting the confirmation investigator visited schools with JPF and collected the data as per requirements.

Data were collected from the selected sample schools. Data were collected using the tools and in the form of field notes taken by the researcher. It took two to three days to complete testing in a school. First day, a meeting with the Head of the School was sought to discuss the detail of the study and chalk out data collection mechanism with his/her permission. First-half of each day was spent in observing the mathematics classroom teaching learning process and second half was devoted to group discussion students or interviews of teachers or head teachers for the study. After completing the classroom observation and students', teachers and head teachers related information was also collected from the school teachers. Field notes were also taken during school visit. After collecting the data, tabulation of the information according to the objective and subsequent evaluation of the data was done.

3.03 Stages of Data Collection:

The study has been carried out in the following phases:

1. In the first phase, related literature and research studies were studied and reviewed.
2. In the second phase, the tools for study – observation schedule, FGD and interview schedules for the stakeholders (students, teachers and head teachers) were constructed and validated.
3. In the third phase the collection of data from the sample had been carried out.
4. In the fourth phase the collected data from the sample were analyzed using the appropriate statistical techniques.
5. In the fifth phase the report was prepared

3.04 Data Analysis:

The data obtained through administration of the tools was classified, tabulated and presented in various forms – tables, diagrams, etc. For analysis of data , both qualitative and qualitative techniques are used. Quantitative data are analysed using simple descriptive statistical techniques such as averages, percentages etc were used as per the nature and need of the collected data. The analyzed data is presented in tables and , graphs etc. as per need.

3.05 Delimitations of the study:

The limitations of the study are as follows-

- The research is limited to study the effectiveness of the specific three months short term course in Mathematics on pedagogical practices conducted during the year 2016-17 in 35 schools.
- The study is limited to 12 schools of M.P. and Chhattisgarh from where teachers undergone and implemented the three months short term course in Mathematics on pedagogical practices conducted by RIE, Bhopal during the year 2016-17
- The study is limited to only identified parameters of the pedagogical practices

The statistical analysis and presentation of data with interpretation based on pre-decided measures is presented in the next chapter.

Chapter: Four

Data Presentation, Analysis and Interpretation

4.01 Introduction

The present study deals with the effect of short term course in mathematics on pedagogical practices in upper primary schools of MP and CG. The study aimed at finding out the effect of a short term course on pedagogy of mathematics for elementary school teachers (a program conducted for three month's duration in the year 2016-17), in a split model comprising of three phases. In the **first phase**, there was a two week face-to-face training programme in which KRPs were provided training into the **developed short term course material (Developed in year 2015-16)**. In the **second phase**, the KRPs went to their schools and pursued the practical assignments in the real classroom situations and sent a report based on their assignment to the PC.

The Resource Person's team of the short term course analyzed and assessed the assignments of KRPs and called them for **third phase** of the programme which was in face-to-face mode. In this two week programme (third phase), KRPs discussed and shared their experiences gained during previous phase(s). After conducting the program teachers who were trained under the program were supposed to implement the pedagogical practices at their workplaces, based on the various pedagogical components discussed in the one month duration short term course.

Data regarding the effect of this short term program on various components of the pedagogy was collected from different stake holders, viz. teachers, Head masters, Students along with an observation by the researcher himself with the help of following tools:

1. Class room observation schedule for observing different pedagogical practices.
2. Interview schedules – teachers and headmasters.
3. Focussed Group Discussion (FGD) with students.

The data so collected with the help of the observation schedule from classroom observations were further triangulated with the help of interview sessions with stakeholders of the process viz. Teachers, Headmasters and FGD with Students. In the following pages data collected as above was tabulated, presented and analysed to achieve the objectives of the study.

4.02 Data Analysis

Objective 1: To identify the critical parameters of pedagogical practices of the mathematics short term course.

Research Question: 1: What are the critical parameters of Pedagogical Practices of the mathematics short term course?

Pedagogy is a generic word consisting of various components. It deals with the theory and practices of teaching. It informs about teaching strategies, teacher's activities and teacher's judgment and decisions taken during different practices at various places of activities.

Therefore, in a study like the present one, it was necessary to analyse and spell out various Parameters related to pedagogical practices with particular reference to mathematics teaching at elementary stage of education.

Three month's duration short term course conducted earlier in the year 2016-17 was also kept in mind while attempting to analyse and spell out the various parameters of the pedagogy.

The parameters identified at the first stage include:

1. Constructivism in Teaching and Learning
2. Involvement of Learners in Teaching – learning
3. Active participation
4. Use of varieties of Teaching – learning strategies.
5. Assessment and feedback during Teaching – learning.
6. Joyful learning.
7. Use of lab activities.
8. Problem solving using Action Research.
9. ICT Integration in Teaching – learning

The so identified parameters at the first stage were further validated by the experts working for the pedagogical aspects of Teaching- Learning process and modifications were made as per suggestions and discussions. The parameters finally arrived at are as follows:

1. Learners participation in Teaching - learning
2. Use of varieties of Teaching – learning strategies.
3. Assessment and feedback during Teaching – learning.
4. Joyful learning.
5. Use of laboratory activities.
6. ICT Integration in Teaching – learning.
7. Problem solving using Action Research.

The above mentioned parameters were used in present study for further analysis.

Objective 2:

To assess the effectiveness of the short - term course in Teaching-Learning of Mathematics against identified parameters.

Research Question 2: What is the extent of the effectiveness of the mathematics short-term course?

One of the significant objective of the present study is to assess the effectiveness of the short term course in mathematics on pedagogical practices in upper primary schools of MP and CG against the identified parameters of pedagogical practices of mathematics as identified under objective 1. In the following pages parameter wise data related to above objective is presented and interpreted.

Objective 2.1:

To assess the effectiveness of short term course against involvement of learners in teaching- learning of Mathematics.

As can be seen from the Class room observation schedule for observing different pedagogical practices, (appendix-1) statements 1, 2,3,4,7,8,10,12,16 and 33 are related to the pedagogical parameter of "Involvement of learners in teaching- learning." Therefore, sum total of scores of the above mentioned statements are the observed score under parameter 1.

The table no. 4.01 presents the statement wise observations of the researcher on the parameter of involvement of learners in teaching- learning in absolute and relative (percentage) form with respect to the states of MP and CG separately and also combindly.

Table 4.01

Involvement of Learners in Teaching-learning of Mathematics

Statement No	Involvement of learners in Teaching-Learning	Absolute						Percentage					
		To Great Extant			To Some Extant			To Great Extant			To Some Extant		
		Madhya Pradesh	Chhattisgarh	Total	Madhya Pradesh	Chhattisgarh	Total	Madhya Pradesh (%age)	Chhattisgarh (%age)	Total (%age)	Madhya Pradesh (%age)	Chhattisgarh (%age)	Total (%age)
1	Teaching-learning process is completed with participation of children.	5	6	11	0	1	1	100	85.71	91.67	0.00	14.29	8.33
2	Children work in small groups in class.	5	7	12	0	0	0	100	100.00	100.00	0.00	0.00	0.00
3	Children get opportunities to speak during teaching in class.	4	7	11	1	0	1	80	100.00	91.67	20.00	0.00	8.33
4	Children get opportunities to think, understand and reason on mathematical problems on giving response.	5	6	11	0	1	1	100	85.71	91.67	0.00	14.29	8.33
7	Teacher tried to know the process of solving a question before the child solves it.	5	7	12	0	0	0	100	100.00	100.00	0.00	0.00	0.00
8	Teacher gave children the opportunity to share experiences in the class.	5	5	10	0	2	2	100	71.43	83.33	0.00	28.57	16.67
10	Children were given opportunities to ask questions in the class at any time	5	7	12	0	0	0	100	100.00	100.00	0.00	0.00	0.00
12	Children were given opportunity to frame their own questions.	4	4	8	1	3	4	80	57.14	66.67	20.00	42.86	33.33
16	All children get equal opportunities in the class.	5	7	12	0	0	0	100	100.00	100.00	0.00	0.00	0.00
33	The students were given chance to solve the numerical on the board.	5	7	12	0	0	0	100	100.00	100.00	0.00	0.00	0.00
	Total	48	63	111	2	7	9						
	Mean	4.80	6.30	11.10	0.20	0.70	0.90			92.50			7.50

From the above table it can be observed that 92.50% observations followed the pedagogical practice of involvement of learners in teaching- learning to the great extent while only 7.50 percent followed the same to only some extent.

If the value of mean observations are considered, 11.1 (n=12) applied the pedagogical practice on this parameter to the great extent while remaining 0.9 (n=12) applied it to some extent only. The table further shows that in the state of Madhya Pradesh 4.8 (n=05) respondents applied the parameter to the great extent while only 0.2 (n=05) applied the same to some extent. Data further reveals in the state of CG, 6.3 (n=07) respondents applied the pedagogical parameter to great extent while only 0.7 (n=07) respondents applied the same to some extent.

Data related to the above parameter on pedagogical practices in mathematics was also collected from teachers with the help of interview schedule prepared for the purpose. It was revealed during interview with teachers of MP that after attending the three months program on pedagogy of mathematics teaching, all activities in the class were child-centred as per their mental standards. Students performed the activities and solved the given problem collaboratively. The teachers of CG also mentioned that child-centred teaching activities in the class rooms were given to students after dividing the large group of the class into smaller groups quite frequently.

The data related to the above parameter on pedagogical practices in mathematics was further verified from the students with the help of Focused Group Discussion. It was revealed from the students of MP that they were given an opportunity to work in group, learn through play way method using pictorial teaching aids on different occasions. It was quite often that they were encouraged to respond to the questions raised during the teaching learning process.

In case of CG students felt that during the whole teaching learning process they were kept active with full interest and attention on the topic. A scope for taking notes on critical mathematical concepts was also provided for better understanding.

It can be inferred from the above interpretations of the data that there is great extent of involvement of learners in teaching-learner process in both the states under investigation. It is revealed from the data that all activities in the classroom were child-centred. Students perform the activities and solve the given problem collectively. There was a great source of opportunity to work through play way method.

Objective 2.2:

To assess the effectiveness of short term course against use of variety of teaching learning strategies in mathematics.

As can be seen from the Class room observation schedule for observing different pedagogical practices, (appendix 2) statements 5,6,13,14, 15,17,18,19,25 and 27 are related to the pedagogical parameter of use of variety of teaching learning strategies. Therefore, sum total of scores of the above mentioned statements are the observed score under parameter 2.

The table no. 4.02 presents the statement wise observations of the researcher on the parameter of use of variety of teaching learning strategies, in absolute and relative (percentage) form with respect to the states of MP and CG separately and also combindly.

Table 4.02

Use of varieties of Teaching -Learning strategies

Statement No.	Use of varieties of Teaching -Learning strategies	Absolute						Percentage					
		To Great Extant			To Some Extant			To Great Extant			To Some Extant		
		Madhya Pradesh	Chhattisgarh	Total	Madhya Pradesh	Chhattisgarh	Total	(%)	Chhattisgarh (%)	Total (%)	(%)	(%)	Total (%)
5	Teacher and children used thought provoking questions during teaching-learning process.	4	6	10	1	1	2	80	85.71	83.33	20.00	14.29	16.67
6	Efforts were made for conceptual grip of children on subject matter.	5	7	12	0	0	0	100	100.00	100.00	0.00	0.00	0.00
13	The teacher had discussion on the introduction of the lesson.	5	7	12	0	0	0	100	100.00	100.00	0.00	0.00	0.00
14	Teacher creates learning situations for children on identification of mathematical problems.	3	7	10	2	0	2	60	100.00	83.33	40.00	0.00	16.67
15	Students were given opportunities on exercises beyond the textbook.	2	5	7	3	2	5	40	71.43	58.33	60.00	28.57	41.67
17	Mathematical signs were clarified during teaching-learning task.	5	6	11	0	1	1	100	85.71	91.67	0.00	14.29	8.33
18	As per content matter appropriate teaching learning approach technique was used in class.	4	6	10	1	1	2	80	85.71	83.33	20.00	14.29	16.67
19	The content matter was summarized at the end of the class.	5	7	12	0	0	0	100	100.00	100.00	0.00	0.00	0.00
25	Teacher also asked students to come prepared for the next day's topic.	5	7	12	0	0	0	100	100.00	100.00	0.00	0.00	0.00
27	Innovative techniques were used in teaching-learning process.	4	5	9	1	2	3	80	71.43	75.00	20.00	28.57	25.00
	Sum	42	63	105	8	7	15	840					
	Mean	4.20	6.30	10.50	0.80	0.70	1.50			87.50			12.50

From the above table it can be observed that 87.50% observations followed the pedagogical practice of **use of variety of teaching learning strategies** to the great extent while only 12.50% followed the same to only some extent.

If the same observations are considered in mean terms, out of 12 observations, 10.50 applied the pedagogical practices on this parameter to the great extent while remaining 1.50 applied it to some extent only. The table further shows that in the state of Madhya Pradesh 4.2 (n=05) applied the parameter to the great extent while only 0.8 (n=05) applied the same to some extent. Data further reveals in the state of CG, 6.3 (n=07) applied the pedagogical parameter to great extent while only 0.7 (n=07) respondents applied the same to some extent.

Data related to the above parameter on pedagogical practices in mathematics was also collected from teachers with the help of interview schedule prepared for the purpose. It was revealed during interview with teachers of MP that they used puzzles from Bal Bhasker, magazines, books from NCERT and other resources from library. The teachers of CG also mentioned the same. Again it was further revealed by the teachers of MP that to solve mathematics problems pictorial charts, learning in groups through internet, mathematics kits and self learning materials were used extensively. One of the noticing features in MP was solving mathematics problems through games and sports in play ground. In case of CG, the teachers reported that use of teaching learning materials and games were prominently used. They also reported that besides lectures, mathematics teaching was done with the help of different methods like practical's lectures, activity-based, group discussion, group work etc. Learning outside the class room for mathematics teaching was also one of the prominent strategies.

The data related to the above parameter on pedagogical practices in mathematics was further verified from the students with the help of Focused

Group Discussion. It was revealed from the students of MP that they were taught by giving opportunity to come over the black board, provided local examples, allowed to work in groups. Teaching tools like magazines and letters are used. Students were given chance to make geometrical shapes through raw materials. They further mentioned that the cooperative teaching, demonstration methods, question- answer and quiz sessions were organised. Class tests and home assignments were also used to provide feedback for learning.

In case of CG, students felt that play-way methods, learning by doing, peer learning and activities based on mathematical concepts were for better understanding. The mathematics learning outside the classroom using local specific material of day-to-day life and videos on mobile are used for motivation of students. Mathematics laboratories with 2 and 3D structures made with papers were found common along with charts and other tools made by the students.

The headmasters of MP schools also reported that teachers use magazines like gullak, navankur, mathematics based puzzles, miracles of science, etc. along with NCERT books. Also use of laptop, mobile and SD card, mathematics kits for simplifying the mathematics concept and making them interesting. In CG along with the above they use Bal Bhasker, graphs, data sheets, charts, models and peer evaluation was also used. Learning outside the classroom through the various activities was also done.

It can be inferred from the above interpretations of the data that variety of teaching learning strategies are used to a great extent. While teaching, mathematics teachers are using variety of ways and means, such as black board-work, group work, different activities in and outside classrooms besides employing other than the traditional teaching methods. It can also be inferred that magazines, mathematics Classroom/ home assignments as well as class tests are used for learning.

Objective 2.3:

To assess the effectiveness of short term course against assessment and feedback during teaching and learning in mathematics.

As can be seen from the class room observation schedule for observing different pedagogical practices, (appendix 3) statements 9, 11, 31, 32 and 34 are related to the pedagogical parameter of assessment and feedback during teaching and learning in mathematics. Therefore, sum total of scores of the above mentioned statements are the observed scores under parameter 3.

The table no. 4.03 presents the statement wise observations of the researcher on the parameter of assessment and feedback during teaching-learning, in absolute and relative (percentage) form with respect to the states of MP and CG separately and also combindly.

Table 4.03

Assessment and Feedback during Teaching and Learning

Statement No	Assessment and Feedback during Teaching and Learning	Absolute						Percentage					
		To Great Extant			To Some Extant			To Great Extant			To Some Extant		
		Madhya Pradesh	Chhattisgarh	Total	Madhya Pradesh	Chhattisgarh	Total	Madhya Pradesh (%age)	Chhattisgarh (%age)	Total (%age)	Madhya Pradesh (%age)	Chhattisgarh (%age)	Total (%age)
9	Children were helped in realizing their mistakes through discussions in the class	5	6	11	0	1	1	100	85.71	91.67	0	14	8.33
11	Children were given chance to check the work of each-other.	5	6	11	0	1	1	100	85.71	91.67	0	14	8.33
31	The teacher had done continuous assessment during teaching-learning process	5	7	12	0	0	0	100	100.00	100.00	0	0	0.00
32	The students were given home assignment at the end	4	6	10	1	1	2	80	85.71	83.33	20	14	16.67

	of the class.												
34	The previous knowledge of the children was assessed before teaching.	5	7	12			0	100	100.00	100.00	0	0	0.00
	Sum	24	32	56	1	3	4						
	Mean	4.80	6.40	11.20	0.20	0.60	0.80			93.33			6.67

From the above table it can be observed that 93.33% observations followed the pedagogical practice of assessment and feedback during teaching and learning to the great extent while only 06.67 % followed the same to only some extent.

If the same observations are considered in mean terms, out of 12 observations 11.20 applied the assessment and feedback in teaching and learning of mathematics to the great extent while remaining 0.80 applied it to some extent only. The table further shows that in the state of Madhya Pradesh 4.80 (n=05) applied the parameter to the great extent while only 0.2 (n=05) applied the same to some extent. Data further reveals in the state of CG, 6.40 (n=07) applied the pedagogical parameter to great extent while only 0.6 (n=07) applied the same to some extent.

Data related to the above parameter on pedagogical practices in mathematics was also collected from teachers with the help of interview schedule prepared for the purpose. It was revealed during interview with teachers of MP that they observe students keenly and during the teaching-learning process itself, they provide right direction for answer. Students were also assessed for their speed in solving the mathematics problems and guided to gain more speed. In Chhattisgarh the assessment of students was reported to be carried out by continuously assessing their homework, unit-tests, monthly and semester wise tests.

The data related to the above parameter on assessment and feedback in mathematics teaching-learning was further verified from the students with the

help of Focused Group Discussion with students. It was revealed from the students of MP that they have undergone assessment of the learning from time to time with the help of class test and question forum. However, they have not commented on how teacher used these assessments for feedback purposes. When data on same parameter as above was collected from the students of CG, students have not commented on the assessment and feedback aspect during the teaching learning process.

The headmasters of MP schools reported that the inputs given in three month short terms course supported teachers for using good assessment practices. According to them professional development of teacher is very important especially with respect to assessment and evaluation. They also reported that teachers are regular in giving home work and checking it regularly. The headmasters of CG Schools also reported similar observations.

It can be inferred from the above interpretations of the data that in both the states assessment is carried out from time to time during the process of teaching-learning. The variety of ways of assessment used in both the states are unit tests, home assignments etc. The assessment also includes both assessment of process as well as speed of learning. It is also inferred that though feedback after each assessment is provided but that systematic feedback is missing which leads to improvement in learning.

Objective 2.04:

To assess the effectiveness of short term course against joyful learning of learners in teaching- learning of Mathematics.

As can be seen from the Class room observation schedule for observing different pedagogical practices, (appendix- 4) statements 21, 22, 23, 24, 26, 29 and 30 are related to the pedagogical parameter of "Joyful learning of learners in teaching- learning", therefore sum total of scores of the above mentioned statements are the observed score under parameter 4.

The table no. 4.04 presents the statement wise observations of the researcher on the parameter of joyful learning of learners in teaching-learning in absolute and relative (percentage) form with respect to the states of MP and CG separately and also combindly.

Table 4.4

Joyful learning

Statement No.	Joyful learning	Absolute						Percentage					
		To Great Extant			To Some Extant			To Great Extant			To Some Extant		
		Madhya Pradesh	Chhattisgarh	Total	M, adhya Pradesh	Ch, hattisgarh	Total	Madhya Pradesh (%age)	Chhattisgarh (%age)	Total (%age)	Madhya Pradesh (%age)	Chhattisgarh (%age)	Total (%age)
21	Activities got sufficient place during teaching-learning.	5	6	11	0	1	1	100	85.71	91.67	0	14	8.33
22	Maximum illustrations were used during teaching in the class.	5	7	12	0	0	0	100	100.00	100.00	0	0	0.00
23	Teacher used more than one methods to solve a numerical.	5	6	11	0	1	1	100	85.71	91.67	0	14	8.33
24	Local puzzles, riddles, etc. also got place during teaching.	5	7	12	0	0	0	100	100.00	100.00	0	0	0.00
26	The teaching was connected with the real life situations.	5	7	12	0	0	0	100	100.00	100.00	0	0	0.00
29	Students were motivated to think and give local examples in the class during discussions on the topic.	5	6	11	0	1	1	100	85.71	91.67	0	14	8.33
30	The content matter was linked with the daily life activities of the children.	5	7	12	0	0	0	100	100.00	100.00	0	0	0.00
	Sum	35	46	81	0	3	3						
	Mean	5	6.57	11.57	0.00	0.43	0.43			96.43			3.57

From the above table it can be observed that 96.43% observations followed the pedagogical practice of joyful learning of learners in teaching-learning to the great extent while only 3.57 percent followed the same to only some extent.

If the value of mean observations are considered, 11.57 (n=12) applied the pedagogical practice on this parameter to the great extent while remaining 0.43 (n=12) applied it to some extent only. The table further shows that in the state of Madhya Pradesh 5.0 (n=05) respondents applied the parameter to the great extent while no one applied the same to some extent. Data further reveals in the state of CG, 6.57 (n=07) respondents applied the pedagogical parameter to great extent while only 0.43 (n=07) respondents applied the same to some extent.

Data related to the above parameter on pedagogical practices in mathematics was also collected from teachers with the help of interview schedule prepared for the purpose. It was revealed during interview with teachers of MP that they have used live examples in the classrooms to explain the concepts along with use of play grounds for concrete explanations. They further mentioned that to make learning more joyful story-telling, relating mathematics to environment, play-way methods drawing and pictures tools and toys were used to make concepts clear to the students.

The teachers of CG mentioned that during the teaching-learning process for mathematics they have used games, story-telling, group discussions, puzzles, videos, Mobile phones etc. for making learning joyful. It is further heartening to note that even you-tube material was also used for teaching mathematics. Models, charts, related to daily life etc. were also used for making learning more joyful.

The data related to the above parameter on pedagogical practices in mathematics was further verified from the Headmasters with the help of Interviews. The interviews with Headmasters of MP and CG revealed no comments from them about the parameter of Joyful Learning.

It can be inferred from the above interpretations of the data that use of various measures taken by the teachers during conduction of teaching-learning process enhanced the students' joy and pleasure in mathematics teaching-learning. The subject of mathematics which is supposed to be a subject with abstract thinking becomes a subject of students' interest and enjoyment.

Objective 2.5:

To assess the effectiveness of short term course against use of Laboratory activities in teaching- learning of Mathematics.

It will be appropriate to mention here that laboratory activities in teaching learning of mathematics not only include models, equipments, instruments, etc. used for the purpose of teaching learning of mathematics but also include use of suitable and appropriate enrichment material locally available for maximizing the effectiveness of explaining the abstract concepts, principles, rules, etc. of mathematics.

As can be seen from the Class room observation schedule for observing different pedagogical practices, (appendix- 5) statements 28 is related to the pedagogical parameter of "Use of laboratory activities in teaching- learning", therefore, score of the above mentioned statement is the observed score under parameter 5.

The table no. 4.05 presents the statement wise observation of the researcher on the parameter of Use of laboratory activities in teaching- learning in absolute

and relative (percentage) form with respect to the states of MP and CG separately and also combindly.

Table 4.05

Use of laboratory activities

State ment No	Use of lab activities	Absolute						Percentage					
		To Great Extant			To Some Extant			To Great Extant			To Some Extant		
		Madhya Pradesh	Chhattisgarh	Total	Madhya Pradesh	Chhattisgarh	Total	(%age)	Chhattisgarh (%age)	Total (%age)	(%age)	Chhattisgarh (%age)	Total (%age)
28	Local materials were used in teaching-learning process	4	7	11	1	1	80	100.00	91.67	20	0	8.33	
	Sum	4	7	11	1	1							
	Mean	4	7	11	1	1			91.67			8.33	

From the above table it can be observed that 91.67% observations followed the pedagogical practice of involvement of learners in teaching- learning to the great extent while only 8.33 percent followed the same to only some extent.

If the value of mean observations are considered, 11 (n=12) applied the pedagogical practice on this parameter to the great extent while remaining 01 (n=12) applied it to some extent only. The table further shows that in the state of Madhya Pradesh 4 (n=05) respondents applied the parameter to the great extent while only 01 (n=05) applied the same to some extent. Data further reveals in the state of CG, all respondents applied the pedagogical parameter to great extent.

Data related to the above parameter on pedagogical practices in mathematics was also collected from teachers with the help of interview schedule prepared for the purpose. It was revealed during interview with teachers of MP that after attending the three months program on Pedagogy of mathematics teaching they are in the position of using toys, raw materials - like clay, wood, stone etc. in

teaching-learning of mathematics. They also mentioned that locally prepared material for mathematics is quite frequently used by them in spite of fact that school does not have mathematics laboratory. Mathematics kits available in the schools are also being used by them in classes.

The teachers of CG also mentioned that besides using toys and raw material as used by the teachers of MP they in addition use locally available material like, leaves and playing material like Ludo, Carrom and cards for explaining complex concepts in simple terms.

An interview with the Headmasters of different schools of MP and CG clarified that they are happy with the mathematics teachers of their school because these teachers are now using locally available as well as made materials also in classrooms for making mathematics easy and understandable at the level of students. Mathematics kits are also used in classrooms.

It can be inferred from the above interpretations of the data that though concept of mathematics laboratory is known to teachers and others but at present these mathematics laboratories are not in existence. There is good use of locally available material for teaching of mathematics in and outside classrooms. Raw material like clay, wood, stone etc. in teaching-learning of mathematics was frequently used in both the states under consideration. However, the use of local material is more in the state of CG compared to MP.

Objective 2.6:

To assess the effectiveness of short term course against ICT integration in teaching- learning of Mathematics.

As can be seen from the Classroom observation schedule for observing different pedagogical practices, (appendix-6) statements 35 is related to the pedagogical parameter of ICT integration in teaching- learning of Mathematics.

Therefore, the score of the above mentioned statement is the observed score under parameter 6.

The table no. 4.06 presents the statement wise observations of the researcher on the parameter of ICT integration in teaching-learning of Mathematics in absolute and relative (percentage) form with respect to the states of MP and CG separately and also combined.

Table 4.06

ICT Integration in teaching -learning

State ment. No	ICT Integration in teaching -learning	Absolute						Percentage					
		To Great Extant			To Some Extant			To Great Extant			To Some Extant		
		Madhya Pradesh	Chhattisgarh	Total	Madhya Pradesh	Chhattisgarh	Total	Madhya Pradesh (%age)	Chhattisgarh (%age)	Total (%age)	Madhya Pradesh (%age)	Chhattisgarh (%age)	Total (%age)
35	ICT was used in the teaching-learning process.	2	1	3	3	6	9	40	14.29	25.00	60	86	75.00
	Sum	2	1	3	3	6	9						
	Mean	2	1	3	3	6	9			25.00			75.00

The table no. 4.06 presents the statement wise observations of the researcher on the parameter of ICT integration in teaching-learning in absolute and relative (percentage) form with respect to states of MP and CG separately and also combindly.

From the above table it can be observed that 25% observations followed the pedagogical practice of involvement of learners in teaching-learning to the great extent while only 75% followed the same to only some extent.

If the value of the observation is considered, 03 (n=12) applied the pedagogical practice on this parameter to the great extent while remaining 09 (n=12) applied it to some extent only. The table further shows that in the state of Madhya Pradesh 02 (n=05) respondents applied the parameter to the great extent while only 03 (n=05) applied the same to some extent. Data further reveals in the state of CG, 01 (n=07) respondents applied the pedagogical parameter to great extent while only 06 (n=07) respondents applied the same to some extent.

Data related to the above parameter on pedagogical practices in mathematics was also collected from teachers with the help of interview schedule prepared for the purpose. It was revealed during interview with teachers of MP and CG that after attending the three months program on Pedagogy of mathematics teaching they have developed the habit of using audio-visual aids, smart classroom, TV, computers, etc for teaching of mathematics. However, a step further teacher of CG further revealed that in addition to the above they also use you-tube; videos and ICT materials - Internet for various purposes in teaching of mathematics.

From the above interpretations it can be inferred that use of ICT is on increase in teaching of mathematics in MP and CG states. However, the CG is comparatively better in use of ICT for teaching of mathematics.

Objective 2.07:

To assess the effectiveness of short term course against Problem solving using Action Research in teaching- learning of Mathematics.

Problem-solving using action research in teaching-learning of mathematics is a task indirectly being applied by the teacher outside the classroom. Therefore, observation schedule for observing different pedagogical practices has no statement related to this parameter.

However, data related to this parameter was collected through teachers and headmasters' interview schedules from both the states viz. MP and CG under consideration.

The data from teachers of MP reveals that problem-solving through action research is being used when situation arises. One of the mathematics teacher mentioned that he/she used action research for solving the problem of removing the fear of mathematics from the minds of weak students.

The interview with mathematics teachers of CG reveals that priority is given for action research in solving problems related to mathematics learning.

It can be inferred from the above interpretations that though teachers are aware of the concept and use of action research for problem solving but the use of this parameter is not so frequent.

Chapter 5

Conclusions and Discussions

The present study aimed at finding out the effect of Short-term Course in Mathematics on Pedagogical Practices in Upper Primary Schools of M.P. and CG. To achieve this study, following research objectives are formulated:

1. To identify the critical parameters of pedagogical practices of the mathematics short term course
2. To assess the effectiveness of the short – term course in Teaching-Learning of Mathematics against identified parameters.

CONCLUSIONS and DISCUSSIONS:

The first objective of the present study was achieved by scanning the concept of Pedagogy and its discussion available in the literature. The preliminary parameters emerged were further validated with the help of experts and finally following parameters of pedagogy were identified:

- Learners participation in Teaching – learning
- Use of varieties of Teaching – learning strategies.
- Assessment and feedback during Teaching – learning.
- Joyful learning.
- Use of laboratory activities.
- ICT Integration in Teaching – learning.
- Problem solving using Action Research.

Though, there may be a still scope of discussion and modifications on these finally identified parameters of mathematics of pedagogical practices. But it

appears that the above seven parameters fairly represent the concept of mathematics pedagogical practices at the level under consideration.

The two objectives of the present study were interrelated in nature. **Objective 1** is the basis of achievement of **objective 2**. Data, both qualitative and quantitative, was collected with the help of researcher's observations in the classroom, focused group discussion and interview schedules of different stakeholders of pedagogical practices, viz. students, teachers and headmasters of MP and CG states.

The researcher both qualitatively and quantitatively analyzed the collected data using appropriate methods and strategies. The parameter wise inferences are given in the following pages:

There is great extent of involvement of learners in teaching-learner process in both the states under investigation. It is revealed from the data that all activities in the classroom were child-centered. Students perform the activities and solve the given problem collectively. There was a great source of opportunity to work through play-way method.

The above conclusion may be justified as the basis of the whole three months short term course on pedagogy of mathematics at elementary level was National Curriculum Framework 2005 which envisages the philosophy of constructivists approach. This approach greatly emphasizes the involvement of learners in teaching learning processes. This approach further emphasizes the fact that child should not be induced learning from outside but should be given an opportunity to construct his / her own learning by providing conducive and facilitative environment for learning.

The above conclusion lead to the fact that the three months short term course on pedagogy of mathematics conducted by RIE, Bhopal helped teachers in adopting the appropriate strategy in tune with NCF as well as Constructivism.

Variety of teaching learning strategies are used to a great extent. While teaching mathematics teachers are using variety of ways and means, such as black board-work, group work, different activities in and outside classrooms besides employing other than the traditional teaching methods. It can also be inferred that magazines, mathematics Classroom/ home assignments as well as class tests are used for learning.

The above conclusions can find support from the facts that researches on present pedagogical practices, particularly mathematics teaching and learning practices, do not favour much use of traditional methods and strategies for effective learning to occur. These researches advocate the use of variety of teaching learning strategies such as blackboard work, working in the group, etc. teaching methods for enhancing the effect of teaching. This shows the effect of the three months short term course on the mathematics pedagogy.

In both the states, assessment is carried out from time to time during the process of teaching –learning. The variety of ways of assessment used in both the states are unit tests, home assignments etc. The assessment also includes both assessment of process as well as speed of learning. It is also inferred that though feedback after each assessment is provided but that systematic feedback is missing which leads to improvement in learning.

Assessment and then feedback plays an important role in maximizing the effectiveness of teaching learning process. The above conclusions leads to the fact that though teachers are conducting assessment of students on regular basis but their providing immediate feedback system is not very satisfactory. Though

this parameter of mathematics pedagogy was given due emphasis in three months course and during discussion with teacher it was also revealed by the teacher that they agree to this parameter but due to shortage of available time and resources, they are not able to implement it satisfactorily.

Use of various measures undertaken by the teachers during conduction of teaching-learning process enhanced the students' joy and pleasure in mathematics teaching-learning. The subject of mathematics which is supposed to be a subject with abstract thinking becomes a subject of students' interest and enjoyment.

In these days students are said to be overburdened with academics and books. This academic work and whole school time engagement leads to unhappy state of mind in the child and gradually he / she start disliking academics, which ultimately lead to dropout situation.. It is now a days observed that students do not want to come to these full of academic environment in classes. Number of researches at this level showed that this state of affair in the classroom, particularly elementary classroom, need to be improved and a live, joyful environment is the need of the hour. Prof. Yashpal in 1993 great Educationist and Ex UGC Chairman once very rightly commented in his famous speech on learning with out burden that burden of books should be reduced and classroom environment should be made joyful to attract children in the classroom and reduce dropouts .

The conclusions of the present study leads to the fact that some measures, discussed during the three months duration short term course with the teachers, are taken by the mathematics teachers of MP and CG to make the mathematics classroom as live and joyful as possible. However, they also opinioned that reducing burden of books is not in their hands as this is a policy issue. Because of this compulsion of covering the prescribed curriculum, they do not find time to make classroom and class activities more and more joyful and interesting.

Though concept of mathematics laboratory is known to teachers and others colleagues but at present these mathematics laboratories are not in existence. There is good use of locally available material for teaching of mathematics in and outside classrooms. Raw material like clay, wood, stone etc. in teaching-learning of mathematics was frequently used in both the states under consideration. However, the use of local material is more in the state of CG compared to MP.

With the change of time and the need of the hour, pedagogy of mathematics teaching and learning is also under gong changes. It is now realized that as in science subjects, in mathematics subject also, concept of laboratory should be promoted. However, this concept is not very similar to the concept of laboratory in science. The concept of developing laboratory for mathematics is picking up very fast and it is because of this that a provision was made in the three months course to discuss the issue with the teachers of MP and CG and promote the same. This concept of laboratory is also in tune with the presently propagated constructivist approach.

Conclusions of the present study shows that being not very old concept, it is still to be percolated in the system. However, teachers are using laboratory in mathematics by allowing students to conduct experiments through prepared models from locally available material. Charts, models and other local material is used by teachers to enrich the abstract concept of mathematics and to verify other mathematical aspects of learning through observations and readings. The use of this may be attributed to the three months pedagogical training of teacher of the states.

Use of ICT is on increase in teaching of mathematics in MP and CG states. However, the CG is comparatively better in use of ICT for teaching of mathematics.

Present era is rightly dubbed as the era of ICT in Education, particularly in teaching and learning. Various researches in the area also justify the use of ICT for enhancing learning. At elementary stage of education, use of various tools and techniques of ICT in teaching learning can make learning environment more attractive, and interesting. Students can extract joy in learning .

Conclusions of the present study reveals that Use of ICT is on increase in teaching of mathematics in MP and CG states but still there is lot of scope to enhance the same. The teachers of the states of MP and CG are of the view that reason for this low use of ICT is not specific to Mathematics teaching , it is basically in all the subjects at this level. Teachers mentioned during the interview that they are well aware of the application and significance of ICT for mathematics teaching as it was included as a topic in the pedagogy course but non availability of ICT facilities in schools make it unusable. Internet facilities are also not easily available to all the teachers. All this debar teachers for use of ICT in mathematics teaching and learning.

Though teachers are aware of the concept and use of action research for problem solving but the use of this parameter is not so frequent.

Action research was one of the important components of three months pedagogy based short term training course. This component was included in the training of MP and CG teachers with a view that action research has proved to be an important component for solving day to day problem and issues.

The conclusions of the present study revealed that teachers of mathematics are well aware of the concept and importance of action research in solving problem but because of less availability of time at their disposal , they normally do not undertake problem solving through action action process. This need to be emphasized agin and agin in various pedagogy based training programmes

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Annexure

REGIONAL INSTITUTE OF EDUCATION, BHOPAL (Format for observation of Pedagogical Processes)

Name of School _____ Cluster _____

Block _____ District _____ State _____

General information (to be filled after/at the time of class observation)

Class _____ Section _____ Topic _____

Name of Teacher _____ (Male/Female)

Educational and Professional Qualifications _____ Age _____ Years

Experience _____ Yrs.

No. Of Students in the class _____ (total) Boys _____ Girls _____

No. Of Students in the school _____ (total) Boys _____ Girls _____

Pedagogical Process Observation

S. No.	Statement	Yes	No	If 'Yes' then		
				To great extent	To some extent	Not at all
1.	Teaching-learning process is completed with participation of children.					
2.	Children work in small groups in class.					
3.	Children get opportunities to speak during teaching in class.					
4.	Children get opportunities to think, understand and reason on mathematical problems on giving response.					
5.	Teacher and children used thought provoking questions during teaching-learning process.					
6.	Efforts were made for conceptual grip of children on subject matter.					
7.	Teacher tried to know the process of solving a question before the child solves it.					
8.	Teacher gave children the opportunity to share experiences in the class.					
9.	Children were helped in realizing their mistakes through discussions in the class					
10.	Children were given opportunities to ask questions in the class at any time					
11.	Children were given chance to check the work of each-other.					
12.	Children were given opportunity to frame their own questions.					
13.	The teacher had discussion on the introduction of the lesson.					
14.	Teacher creates learning situations for children on identification of mathematical problems.					
15.	Students were given opportunities on exercises beyond the textbook.					
16.	All children get equal opportunities in the class.					
17.	Mathematical signs were clarified during teaching-learning task.					
18.	As per content matter appropriate teaching learning approach technique was used in class.					
19.	The content matter was summarized at the end of the class.					
20.	The teacher was confident at the time of teaching.					
21.	Activities got sufficient place during teaching-learning.					
22.	Maximum illustrations were used during teaching in the class.					
23.	Teacher used more than one method to solve a numerical.					
24.	Local puzzles, riddles, etc. also got place during teaching.					

REGIONAL INSTITUTE OF EDUCATION, BHOPAL
(Teacher Interview Schedule)

Name of School _____ Cluster _____

Block _____ District _____ State _____

Note: The interviewer will try to find out by asking questions on the mentioned points that how much importance was given to them in training programme and how much they were used in teaching-learning process after training.

1. Use of constructivism in teaching of Mathematics.
 2. Use of books other than the prescribed textbook.
 3. Strategies that make mathematics joyful.
 4. Assessment during teaching-learning of mathematics
 5. Activities done during teaching-learning of mathematics.
 6. Method of teaching a concept of mathematics
 7. Incorporation of ICT in mathematics
 8. Action research in mathematics
 9. Various methods used in teaching of mathematics
 10. Use of laboratory in teaching of mathematics
 11. Child-centered process and teaching
 12. Use of special method in teaching of specific topics
 13. Use of innovative methods in teaching methods
 14. Effect on learning and achievement in mathematics after the training
 15. In-conveniences in execution of teaching-learning processes (if any)
 16. What modifications (additions and deletions) you suggest in the training programme
- Additions:
 - Deletions:

REGIONAL INSTITUTE OF EDUCATION, BHOPAL
(Headmaster Interview Schedule)

Name of School _____ Cluster _____

Block _____ District _____ State _____

Note: The interviewer will try to assess the changes in the teaching work methodology after training by asking question on the following points.

1. Change in teaching-learning of mathematics after the training
2. Use of books other than the textbook
3. Use of innovations (new methods) by the teacher
4. Encouragement to action research
5. Use of ICT in teaching-learning
6. Inclusion of continuous assessment to improve the level of achievement.
7. Improvement of the confidence of teachers after training
8. Effect of training on giving home work and its checking
9. Demand of instruments on teaching of mathematics after training.
10. Change in students' attraction towards mathematics (after training)
11. Change in achievement level of students-
12. Change in working methodology of other teachers.

REGIONAL INSTITUTE OF EDUCATION, BHOPAL
(Schedule on FGD with students)

Name of School _____ Cluster _____

Block _____ District _____ State _____

Note: The class may be divided in four-five groups for this activity. After discussion on the given points the changes in teaching-learning process will be assessed.

1. Activities performed during teaching-learning of mathematics
2. Participation of children during classroom teaching
3. Methods used during classroom teaching apart from lecture
4. Changes in the classroom atmosphere
5. Your liking with the mathematics.

