Research Article

Effect of Branching Programme on Achievement of Primary Students on L.C.M and H.C.F

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Abstract

Mathematics as a subject is very important and a strong foundation in mathematics ensures better academic performance and a confident personality. A strong foundation of computation skills and understanding of mathematical concepts must be developed during primary school. To achieve this goal the teaching should be individualized so that students can learn, understand, and practice Mathematical concepts at their own pace and using their specific learning styles. Mathematics learning can be made an individualized and joyful experience for students by using the Branching programme as a teaching-learning strategy. The present paper presents the research done to study the impact of the Branching programme on the learning and understanding of two basic concepts of mathematics-L.C.M. and H.C.F. The researcher has developed the branching programme and tested its efficacy of it on students' achievement. The finding shows that the programme was found to be effective for grade five children. Presentation of the concepts of L.C.M and H.C.F. in the form of small frames along with practice questions and providing immediate reinforcement and remedial material proved to be beneficial for the students.content and comes out with a significant sprucing up of student's achievement.

Keywords: Programmed Instruction, Intrinsic Programming, Achievement, Primary Education

Introduction

Primary education is the most important stage in a child's education as it lays the foundation of skills, capabilities, and interests that will help build the career of the child, considering its relevance curriculum, methodology, pupil-teacher relationship, and learning environment must be all designed in such a way that they provide freedom to students and give him practice in hiking abilities and other various skills. Any fears, phobias, or negative conditioning if developed in this stage will have a damaging effect on the child's future so the teachers, parents, and educationists have to build a positive, cordial atmosphere in the primary classrooms and save the child from developing any negative attitude. Primary education mainly emphasizes the three R's -reading writing and Arithmetic. Education Commission (1964-66) suggested that Mathematics should be taught as a compulsory subject at primary level.

Mathematics is an important subject due to its professional, disciplinary, intellectual utilitarian and aesthetic value from ancient times to present times. Mathematics is a fundamental subject needed for students to learn along with languages.

The aims of mathematics teaching at the primary level are-

- To initiate their interest in learning mathematics
- To develop a conceptual understanding of the basic concept and terminology of mathematics.
- To inculcate a love for mathematics.
- To introduce them to mathematical games, puzzles, recreations, hobbies & activities.
- To develop and sustain their confidence in solving mathematical problems
- To ensure their efficiency in fundamental processes.
- To make them aware of the practical relevance and use of mathematics in daily life.
- To make them aware of language & symbols of mathematics.
- To provide a proper framework for learning mathematical concepts in higher classes.
- To cultivate in them the qualities like punctuality, persistence efforts, tolerance autonomy in doing their work sincerely and dedicatedly.

Status of teaching Mathematics at the primary level

Primary mathematics generally introduces students to the number system, and four basic skills addition, subtraction, multiplication, and division. In addition to this as we move further on the ladder, students are made familiar with the concepts of fractions, multiples, factors, decimal numbers, lowest common multiple, highest common factors, simple interest, and basic geometry. The teaching in Indian schools is group classroom teaching generally applying a deductive approach involving the presentation of examples by teachers on a blackboard and students following the teacher's steps and doing lots of practice in their practice books. With the recent emphasis on child psychology use of manipulation in mathematics has increased but students are not getting the freedom to move at their own pace and little scope is there for exploration and, experimentation. They are forced to follow a set pattern and if mistakes are made either they are scolded for it or they are told the correct responses without explaining to them where they are wrong. Our classrooms and evaluation system are not flexible enough to cater to individual differences. With inclusive education coming into force we more urgently need to have teaching methods that help meet the individual needs of learners and help each child to learn using his style, learning by his mistakes, and moving at his own pace. In the words of B.F. Skinner's "mistakes are the gateway to student's mind". We need methods that explain to the child how he is thinking and what needs to be rectified. In one of his articles, B.F. Skinner stated his experience in a mathematics classroom he visited. He found the problem in the classroom was that students were making their efforts and solving the problem given by teachers but they were not getting immediate reinforcement. This was one of the causes that students lose interest, their errors accumulate, and due to lack of remedial teaching, their achievements decrease. We need a process to provide immediate feedback to students' efforts that helps them to feel motivate on moving towards the right path and understand their mistakes and learn from them if they are wrong. Such a process and mechanism is not possible in traditional classroom with inappropriate pupil teacher ratio. It is essential that we adapt individualized learning.

We need strategies that follow the given principles-

- Principle of freedom
- Principles of immediate reinforcement
- Principles of self-pacing
- Principle of self-evaluation
- Principle of learning by doing

To improve the present status programmed instruction can prove beneficial. The material in programmed instruction can be arranged in different ways leading to different styles of programming linear, branching, and mathetics.

Concept of Programmed Instruction

In programmed instruction a logical sequence of information is presented in the form of small units at a time to individual units, students make an active response to each unit and they get immediate knowledge of whether their result is correct. In programmed learning each student works at his own best pace, which makes the learner's experience an individual affair. Programmed instruction makes the learning an interesting and motivating activity by providing immediate feedback and it boost student's confidence on his abilities and skills. As defined by Markle programmed instruction is the strategy of individualized learning in which material is prepared in a way to provide small content to the students at one time that is easy to comprehend and then assessing his/her learning of that content. Programmed instruction makes learning individualized as every student is able to learn at his/her own pace and feel motivated due to its self-evaluation feature Programmed instruction cans be provided to students in the form of books, self-learning modules or in e-form. Various formats of programmed instruction are available like linear programming, branching programming and mathematics.

Branching programme

In the present study researchers have developed a Branching programme for teaching a topic on mathematics because branching programme is well suitable for learning of mathematics because it does not ignore student's mistakes but try to make students understand the mistake and learn from them. It provides the features of sub-looping and sub branching similar to hyperlink feature of HTML language. It helps the students to comprehend and practice the previous concepts that are necessary to learn the new concepts.

Statement of the problem

The study aims to develop teaching-learning strategies for selected topics in mathematics at the primary level which will aid to understand the concept more clearly and make the teaching-learning environment more conducive.

More specifically the problem is stated as under "Effect of Branching Programme on achievement of Primary students on L.C.M and H.C.F"

Objectives

The objectives framed in the present study are :

- To develop programmed material (Branching programme) for teaching L.C.M and H.C.F.
- To apply programmed material (Branching programme) developed in the real classroom situation.
- To test the efficacy of programmed material (Branching programme) on L.C.M and H.C.F.
- Hypotheses
- For the third objective of study five null hypotheses were framed.
- Review of Related Literature
- Wangila M.J, Martin W & Ronald M. (2015) studied the impact of

programmed learning material instruction developed on the topics of atom and periodic table on the attitude of students towards these topics. Instructional software was developed and a Students' Attitude Determination Questionnaire (SADQ) was constructed. The sample included 300 students. The results indicated a significantly higher attitude in the experimental group after the intervention programme.

- Sambasivarao, Rachumallu. (2020) study reveals that the use of a programmed instruction strategy improves achievement in mathematics. The study was conducted in Andhra Pradesh, India on students of the class eighth. The study was quasi-experimental. This study also indicated the positive effect of programmed instruction material on achievement in Mathematics
- Kurbanoğlu, İzzet & Taskesenligil, Yavuz & Sozbilir, Mustafa. (2006) researched to compare the success of programme instruction and the traditional approach to teaching stereochemistry. The sample included forty chemistry teacher trainees from a state university in Turkey. The tools included programmed frames on the topic of stereochemistry and a stereochemistry achievement test. Results indicated the effectiveness of the prepared programme.

Bhatia (1992) did a research to identify and remediation of learning issues in Mathematics with the help of programmed learning material . The sample included fifty class-five students. The results revealed that students who received programmed instruction performed better in post-test and programmed instruction worked effectively as a remedial tool.

A review of related literature supports the view that programmed instruction is an effective teaching strategy and helps enhance conceptual understanding and improve achievement. The review also shows that there are few studies related to the development of programmed instruction material for Mathematics at the primary level and many fundamental topics in Mathematics need to be included in such studies so the researchers undertook the study.

Methodology

The present study is experimental and a randomized pre-test post-test control-group design was used.

Design of the study:

The design employed during the implementation and evaluation of the strategy is a randomized pre-test post-test control-group design -

Experimental group R O1 X O2

Control group R O3 O4

Where O1O3 - PRETEST

O2O4 -POSTTEST, X -INTERVENTION PROGRAMME

Sample and sampling

The sample was selected in two phases-

Phase 1- During field testing for the preparation of the final draft of branching programmes developed on L.C.M and H.C.F sample of 51 students of the class fifth were selected.

Phase 2- In this phase sample was selected to test the effectiveness of the branching programme on L.C.M &H.C.F was 80.

For the selection of samples in the second phase, two-stage sampling was done

1st stage – In the selection of schools

2nd stage – In the selection of students and allotment of groups in selected schools

In the first stage, as the programme was developed in the English language so two English medium schools Dabble College and Delhi Public School were selected

through a purposive sampling procedure.

In the second stage, random sampling was done. The two groups were divided in the class by odd, even method. Then lottery method was used to decide the groups.

Tools

The tools constructed for the presented research are -

- Branching programme on L.C.M & H.C.F
- Achievement test 1 & 2 on L.C.M and H.C.F (pre-test and Post-test)

Statistical techniques employed:

The statistical techniques employed were mean, standard deviation, correlation, and C.R value.

Results and Interpretation

The main purposes of the present study were to develop the teaching-learning strategies for mathematics at the primary level & test their efficacy. The teaching-learning strategy selected was "branching programmed instruction". The branching programme was developed and then the experimental design was implied to test its efficacy.
Five null hypotheses were framed for each programme and subjected to tests to find the results. The level of significance was considered at .05.

✤ Hypothesis 1

"There is no significant difference between mean scores of pre-test of control and pre-test of the experimental group."

Table-1 : 't' test for the mean scores of pre-test of experimental group and pre-test of control group

Sl.No	Group	N	M	S.D	SE_D	C.R
1.	Control{Pre-test}	40	13.325	2.44307	.57778039	0.302883 *
2.	Experimental {Pre-test}	40	13.5	2.717465		

*not significant

Table 1 indicates that the critical ratio value calculated between the mean scores is not found significant at a .05 level of significance. Hypothesis 1 is accepted. This is attributed to the fact that the students were randomly selected for both groups.

✤ Hypothesis 2

"There will be no significant difference between the mean scores of pre-test and post-test of control group"

Table-2 : 't' test of mean scores of pre-test and post-test of control group

Sl.No	Control group	N	M	S.D	r	SED	C.R value
1.	Pre-test	40	13.325	2.44307	.568776	3.535896	.11312 *
2	Post-test	40	12.925	4.29990			

*not significant

Table 2 shows that mean of the post-test scores is slightly lower than the mean of the pre-test scores but the calculated CR value is not significant. Therefore hypothesis no. 2 is retained.

✤ Hypothesis 3

"There will be no significant difference between mean scores of pre-test and post-test of the experimental group"

Table-3 : 't' test of mean scores of pre-test and post-test of experimental group

Sl.No	Experimental group	N	M	S.D	R	SED	C.R value
1.	Pre-test	40	13.5	2.717465	.683996	1.96361098	2.4826 *
2.	Post test	40	18.375	2.467091			

*significant

Table 3 shows that the mean of the post-test score of the group that received intervention is more than the mean of its pre-test scores and the calculated C.R value (2.4826) is found significant. Therefore hypothesis no. 3 is not accepted.

It shows that the programme developed on L.C.M and H.C.F has helped to enhance the understanding level of students.

- **Hypothesis 4**

"There is no significant difference between mean scores of post-test of the control group and mean scores of post-test of the experimental group"

Table-4 : 't' test of mean scores of post-test of experimental group and post-test of control group

	Group	N	M	S.D	SED	C.R value
1.	Experimental {Post-test}	40	18.375	2.467091	.7837083	6.95411 *
2.	Control{Post-test}	40	12.925	4.299900		

*significant

Table 4 shows that the difference in the means of above-stated groups is found statistically significant.

Therefore hypothesis no.4 is not accepted. It can be concluded that the group that received the intervention programme scored higher compared to the group that was taught by the traditional method. This can be attributed to the fact that the experimental group studied the programme developed on L.C.M and H.C.F which resulted in a better understanding of the concepts.

- **Hypothesis 5**

"There is no significant difference between the mean of 'd' scores of the control & experimental group."

Table-5 : 't' test of mean of 'd' scores of experimental group and 'd' scores of control group

	Group	N	M	S.D	SE_D	C.R
1.	Experimental 'd' scores	40	4.95	1.907475	.59646398	8.55039 *
2.	Control 'd' scores	40	-.15	3.254583		

*significant

Table 5 shows that the mean of the 'd' scores of the group that received intervention programme is significantly higher (C.R value =8.55039) than the mean of the 'd' score of the control group.

Therefore hypothesis number 5 is rejected.

It reflects that the group that received the intervention programme developed a better comprehension of the concept and was able to apply the understood concepts in solving the related problems.

According to the results, it can be said that the branching programme developed on L.C.M and H.C.F was found beneficial for the children in comprehending the related concepts.

Discussion

The topic of L.C.M and H.C.F is important in primary and elementary Mathematics. Factors and multiples are generally introduced in class three or some schools in class four along with the concepts of prime numbers and co-primes. Later on, L.C.M. and H.C.F. were introduced and different method to calculate them is included in the syllabus of class five. The L.C.M. and H.C.F. form the basis of calculations that the students study in higher classes so students must get good practice in computational skills in L.C.M. and H.C.F. Researcher has come across only one study by Shah (1981) who developed a programmed learning material on the same topic.

To test the efficacy of these programme five null hypotheses were framed.

The findings of the study concerning hypothesis number 1 show that the initial level of both groups was the same. The pre-test was administered before classifying the students in both groups and this classification was done using random methods. Only nineteen students from eighty students secured more than 60 per cent marks in the pre-test and the highest score gained was nineteen which was secured by only two students. This shows that the computation of L.C.M. and H.C.F. by students involves lots of errors and they need more practice in it.

For hypothesis number 2 results signify that students who did not receive the intervention did not show any improvement in the achievement of concerned concepts. This is because the control group was taught the topic by the traditional method. Nearly fifteen students out of forty gained fewer marks in the post-test. This can be attributed to the fact that as there was a difference of only a fortnight between pre-test and post-test so students were not enthusiastic about doing the similar test again. It was found that although students have studied the topic in their regular classes their achievement in the test was very low. Only two individuals in the pre-test and four in the post-test achieved more than 70 per cent marks. The minimum score gained was five. This indicates that students do not well understand the methods to calculate L.C.M. and H.C.F.

The results of the study concerning hypothesis number 3 imply that the students who received the intervention gained significantly more in the post-test than in the pre-test. This can be attributed to the fact that they were given the intervention programme. The gain in post-test supports the fact that programmed learning material developed in the study is effective in making students understand the topics of L.C.M. and H.C.F. The results can be correlated with the results of Shah (1981) who developed the programmed material on L.C.M. and H.C.F. and the results revealed favourable reactions from both the students and teachers.

The analysis of scores shows that the maximum gain of ten marks was achieved by the student who was one of the low scorers in the pre-test this supports the fact that programmed instructional material is beneficial for the low achievers also. Though there is a gain of marks in the post-test but none of the students secured 100 per cent marks this may pertain to the fact that students were asked to study the programme in their classroom only and for a specific period. If the students are allowed to study the programme as and when suited to them in their favourable conditions their achievement will surely be higher. In all nearly 72 per cent of students i.e. twenty-nine students out of forty secured above 70 per cent marks in the post-test.

Regarding hypothesis number 4 findings reveal a superior performance on the part of the experimental group in comparison to the control group. The experimental group gained higher in the post-test because they studied programmed instructional material. This result is also in favour of the positive role played by the branching learning material in making the pupil better understand the methods to calculate L.C.M. and H.C.F. and in helping them gain proficiency in the skills to calculate L.C.M. and H.C.F.

The results for hypothesis number 5 prove that the students who studied through developed programmed learning material on selected topics showed significant improvement in their performance in comparison to the students of the control groups. As the experimental group studied the programmed learning material so there is an enhancement in their post-test scores. This enhancement in the post-test led to a rise in the mean of the "d" scores whereas the control group performed almost the same in the pre-test and post-test.

Thus it can be said that the branching programme developed was effective in helping the students to conceptualize the concepts and developing their skills to solve the sums related to the topic. The result of the study can be correlated with many studies by Winnle, Sharma (1981), Davies (1982), Inamdar (1981), Mehta (1985), Rao (1983), Prabha (1992), and Bharitya. All of them developed programmed learning material to teach various topics on mathematics at different levels and found it effective; students involved benefited from the programmed learning material.

Educational Implications and Recommendations

The result of the research indicates that the branching programme is effective in improving the student's achievement in mathematics and developing interest in the subject. Further research can be done by developing the intrinsic programme for other topics of Mathematics at the primary level and also extended to the secondary level. The researcher developed the intrinsic programme in the form of a module; the research can be forwarded by developing e-modules or computer games based on the concept of a branching programme.

Conclusion

Branching programmed learning material prepared on the topic L.C.M. and H.C.F. have been found effective for grade five children. Post-test scores comparison of the experimental group with their pre-test scores revealed that students gain efficiency in calculating L.C.M and H.C.F. by different methods. Presentation of the concepts of L.C.M and H.C.F. in the form of small frames along with practice questions and providing immediate reinforcement and remedial material proved to be beneficial for the students.

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