

Development of a Training Package in School Mathematics (DTPSM) for Pre-Service and In-Service Teachers

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The country needs, today effective and productive citizens who display scientific and constructive thinking and attitudes in all walks of life. In this direction, a new chapter is opined into the 21st century, which is going to be an era of science and technology. The child of today has to be prepared for this era of technology for which a strong base of mathematics education is a necessity.

Mathematics has prominent place at the school. Secondary education is the minimum requirement for life. After completing Secondary education some students enters into life while others go in for higher education. It is on account of this fact, that it has been suggested that the curriculum at the secondary stage should be terminus as well as preparatory and should comprise mathematics.

Mathematics is a discovery of human mind and learning mathematics is supposed to be a re-discovery at least to some extent. To achieve this goal, the classroom could be turned into a laboratory or a work room for the improvement of mathematics education. Here pupils work and learn by developing, constructing knowledge, self learning, self-study, exploratory and investigatory techniques. But it is important to observe that even today, after 65 years of Independence, the education system in India remains essentially examination oriented. Under this system, learners do not receive mathematical education. They mostly prepare themselves for examination and success in examination. Such a situation not only damages the purpose of all education but also proves ruinous for mathematics education. Learners memorise important results, theorems, formulae... in order to be able to reproduce them in the examinations. The result is meaningless and mechanical learning, which leads the pupils committing more and more mistakes.

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Need and Significance of the Study

Many changes and improvements are being brought in the field of education. In mathematics this change is vast and manifold as mathematics occupies the place and pride in the present age of Science and Technology. In addition to utilitarian, disciplinary, intellectual and cultural values mathematics has the characteristics of simplicity, brevity, accuracy, certainty of results, originality, verification of results, similarity to the reasoning of life, development of concentration, art of economical living, power of expression, self-reliance, attitude of discovery, quality of hardwork, National and International understanding and so on.

Good mathematics education depends not so much on the syllabus as on the teacher, the teaching approaches and the learning strategies developed in children, since all these can give meaning to the syllabus. In the secondary school mathematics curriculum, many changes and improvements have come all over the world. Unfortunately, many of these attempts took place without a simultaneous effort to expose educators to research on the nature of mathematical concepts and the process of learning them.

Hence in this research project an attempt is made to develop instructional strategies that could be used as training packages for pre-service and in-service mathematics teachers in order to minimise the mistakes committed by students in mathematics at secondary school level.

Objectives of the Study

The objectives of the present study are:

1. To identify the difficult units/concepts for teachers to teach in secondary school mathematics.
2. To identify the difficult units/concepts for students to learn in secondary school mathematics.
3. To develop Instructional strategies, for teaching the selected basic mathematical concepts, useful for pre-service and in-service teachers to improve the quality of mathematics education at school level.
4. To validate the effectiveness of the developed Instructional Strategies

Hypothesis

The developed instructional strategies (could be used as training package for pre-service and in-service teachers) are more effective

than the existing method of teaching basic mathematical concepts at secondary school level.

Tools Developed and Used in the Study

To achieve the first and second objectives of the study three questionnaires were prepared both for teachers and for students to find out the most difficult unit/concept at each of the standards VIII, IX and X to teach and / or learn and identified as 'Polynomials', 'Motion Geometry' and 'Linear Programming' respectively. Based on Vygotsky's and Piaget's theories Instructional Strategies (lesson plans) were prepared to fulfill the third objective. The following tools were constructed and used for the validation of the Instructional Strategies.

1. Achievement Test for the Concept 'Polynomials'
2. Achievement Test for the Concept 'Motion Geometry'
3. Achievement Test for the Concept 'Linear Programming'

Major Findings

The major findings of the study are given below.

Comparison of Means

The means of Achievement score in the basic mathematical concepts of the pre-test and post-test of the experimental and control groups in standards VIII, IX and X were compared by two statistical techniques 'Effect Size' and Test of Significance of Difference between means.

i. Effect Size

The comparison of Achievement score means by using the statistical technique 'Effect Size' was done for three standards VIII, IX and X.

It was found that the new Instructional Strategies of the Concepts, 'Polynomials', 'Motion Geometry' and 'Linear Programming' improved the performance of students significantly.

The mean Achievement scores obtained in the post-test of the experimental and control groups were compared using effect size in standards VIII, IX and X.

The obtained values of Effect size indicate that an average student in the experimental group of these standards had an Achievement significantly greater than that of the control group.

ii. Test of Significance of Difference between Means

The comparison of means of Achievement scores using the statistical technique 'Test of Significance in Difference between Means' was done. The pre-test scores of the experimental and control groups of standards VIII, IX and X were compared.

The obtained 't' values indicate that in standards VIII and X there is no significant difference between the mean pre-test scores of the experimental and control groups. That is both the groups were equivalent in terms of the pre-test scores. But in standard IX no significant difference between the mean pre-test scores of the experimental and control group was noticed. That is the experimental and control groups of standard IX were not equivalent in terms of pre-test scores.

The comparison of Mean post-test Achievement scores of the experimental and control groups of Standards VIII, IX and X were done by the test of significance of difference between means.

It was found that there is significant difference between the Mean post-test scores of the experimental and control groups of standards VIII, IX and X. The significant values of 't' indicate the better performance of students of the experimental groups in the post-test. This is due to the effect of the treatment (teaching the concerned mathematical concepts by the newly developed Instructional Strategies) given to the experimental groups.

Conclusions and Interpretations

In the new Instructional Strategy, the activities are taken from the familiar surroundings of the students. These activities and hands on experiences are understandable, suitable to their needs and sufficiently elaborated. Elaboration means internal processing of new and prior knowledge in a meaningful context. Elaborative strategies for new information result in better learning.

Therefore, the new developed Instructional Strategy enabled the students in the experimental group to have better Achievement in the basic mathematical concepts than the students in the control group who have been taught by Conventional Method of teaching.

Educational Implications

The present study revealed that the newly developed Instructional Strategies based on Piaget and Vygotsky's theories prepared for teaching the three selected basic mathematical concepts each from

standards VIII, IX and X are very effective than the conventional method of teaching mathematics.

Following the structure of the developed Instructional Strategies, for teaching any mathematical concept, Instructional Strategies can be developed by a mathematics teacher for the clear concept formation and attainment and also to prevent the students in committing mistakes while solving problems.

The PI found that the newly developed Instructional Strategy enables the students to learn to think mathematically and make sense in mathematics. It also develops collaborative learning and communication skills (mathematical as well as language) in students. Students develop problem solving capacities and experiences of the actual mathematical process.

This approach reduces gap between the teacher and students as they work together in discussions, in joint activities, academic conversations, exchange ideas and so on. This gives ample opportunities for the teacher to understand the level of attainability of each student.

Adopting this newly developed Instructional Strategy in the secondary school mathematics education, students can acquire the basic mathematical concepts, which is essential for the content mastery in mathematics. This approach reduces committing mistakes and most of the other problems related to teaching learning of mathematics at secondary school mathematics education.