

Teaching of Mathematics through Integrated Approach for Value Inculcation

¹Dr. Vishal Mohandas Panicker, ²Prof. Sujata Srivastava

¹Head of Department cum PGT Mathematics, ²Professor

¹Mathematics, ² Education & Psychology

¹Kokilaben Dhirubhai Ambani Reliance Foundation School, Jamnagar, India,

²The Maharaja Sayajirao University of Baroda, Vadodara, India

Email - ¹vishalmpanicker@gmail.com , ²sujatasrivastava2424@gmail.com

Abstract: *Teaching of Mathematics through an innovative method is the need of the hour. The integrated approach is one such methodology where the teacher can teach Mathematics and simultaneously integrate other components which can enrich and complement both the subjects. In this study integration is done for value inculcation along with the teaching of Mathematics. The objectives of the study were to develop strategies for teaching of Mathematics through integrated approach for value inculcation in the values of Equality and Cooperation, implement the strategies and study the effectiveness of the integrated approach for teaching Mathematics in the development of value conceptual knowledge and value perception in students. A Quasi experimental research design, the Pre-test Post-test Non- Equivalent –Control Group design was followed in this research. Two divisions of class VIII of a school in Vadodara were selected as the experimental and control group by convenience sampling technique. The final sample consisted of 26 students in each group after matching the groups. The findings of the study revealed that the teaching of Mathematics through integrated approach for value inculcation was found to be effective. The value perception and value conceptual knowledge in the values Equality and Cooperation was higher in the students of the Experimental group.*

Key Words: *Value Perception, Value Conceptual Knowledge, Integrated Approach, Teaching of Mathematics.*

1. INTRODUCTION:

Mathematics teaching has lost its luster. Mathematics is taught in schools for achieving a good score and is through more of rote memorization than developing Mathematical competencies. In present times, teaching of Mathematics is very monotonous and develops less interest in students to enquire and explore. According to National Curriculum Framework (2005), some problems in school Mathematics education relates to a sense of fear and failure among children, hence they give up and drop out of serious mathematical learning and the curriculum is disappointing and not catering the needs of high achievers and slow learners. Problems, exercises and methods of evaluation are mechanical and repetitive, which only focus on computation. There are areas of Mathematics such as higher order thinking that are not developed enough in the curriculum. Teachers lack the expertise, confidence, preparation and support.

The teaching and learning in the school premises is only applicable within the school boundaries, students are unable to use their application skills outside the class rooms. Lave (1988) has stated in his research about the application of mathematics outside schools by students. He concluded that students are unable to use the Mathematics they learn at school outside their classrooms.

Mathematics teaching needs to be innovative to regain its beauty and it can be done through many appropriate methodologies. The teaching of Mathematics has a scope of using various methods in its transaction, which are interesting and useful. Mathematics instruction should be focused on meaningful development of important mathematical concepts and highlight the mathematical meaning of these concepts. Along with the deterioration of teaching of Mathematics in schools today, there is also a dearth of values in an individual. There is a change in value system in schools and there are changes taking place in social values. Values are getting deteriorated by the family atmosphere in present scenario, socio-economic status of a child, broken family, family size showed students getting poor adjustment, activism and high personal and materialistic value getting developed instead of true values,' (Bhatnagar,1984). The need for value education has never been as strong as it is today. It should form an integral part of general instruction. Every subject whether its science, social science, languages, art or physical education has a scope of value education. Mathematics and its concepts can have values embedded in it and the nature of Mathematics is such that it has values inherent in it and values can be inculcated by the teaching of mathematics. Values in Mathematics education have the deep affective qualities which education nurtures through the school subject of Mathematics. These are inculcated as per the nature of Mathematics and through the individual's experience in the mathematics classroom.

These values equip the individual with cognitive and affective domain that shape and modify his/her way of perceiving and interpreting the world, and guide his/her choice of course of action (Fasheh,1982).

Integrated approach can be an innovative way, in which values can be inculcated along with teaching of Mathematics. The values of equality and cooperation are important in any democratic society. Equality basically means access or provision of equal opportunities, where individuals are protected from being discriminated. It is the state of being equal, especially, in status, rights, and opportunities and Co-operation means living in accord with others. People should be helpful to one another. It is the process of working or acting together. In its simplest form it involves things working in harmony. It is important to develop the conceptual knowledge and perception of these two values in students through teaching of Mathematics.

2. LITERATURE REVIEW:

Vaidya (1991) conducted a study in the context of life/human values in the physics textbook of standard 10th. His findings indicated that science subjects helped in the moral development of students and dramatization method of teaching was found to be effective in the development of values than the traditional method in teaching of physics.

Singh (1992) compared the results of compute assisted instruction (CAI) with conventional method of instruction in teaching mathematics for certain selected units of the mathematical curriculum. His findings revealed that the group taught through CAI in all the schools showed a substantial progress. The CAI method of teaching mathematics had proved to be more effective. Both boys and girls gained from the computed treatment. Deshmukh (1997) conducted an experiment in the use of educational technology for teaching mathematical concepts. This experiment was designed to develop alternative strategies and support activities as well as instructional materials to facilitate learning of the unit- 'Vulgar Fraction for Class V students. His findings also showed that use of educational technology was found to effective in teaching mathematical concepts.

Marquand(2013) did a study on "A value-added study of a federal grant program in Mathematics for military dependent students" The purpose of this study was to provide additional, value-added information, to the findings of the district's annual assessment report of a three-year federally funded grant designed to close the mathematics achievement gap for military dependent students performing below grade level at a California middle school. The results of this study provide value-added information for the district and stakeholders investing resources into school support programs designed to increase student achievement, particularly for military dependent students performing below grade level in mathematics.

Anilkumar (2014) did a study to find the effectiveness of value integrated education on value based student behavior and on value attainment of students at upper primary level using a pre-test post-test Quasi experimental design. The study revealed that value integrated education is effective for modification of value based behavior and value attainment of the Upper primary school students.

Very few studies dealing with value inculcation using the integrated approach and no study on value inculcation through teaching of Mathematics was found in the literature reviewed.

Therefore, the current study aims to develop strategies for teaching of Mathematics through integrated approach for value inculcation in the values of Equality and Cooperation.

3. OBJECTIVES OF THE STUDY:

- To develop strategies for teaching of mathematics through integrated approach for the inculcation of values of equality and co-operation.
- To implement the strategies for teaching of Mathematics through Integrated approach for the inculcation of the values.
- To study the effectiveness of the integrated approach of teaching Mathematics in terms of conceptual knowledge of values and value perception.

3.1 HYPOTHESES:

The proposed study had null hypotheses formulated and tested at 0.05 level of significance.

- There will be no significant difference between the mean gain scores of the students of control and experimental group of class VIII in the conceptual knowledge of the value equality.
- There will be no significant difference between the mean gain scores of the students of control and experimental group of class VIII in the conceptual knowledge of the value Co-operation.
- There will be no significant difference between the mean gain scores of the students of control and experimental group of class VIII in the value perception of the value equality.
- There will be no significant difference between the mean gain scores of the students of control and experimental group of class VIII in the value perception of the value Co-operation.

4. METHOD:

Quasi experimental research design was followed in the present study. The Pretest-Posttest non- Equivalent-Control Group Design was followed in this research. The sample for the present study was selected by the convenient sampling technique. Two divisions of class VIII of a CBSE school at Vadodara were selected. An achievement test was administered to both the experimental and control group as a pre- test in order to match the groups. The sample consisted of 26 students in experimental group and 26 students in the control group after the groups were matched.

4.1 MATERIALS:

Value Knowledge Test:

In order to test the conceptual knowledge of the students about the values, a value knowledge test was constructed. There were three questions asked on each value of Equality and Cooperation. The questions were related to the meaning, the definition and the characteristics of each value. The value knowledge test had a total of 14 marks for the two values. A maximum score of 7 was assigned for the three questions in each value.

Value Perception Scale:

In order to test the perception of students about the values taken in the study a value perception scale was constructed. There were 10 items in the value perception scale. For each value five items were formulated by the researcher. These five items on different values focused on the different components and characteristics of the selected value. The five situations of each item ranged from strongly positive polarity, positive polarity, neutral polarity, negative polarity and strongly negative polarity. The situations were not in the above mentioned order, they were jumbled up to avoid pattern error. Scoring was done on the basis of scale product technique by giving scores to each response category in the usual Likert Fashion. The situations related to each value showing different polarities were given scores ranging from 1 -5.

Achievement Test:

The achievement test in mathematics was constructed by researcher. This test was constructed keeping in mind the content of all chapters of the class VIII mathematics text book. The pattern of question paper was similar to the question paper constructed in the school. It covered all the chapters of the textbook. There were 25 questions of a total of 100 marks. The questions were related to knowledge, understanding and application level provided with adequate weight age to each respective components.

4.2 PROCEDURE:

The Procedure included selection of the course content, identification of values and development of strategy. The development of values included Identification of Chapters in Mathematics text book of class VIII, content analysis and value identification. The development of activities for inculcation of Values included story telling based on values, value games, value discussions, Maths models making, and educational field trips. Lesson Plans were prepared after development of activities which followed all the components of Model Lesson Plans. The components of lesson plans were entry behaviour, objectives, integrated approach, methods like inductive method, deductive method, analytic, heuristic, discussions method, lecture method and problem solving method. There were value discussions based on meaning, definitions and characteristics of values. The activities like class room games, on field sports, story- telling, presentations, model making and educational trips which were included for various Mathematical conceptual developed had value based discussions integrated.

The data collection procedure was done in different phases. In the first phase, Pre-test was conducted on control and experimental group in terms of achievement test, value knowledge test and perception scale. An achievement test was administered to both the experimental and control group in order to match the groups. In the second phase teaching of Mathematics with the help of the developed strategy was done on the experimental group. At the same time the Control group students were taught Mathematics by the usual regular method using their Mathematics text book. The developed strategies for Experimental group students mainly focused on values of Equality and Cooperation and Mathematics concepts. The process consisted of teaching of Mathematics using various methodologies, activities planned for various mathematical concepts and appropriate value discussions in Experimental group. In the third phase, value knowledge test and value perception scale were administered to both control group and the experimental group as a post-test. The collected data was analysed quantitatively using non-parametric statistics, which included Mean, SD, and Mann-Whitney U-test. The mean gain scores were calculated by finding the difference between post-test and pre-test scores of the experimental and control group.

5. RESULTS AND DISCUSSION:

Table-1

Mean, Standard Deviation, Standard Error of Mean of Control Group and Experimental Group for Conceptual Knowledge of Equality.

Value Conceptual Knowledge of Equality	N	Mean	Standard Deviation	Standard Error of Mean
Control Group	26	-0.73	2.051	0.402
Experimental Group	26	2.00	1.386	0.272

Table-2

Summary of Mann- Whitney U- Test for Conceptual Knowledge of Equality for Control Group and Experimental Group students with the Number of Sample, Sum if Ranks, U-Value, z- Value and Probability.

Students	N	Sum of Ranks	U-Value	Z- Value	Probability(p)
Control Group	26	448.50	97.50	-4.460	0.000
Experimental Group	26	929.50			

Table 1 reveals that the mean gain scores of students in the conceptual knowledge of the value of Equality of the control group and the experimental group were -0.73 and 2.00 respectively. The standard deviations were found to be 2.051 and 1.386 and the standard error of mean was 0.402 and 0.272 for the respective groups. The difference in the mean was tested statistically.

It was found that the U-value and z value were found to be 97.50 and -4.460 respectively. Referring the table for normal probability (Table A of Siegel, 1956) under null hypothesis (H_0) of z, for $z \leq -4.460$, the two tailed probability was found to be 0.000 which was lesser than our decided $\alpha = 0.05$. (Table 2) Hence the null hypothesis H_0 , i.e. “there will be no significant difference between the mean gain scores of the students of control and experimental group of class VIII in the conceptual knowledge of the value Equality”, was rejected. Therefore it was clear that the control group and the experimental group students differed significantly in terms of their conceptual knowledge in the value of Equality. Hence it can be concluded, that conceptual knowledge of the students in the experimental group was stochastically higher than the students in the control group due to the integrated Approach of teaching Mathematics for value inculcation.

Table-3

Mean, Standard Deviation, Standard Error of Mean of Control Group and Experimental Group for Conceptual Knowledge of Cooperation.

Value Conceptual Knowledge of Equality	N	Mean	Standard Deviation	Standard Error of Mean
Control Group	26	-0.69	1.955	0.383
Experimental Group	26	2.12	1.966	0.386

Table-4

Summary of Mann- Whitney U- Test for Conceptual Knowledge of Cooperation for Control Group and Experimental Group students with the Number of Sample, Sum if Ranks, U-Value, z- Value and Probability.

Students	N	Sum of Ranks	U-Value	Z- Value	Probability(p)
Control Group	26	462.50	111.50	-4.177	0.000
Experimental Group	26	915.50			

Table 3 reveals that the mean gain scores of students in the conceptual knowledge of the value of co-operation of the control group and the experimental group were -0.69 and 2.12 respectively. The standard deviations were found to be 1.955 and 1.966 and the standard error of mean was 0.383 and 0.386 for the respective groups. The difference in the mean was tested statistically.

It was found that the U-value and z value were found to be 111.50 and -4.177 respectively. Referring the table for normal probability (Table A of Siegel, 1956) under null hypothesis (H_0) of z, for $z \leq -4.177$, the two tailed probability was found to be 0.000 which was lesser than our decided $\alpha = 0.05$ (Table 4). Hence the null hypothesis H_0 , i.e. “there will be no significant difference between the mean gain scores of the students of control and experimental group of class VIII in the conceptual knowledge of the value co-operation”, was rejected. Therefore it was clear that the

control group and the experimental group students differed significantly in terms of their conceptual knowledge in the value of cooperation. Hence it can be concluded, that conceptual knowledge of the students in the experimental group was stochastically higher than the students in the control group due to the integrated approach of teaching Mathematics for value inculcation.

Table-5

Mean, Standard Deviation, Standard Error of Mean of Control Group and Experimental Group for Value Perception of Equality.

Value perception of Equality	N	Mean	Standard Deviation	Standard Error of Mean
Control Group	26	-0.81	2.191	0.430
Experimental Group	26	1.69	3.095	0.607

Table- 6

Summary of Mann- Whitney U- Test for Value Perception of Equality for Control Group and Experimental Group students with the Number of Sample, Sum if Ranks, U-Value, z- Value and Probability.

Students	N	Sum of Ranks	U-Value	Z- Value	Probability(p)
Control Group	26	521.00	170.00	-3.115	0.002
Experimental Group	26	857.00			

Table 5 reveals that the mean gain scores of students in the perception of the value of Equality of the control group and the experimental group were -0.81 and 1.69 respectively. The standard deviations were found to be 2.191 and 3.095 and the standard error of mean was 0.430 and 0.607 for the respective groups. The difference in the mean was tested statistically.

It was found that the U-value and z value were found to be 170.00 and -3.115 respectively. Referring the table for normal probability (Table A of Siegel, 1956) under null hypothesis (H_0) of z, for $z \leq -3.115$, the two tailed probability was found to be 0.002 which was lesser than our decided $\alpha = 0.05$ (Table 6). Hence the null hypothesis H_0 , i.e. “there will be no significant difference between the mean gain scores of the students of control and experimental group of class VIII in the perception of the value Equality”, was rejected. Therefore it was clear that the control group and the experimental group students differed significantly in terms of their perceptions in the value Equality. Hence it can be concluded, that value perception of the students in the experimental group was stochastically higher than the students in the control group due to the integrated approach of teaching Mathematics for value inculcation.

Table-7

Mean, Standard Deviation, Standard Error of Mean of Control Group and Experimental Group for Value Perception of Cooperation.

Value perception of Cooperation	N	Mean	Standard Deviation	Standard Error of Mean
Control Group	26	--1.15	2.880	0.565
Experimental Group	26	2.08	3.212	0.630

Table-8

Summary of Mann- Whitney U- Test for Value Perception of Cooperation for Control Group and Experimental Group students with the Number of Sample, Sum if Ranks, U-Value, z- Value and Probability.

Students	N	Sum of Ranks	U-Value	Z- Value	Probability(p)
Control Group	26	504.50	153.50	-3.394	0.001
Experimental Group	26	873.50			

Table 7 reveals that the mean gain scores of students in the perception of the value co-operation of the control group and the experimental group were -1.15 and 2.08 respectively. The standard deviations were found to be 2.880 and 3.212 and the standard error of mean was 0.565 and 0.630 for the respective groups. The difference in the mean was tested statistically.

It was found that the U-value and z value were found to be 153.50 and -3.394 respectively. Referring the table for normal probability (Table A of Siegel, 1956) under null hypothesis (H_0) of z, for $z \leq -3.394$, the two tailed probability was found to be 0.001 which was lesser than our decided $\alpha = 0.05$ (Table 8). Hence the null hypothesis H_0 , i.e. “there will be no significant difference between the mean gain scores of the students of control and experimental group of class VIII in the perception of the value Co-operation”, was rejected. Therefore it was clear that the control

group and the experimental group students differed significantly in terms of their perceptions in the value of Cooperation. Hence it can be concluded, that Value Perception of the students in the experimental group was stochastically higher than the students in the control group due to the integrated approach of teaching Mathematics for value inculcation.

The Integrated Approach was found to be effective in developing the conceptual knowledge and perception of the values of Equality and co-operation in students of class VIII. One of the reasons of its effectiveness was the various value discussions held in the class. These discussions included giving conceptual clarity related to the meaning, definition and characteristics of values. The mathematical concepts were integrated with values and relevant examples were given bringing out the different components of values. The development of the value perception of the values like, Equality and Co-operation was because of the various value based activities like storytelling, games, model making and presentations conducted in the class. The Integrated Approach was found effective in inculcating the values like Equality, and Co-operation.

6. CONCLUSION:

The integrated approach in mathematics teaching for value inculcation at secondary level was found to be effective in developing value perception and value conceptual knowledge in the taken values Equality and Co-operation. The deterioration in values can be observed everywhere in the society. The need for value education is of paramount importance in schools today. The school curriculum has to focus on values which is the need of the hour. This study has implications for the text book designers in the Text Book Boards. Value-based modules can be designed for teachers for various secondary school subjects. This study also has implication for the policy makers who formulate curriculum for teacher education programs at all levels. The teachers in schools need to make a conscious, deliberate and a systematic effort to inculcate a few values through the teaching of their subject areas. The children of today who are the future citizens of tomorrow would practice value- based behavior and which would make this world a better place to live in.

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