

**TEACHING OF MATHEMATICS THROUGH INTEGRATED
APPROACH AT SECONDARY LEVEL FOR
VALUE INCULCATION**

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1.1 INTRODUCTION:

The educational scenario is in a state of flux. The teaching learning process has undergone a drastic change over the years. This is the period of transition and a change. The development of the individual and the nation at large is one of the goals of education. Mathematics is said to be the mother of all sciences. It is also believed that Mathematics reveals the true nature of reality. At a very spiritual level it is also believed that concepts of Mathematics bring an individual closer to God. Mathematics has the ability to develop both cognitive and affective domain of an individual. Mathematics with its diversified beauty and its correlation with various fields has always enabled for a development of a perfect and strong foundation and magnificent structures. Mathematics holds a high status in this earth as well as the whole universe. Without Mathematics, the world is like a big zero in terms of development. Mathematics has the power to not only develop the basic infrastructure in this world but it also enables a person to develop various personality attributes. The problem solving nature of Mathematics enables an individual to be more efficient and helps him or her to be stronger in any circumstances. The determined approach to get a solution develops discipline and determination to do something worthwhile in the world. The true and honest derivation of mathematical concepts teaches how a person can achieve its desired results by having an honest approach. The development in information technology the various calculations, development of software, the invention based upon the hypothesis and assumptions hold no place without Mathematics. With the passage of time there has been a change in the attitude of students towards Mathematics and there is a mixed feeling towards it. The students who deal with it perfectly are able to enjoy the true essence of Mathematics, but the students who do not deal with it in an ideal manner, Mathematics becomes a problem. Mathematics teaching needs to be innovative to regain its beauty and it can be done through many appropriate means and ways.

1.2 NATURE AND IMPORTANCE OF MATHEMATICS

National Curriculum Framework (2005) emphasized on developing abilities of children for mathematisaton as the main goal of Mathematics education. While, the narrow aim of school Mathematics is to develop ‘useful’ capabilities, particularly those relating to numeracy-numbers, number operations, measurements, decimals and percentages.

The higher aim as mentioned by NCF (2005) is to help a child with useful resources that can enable them to think and reason mathematically to deal logically with the various assumptions and to resolve the abstractions. It includes the way of doing things and the abilities to formulate and solve problems. In this regard, there arises a need for a curriculum that is ambitious, coherent and teaches important principles of Mathematics. It should possess variety of methods, skills requisite to address problems that come from other subjects such as science and social studies in high school. It should be as such that both the teachers and students find it important as well as useful to solve the given problems in a meaningful manner.

Mathematics is a compulsory subject at the secondary stage in various boards of education and it is the right of every student to get the quality education in Mathematics. It is skillful, it is methodical, it is problem-solving and it is artistic in nature. Most of the skills taught in primary school Mathematics are useful. At secondary stage Mathematics related to arithmetic, calculations, geometry and more on numbers are again developing various attributes in a child. If the teaching of Mathematics in school is clubbed with an effective and appropriate methodology, confronting them with the true artistic nature of Mathematics followed by working with the wide numero-logical applications, then the objectives in Mathematics would be achieved.

The everyday use of arithmetic and the display of information by means of graphs are commonly seen. These are the basic things in Mathematics which many of the educated population do. There is a different world of Mathematics: Advanced Mathematics which is used widely in many other areas which is not familiar to the world directly. It consist of space world, the stunning pictures of faraway planets could not have had their salient features and quality without such Mathematics. Journey to the planets could not have been calculated without the Mathematics of differential equations. Whenever there are advances made with supercomputers, mathematical theory instructs the progress.

1.2.1 OBJECTIVES OF MATHEMATICS

According to **Sidhu (1995)** the objectives of Mathematics are stated as under.

- To develop understanding and knowledge of language of Mathematics.
- To develop skill in the use and understanding of mathematical language.
- To develop and acquire speed, neatness, accuracy, precision in mathematical calculations, etc.
- To learn technique of problem solving
- To develop the ability of mental calculations, to verify, to estimate, to evaluate, to check, etc.
- To make use of mathematical tables and ready references, to develop measuring skills weighing and surveying, etc.
- To develop logical thinking in students.
- To develop the ability to use the mathematical knowledge in their day to day life.

- To develop the ability to analyze, synthesize, to differentiate, to integrate, etc. and to check any probability of any situation using mathematical concepts.

1.2.2 OBJECTIVES OF TEACHING OF MATHEMATICS AT SECONDARY LEVEL:

According to the National Curriculum Framework (2000), the objectives of teaching Mathematics at secondary stage are as follows:

- To further enhance the capacity of the students to employ Mathematics in solving problems that they face in their day-to-day life.
- A systematic study of Mathematics has to be started here and continued further.
- The curriculum may include the study of relevant arithmetical concepts, number system, algebra, geometry, trigonometry, co-ordinated geometry, mensuration, graphs, statistics, etc.
- The idea of proof should be developed with thrust on deductive reasoning.
- Emphasis is to be laid on wider application of Mathematics by way of making data based problems pertaining to actual data on population, agriculture, environment, industry, physical and biological sciences, engineering, defense etc.
- Student should attain proficiency in presenting information available in their environment in the form of graphs and charts and be able to do calculation with speed and accuracy.
- Student should acquire the ability to solve problems using algebraic methods and apply knowledge of simple trigonometry to solve the problems of height and distance.

- The history of Mathematics with special reference to India and the nature of mathematical thinking should find an importance.
- Students may be encouraged to enhance their computational skill by the use of Vedic Mathematics.

1.2.3 TEACHING OF MATHEMATICS IN SCHOOLS: THE PRESENT SCENARIO:

Mathematics is a primordial subject. It has all the key features which enables cognitive development in a child i.e. good memory, understand various shapes and counting at his/her initial days of acquiring knowledge. After the initial levels of learning Mathematics the same child performs calculations that are easy and complex, problems with diverse situations, puzzles to challenge their intellects. A person who enjoys Mathematics is considered to be a person with good intellectual abilities in our society. In school many students enjoy doing the problem solving sums, some students like the arithmetic calculations while some are found engrossed in solving the algebraic equations and there are students enjoying the constructions and menstruation related activities and examples. In a school if the subject is taught in a right manner and if it is able to achieve all the objectives related to teaching Mathematics, the students will enjoy every aspects of Mathematics. The present day instruction in Mathematics to some extent is very mechanical and monotonous. There are schools and institutes which emphasize more on results rather than the process; For the students it is just a number game, they are running behind the subject to score marks rather than developing critical thinking skills. It had been a matter of concern over the teaching of Mathematics in schools.

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. 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. Areas of Mathematics such as spatial thinking are not developed enough in the curriculum teachers lack the expertise, confidence, preparation and support.

The nature of Mathematics is such that it has values inherent in it and values can be inculcated by the teaching of Mathematics using various innovative approaches.

1.3 VALUES AND MATHEMATICS

There are certain values, i.e., implicit values which are interdisciplinary to Mathematics. The nature of Mathematics as such requires more of analytical thinking. This nature can be very useful in developing the values in students by providing them with various situations. One of the many ways in which value education can be incorporated in schools is through problem solving approach by the teaching of Mathematics. When a problem is presented and the skills required to solve that problem are developed, it motivates the student to learn Mathematics and become more deeply involved in the learning process. Teaching through problem solving enhances logical reasoning.

Values in Mathematics education have the deep affective qualities which education nurtures through the school subject of Mathematics. They are inculcated through the nature of Mathematics and through the individual's experience in the Mathematics classroom. Earlier Mathematics was considered a value-free and culture-free subject. This perception has changed as far as the value part is concerned in Mathematics. Values have their own identity and it is one of the key components of basic education in a country like India. There is a very basic need of understanding the values and how it can be integrated through Mathematics teaching in school.

1.4 MEANING AND CONCEPT OF VALUE.

The Dictionary of Education (1959) defines value “as the things in which people are interested – things they want to desire to be or become; feel as obligatory, worship or enjoy.”

Values in an individual makes them fall apart from the rest, it is the values that gives character and recognition to any individual. It is the guiding light of any human which enlightens the mind and later on the character of an individual. The soul brings life into a body while values bring quality in the body. A value is a relationship between a person and an environmental situation which conjures a concerned response in the individual. According to Mohan (2007) “ Mutual survival of people in a progressive society is value based. Human and social values have sustained the humanity ever since advances in civilization gave rise to organized social structures,”

1.4.1 *Nature and Classification Of Values:*

Values are not static in nature, it is a dynamic concept. It changes with time and space. It possesses both cognitive and affective dimensions. Values steer our life’s journey. Values are modes of organizing conduct. Values are influenced by emotions. Values can be derived from several sources. Anything which has utility has value. Values are helpful for survival.

Based upon the nature and concept of values these values are further classified below:

Value is a broad concept, as discussed above about value being divided in two different types like social, personal, national, ethical, aesthetic, etc. **NCERT (1979)** has listed 83 values under 3 categories like, (1) Social values (2) Ethical values (3) Spiritual values. They are as under.

1. Abstinence,
- 2.Appreciation of cultural values of others,
- 3.Anti-untouchability,
- 4.Citizenship,
- 5.Consideration for others,
- 6.Concern for others,

7.Co-operation, 8.Cleanliness, 9.Compassion, 10.Common cause, 11.Common goal, 12.Courage, 13.Courtesy, 14.Curiosity, 15.Democratic Decision making, 16.Devotion,17. Dignity of the individual 18.Dignity of manual work, 19.Duty, 20.Discipline, 21.Empathy,22. Endurance, 23.Equality, 24.Friendship, 25.Faithfulness, 26.Fellowfeeling, 27.Freedom, 28.Forward look, 29.Good manners, 30.Gratitude, 31.Gentlemanliness, 32.Honesty, 33.Helpfulness, 34.Humanism, 35.Hygenic living, 36.Initiative, 37.Integrity, 38.Justice, 39.Kindness, 40.Kindness to animals, 41.Leadership, 42.Loyalty to duty, 43.National unity, 44.National consciousness, 45.Non-violence, 46.Obedience, 47.Peace, 48.Proper utilization of time, 49.Punctuality, 50.Patriotism, 51.Purity, 52.Quest for knowledge, 53.Resourcefulness, 54.Regularity, 55.Respect for others, 56.Reverence for old age, 57.Sincerity, 58.Simple living, 59.Social justice, 60.Self-discipline, 61.Self-help, 62.Self-confidence, 63.Self-respect, 64.Self-support, 65.Self-study, 66.Self-reliance, 67.Self-control, 68.Self-restraint, 69.Social service, 70.Solidarity of mankind, 71.Sense of social responsibility, 72.Sense of discrimination, 73.Socialism, 74.Sympathy, 75.Secularism and respect for all religions, 76.Spirit of enquiry, 77.Team work, 78.Truthfulness, 79.Team spirit, 80.Tolerance, 81.Universal truth, 82.Universal love, 83.Value for national and civic property.

1.4.2. Value Deterioration: The Present Scenario

There is a change in value system in schools and there are changes taking place in social values and their educational implications. Further, incidences like leakage of entrance exam papers, mal-practices in exams, admissions for seats in engineering colleges and medical sciences are the instances of a value deteriorated society in the education field. Education today is being termed as industry, where schools get converted to five star rated setups,

commercialization of educational institutions, brand developments, etc., further add up to the deterioration.

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).

In our country there is a rapid degradation of our cultural heritage which is considered to be the mirror of our values, morals, customs, etc. There is a misconception of notion of modernity, in the changed social set up, our definition of good morals stand questioned.

It is hence no surprise that the government of India and the ministry of HRD are keen to promote value education in schools.

There is a deterioration of values leading to value crisis in the society. The need for value education has never been as strong as it is today.

1.4.3. *Value Education: Meaning and Concept*

The Education Commission (1964-66), the National Policy on Education (1986) and the Ramamurthy Commission Report (1990),National Curriculum Framework(2000)and National Curriculum framework(2005) and recommended that imparting of value education should be an integral part of the entire educational process

Value education means inculcating in the children a sense of humanism, a deep concern for the well- being of others and the nation. Value education is wider, practicable and adoptable than religious education or moral education as no specific faith or religion is reflected through ethical, moral, social, cultural or spiritual values (Venkataiah and Sandhya, 2002)

In schools the value education can be given to students while integrated with all the subjects directly and indirectly through the activities like morning

assembly, playground, field trips and various other school events like annual day, sports day and cultural programs. Rajput (2002) stated that the value education needs to be integrated to all activities of the school, classroom teaching, games, cultural activities, welfare services, help to needy students, remediation and nurturing of talent etc.

Value education has the capacity to transform a diseased mind into a very young, fresh, innocent, healthy, natural and attentive mind. The transformed mind is capable of higher sensitivity and a heightened level of perception. This leads to fulfillment of the evolutionary role in man and in life. (Venkataiyah, 2002)

1.4.4. *Need and Importance of Value Education in Schools*

The National Policy of Education, (1986) speaks of the need for value education and has stated that there is a growing concern over the erosion of essential values and on increasing cynicism in society has brought to focus the need for readjustments in the curriculum in order to make education a forceful tool for the cultivation of social and moral values.

In our culturally plural society, education should foster universal and eternal values, oriented towards the unity and integration of our people. Such value education should help eliminate obscurantism, religious fanaticism, violence, superstition and fatalism.

Value education is not just important factor in our country but also in other countries as well. UNESCO lays emphasis on this subject in different ways. Value education has become quest of ethics in every aspect world -wide.

The National Council of Educational Research and Training (1975) considered moral erosion a major issue and put forward a ten year program for the moral rejuvenation. It wanted to lessen the inequality of sex, caste, religion, language, regionalism and race. They wanted to promote value and character building through various programs.

Value education need to be imparted in schools systematically and methodically by using various approaches and methods.

1.4.5. *Status of Value Education in Schools Today*

Many schools impart value education in some form or the other, but it lacks focus. Some schools offer value education in the name of Moral Science.

The deterioration of values in the society is also due to the lack of value education in schools today. The schools have an important role to play in value inculcation. There is a significant change in self-respect, wisdom, and a sense of accomplishment in secondary school students as a result of value education, (Kapoor, 1995).

Most teachers feel that parents expect schools to provide values education, though they seem undecided as to whether students really want to know what is right and wrong. Most teachers feel that their schools reflect the dominant values of the communities which they serve, but admit that their schools lack clearly-defined goals for values education programs. Teachers feel less qualified in value education. Very few teachers set aside a special time during the day to teach values. (Whitney, 1986). There doesn't seem to be much change in the situation even today.

There is often dissatisfaction with education in India and elsewhere, because it lacks the provisions for education in values in general and the moral and spiritual values in particular. That is the reason why many thinkers, educationists, committees and commissions have recommended imparting education in values, particularly moral and spiritual values, But in spite of the recommendations, value education had remained almost a non-starter in India Lack of proper conviction in value education, and opposition to moral and

spiritual education by some people are the major causes of this state of affairs. (Kar, 1996).

If we look around our present education system, the focus of our education is on towards the main subjects like Mathematics, Science, Social Science, Languages, etc. Many schools and many teachers have never considered value education as an important subject. Most of the teachers are unaware of the methods involved in teaching and learning of values, or in developing a perception towards values. It is also known that all the subjects have some or the other value components. These aspects have largely not been given importance. In fact there are several approaches and methods which the teachers can use in their teachings to develop and strengthen different value system among students to inculcate values specifically or simultaneously with other subjects. .

1.5 APPROACHES AND METHODS IN TEACHING OF VALUES:

Value education is an important aspect in education It should form an integral part of general instruction.

Venkataiah and Sandhya (2002) admit about value education that. “value education means inculcating in the children a sense of humanism, a deep concern for the well-being of others and the nation. Through value education we like to develop the social, moral, aesthetic and spiritual sides of a person which are often undermined in formal education”. This observation establishes that value education can be imparted in two ways which include: (1) Class Room Teaching Learning Process; (2) Practical Activities

In the process of imparting value education there are various approaches and methods which can be used for inculcating the desired values in students.

1.5.1. *The Integrated Approach*

According to Veer (2012) .the integrated curriculum is an activity- centered curriculum. Group- controlled instructions are employed in this type of curriculum. It is also known as activity-oriented curriculum. The knowledge of all subjects is imparted by relating to life.

The Integrated approach is a process in which any knowledge or basic concept can be spontaneously incorporated into the various subjects of the curriculum .The Integrated approach leads to integrative learning, which is all about connecting skills and knowledge from multiple sources and experiences; applying skills and practices in various settings; utilizing diverse and even contradictory points of view; and, understanding issues and positions contextually.

The values can be integrated effectively with various subjects by using the integrated approach. Integration of human values along with scholastic and co scholastic activities of students in value -based education, is significant of the al round development of students.

As the very word itself clears that integration in no ways contradicts or alters the existing pattern rather it means supplementing or strengthening the existing pattern with what is pivotal in view of changing needs, situations etc.

Thus integrated approach with respect to value education is a process with which values can be spontaneously incorporated into the various subjects of the curriculum.

The integrated approach enables the teacher to go deeper rather than remain at the information level (Priyakumari, 2003). Values no longer need to be isolated as ‘moral science’ on ‘human values’, evaluated and assessed like any other body of information. (Saraf, 1999). There is a process for integration of values.

This approach can be dealt by involving various methods of teaching Discussion method are very useful in this approach. The various activities like

story- telling, games, presentation, model making, problem solving, project method and field trips can supplements the integrated approach of teaching any subject.

Realizing the call of the time and to sharpen our future generations we can integrate value orientation along with the normal course of teaching-learning process.

The Characteristics of Integrated approach according to Veer (2004)

1. The knowledge of subjects is given in the integrated form.
2. The students learn the various subjects simultaneously.
3. This type of curriculum is activity oriented and experience-centered.
4. This type of curriculum provides knowledge of the subject which is useful in the real life.
5. The students' interest is taken into considerations.
6. It employs group controlled instruction therefore duties and responsibility are assigned to the students.

These approaches cannot be successful if they do not use a method of teaching values; method enables to supplement the values approaches in the value inculcation. There are various methods that can be used during the various approaches used while inculcating value education. These methods can be categorized in the form of **(i) Direct Method; (ii) Indirect method and (iii) Incidental Method.**

These methods can be used effectively during the teaching of students through various approaches. The integrated approach is one of the useful approaches for imparting value education and inculcating values in students. This integrated approach has been used by the researcher in the present study.

1.6 VALUES INTEGRATED WITH MATHEMATICS:

For the present study ten values namely equality, co-operation, determination, simplicity, team work, discipline, loyalty, dignity of labour, regularity and honesty were identified by the researcher to be inculcated through teaching of Mathematics. These ten values were identified on the basis of a thorough content analysis of the class VIII Mathematics text book. These were the frequently occurring values in the various chapters which had a scope of integration with different topics of Mathematics. A brief account of these values and their integration with Mathematics has been given below.

2.0 IMPLICATIONS OF THE REVIEW OF RELATED LITERATURE FOR THE PRESENT STUDY

The studies reviewed were mainly of two types. The nature of the studies included survey and experimental types of research. Both these types of studies had different objectives and focus. The survey type studies were conducted with a view to study the relationship between various values and different variables like, family background, sex, rural-urban background, caste, etc. of students at school and graduate level.

The experimental studies were conducted in order to study the effectiveness of different intervention strategies, as well as models on development and status of changing values among students. The researcher came across different studies related to textbooks of different subjects and curriculum. There were several studies which focused on various models, methods, approaches, designs, programmes on value development in students. The different tools used in the studies reviewed were questionnaires, value tests, reaction scales, inventories, perception scales, etc. Anilkumar (2014) studied the effectiveness of value integrated education on value based student behaviour and on value attainment of students at upper primary level through the teaching of Malayalam. There were few studies which focused on CAI, technology enabled programme, and co-related approach with an aim to improve

achievement in Mathematics. The literature reviewed did not include any study related to integrated approach in teaching of Mathematics for inculcation of values in students at secondary level. Hence the researcher conducted a study on teaching Mathematics through the integrated approach for value inculcation at secondary level.

2.1 RATIONALE OF THE STUDY:

Since last few years our country has seen the downfall in the basic values which are required for any society to form a strong and healthy foundation of the society and the nation. Hence there are serious efforts made all across India to integrate these values through the education system.

The Educational Boards and institutes are seeking various measures to develop a proper way for value education in the teaching learning process. The Central Board of Secondary Education (CBSE) has introduced the concept of value based question in question papers. Questions of three to five marks in almost all the major subjects in Class 9, Class 10, Class 11 and Class 12 in CBSE Board Exams were made effective since academic session 2012 – 2013. The Central Board of Secondary Education towards the introduction of CCE (Continuous Comprehensive Evaluation), in the co-scholastic assessment the students are graded on the basis of attitude and values. However values are not being taught systematically and methodically in most of the schools.

The degradation of value system and deterioration of values and culture in the run of materialistic and economic development is evident everywhere. The school is considered to be the place a student can be given the proper guidance on values and wholistic education. In the present times the emphasis on consumerism and competition for achievement, has sidelined its central concern for the overall development of the persons being educated. The important dimension of education, i.e., the development of moral and spiritual side of human personality needs more focus.

Value education which needs to be looked upon as an essential aspect for the overall qualitative improvement of education is being neglected to a great extent. There is a need to strengthen the value education at schools today and many approaches and methods need to be adopted for imparting value education. The curriculum would get overcrowded if new subjects are added according to the needs of the changing times. Therefore the integrated approach goes a long way in the inculcation of values.

Mathematics and its nature helps students to develop the ability to analyze, synthesize, to differentiate, to integrate, etc. and to check any probability of any situation using mathematical concepts. These qualities of Mathematics have an ability to use any approach or strategy in order to develop various skills in a student. If values are interwoven in the teaching process of Mathematics then, there is a much better scope of inculcation of values in student through various situations and examples used while teaching of Mathematics.

The researcher came across survey and experimental types of research in the literature reviewed. The survey type studies focused on the relationship between values and different variables. There were other studies which focused on various models, methods, approaches, designs, programmes on value development in students. There were few studies which focused on CAI, technology enabled programme, and co-related approach with an aim to improve achievement in Mathematics. However the literature reviewed did not include any study related to Integrated Approach in teaching of Mathematics for inculcation of values in students at secondary level. Therefore the researcher took up a study and developed strategies to integrate the identified ten values namely equality, co-operation, and simplicity, dignity of labour, team work, honesty, regularity, discipline, loyalty and determination through the teaching of Mathematics.

The researcher formulated the following research questions for the present study.

- 1) Can values be inculcated through teaching of Mathematics using the integrated approach?
- 2) Can the developed strategies be effective for value inculcation?

3.1. STATEMENT OF THE PROBLEM:

TEACHING OF MATHEMATICS THROUGH INTEGRATED APPROACH AT SECONDARY LEVEL FOR VALUE INCULCATION.

3.2. OBJECTIVES OF THE STUDY:

1. To develop strategies for teaching of Mathematics through integrated approach for the inculcation of values like equality, co-operation, simplicity, dignity of labour, determination, honesty, regularity, discipline, loyalty and team work
2. To implement the strategies for teaching of Mathematics through Integrated approach for the inculcation of the values.
3. To study the effectiveness of the integrated approach of teaching Mathematics in terms of conceptual knowledge of values, value perception and value practice along with the achievement in Mathematics
4. To study the reaction of students towards the value integrated approach.

3.3. HYPOTHESES:

The proposed study will have null hypothesis. Out of the literature reviewed , no clear direction emerged that the interventions or experiments conducted would lead to value inculcation in the experimental group . Therefore Null hypotheses was formulated by the researcher.

1. 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.
2. 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.
3. 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 dignity of labour.
4. 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 simplicity.
5. 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 determination.
6. 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 honesty.
7. 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 regularity.
8. 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 discipline.
9. 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 loyalty.

10. 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 team work.
11. 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 all the values as a whole.
12. 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.
13. 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.
14. 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 dignity of labour.
15. 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 simplicity.
16. 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 determination.
17. 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 honesty.
18. 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 regularity.

19. 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 discipline.
20. 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 loyalty.
21. 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 team work.
22. 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 all the values as a whole.
23. There will be no significant difference between the mean gain scores of the students of control and experimental group in the Achievement Test in Mathematics of Class VIII students.

The null hypotheses will be tested at 0.05 level of significance in the present study

3.4. OPERATIONAL DEFINITIONS:

- (1) Value Conceptual Knowledge: Value conceptual knowledge of a specific value is the score secured by a person in that value present in the value knowledge test prepared by the researcher. The conceptual knowledge of the ten values taken as a whole is the total score secured by a person in the value knowledge test prepared by the researcher.
- (2) Value Perception: Value perception of a specific value is the score secured by a person in that value present in the five point value perception scale prepared by the researcher. Value perception of ten values as a whole is the total score

secured by a person in the five point value perception scale prepared by the researcher.

- (3) Value practice: The value practices are the different values exhibited by the students in their behaviour.
- (4) Achievement in Mathematics: The achievement in Mathematics in the present study will be considered as the total marks secured in the achievement test prepared by the investigator.

3.5. Explanation of the terms:

Integrated Approach in Mathematics: An approach of teaching values indirectly through the teaching of Mathematics.

Strategy: A strategy is a plan of action which includes all activities designed for the inculcation of the values.

3.6. DELIMITATIONS OF THE STUDY:

- (A) The present study was delimited to the Class VIII English medium students of secondary level following Central Board of Secondary Education curriculum.
- (B) Values in the present study were delimited to the values of equality, co-operation, simplicity, dignity of labour, determination, honesty, regularity, discipline, loyalty and team work.

3.7. PLAN & PROCEDURE OF THE STUDY

The study has been conducted in two sections. Section -I includes the procedure of selection of the course content, identification of values and development of the strategies. Section-II gives details about the population, sampling technique, description of the tools , method of data collection and techniques used for data analysis.

3.7.1. Section I:

Development of the Strategy: This consisted of chapters of Mathematics taken from Mathematics text book of standard VIII, content analysis and value identification, development of activities for value inculcation and preparation of value integrated lesson plans. The activities used during the teaching of Mathematics using integrated approach for value inculcation were value based storytelling, value games, model making, presentations and educational trips.

Implementation of the Developed Strategy:

The developed strategies were implemented in the Mathematics class of class VIII during the academic session 2011-12 by the researcher. The Mathematics class was six times a week in the class time-table. The duration of the class was of 40 minutes

3.8. Section II:

3.8.1. Research Design

The research design was experimental in nature. It was Quasi-experimental design. The Pretest-Posttest Non Equivalent-Control Group Design was followed in this research.

The design of the study is shown graphically which is as follows. :

Pre-test Post-test Groups

Experimental Group	O ₁	X	O ₂
Control Group	O ₃	C	O ₄

X = Treatment ; O₁, O₃ - Pre-test ; O₂, O₄- Post-test; C :No Treatment.

3.8.2. Population

The population for the present study consisted of all class VIII students studying in English medium schools affiliated to CBSE in Vadodara district in the state of Gujarat.

3.8.3. *Sample*

The sample for the present study was selected by the convenience sampling technique. Two divisions of class VIII of the school named Bharatiya Vidya Bhavan's V.M. Public school at Vadodara were selected. Out of the three divisions of class VIII present in the school, class VIII B and VIII C were selected for the present study. Class VIII C formed the experimental group while class VIII B formed the control group.

There were 42 students in VIII B and 43 students in VIII C. An achievement test administered to both the experimental and control group as a pre- test. One to one matching was done taking into account the equivalent scores obtained by students of both groups in the achievement test. The groups were perfectly matched. After one to one matching, the sample consisted of 26 students in experimental group and 26 students in the control group.

3.8.4. *Tools and Technique*

The following tools were constructed for the present study by the researcher.

Value Knowledge Test: This tool is used to collect data for objective 3. In order to test the conceptual knowledge of the students about the ten values, a value knowledge test was constructed. The values taken were equality, cooperation, simplicity, dignity of labour, determination, honesty, discipline, loyalty, regularity and team work. The value knowledge test had a total of 30 questions. There were three questions asked on each value. The questions were asked on three dimensions. The questions were related to the meaning, the definition and the characteristics of each value. The validation of the tool was done by the experts and suggestions were incorporated.

Value Perception Scale : This tool was used to collect data for objective 3. In order to test the perception of students about the ten values taken in the study a value perception scale was constructed by the researcher. The values taken were equality, co-operation, simplicity, dignity of labour, determination, honesty, regularity, discipline, loyalty and team work. There were 50 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. Students had to tick mark () in one appropriate situation out of the five situations. The time allotted to give the responses was 40 minutes both for pre-test and post- test. The tool was validated by the experts based on the tools were corrected based on the suggestions given by the expert. The reliability of the tool was also obtained by administering it on 150 students of class VIII other than the experimental and control group. Cronbach's alpha coefficient was used to find out the reliability of the tool. The scale was found reliable.

Achievement Test: The achievement test was used to collect data as per objective 3. The achievement test in Mathematics was constructed by researcher for the students of the experimental and control group.. This test was constructed keeping in mind the content of all 15 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. It was a hundred marks paper. It had question related to knowledge, understanding and application level provided with adequate weightage to each respective components. All the questions asked were taken from the textbook. There were 25 questions in all. The question paper had 3 sections A, B and C. Section A consisted of very short answer type questions. Section B consisted of short answer type. Section C consisted of long answer type questions. The time allotted for the test was 3 hours. The prepared tool was shown to the

experts in the field of education and Mathematics teachers of the same school for its validation.

Observation: Observation was used as a technique to collect data for objective 3. The researcher decided to use this technique to observe all the behaviours of the students related to various values. The observation would be done on the value practices exhibited by the students during the school hours and even outside the school hours such as during field trips. The researcher would note down their actions or any noticeable behaviour related to values in a diary.

Reaction Scale : The reaction scale was used to collect data for objective 4.

A 5 point Likert type reaction scale was prepared by the researcher for the students of the experimental group .The aim of the reaction scale was to take the reaction of the students towards the value integrated approach of teaching Mathematics. The reaction scale had 20 items. These items were related to different components like the effectiveness of the integrated approach, effectiveness of the activities conducted, relevance of the stories integrating with mathematical concepts and values, examples used for Mathematics content, participation of the class, understanding and perception of values, value practice, explanation of values, classroom management, time management, learning experiences, integration of Mathematics with values.The prepared tool was validated by referring it to the experts in the field of Education and suggestions were incorporated.

3.8.5. DATA COLLECTION PROCEDURE:

The data were collected using above mentioned five tools. The data collection was done in different phases.

3.8.6. PHASE I : PRE-TEST PHASE

During this phase pre- tests were administered on both the control and the experimental group. The achievement test was administered to both control and experimental group on the first day of the new academic session. The value perception scale was administered on the experimental and control group on the second day. The value knowledge test was administered to both the experimental and control group on the third day. The data from the pre- tests which included the achievement test, value knowledge test and value perception scale were collected.

3.8.6.1. *Phase II : Experimentation Phase*

During this phase the experiment was conducted. The experimental group consisted of students who were taught Mathematics using the value integrated approach by the researcher. There students in the control group who were taught Mathematics using the traditional method by the school Mathematics teacher. The traditional method followed in the control group largely consisted of the Chalk and Talk method. The Integrated Approach for teaching of Mathematics was not followed. However the different methodologies of teaching Mathematics consisted of the Lecture method, Discussion method, Inductive method, Deductive method and Problem –Solving method. The various mathematical concepts were not integrated with values. There were no narration of stories related to values, no value games conducted and no value discussions done. The researcher used lesson plans where mathematical concepts were integrated with values. The integrated lesson plans were made for each chapter with values integrated to various topics. The researcher used different methods of teaching Mathematics like lecture cum discussion method, problem solving method, deductive method, and inductive method amongst others. Different activities which included were storytelling, value games, value discussion, presentation, preparation of models and field trips while using the integrated approach for value inculcation through teaching of Mathematics.

3.8.6.2. Phase III : Post-Test Phase

The post-tests were administered on both the control and the experimental group. It was conducted in the similar order followed during the Phase I. The Achievement Test was administered on both the control and the experimental groups. It was conducted after the completion of the Mathematics course at the end of academic session. The value perception scale was administered on the experimental and control group on the second day. The value knowledge test was administered to both the experimental and control group on the third day.

The reaction scale was administered on the experimental group on the fourth day. The data from the post-tests which included the achievement test, value knowledge test, value perception scale and reaction scale were collected.

3.8.6.3. Phase IV:

The students were observed the whole year for value based behaviour. The behaviours were noted down in the diary of the researcher

4.1. DATA ANALYSIS:

The data collected during the different phases were analysed. The analysis of the data were done objective wise which is given below:

Data Analysis related to objective 1 : “To develop strategies for teaching of Mathematics through integrated approach for the inculcation of values like Equality, Co-operation, Simplicity, Dignity of Labor, Determination, Honesty, Regularity, Discipline, Loyalty, and Team Work”. There was no statistic used for this objective.

Data Analysis related to objective 2:“To implement the strategies for teaching of Mathematics through Integrated approach for the inculcation of the values.” There was no statistics used for this objective.

Data Analysis related to objective 3: “To study the effectiveness of the value integrated approach of teaching Mathematics in terms of value conceptual knowledge, value perception and value practice along with the achievement in Mathematics.”

The value conceptual knowledge, value perception, value practice for each value and for all values as a whole and achievement in Mathematics were taken separately for analysis. The value conceptual knowledge, the value perception and the achievement in Mathematics were analysed quantitatively by using the Mann Whitney U-Test. The value practice was analysed qualitatively based upon the observations made by teacher in his diary.

Data Analysis related to objective 4:

“To study the reaction of students towards the value integrated approach”. A reaction scale was used for collecting the data. Frequency, Intensity Index and Average Intensity Index were calculated.

5.1. MAJOR FINDINGS OF THE STUDY

The major findings related to all the four objectives are given below.

1. The integrated approach of teaching Mathematics was found to be effective in terms of student's *conceptual knowledge* in each of the taken values for the present study like, cooperation, determination, dignity of labour, discipline, equality, honesty, loyalty, regularity, simplicity and team work. The mean gain scores of conceptual knowledge of the experimental group in each of these values were found significantly higher than those of control group. The students in the experimental group had higher conceptual knowledge than the control group in the values of cooperation, determination, dignity of labour, discipline, equality, honesty, loyalty, regularity, simplicity, team work.
2. The integrated approach of teaching Mathematics was found to be effective in terms of student's *conceptual knowledge* in all the values for the present study

like, cooperation, determination, dignity of labour, discipline, equality, honesty, loyalty, regularity, simplicity, team work when taken as a whole.

3. The integrated approach of teaching Mathematics was found to be effective in terms of student's *perception* in each of the taken values like, cooperation, determination, dignity of labour, discipline, equality, honesty, regularity and simplicity. The mean gain scores of value perception of the experimental group in these values were found significantly higher than those of control group. The perception of the students of the experimental group was higher than the control group in co-operation, determination, dignity of labour, discipline, equality, honesty, regularity and simplicity.
4. The integrated approach of teaching Mathematics was not found to be effective in terms of student's *perception* in the values of loyalty and team work. It was found that there was no difference in the perception of the values of team work and loyalty in the students of experimental group and control group during the teaching of Mathematics by integrated approach. This indicates that the integrated approach of teaching Mathematics did not make any impact.
5. The integrated approach of teaching Mathematics was found to be effective in terms of student's *perception* in all the values for the present study like, cooperation, determination, dignity of labour, discipline, equality, honesty, loyalty, regularity, simplicity, team work when taken as a whole.
6. The integrated approach was found to be effective in terms of the achievement in Mathematics of standard VIII students as the mean gain scores of achievement in Mathematics of experimental group was found significantly higher than those of control group. The students of the experimental group had higher achievement in Mathematics than the control group.
7. The Integrated Approach was found effective in inculcating all the taken values like equality, honesty, co-operation, determination, dignity of labour, discipline, teamwork, regularity, loyalty and simplicity in terms of value

practice in students. Behaviour of students of experimental group at different situations like assembly programme, class room participation, play grounds, dining hall, field trips and through day- to-day activities showed the specific reflections of the values like equality, honesty, co-operation, determination, dignity of labour, discipline, teamwork, regularity, loyalty and simplicity. These behaviors of the students in terms of these values showed the effectiveness of the integrated approach.

8. The integrated approach in value inculcation through teaching of Mathematics was effective in terms of student's reaction towards the integrated approach, effectiveness of the activities conducted, relevance of the stories integrating with mathematical concepts and values, examples used for Mathematics content, participation of the class, understanding and perception of values, value practice, explanation of values, class room management, time management, learning experience, integration of Mathematics with values.

5.2. IMPLICATION FOR THE PRESENT FINDINGS:

Values in Textbooks.

This has implications for the text book designers in the Text Book Boards. The Central Board of Secondary Education (CBSE) has introduced the concept of value based questions in question papers in all the subjects. In the present Continuous and Comprehensive Evaluation system in the schools affiliated to the Gujarat Secondary and Higher Secondary Education Board the co-scholastic assessment of the students are done on the basis of attitude and values. The Mathematics text books must contain conceptual clarity about different values. Information and knowledge about different values, value dilemmas and value based activities should be included in the Mathematics text books. This would help the students in developing conceptual knowledge, value perception and would help them to practice these values.

Value –Based Modules for Teachers

Value-based modules can be designed for teachers for various secondary school subjects, specially Mathematics.. This would assist them in the teaching of values. These modules could focus on the value integration with various concepts of Mathematics. The modules can include discussions on values and all value-based activities for value inculcation in students.

Value- Based Curriculum

This has implication for the policy makers who formulate curriculum for teacher education programs at all levels. Value Education course should be made compulsory as a core subject in B.Ed ,D.El.Ed. courses all over India. Within this course more emphasis should be laid on: 1) Meaning and understanding of various components of values. 2) The various teaching approaches and methods of value education. 3) The tools used for the evaluation of values in students. In the various skills of teaching; skill of Integration can also be included. The student teacher can be taught the art of integrating values, environmental concern, human rights, etc. All these aspects related to values should be taught in detail so that the teachers may exercise this approach well in advance and also develop this approach in them.

Use of the Integrated Approach for Value Inculcation in schools.

This has implications for school principals and educational administrators. The principals and administrators must ensure that integrated approach of value inculcation is used by all teachers in the teaching of Mathematics, wherein they focus on various value based activities in and outside the class room. Principals and educational administrators can organize training programmes on this integrated approach for the school teacher. Principal must ensure that teachers submit lesson plans in Mathematics where Mathematical concepts are integrated with values.

5.3. SUGGESTIONS FOR FURTHER RESEARCH

The suggestions for research are given below:

- (1) A study on value inculcation using the integrated approach of teaching Mathematics may also be conducted at the primary or higher secondary school level.
- (2) A study on value inculcation using integrated approach may be conducted in different subjects like Hindi, English, Science, Physics, Chemistry, etc. at different school levels.
- (3) Studies can be conducted to integrate the values using multimedia packages.
- (4) Studies can be conducted in Mathematics for inculcation of various other aspects like environmental education, human rights, ICT, through this integrated approach.
- (5) A comparative study based on sex, medium, background can be carried out by using the integrated approach can be conducted.
- (6) Case study on schools run on value based religious philosophies can be conducted.
- (7) A comparative study on integrated approach of inculcating values in two or more subjects in terms of value development and achievement of the subject can be conducted.

5.4. CONCLUSION:

The study focused on using the integrated approach in Mathematics teaching for value inculcation at secondary level. This integrated approach was found to be effective in developing value perception and value conceptual knowledge in almost all the taken values. The reaction of students towards the integrated approach was also found to be highly positive and favourable. The different

value behaviors exhibited by the students showed good value practice in them. 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 are the need of the hour. The teachers in schools need to be familiar and practice the different approaches and methods for value inculcation. The integrated approach has been found to be an effective approach for value inculcation. The findings of the present study can be used for the preparation of instructional materials for the teachers and value based learning materials for students. The present study is an attempt in this direction to use the integrated approach for value inculcation and similar attempts are needed to be made in this direction. 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 behaviour and which would make this world a better place to live in.