Chapter-4

Aims and objective of Teaching Mathematics

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Introduction

While starting to teach a particular subject it is essential to know why we are going to teach that subject. Until we have clear-cut aims of teaching a subject, we would not be able to proceed on the right track. Aimlessness makes the work uninteresting and results in the wastage of time, energy and other material resources both on the part of the teacher and the taught. Therefore, we must have some definite aims of teaching a subject before starting its actual teaching.

Aims

The meaning of the word 'Aim' is the "broad goals" which our education system embraces and which are accepted to obtain. The Aim of education is based on philosophical and socio- psychological aspects of society and culture. Aim is a statement showing general declaration of a purpose and it gives direction to the activity which is design to achieve the aim in the future.

Meaning and definitions

John Dewey, "An Aim is a foreseen end that gives directions to an activity or motivates behavior."
Education Aims are broad and also hold group for educational system, sometimes they take the form of lofty

ideas “may speak of perfect condition, which may be attained or not.”

Example: Attainment of salvation, establishment of a classless society.

Aims of Teaching Mathematics

Keys of opening the entire process of teaching and learning cannot be thought without aims. All the aspects of education that is curriculum construction, method of teaching and evaluation system, are shaped and moulded according to aims of education.

There are two types of aims of teaching computer science.

- General Aims
- Value Based Aims

General Aims

These are as follows:

(i) **Related to Daily Life:** To enable the child to understand the use of computer in solving daily life problems.

(ii) **To understand Mathematics:** To enable the child to make and understand the the subject of Mathematics.

(iii) **Suitable type of discipline:** To create a suitable type of discipline in the mind of the child.

(iv) **Fulfill the needs:** To familiarize the child with the latest mathematics knowledge to fulfill the existing needs

of the society.

(v) **Provide Knowledge:** To give knowledge about the broad objectives of teaching mathematics such as knowledge, understanding, application etc.

(vi) **Sense of Appreciation:** To develop in the child a sense of appreciation of cultural value of mathematics.

(vii) **Prepare the Child:** To prepare the child for elementary as well as higher education in mathematics, science, engineering etc.

(viii) **Develop the good habits:** To develop in the child the mental powers, like thinking, reasoning etc.

(ix) **Develop the mental powers:** To develop in the child the mental powers, like thinking, reasoning etc.

(x) **Develop Scientific and realistic attitude:** To develop scientific and realistic attitude towards life.

(xi) **Give practical knowledge:** To give practical knowledge of mathematics to face the day to day problems.

(xii) **To prepare child for Professions:** To prepare the child for professions such as mathematician, Engineer, technicians, teacher etc.

(xiii) **All round and harmonious development:** To bring an all-round and harmonious development of the personality of child.

(xiv) **Develop the skills:** To develop the skills to use the mathematics in day to day life.

(xv) **Develop the Abilities:** To develop the abilities of using mathematical knowledge in other fields, reasoning etc.

(xvi) **Develops interest in mathematics:** The aim of

teaching of mathematics is to develop interest in mathematics.

These are the general aims of teaching mathematics. Now we discuss the value based aims of teaching mathematics.

VALUE BASED AIMS

(i) **Social aim:** Man is a social animal and human life depends upon the co-operation of each other. In order to live a social life, its knowledge is needed because the give and take process, business and industry depend upon the knowledge of mathematics. Study of mathematics aims in the development of social virtues among the students for leading a well adjusted social life. It also aims to understand the role of mathematics in the development of society and globalization.

In this way the aim of mathematics plays an important role in not only understanding the progress of society but also to develop the society.

(ii) **Practical aim:** We need knowledge of mathematics in our daily routine, house, outside market etc. Teaching of mathematics enables the students to make use of the knowledge of mathematics in daily life activities.

(iii) Skill development aim: Teaching of mathematics aims to develop useful skills among students.

(iv) **Intellectual aim:** Teaching of mathematics is very important for intellectual development. The mathematics helps use in development of mental faculties. As the student, faces a problem in mathematics his brain become active in solving those problems. Each problem of mathematics possesses such a sequence which is necessary for constructive and creative process. Teaching of mathematics aims to develop the intellectual abilities and widens the mental horizon of the students.

(v) **Cultural aim:** The culture of every nation or society has its unique characteristics. It has its own importance. Each nation or society reflects its culture by its living standards, rituals, artistic progress, economic, social and political aspects etc. The history of mathematics presents the image of culture of different nations. Teaching of mathematics aims towards sharing, preserving, promoting and transmitting culture among students.

(vi) **Aesthetic aim:** Mathematics is just like an art, music and means of gaining pleasure for those who studies and like it. One get pleasure in making programs, use of hardware, use of internet. Teaching of mathematics aims to develop aesthetic sense of students and acquaint them with

artistic values.

(vii) **Disciplinary Aim:** The aim of teaching mathematics is not only for development of mental abilities but also to develop their personality with some qualities like concentration, truthfulness, seriousness etc. It helps the students to make their mind disciplined and develop good qualities like regularity, punctuality etc.

(viii) **Moral aim:** Morality is the important phase of life which is most affected by time, person, situation and place. Its aim is to develop all those qualities which a person of strong character must possess. Child develops qualities such as honesty, truthfulness, punctuality, patience, self-reliance, loyalty by studying mathematics.

(ix) **Vocational aim:** The main aim of education is to develop the children to earn their living and to make them self dependent. To achieve such aim, mathematics is the most important subject than any other. Teaching of mathematics aims to prepare the child for the future professions or jobs such as teacher, programmer, engineer etc.

(x) **Psychological aim:** Mathematics is also useful for the point of view of psychological aspects. Mathematics fulfills the psychological needs of children. The teaching of mathematics follows the various laws and principles of psychology. For example: The child requires knowledge on the various principles of psychology such as learning by doing, learning through experience problem solving etc. Through its knowledge the child develops satisfies his desires creative and constructive tendencies, self

satisfaction etc.

(xi) **Scientific attitude aim:** The knowledge of mathematics trains the children

in attempting the problems according to a definite distinct procedure which may be called as scientific. It makes the individual open minded, keen observer, critical thinker. It helps in removing superstitions and false beliefs.

(xii) **International aim:** Mathematics not only gives the knowledge about the nation its background but also give a message of nationality. The progress in the field of mathematics is neither the achievement of a single person, nation, society, caste or religion followers only nor it is the property of a particular nation. Any invention of a nation when crosses its boundaries, it reaches to its international value. These all facts reflect the international aims value of teaching mathematics.

DIFFERENCE BETWEEN AIMS AND OBJECTIVES

Before we proceed further, we must briefly differentiate objectives from aims in order to avoid confusion. Aims are general and long term goals and may be common to more than one subject. While objectives are specific, immediate and attainable goals, specific to one subject precise and clearly defined, objective are more directly concerned with what specifically is being attempted over a relatively short period.

	Aims	Objectives
1	Aims are comprehensive and general.	Objectives are narrow and specific.

2	These are not definite and clear.	These are definite and clear.
3	Aims give directions.	These are end point of point of possible achievement.
4	These cannot be evaluated.	These can be easily evaluated though the expected behaviour modification.
5	These are of long term and long term planning is needed.	These are immediate and short duration planning is needed
6	Philosophy and sociology affect the aims.	Psychology is the main source of objectives.
7	These are not of much use to a teacher.	These are useful to teachers.
8	These are difficult to achieve.	These can be easily achieved.

CONCLUSION

From above discussion it is clear that aim of teaching mathematics is so valuable, important, psychologically based and so closely connected with day to day life, it is justified to be included in the school curriculum.

Objectives of Teaching Mathematics

OBJECTIVES

Teaching and instructions are organized to achieve the educational objectives. The desired behavioural change is brought among the students to realize the educational objectives. The

teaching and instructional objectives are helpful for achieving meaningful process. The teacher has to set objectives. He can identify his instructional objectives with the help of his knowledge and understanding of educational objectives.

MEANING OF OBJECTIVE

An objective is a statement or a form of category which suggest any kind of desired change. According to **NCERT's Evaluation &Examination** Issue:
"An objective is a point or end in view of something towards which action is directed, a planned change is brought through any activity what we set out to do."

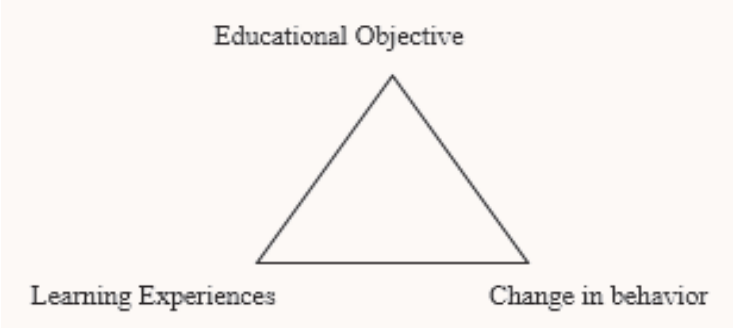
According to **Robert Mager's** View:
"An objective is a collection of words which describes a desired outcome of course."

MEANING OF EDUCATIONAL OBJECTIVE

The educational objectives imply the changes that we try to produce in the child. In the words of B.S. Bloom, "Educational objectives are not only the goals towards which the curriculum is shaped and towards which instruction is guided, but they also the goals that provide the detailed specification for the construction and use of evaluative techniques."

Bloom is the view that education is a tri-polar process. The Three poles are:

(1) Educational Objectives
(2) Learning Experiences
(3) Change in Behaviour.



The learning experiences are provided by teaching activities to achieve educational objectives & Change of behaviour is evaluated in terms of educational objectives. Thus educational objectives are basis for teaching activities& evaluation techniques.

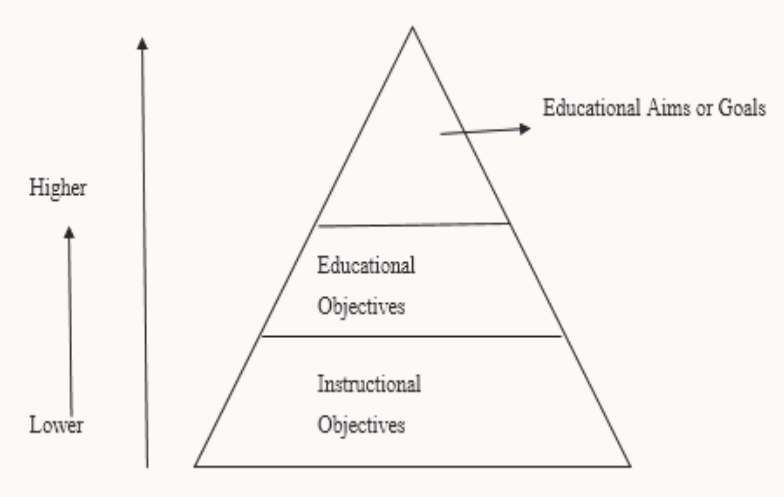
MEANING OF INSTRUCTIONAL OBJECTIVE

Instructional objectives are achieved in terms of change of behaviour of learners. They are related to desired learning or teaching outcomes or changes of behaviour of the learners. They may be termed as teaching-learning objectives or behavioral objectives. An instructional objectives indicates those knowledge, skills, abilities and attitudes that the teacher experts the students to acquire as a result of instructions. They are related to classroom teaching. They are the basic targets that could be easily

achieved within the limited period and means.

In the words, of **Robert Mager**: An instructional objective may be defined as an intent communication by a statement describing a proposed change in learner.

HIERARCHY OF OBJECTIVES



Objectives of Teaching Mathematics

The objectives of Teaching Mathematics are classified as:

(1) Knowledge
(2) Understanding
(3) Application
(4) Skill
(5) Interest
(6) Attitudes
(7) Appreciation
(8) Abilities

For making the objectives unambiguous and attainable they are always expressed in the behavioral terms (testable behaviors). What the student is expected to achieve is

clearly known by the teacher while teaching a particular topic. We will try to keep this thing in view while describing the different objectives of teaching Mathematics.

Knowledge Objectives: Through mahtematics a student acquires the knowledge of:

(i) Various Geometrical figures, symbols, formulas, figures, diagrams, language of mathematics etc.

(ii) Basic mathematical concepts such as numbers, units, direction, measurement and characteristics of different geometrical figures etc.

(iii) Facts, principles, ideas and relationships etc.

(iv) Two dimensional and three dimensional figures.

(v) The inter-relationship between branches of mathematics different types of figures.

(vi) Meaning, its uses, limitations, terminology etc.

(vii) Setting related to mathematical environment.

(viii) Development of mathematics and its contribution to society.

Understanding Objectives: At this stage students do not have superficial knowledge rather they have in-depth knowledge. Through mathematics student acquire understandings of:

(i) Discriminate between different types of figures etc.
(ii) Explain basic concepts of mathematics.
(iii) Interpret the results of geometry, functioning or processes etc.
(iv) Cite examples related to different concepts.
(v) Classify different concepts/figures into their respective categories.
(vi) Verify the facts, related to mathematics.
(vii) Find similarities between different types of mathematics facts and figures.
(viii) See relationship between various concepts types of mathematical concepts.

Skill Objectives: Through the study of mathematics students are expected to develop certain skills required for performing practical work. Mathematics makes the students able to.

(i) Connect various concepts of mathematics at their proper place.
(ii) Speed, accuracy, neatness and precision in mathematical work.
(iii) Recognize correctly forms of formulas and figures.
(iv) Develop the techniques of problem solving.
(v) Develop ability to estimate and check results.
(vi) Develop ability to perform calculations orally and

mentally.

(vii) Develop ability to think correctly, to draw inferences and to generalize.

Application Objectives: Application objectives are achieved when a pupil applies the gained knowledge in solving day to day problems. The application objectives in mathematics has been realized if the child can.

(i) Solve elementary mathematical problems independently oral as well as in written form.

(ii) Apply mathematical knowledge in solving day-to-day or daily life situations.

(iii) Use mathematics in learning of other subjects and higher studies in mathematics itself.

(iv) Make use of concept of mathematics in every day life.
(v) Develop ability to think and express precisely, exactly and systematically by making proper use of mathematical language.

Interest Objectives: Teaching computer science should arouse interests in students for.

(i) Participating in debates quiz and competitions on mathematics subject.
(ii) Learning mathematics concepts.
(iii) Practical work in mathematics laboratory.
(iv) Reading mathematics literature.
(v) Undertaking projects method in mathematics.
(vi) Co-curricular activities related to mathematics.
(vii) Hobbies related to mathematics, their applications etc.
(viii) Independent study on mathematics and its literature etc.

Attitudes Objectives: Teaching of mathematics must develop positive attitude among the learners. That will help them to make critical observation develop intellectual honesty, curiosity, freedom form bias and prejudice.

This objective is considered to have been achieved if a student is able to:

(i) Intellectually honest.
(ii) Analyze the problem.
(iii) Observe and discover solutions by collecting data.
(iv) Think logically and critically.
(v) Verify the results.
(vi) Shows the originality and creativity.
(vii) Develops the curiosity to know more about the things

around him.

(viii) Develops unbiased and impartial attitude in judgment.

(ix) Develops an attitude of independent work.

(x) Develops heuristic attitude among students.

(xi) Express his opinions precisely, systematically and logically.

(xii) Recognize adequacy or inadequacy of data or information for solving problems.

Appreciation Objectives: To enable the students to appreciate.

(i) To appreciate the role of mathematics in daily life.

(ii) To appreciate the recreational and amusement values of mathematics.

(iii) To appreciate the importance of mathematics in modern civilization.

(iv) To appreciate the vocational value of mathematics.

(v) To appreciate the contribution of scientists and engineers in the development of mathematics.

(vi) To appreciate the power of computation in mathematics.

(vii) To appreciate the history of mathematics development.

(viii) To appreciate the role of mathematics in understanding the environment.

(ix) To appreciate the mathematics facts, principles and processes.

(x) To appreciate mathematics for its exactness, precision, truthfulness like qualities.

Abilities Objectives: Through teaching of mathematics student is able:

(i) To develop the ability to sense a problem.

(ii) To develop the ability to use mathematical skills in daily life.

(iii) Use problem solving method.

(iv) Problem solving abilities is developed among the students.

(v) Apply the acquired knowledge.

(vi) To develop the ability to organize and interpret.

(vii) To report output in a technical language.

BLOOM'S TAXONOMY OF OBJECTIVES

Bloom was the editor of the first volume of "Taxonomy of educational objectives." Produced by an American Committee of College and University examiners. Taxonomy means a system of classification and in the sense Bloom's Taxonomy presents a system of classification of the objectives in the similar way as Dewey's decimal system tends to classify a number of books in a library. Bloom's Taxonomy (classification) of learning, educational and instructional objectives into the following three domains is in a proper hierarchy:

(a) **Cognitive domain:** In cognitive domain only those educational objectives are included which are concerned only with knowledge, recognition and recall and cater to the development of intellectual abilities and skills.

(b) **Affective domain:** In affective domain only those

educational objectives are included which are related to the domain of interests, attitudes and values and bring about desirable changes in the same. The main weakness of these objectives is that they cannot be stated in terminal behaviour because they are related only to inner feelings and emotions.

(c) **Conative or psychomotor domain:** Conative domain helps in the development of skills. Training of physical activities is the main objective of this domain. Simpson is primarily responsible for developing this domain.

Bloom's Taxonomy (classification) of learning, educational or instructional objectives into cognitive, affective and conative domain has special importance because it is directly related to the problem of curriculum and evolution and this has proved more useful in formulating the techniques of communication, evaluation and development of the curriculum.

Educational objectives in three domains:

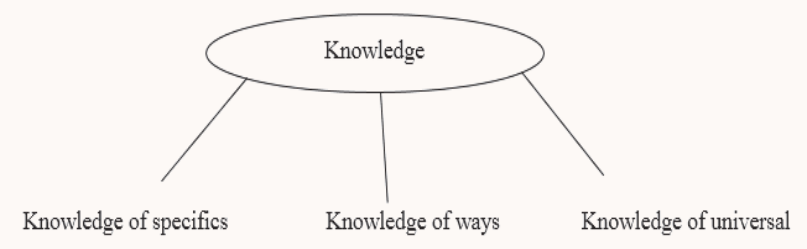
		Cognitive Domain	**Affective Domain**	**Conative Domain**
		Category	Category	Category
Low	1.	Knowledge	Receiving	Impulsion
	2.	Comprehension	Responding	Manipulation
	3.	Application	Valuing	Control
	4.	Analysis	Conceptualization	Co-ordination
	5.	Synthesis	Organization	Naturalization
High	6.	Evaluation	Characterization of value system	Habit formation

(I) COGNITIVE OBJECTIVES:

Dr. B.S. Bloom's has divided the cognitive objectives into six categories arranged from lowers to highest level of functioning.

(1) **Knowledge**: It is the lowest level of the objectives belonging to cognitive domain knowledge objective involves the recall of specifies and universals, the recall of method and process. or the recall of pattern, structure or setting. The teacher plans the situations for the learner to recall and recognize traditional, classifications, criteria, principles and theories. From content point of view, there are the following three levels in the knowledge.

Knowledge of specifics Knowledge of ways Knowledge of universal



1. Knowledge of Specifies: Knowledge of specifics means recall of specific terminology, facts and information. The knowledge of specifics are divided into:

(a) **Knowledge of terminology:** Knowledge of terminology is the knowledge of verbal and non-verbal references. It may include the definition of technical terms by giving their attributes, qualities, relationships and their parts so that the general meaning of the various terms may be acquired.

(b) **Knowledge of specific factor:** It means the knowledge of specific information such as events, dates, persons and places. In other words knowledge of specific facts is concerned with the general knowledge of specific facts and their recalling.

2. Knowledge of ways and means of dealing with specifics: It includes the ways and means of organizing, studying, judging and criticizing. It also involves the methods of inquiry, the chronological sequences and the standards of judgment within as a field as well as patterns of organization through which the areas of fields themselves are determined and internally organized.

Bloom has divided the ways and means of dealing with specifics into five categories:

(a) **Knowledge of Conventions:** To make students conscious of correct form and message in speech and writing.

(b) **Knowledge of trends and sequences:** An understanding of the continuity and development of Indian culture as exemplified in Indian life.

(c) **Knowledge of Criteria:** Knowledge of criteria for the evaluation of recreational activities.

(d) **Knowledge of methodology:** Knowledge of methods of inquiry, techniques, and procedures employed in a particular subject field as well as those employed in investigation of particular problem.

(e) **Knowledge of classification and categories:** It includes the knowledge of classes, sets, divisions and arrangements which are regarded as fundamental for a given specific field, purpose, argument or problem.

3. Knowledge of universals and abstractions: It is concerned with laws, principles, generalizations, theories and structures. It has given two forms of knowledge of universals:

(a) Knowledge of principles and generalization.
(b) Knowledge of theories and structures.

(2) **Comprehension:** This category indicates the lowest level of understanding. It is based upon no comprehension. Comprehension means the basic understanding of the facts, ideas, methods, processes, principles or theories etc. It is divided into three areas:

(i) Translation
(ii) Interpretation
(iii) Extrapolation.

(3) **Application:** Application refers to the ability to use learned material in new and concrete situations. This may include the application of such things as rules, methods, concepts, principles, laws and theories. Learning outcomes in this area require a higher level of understanding then those under comprehension. It has three levels.

(i) Application of abstractions.
(ii) Application of phenomena at concept.
(iii) Prediction of proper effects.

(4) **Analysis:** Analysis refers to the ability to break

down material into its component parts so that its organizational structure may be understood. This may include the identification of the parts, analysis of the relationships between parts, and recognition of the organizational principles involved. Learning outcomes here represent a higher intellectual level than comprehension and application because they require an understanding of both the content and the structural form of the material. It has three levels:

(i) Analysis of elements
(ii) Analysis of relationships
(iii) Analysis of organized principles.

(5) **Synthesis:** Synthesis refers to the ability to put parts together to form a new whole. This may involve the production of a unique communication (theme or speech), a plan of operations (research proposal), or a set of abstract relations (scheme for classifying information). Learning outcomes in this area stress creative behaviours, with major emphasis on the formulation of new patterns or structures. It has three levels:

(i) Production of a unique communication.
(ii) Production of a plan or proposed set of operations.
(iii) Derivation of a set of abstract relations.

(6) **Evaluation:** Evaluation is the highest level of objectives of cognitive domain. It aims to develop in the student the ability to make proper value judgment about what has been acquired by him in the form of knowledge, understanding, application, analysis and synthesis, It involves

knowledge, comprehension, application, analysis, synthesis, As a result the student is expected to take proper decision about the qualitative and quantitative value of a particular idea object, principle or theory. It has two levels.

(i) Internal judgment of the material and methods.

(ii) External judgment of the material and methods.

Level		**Category**
Low level	(i)	**Knowledge**
	(a)	**Knowledge of specifies:**
	(b)	knowledge of terminology
	(ii)	knowledge of specific facts
	(a)	
	(b)	**Knowledge of ways and means of dealing with specifics:**
	(c)	Knowledge of conventions
	(d)	Knowledge of trends and sequences
	(e)	Knowledge of classifications and categories Knowledge of criteria
	(iii)	Knowledge of methodology
	(a)	**Knowledge of universals and abstractions in a field:**
	(b)	Knowledge of principles and generalization Knowledge of theories and structures

	(i) (ii) (iii) (i) (ii) (iii)	**Comprehension** Translation Interpretation Exploration Application Application of abstractions Application of phenomena or concept Prediction of proper effects
Medium level	(i) (ii) (iii) (i) (ii) (iii)	**Analysis** Analysis of Elements Analysis of relationships Analysis of organizational practices **Synthesis** Production of unique communication Production of a plan or proposal set of operations Derivation of a set of abstract relations
High level	(i) (ii)	**Evaluation** Judgment in terms of Internal evidence Judgment in terms of external evidence.

(II) **Affective Domain:** Affective objectives are concerned with the interests, emotions, appreciation, attitudes, mental tendencies and values of the pupils.

Bloom, classified the objectives of affective domain as under.

(1) **Receiving:** Receiving means pupil's will to receive. It is directly concerned with the sensitivity of the pupils which occurs in the presence of some activity or stimulus. It includes inculcation of certain interests, attitudes, values or the ideas. Following are the three sequential activities of this domain.

(i) Awareness of the phenomenon
(ii) Willingness to receive phenomenon
(iii) Controlling or selected attention.

(2) **Responding**: Receiving is pre-requisite for responding. Once a learner receiver or attends to a particular idea, event or thing he must be made to respond to it as actively as possible which is manifested in the active behaviour like obeying, answering, reading, discussing, recording, writing and reading to a stimulus. It has three levels:

(i) Obedience for responding.
(ii) Willingness to respond
(iii) Satisfaction in response

(3) **Valuing:** Valuing depends upon the responding and receiving. Valuating includes the worth of a thing, phenomenon or behaviors. Here, the learner expected to imbibe a definite value pattern towards different ideas, events and objects. This level has three types of activities:

(i) Acceptance of a value.
(ii) Performance for a value.

(iii) Commitment to a value.

(4) **Organization:** In this category of objective a student gives some order to each value. As the student successfully internalizes value, he encourages situations for which more than one value is required. It includes:

(i) Conceptualization of a value.

(ii) Organization of a value system.

(5) **Characterization of a value:** It is the highest level of affective domain. All the above objectives are involved in the objectives of this category. So at this stage, learner is able to imbibe various interests, attitudes, values, value patterns and value structure and ultimately he is destined to imbibe his own life style i.e. acceptance of a value system. It has two aspects.

(i) Generalized set

(ii) Characterization

SUMMARY OF AFFECTIVE DOMAIN OF BLOOM'S TAXONOMY

Level		**Category**
Low level	(1)	**Receiving**
	(i)	Awareness
	(ii)	Willingness to receive
	(iii)	Controlled or selected attention

Level		Category
	(2) (i) (ii) (iii) (3) (i) (ii) (iii) (4) (i) (ii)	**Responding** obedience for responding Willingness to response Satisfaction in response **Valuing** Acceptance of a value Preference foe a value Commitment to a value **Organization** Conceptualizatio n to a value Organization of a value system
High level	(5) (i) (ii)	**Characterization of a value** Generaliz ed set Character ization

(III) **Psychomotor Domain:** It is a domain of manipulation or motor skills areas. It is concerned with the training of the student's physical activities. Although it is very important domain, yet not much work has been done to define objectives in this area. The main levels of psychomotor

domain an

(1) Impulsive (2) Manipulation (3) Control (4) Co-ordinary (5) Naturalization & habit formation

Meaning of Behavioural objectives

Specification of objectives in a task of teaching and learning may prove more effective and purposeful if they are translated into behavioral languages. It means that the objective must state what the learner should be able to do after the instruction is over.

Druker (1954) also advocated that, "The activities of management should be explained in terms of objectives." He emphasized the behavioral aspects of the objectives."

According to **Bloom**, "emphasis must be shifted from content to the objectives in examination system. He favored that achievement tests should be objective rather than subjective type. Each question should evaluate one specific objective."

From the above discussion, behavioral objective may be defined as the specific, concrete, delimited objective in relation to a broad general objective. After achieving a particular objective of teaching mathematics, it is expected that the learner must develop behavioral changes.

Need or importance or advantage for writing objectives in terms of behavioural terms

Need or importance or advantage for writing objectives in terms of behavioural terms are as follows:

(1) **Determining teaching activities:** Determining and delimited certain specific teaching activities such as selection and organization of subject matter, allocation of time.

(2) **Objective centered teaching learning:** Teaching and learning can be made objective centered.

(3) **Widened scope of objectives:** It broadens the scope of objectives.

(4) **Selection of teaching strategies:** The appropriate teaching strategies and tactics can be conveniently and smoothly selected for effective learning.

(5) **Facilitating testing:** Testing may be based on teaching. The selection of questions and problems for testing is facilitated.

(6) **Explanation of salient features of teaching material:** Some salient features of teaching material can be explained to the learners.

(7) **Integrating teaching-learning process:** Teaching and learning processes can be integrated for effective learning outcomes. Proper balance can be maintained between teaching and learning.

(8) **Evaluation of learning outcomes:** The objectives of all the aspects of learning can be evaluated. In other words, the objectives written in behavioral terms help in managing an examination for the achievement of objective relating to all aspects.

(9) **Provides feedback:** Behavioral objectives are the measuring rods. These evaluate curriculum, instructional strategies, and evaluation tools. On the basis of evaluation, these provide guidelines and feedback setting the standards of curriculum, instructional techniques and measuring achievements.

(10) **Indicate desired behaviour:** It indicates the desired behavior of the child:

Scafold's View: According to Scafold, there are following advantages of writing objectives in behavioral terms:

(i) Specification of objectives
(ii) Selection of subject matter, teaching methods.
(iii) Teaching can be related to learning.
(iv) Integration between learning experiences and changes in behaviour.
(v) Selection of items of preparing test.

Methods or approaches of writing instructional objectives in behavioral term

The writing of an objective in behavioral terms is always done in relation to the following, three things;

(1) Nature of the objectives i.e. knowledge, application, understanding etc.
(2) Area or domain of the behavior i.e. cognitive, affective and psychomotor.
(3) Specific content areas in which behavioral changes are planned to be brought about i.e. applications of trigonometery, steps to create table of raw data in statistics.

There are various methods or approaches of writing objective in behavioral terms, here we are discussing the following three approaches.

(i) Robert Mager's approach
(ii) Robert Miller's approach
(iii) RCEM approach.

(1) **Robert Mager's approach:** According to Robert Mager, the instructional objectives

are best described in terms of terminal behavior expected from the learners. He considers that the behavioral objective should be written in the following manner:

(i) Indentify the terminal behavior by name.

(ii) Describe the important conditions under which the behavior is expected to occur.

(iii) Specify the criteria of acceptable performance (desired terminal behaviour) by describing how will the learners must perform to be considered acceptable.

Mager made Bloom's taxonomy as the basis for writing objectives in behavioral terms. He concentrates on cognitive and affective objectives. He gives emphasis on action verbs rather than mental processes. The verbs helps in describing the outcomes of learning or terminal behavior of the learner in a well defined way.

A LIST OF ASSOCIATED ACTION VERBS FOR THE COGNITIVE DOMAIN

Sr. no.	**Objectives(Based on Bloom's taxonomy)**	**Associated action verbs**
1	Knowledge	Define Label, list, measure, name, recall, recognize, reproduce, select, state, write, underline etc.
2	Comprehension	Change, classify, explain, distinguish, identify, illustrate, indicate, justify, judge, translate etc.

3	Application	Asses, conduct, construct, compute, discover, explain, generate, perform, solve, use etc.
4	Analysis	Analysis, associate, conclude, criticize, divide, point out, separate, etc.
5	Synthesize	Conclude, combine, discuss, generalize, integrate, organize, relate, summarise, synthesize etc.
6	Evaluation	Judge, Evaluate, verify, choose, compare, etc.

LIST OF ASSOCIATED ACTION VERBS FOR THE AFFECTIVE DOMAIN

Sr. no.	**Objectives(Based on Bloom's taxonomy**	**Associated action verbs**
1	Receiving	Accept, indentify, observe, attend, catch, follow, discover, prefer, favor, receive etc.
2	Responding	Answer, assist, select, obey, state, write, present, derive, develop, complete, list, label etc.
3	Valuing	Accept, attain, demonstrate, decide, recognize, choose, discriminate, participate, complete, prefer etc.

4	Organizing	Organize, change, associate, judge, compare, select, correlate, determine etc.
5	Characterization	Accept, decide, solve, revise, indentify, verify, demonstration, develop, judge, change, decide etc.

The action verbs of above category (Cognitive& Affective) indicate the level of teaching and learning activity. The behavioural objective may be written by combining action verb with the content.

Behavioral Objective = Content + Action Verb

Thus, first of all, teacher selects the content then action verb and then write objectives in behavioral term:

For example

The Child will be

(i) Able to define quadratic equation in his own words.
(ii) Able to predict the roots of quadratic equation.
(iii) Able to solve quadratic equation.
(iv) Able to explain the nature of roots of quadratic equation.

Illustration with examples:

Example I.

Subject=Mathematics

Objectives = Cognitive

Topic=Sets

Sr. no.	**Instructional Objectives**	**Writing in behavioural terms**
1.	Knowledge	The pupils are able to define Set.
2.	Comprehension	The pupils are able to explain the types of sets.

3.	Application	The pupils are able to draw different set notations.
4.	Analysis	The pupils are able to analyze the different operations on sets

Example 2: Subject = Mathematics

Objectives= Affective Domain
Topic = Area and volume

Sr. no.	**Instructional Objectives**	**Writing in behavioral terms**
1.	Receiving	The pupils confirm their knowledge about area and volume
2.	Responding	The pupils are able to discriminate between area and volume
3.	Valuing	The pupils are able to discriminate and calculate area and volume
4.	Organizing	The pupils can organize the essential characteristics of area and volume

LIMITATIONS OF ROBERT MAGER'S APPROACH

(1) **No emphasis on mental processes:** Robert Mager's approach puts main emphasis on action verbs than mental processes or abilities.

(2) **Long list of action verbs:** List of action verbs provided is so lengthy and unwieldy that it does not have any meaningful application to a class-room teaching.

(3) **Overlapping of action verbs in different categories:** The list of action verbs reveals that there is overlapping of action verbs in different categories. For example: Select, analysis etc.

(4) **Overlapping of action verbs in cognitive and affective domain:** Three is also overlapping of action verbs provided in the lists of cognitive and affective action verbs. For example: analysis, list, recognize, select, state are common in both the lists.

(5) **Not Effective:** It cannot be effectively used in writing instructional objectives in behavioral terms because instructional objectives are of three types. Knowledge, skill. Attitude & interest. It can be effectively used in the development of programmed instruction.

(6) **Neglecting psychomotor domain:** This approach is applicable only for cognitive and effective objectives. Psychomotor objectives cannot be written by Mager's approach.

(7) **Not applicable to all human learning:** He explains learning in terms of stimulus and response (S-R) but all human learning cannot be explained by stimulus response learning.

(8) **Not suitable for higher level objectives:** Higher level objectives cannot be written clearly with this method.

Robert Miller's Approach (1962)

Robert Miller developed his approach for meeting the requirement of writing psychomotor objectives. In his approach, he emphasized skill analysis. He described the following procedure for writing psychomotor objectives in behavioural terms:

(i) Description of the Indicator, indication the relevant or essential activity.

(ii) Description of the Indication or stimulus which calls for a response.

(iii) Controlling of the object which is to be activated.

(iv) Writing or description of the activity to be performed.

(v) Indication of the adequacy or responses or feedback (reinforcement).

Like Mager, Miller also tried to enlist associated action verbs for the psychomotor objectives- Following are the instructional activities verb for writing the objectives in behavioural terms.

Sr. no.	**Objective**	**Action verbs**
1.	Perception	Construct, sketch
2.	Set	Design
3.	Guided responses	Fixes, Identifies
4.	Mechanism	Drills, Mends
5.	Complex overt response	Changes, connects, creates, locates.

(3) **RCEM Approach (Regional college of education Mysore approach.):** A successful approach of writing instructional and educational objective in behavioral terms is one where all the three domains of behavior i.e. cognitive, affective and conative or psychomotor are represented. Miller's and Mager's approach have remained unsuccessful in the task of writing all instructional objectives belonging to all the three domains of behaviour. Mager's approach covers the purpose of cognitive and affective objectives. While Miller's approach covers the psychomotor objectives. None of these two approaches cover all the domains of human behaviour.

Moreover, both of these approaches put emphasis on action verbs designating behaviour for writing a particular objective and completely neglect the mental processes or abilities of the learners in the learning process. Keeping in view their limitations, Regional College of education, Mysore innovated an approach known as RCEM approach.

FEATURES OF RCEM APPROACH

(1) **Modification of Bloom's Taxonomy:** Bloom has given sic categories of objectives but RCEM has given four categories namely knowledge, understanding, application and creativity. The other difference lies in naming bloom's comprehension category as understanding in RCEM approach.

(2) **Use of Mental processes:** It makes use of mental processes or mental abilities in place of action verbs in writing instructional objectives. The assumption of this system is that human learning can be best explained in terms of mental processes rather than behaviour.

(3) **Division into mental processes:** The four categories of RCEM has been divided into 17 mental processes or abilities. These abilities are used for writing objectives of cognitive, affective and psychomotor domain in behavioural terms.

TAXONOMY OF EDUCATIONAL OBJECTIVES IN RCEM SYSTEM

Sr. no.	Objectives	Sr. no.	Mental Process or Abilities
1.	Knowledge	1. 2.	Recall Recognize

2.	Understanding	1. 2. 3. 4. 5. 6. 7.	Seeing relationship Cite example Discriminate Classify Interpret Verify Generalize
3.	Application	1. 2. 3. 4. 5.	Reason out Formulate hypothesis Establish hypothesis Infer Predict
4.	Creativity	1. 2. 3.	Analyses Synthesis Evaluate

The above table shows four categories which are classified into 17 sub-categories, called mental abilities.

STEPS/PROCEDURE OF WRITING OBJECTIVES IN RCEM APPROACH'S

(1) Keep in mind the entry behaviour of the child (learner).

(2) Select the element of content/topic/learning experience to be given to the learner.

(3) Stating teaching or learning objectives.

(4) On the basis of entry behaviour, content and the objectives, select appropriate mental abilities for writing the objective in question.

(5) Try to make use of seventeen frames of RCEM approach and fill in the following in view of the entry behaviour of the child and learning experiences given to him.

An outline of writing objective in behavioural terms according to RCEM approach

(1) Knowledge Objectives:

The learner is able to recognize

The learner is able to recall

(2) Understanding Objectives:

The learner is able to see relationship between…….and…….

The learner is able to cite example of……

The learner is able to discriminate between…….and……

The learner is able to classify……

The learner is able to interpret……

The leaner is able to verify…..

The learner is able to generalize…..

(3) Application Objectives:

The learner is able to reason out……

The learner is able to formulate hypothesis for…….

The learner is able to establish hypothesis for……

The learner is able to infer about……

The learner is able to predict about……

(4) Creativity Objectives:

The learner is able to analyze.

The learner is able to synthesize.

The learner is able to evaluate.

EXAMPLE OF WRITING OBJECTIVES BY USING RCEM APPROACH:

Subject : Mathematics

Topic : Sets

(1) The learner is able to recall Set. (Knowledge)

(2) (a) The learner is able to discriminate Sets and non Sets. (understanding)

(3) The learner is able to classify Sets (understanding).

(4) The learner is able to reason out why this collection of objects is Set. (application)

(5)The learner is able to evaluate types and notation of sets (creativity).

ADVANTAGES OF RCEM APPROACH

(1) **Specific and definite:**RCEM approach is more specific and definite than Robert Mager's or Robert Miller's approach.

(2) **Emphasis on Learning Process:** This approach gives more importance to the learning

process than learning outcome. Thus it has shifted focus form product to process in writing objectives in behavioural terms.

(3) **Based on Indian conditions:** RECM approach has been developed in and according to Indian conditions. Therefore, it seems to be most useful for writing objectives in behavioural terms in Indian context.

(4) **Easy:** Writing objectives into behavioural terms is easy and useful. The learner no longer needs a long list of action verbs.

(5) **Applicable for all three domains:** RCEM approach is applicable for all three domains namely cognitive, affective, and conative or psychomotor domain. Therefore all the educational and instructional objectives can be written in behavioural term in this system.

(6) **No confusion and doubt:** RCEM approach does not leave any doubt and confusion in preparing criterion test items. The construction of test items is simple, convenient and objective.

(7) **Applicable for all school teaching subjects:** The objectives all school teaching subjects can be conveniently written with the help of seventeen frames or statements proposed in this scheme by placing the elements of the content in blank space.

(8) **List of mental processes:** This approach provides a list of seventeen mental processes or abilities associated with the instructional objectives. It explain human learning in terms of mental processes or abilities.

LIMITATIONS OF RCEM APPROACH (SYSTEM)

(1) **Not suitable for certain objective and content areas:** The objectives concerning the development of skills, appreciation, interest and attitude in some of the subjects and content areas cannot be properly deals with this approach.

(2) **Insufficient creative mental abilities:** In RCEM approach there are only three mental abilities in creativity objectives whereas Torrance& others have given five types of abilities in creativity domain.

(3) **No balance:** The table of objectives clearly shows that there is no proper balance between the various mental abilities assigned to different categories. There are two mental abilities for knowledge objectives, seven for understanding objectives, five for application objective and three for creativities objectives.

(4) **Difficulty in selecting mental process:** It is generally very difficult to select appropriate mental process for content element.

(5) **Erroneous assumption:** The assumption that the human learning can be explained through the seventeen mental processes or abilities is erroneous. It is very difficult to explain each and every change in behaviour on account of learning or teaching through the framework of the seventeen statements provided in this approach. The list of the mental abilities cannot be too marrow as evident by the findings of Guilford who has extracted 120 mental abilities.

(6) **Arbitrary Compiling:** The compiling of abilities within the categories seems to be quite subjective and

arbitrary. It is not based on sufficient ground work.

(7) **Not useful for cognitive objectives only:**The approach suits more to the cognitive objectives than the conative objectives. Use of a single design for cognitive, affective and conative

does not seem to be appropriate.

(8) **No clear cut distinction:** In RCEM's approach no clear cut distinction is mode among objectives of cognitive, affective and psychomotor domain on the basis of behavioural objectives.

Exercise:

SHORT ANSWER TYPE QUESTIONS

(1) Explain the difference between aims and objectives.

(2) What are behavioral objectives?

(3) Write the aims of mathematics teaching.

(4) Discuss the aims and objectives of teaching mathematics in schools. (GNDU, 2016)

LONG ANSWER TYPE QUESTIONS

(1) Explain the term "Writing objectives in behavioural term." What is Bloom taxonomy of cognitive domain? (GNDU, 2014)

(2) Write the aims and objective of mathematics teaching in instructional and behavioral terms. (GNDU, 2013)

(3) Discuss the aims and objective of mathematics in behavioural terms.

(4) Explain in detail Bloom Taxonomy of objectives.

(5) What do you understand, by the term 'Taxonomy of educational objectives'. Discuss the cognitive domain of Bloom taxonomy. (GNDU, 2013)