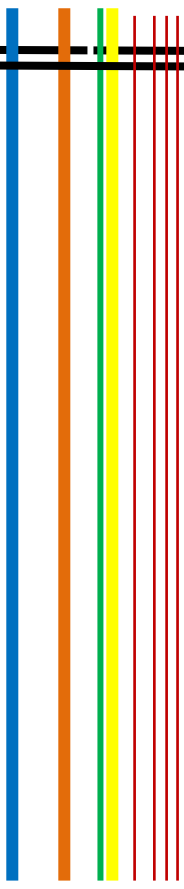


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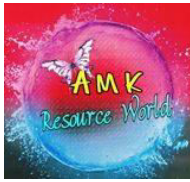
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### METHODOLOGY OF TEACHING MATHEMATICS

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## METHODOLOGY OF TEACHING MATHEMATICS

### ORIGIN & GROWTH IN MATHEMATICS

#### Human Needs as a Basis of Growth in Mathematics

Mathematics, like everything else that man has created, exists to fulfill certain human needs and desires. It is very difficult to say at what point of time in the history of mankind, and in which part of the world, mathematics had its birth.

The fact that it has been steadily pursued for so many centuries, that it has attracted ever increasing attention and that it is now the dominant intellectual interest of mankind shows that it appeals very powerfully, to mankind.

#### Origin of Mathematics

This conclusion is borne out by everything that we know about the origin of mathematics. More than 2,000 years before the beginning of the Christian era, both the Babylonians and the Egyptians were in possession of systematic methods of measuring space and time. They had the knowledge of rudimentary geometry and rudimentary astronomy.

This rudimentary mathematics was formulated to meet the practical needs of an agricultural population. Their geometry resulted from the measurements made necessary by problems of land surveying Units of measurement, originally a stone or a Vessel of water for weight, eventually became uniform over considerable areas under names which are now almost forgotten.

Undoubtedly. similar efforts occurred in early times in the southern part of Central Asia along the Indus and Ganges rivers and in Eastern Asia. Projects related to engineering, financing, irrigation, flood control, and navigation required mathematics. Again a usable calendar had to be developed to serve agricultural needs. Zero was defined and this at once led

to positional notations for whole numbers and later to the s&e notation fractions.

The place value system which eventually developed was a gift of this period. These achievements and many more of a similar nature are the triumph of the human spirit. They responded to the needs of human society as it became more complex. Primitive men can hardly be said to have invented or discovered their arithmetic; they actually lived it. The men who shaped the stones in erecting the Temple of Mathematics were widely scattered, a few in Egypt, a few in India, and yet others in Babylon and China. These workmen confronted nature and worked in harmony with it. Their products, therefore though scattered in time and space, partook of the unity of nature.

## GROWTH IN MATHEMATICS

Mathematics is something that the man has himself created to meet the cultural demands of time. Nearly every primitive tribe invented words to represent numbers. But it was only when ancient civilizations such as the Summerian, Babylonian, the Chinese and the Mayan developed trade, architecture, taxation and other civilized contracts that the number systems were developed.

### BRANCH OF MATHEMATICS: PURE AND APPLIED MATHEMATICS

Thus, mathematics has grown into one of the most important cultural components of our society. Our modern way of life would hardly have been possible without mathematics. Imagine trying to get through the day without using a number in some manner or the other. If a person lacks the ability to compute, he is as good as crippled. For instance, we need to know the time and tell the same. Telling the time is difficult and yet nearly everyone learns it. Soon, we shall lose an important experience of looking at the old fashioned clock with rotating hands, as we shall all be using digital readings to read time. A degree of estimation, not only in money but in 'weights and measures, is very important.

Many of our daily routine chores involve sorting, ordering and organizing processes. We handle many mechanized devices which require geometrical or spatial skills. For travel, reading of maps, diagrams, interpreting scales becomes an essential part of our intellectual equipment. A knowledge of mathematics is useful to understand and interpret matters such as income tax and read information presented to us by the mass media in numerical form or in the form of graphs and understand the use of phrases such as rising prices, index, per capita income, inflation, stock market index etc. in ordinary day to day language. It is not necessary to provide an exhaustive list to prove the case in favour of "mathematics for survival" or "useful mathematics".

## BRANCH OF MATHEMATICS

### Applied Mathematics

In a classroom much of the mathematics we teach is applied mathematics in the sense that it relates directly to life's activities connected with buying, selling, trade, business, consumer applications, weighing, measuring etc. These applications of mathematics to the world around us can be extended to more technical ones.

Mathematics has helped in analysing motion and in doing so, Newton created the calculus which became known as applied mathematics.

More recently mathematical growth has been in areas such as operational research, linear programming, system analysis, statistics, all involving processes to handle numerical information in an increasingly technologically advanced world. The mathematical ideas we teach in schools develop over many years of study and become associated in our minds with all the applications and illustrations presented to explain them. It is always easier to explain what we can do with a concept in mathematics than to say what it is. A teacher has to answer questions such as "what is the use of this to us this?", or "why do we have to learn this?" If he/she fails to do so there will be many children who will not be able to see the point.

### Pure Mathematics:

In pure mathematics we start from certain rules of inference, by which we can infer that if one proposition is true, then some other proposition is also true. These rules of inference constitute the major part of the principles of formal logic. For instance, we all know the axiom that in real numbers if  $a > b$  and  $b > c$ , then  $a > c$ . Thus, from given propositions we conclude that some other proposition is true. We then take any hypothesis that seems amusing, and deduce its consequences. If our hypothesis is about anything, and not about some (one or more) particular person or thing, then our deductions constitute mathematics.

Thus, mathematics may be defined as "the subject in which we never know what we are talking about, nor whether what we are saying is me" - Bertrand Russell

These ideas point out the abstract nature of mathematics. Mathematics deals with the application of arbitrary rules in an arbitrary situation which may or may not have significance in the world outside. It is a network of logical relationships. In school mathematics Euclidean geometry is essentially pure mathematics. A set of axioms and postulates are given and from them a body of definitions, theorems and propositions are derived. All pure mathematics is built up by combinations of primitive ideas of logic; its propositions are deduced from the general axioms of logic, such as the syllogism and the other rules of inference.

There is a very thin line dividing pure and applied concepts. On the one hand concepts of pure mathematics are formulated because of the need to apply them and on the other, every discovery or formulation has some application somewhere.

## MEANING AND NATURE OF MATHEMATICS

### Meaning of Mathematics

The term '**Mathematics**' has been interpreted and explained in various ways. This is due to our empirical knowledge and various types of experiences. But ultimately all types of explanations conclusively end at some kinds of relationship with number and space. Thus, mathematics deals with quantitative facts and relationships as-well-as with problems involving space and form.

It enables the man to study various phenomena in space and establish different types of relationship between magnitudes of quantitative and quantitative facts. Therefore it may be concluded that mathematics is the enumerative and calculative part of human life and knowledge the person to given an exact interpretation.

**According to New English Dictionary**, "Mathematics, in a strict sense, is the abstract science which investigates deductively the conclusions implicit in the elementary conceptions of spatial and numerical relations."

**According to Webster's Dictionary**, "Mathematics is the science of numbers and their operations, interrelations, combinations, generalizations and abstractions and of space configuration and their structure, measurement, transformations and generalizations."

**In the words of Locke**, "Mathematics is a way to settle in the mind a habit of reasoning."

**According to Roger Bacon**, "Mathematics is the gate and key of the sciences.... Neglect of mathematics work injury to all knowledge, since who is ignorant of it cannot know the other sciences or the things of the world. And what is worse, men who are thus ignorant are unable to perceive their own ignorance and so do not seek a remedy."

On the basis of above definitions, we can say or conclude that –

- Mathematics is the science of magnitude and numbers.
- Mathematics is the science of quantity and space.
- Mathematics is the important means of generalisation,
- Mathematics is the an applied science for the expression of other sciences.
- Mathematics is the method of progress of various subjects.
- Mathematics as the means to draw conclusion and judgement.
- Mathematics is the perfection of generalisation.
- Mathematics is the science of logical reasoning.

### Nature of Mathematics

What is Mathematics and how does it grow are the basic questions which all the students of Mathematics must understand. In school, those subjects

which are included in the curriculum must have certain aims and objectives on the basis of which its nature is decided. Mathematics holds a strong and unbreakable position as compared to other school subjects.

With this reason, mathematics is more stable and important than other school subjects. The way in which the structure of a subject becomes weak, its truthfulness, reliability and prediction also decreases in the same manner. On the basis of this specific structure, the nature of each subject is determined and placed in the school curriculum.

It is not necessary that all subjects have same nature. Mathematics has its unique nature thus on the basis of which we can compare it with other subjects. The basis of comparison of two or more subject is their nature. We can understand the nature of Mathematics on the basis of following features

- Mathematics is a science of space, numbers, magnitude and measurement.
- Mathematics has its own language. Language consists of mathematical terms, mathematical concepts, formulae, theories, principles and signs, etc.
- It gives accurate and reliable knowledge.
- Mathematics knowledge is exact, systematic, logical, and clear so that once it is captured it can never be forgotten.
- Mathematical rules, laws and formulae, are universal and that can be verified at any place and time.
- It develops the ability of induction, deduction and generalisation.
- Mathematics helps in developing scientific attitude among children.
- The study of Mathematics gives the training of scientific method to the children.
- Mathematical knowledge is based on sense organs.
- Mathematics is a systematised, organized and exact branch of science.
- Mathematics involves conversation of abstract concepts into concrete form.
- Mathematics is the science of logical reasoning.
- Mathematics does not leave any doubt in the mind of learner about theories, principles concepts etc.
- Mathematics helps to develop that habit of self-confidence and self reliance in children.
- Mathematics helps in the developments of sense of appreciation among children.
- Mathematics language is well defined, useful and clear.
- It draws numerical inferences on the basis of given information and data.
- Mathematical knowledge is applied in the study of science and in this different branches; for example physics, chemistry, biology, and other sciences.
- It is not only useful for different branches of science but also helps in its progress and organisation.



Thus on the basis of above points we can understand the nature of mathematics and draw conclusion that the structure of mathematics is indeed the basis of its nature and is more strong as compared to other school subjects. That is why its study is essential in school education.

### **MATHEMATICS AS THE SCIENCE OF LOGICAL REASONING**

Reasoning is based on previous established facts. To establish a new fact or truth one has to put it on test of reasoning. If the new fact coincides with the previously established facts, it is called logical or rational. Logical reasoning is beyond subjectiveness.

In the process of logical reasoning, we approach everything with a question mark in our mind. For each question we make a hypothesis and this hypothesis is tested empirically or theoretically with the help of previously proved or established truths or facts. In mathematical working we also move upwards by the process of reasoning.

From our observation of physical and social environment we form certain intuitive ideas or notions called postulates and axioms. These postulates and axioms are self-evident truths and need no further proof or explanation. Thus, postulates and axioms are assumed to be true without reasoning. But this does not mean that here we ignore the process of reasoning. Actually self-evident truths are beyond reasoning. That is why we can not assume any evidence to be true. Only those evidences can be assumed as true that could not be proved untrue or irrational by existing logical knowledge.

Thus, postulates and axioms are bases of mathematics as-well-as of our process of logical reasoning. In mathematics we make several propositions and while proving a proposition we base our arguments on previously proved proposition. Thus, each proposition is supported by another proposition that has already been proved or established. Consequently if we go back one-by-one, we reach to a propositions that is based on postulates and axioms. Thus, in mathematics we always use the process of logical reasoning. Therefore, mathematics may be called as the science of logical reasoning.

In mathematics two types of reasoning is used. These prominent types of reasoning are:

1. **Inductive Reasoning and**
2. **Deductive Reasoning**

“Mathematics in the making is not a deductive science, it is an inductive, experimental science and guessing is the tool of mathematics. Mathematician like all other scientists, formulate their theories form bunches, analogies and simple examples. They are pretty confident that what they are trying to prove is correct, and in writing these, they use only the bulldozer of logical deduction”.

**Whitehead** has also emphasised the importance of deductive reasoning in mathematics by saying, “Mathematics in its widest sense is the development of all types of deductive reasoning.”

**D’ Alembert** says, “Geometry is a practical logic, because in it, rules of reasoning are applied in the most simple and sensible manner.

**Pascal says**, “Logic has borrowed the rules of geometry. The method of avoiding error is sought by everyone. The logicians profess to lead the way, the geometers alone reach it, and aside from their science there is no true demonstration.”

Geometry is a true demonstration of logic Mathematics is the only branch of knowledge, in which logical reasoning or logical laws are applied and the results can be verified by the method of logical reasoning.

**W.C.D. Whetham-** “Mathematics is but the higher development of Symbolic Logic.”

**C.J. Keyser-** “Symbolic Logic is Mathematics; Mathematics is Symbolic Logic.”

For another example, take the symbol ‘ $x$ ’. Let A denote the class, ‘Teachers’ and B the class, ‘Ladies.’  $AXB$  may be interpreted to mean the class of persons who are both Teachers and Ladies.

Thus the meanings of mathematical symbols have been extended to represent the relationship of propositions in logic. The aims of the mathematician and those of the logician are practically the same.

### PLACE OF MATHEMATICS IN SCHOOL CURRICULUM

Curriculum includes all those activities, experiences and environment which the child receives during his educational career under the guidance of educational authorities. Thus curriculum is the total education of the child. Curriculum touches all the aspects of the life of the pupils- the need and interest of pupils environment which should be educationally congenial to them, ways and manners in which their interest can be kindled warmed up, the procedures and approaches which cause effective learning among them, the social efficiency of the individual and how they fit in with the community around.

In education, the importance and the place of a particular subject depends on the fact that “to what extent the subject is helpful in achieving the aims of the education”. If any subject is more useful for achieving educational objectives then its importance increases accordingly. Since ancient times mathematics has played a vital role in ‘achieving aims of education, as compared to others. Present age is the age of science and information. Whatever, technological and physical progress being made, shall be



correspondent to the role of mathematics. Being so important “What place should be given to mathematics in the curriculum?”

In school **Kothari Commission** has explained about placing mathematics as a compulsory subject upto higher secondary or tenth standard and has said, “Mathematics should be made a compulsory subject for the students of 1st to Xth standard, as a part of general education.”

But some people lay more emphasis on making it an optional subject after eight-standard, therefore various reasons were framed against this proposal:

- It is very difficult subject and its learning requires a sharp brain and intelligence, as many children will face difficulties for gaining the knowledge.
- It is only an imagination the mental abilities, discipline, culture, social and moral developments can be done by mathematics.
- The numbers of failures in mathematics in high school examination are more as compared to that of other subjects.
- Every student can't become an engineer or a technician, then what is the necessity of mathematics for all.

In this way, the reasons forbidding the compulsion of mathematics upto tenth standard seems to Ideological.

All great educationalist like **Herbert, Pestolozzi** etc. has accepted mathematics as a symbol of human development. Accepting mathematics as a best means of intellectual and cultural developments, these educationists placed mathematics on the top in the curriculum.

***Thus we can give certain logical points regarding mathematics as a compulsory subject. These are as follows:***

- If mathematics is not given an important place in the curriculum then students would not get any opportunity for mental training and in the absence of which their intellectual development might be affected.
- For gaining the knowledge of mathematics no innate power is required, which is separate from ability of study of other subject.
- Training of reasoning, thinking, discipline, self confidence and emotions are developed in students by mathematics.
- Through mathematics child leads to gain knowledge systematically.
- It is needed either forwardly or adversely for studying almost all the subjects because it is considered as the basis of science and each and every art.

Thus on the basis of above discussion, we can conclude that mathematics is only subject whose knowledge is needed for the whole life. It can be possible only when every child will study mathematics as a compulsory subject upto tenth standard. Mathematics occupy a prominent place in men's life, from an engineer to technician or labour to finance minister and other businessmen, all needed the help of mathematics according to their requirements. The knowledge of this subject is indispensable and it is bound to grow as the need grows. A mathematical approach is essential for any

progress. Any approach devoid of mathematical consideration is likely to lead to failure. If anybody wants to get success in his life, he must have recourse to mathematics.

Thus mathematics should be placed on higher level even through it is required for earning. There are some reasons for giving in an important place in school curriculum, some of them are as follows:

### Reasons for Keeping Mathematics in School Curriculum

- Mathematics is the Basis of all Sciences: The different branches of science likewise-Physics, Chemistry, Astronomy, Biology, Medical Science, Geology, Astrology etc. are the important subjects which are based on mathematics for e.g. area, volume, weight, density, number of atoms and electrons, medicines all are related to mathematical study.
- Mathematics is Related to Human Life: Right from getting up in the morning till going to bed we need the help of mathematics. For purchasing, planning our day, each and every aspect involves the use of mathematics. Today in the modern age, the knowledge of mathematics is essential and more important in one form or the other.
- Mathematics Generates Logical Attitude: Mathematics give training to different faculties of mind. In order to solve a mathematical problem a child has to think logically. Every step is, related to other step on the basis of some logic with which child develops his mental abilities and it further effects his intellectual development.
- Mathematics Provides a Definite way of Thinking: The children who study mathematics develop attitude with which they learn to work systematically, regularly and properly. Along with this it also develops a logical thinking in them.
- Mathematics is an exact science: By the study of mathematics child develops the attitude to accept the knowledge of mathematics in an exact form. All mathematical concepts, formulae, facts are related to exactness and thus it removes the feeling of doubt. For example;  $4 + 4 = 8$ . Which cannot be 7 or 9 etc.
- Mathematics provides opportunity to develop mental abilities of the child.
- Mathematics deals with significant, abstracts and consistent structures.
- Mathematics is the study of sets and structures.
- Mathematics helps in character formation as well as morality.
- The develops the characteristic of discipline.
- The language of mathematics is universal.
- Knowledge of mathematics is useful in the study of other school subjects.

We are familiar with the saying “**Brevity the soul of wisdom.**” Mathematics applies this principle in its language. Mathematical language is free from verbosity and is empowered to put the things or ideas pin-pointedly. Thus, mathematical language cut short the lengthy statements and helps the people to express their ideas or things in exact form by using notations, symbols and formula.

The mathematical ability is inherent in the man. Therefore, he is able to assign notations and symbols to ideas and objects. This is the basis for the development of mathematical language. Thus, the mathematics has its from several and symbolism which distinguishes it from several other subjects and helps us in expressing the facts in clear, to the point and exact form. For example, the statement, “The different of squares of two terms or numbers is equal to the product of sum and difference of the terms”, may easily be written as:

$y^2=(x+y)(x-y)$  by using the symbol  $x$  and  $y$  for The above symbolic form of a given statement impressments the mathematical language. Mathematical results in their symbolic form helps us in solving various complicated problems. The progress of mathematics depends on the enormous use of mathematical language and symbolism. Most of the results of scientific inventions and discovers are stated through this language. The importance of mathematics and mathematical language may easily be understood through the saying of **Lindsay and Galileo**;

**Lindsay** says, “Mathematics is the language of physical science and certainly no more marvelous language was ever created by the mind of the man.”

More above **Galileo** has expressed has views as "Mathematics is language in which god has written the universe"

Thus, mathematics works out with a peculiar language. Therefore, in teaching of mathematics, the teacher has to develop in learners the ability to employ mathematical language and symbolism. We are very much familiar with the symbols of addition, subtraction, multiplication and division. There are a large number of symbols and notations used in mathematics and it is not possible to prepare a comprehensive and complete list of those. But students must be made familiar with them so that they may be able to understand advanced mathematical processes and literature. A good student of mathematics must be in position to appreciate the precision, logic, sharpness and beauty of its perculiar language. Several students lose interest in the subject as they are symbolism. Thus, it is the duty of the teacher of mathematics to create in him an interest towards its language. Though, it is not the content of this book, some important symbols are given below to comprehend the beauty and precision of mathematical language.

**Symbols** || **Used for**

=	Equal to
∴	Since or because or As
∴	Therefore
>	Greater than
<	Less than
√	Square root
∑	Summation (Sigma)
∥	Parallel lines
∠	Angle
Δ	Triangle
≡	Congruency
S	Semi-perimeter of triangle
⊂	Subset
N	Set-of Natural Numbers
R	Set of Real Numbers
I	Set of Integers
Q	Set of Rational Numbers

There are some important symbols which are mostly used. In fact, it is a difficult task to prepare a comprehensive and complete list of all the mathematical symbol. Generally students fail to understand some mathematical procedure because of their inability to understand the symbols used. So, they try to cram the statements mechanically without knowing the meaning of symbols. Therefore, students should be very familiar with these symbols. Teachers should make an effort to train the students in the use of mathematical language and symbols. Students should team to appreciate the precision, brevity, exactness and beauty of mathematical language and symbolism.

### COMMUNITY MATHEMATICS

After knowing what Mathematics is, it is proper to answer the questions like why should everybody learn Mathematics? What is the advantage of doing so much labour in learning Mathematics? The answer to all such questions lies in the knowledge of the utility or values of teaching Mathematics?

Mathematics is subject of great social importance. It helps in proper organisation and maintenance of our social structure. Society is the result of the union of individuals. It needs various laws, mores and traditions for its perpetuation. Mathematics helps not only in the formation of laws but also in their compliance. In fact the harmony, law and order and dynamicity prevailed in our society are all because of Mathematics. The world transaction, exchange, commercial trade and business depend on Mathematics. The means of transport, communication and the so many scientific inventions and discoveries that have knitted the world into a family owe their existence to Mathematics.

Moreover, one can lead a normal social life only when he is able to adjust himself in the existing social set-up. Today our social set-up-or social existence is totally governed by the scientific and technological knowledge

which can only be attained by the study of Mathematics. In fact the ignorance about Mathematics is the stumbling block in the progress of a nation or society. History of Mathematics openly reveals that whenever a country has given due weightage to the teaching of Mathematics it has made a tremendous progress. It is in disconnection that great **Napoleon** once said, “The progress and the improvement of Mathematics are linked with the prosperity of the State.”

In this way Mathematics has been a pioneer not only in adjusting with the progress of the society but also in the advancement of the society. Whatever is seen in the name of the progress and development in the world is all due to Mathematics. The journey to the moon has been only possible through the concrete principles of Mathematics. In brief what we are enjoying in our social set-up and planning to get in future is based on the study and knowledge of Mathematics.

By culture of a nation or society we mean the mode of living of its inhabitants. The culture is reflected through how they live, behave, eat, drink and maintain their social relationship. The scientific discoveries, which owe their roots in Mathematics, are to a great extent, responsible for bringing changes in the mode of living and thereby the culture has been continuously influenced by the progress and improvement of Mathematics. **Hogben** says, “Mathematics is the mirror of “civilization.” The history of Mathematics portrays civilization and culture of different countries at different periods. The greatness of Indian culture is once reflected through the glory of Indian Mathematics of olden days. Similarly, having come to know the progress of Egyptians and Greeks in Mathematics one can be aware of their progress in culture and civilization.

Mathematics does not only acquaint us with the culture and civilization but it also helps in its preservation, promotion and transmission to the coming generation. Our life is too short to discover by ourselves all the knowledge we need to lead our life. We have to take the help of others in getting this knowledge. Books are the chief sources of acquainting us with the past achievements of one’s race, culture of humanity at large. Mathematics books are no exceptions. They also contain valuable treasure of our culture that can only be known by lying emphasis on Mathematics teaching. In this way important aspects of our culture can only be preserved through Mathematical teaching. Further, after knowing what our ancestors have done we as students of ‘Mathematics’ bring new ideas in the body of Mathematical knowledge and thus increase our cultural heritage. This heritage is passed to the younger generation through the teaching of Mathematics in the hope that they will preserve promote and transmit it further to the coming generation.

Mathematics plays an important role in the organisation and maintenance of our social structure. Society is the result of the inter-relations of individuals. It consists of big and small groups and there are sub-groups

within each group. Mathematics enables us to understand the inter-relations of individuals and the possibilities of various groups.

Society is a phenomena of balancing and counter-balancing of various social forces. Mathematics helps in creating a social order in this phenomena. It regulates the functioning of society in many ways. Social conditions like justice, fairplay, healthy competition, symmetry, harmony, etc. have often to be described in mathematical terms for the purpose of clarity.

For smooth transactions, exchange, trade, business and bargaining, mathematics becomes a useful tool. It has its own role to play in the development of means of communication. It has helped in knitting the vast society into a family. When the dealings between individuals are given a mathematical touch, it leads to social progress, prosperity and welfare.

History of mathematics reveals that whenever a society gave due weigh-tage to the knowledge of mathematics, it made a tremendous progress. When mathematics make its contribution in the advancement of science and technology, society draws huge benefits. Its contribution is evident in the fields of atomic energy, space research, space travel, and man-made satellites.

The harnessing of social resources can best be done by mathematical and scientific approach.

Mathematics helps in the formation of social norms and their implementation. The dominance of materialistic outlook in our society is one of the chief attributes of mathematics. Our monetary dealings are a major domain of our social dealings and relations. We earn a social status by virtue of our economic status and behaviour. The social status is governed by our property, income, bank balance and economic potential. Social security is bound to imply economic security.

The ideas like manpower planning have originated party due to the influence of mathematics. The statistical data and the census provides bases for short-term and long range planning for the welfare of the society.

### **CORRELATION OF MATHEMATICS WITH OTHER ASPECTS OF LIFE**

Mathematics is not confined to the classroom or school only. Its utility is very comprehensive and wide. It has an important bearing on various aspects of life beyond the school. Therefore, it is desirable at the part of the teacher to make the references regarding its use in actual life, while teaching the mathematics. The students should be explained the utilitarian and cultural values of mathematics in practical life.

To highlight the importance of mathematics in other fields of life, a teacher should always make an effort to explain to the students the practical application of the mathematical knowledge. He may show big industries,



dams, bridges, prominent building, electrical installations etc and explain to the students that all this has been made possible with the help of mathematics. In this way, a good experience may be provided to the students about the utility of mathematics in actual life. Thus the correlation of mathematics with other aspects of human life can be expressed and explained while teaching the different topics of mathematics.

### **BLOOM'S TAXONOMY OF INSTRUCTIONAL OBJECTIVES**

In 1956, Benjamin Bloom with collaborators Max Englehart, Edward Furst, Walter Hill, and David Krathwohl published a framework for categorizing educational goals: *Taxonomy of Educational Objectives*. Familiarly known as Bloom's Taxonomy, this framework has been applied by generations of K-12 teachers and college instructors in their teaching.

The framework elaborated by Bloom and his collaborators consisted of six major categories: Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation. The categories after Knowledge were presented as "skills and abilities," with the understanding that knowledge was the necessary precondition for putting these skills and abilities into practice.

**Bloom's taxonomy** is a classification of learning objectives within education. It is named for Benjamin Bloom, who chaired the committee of educators that devised the taxonomy, and who also edited the first volume of the standard text, *Taxonomy of Educational Objectives: The Classification of Educational Goals*.

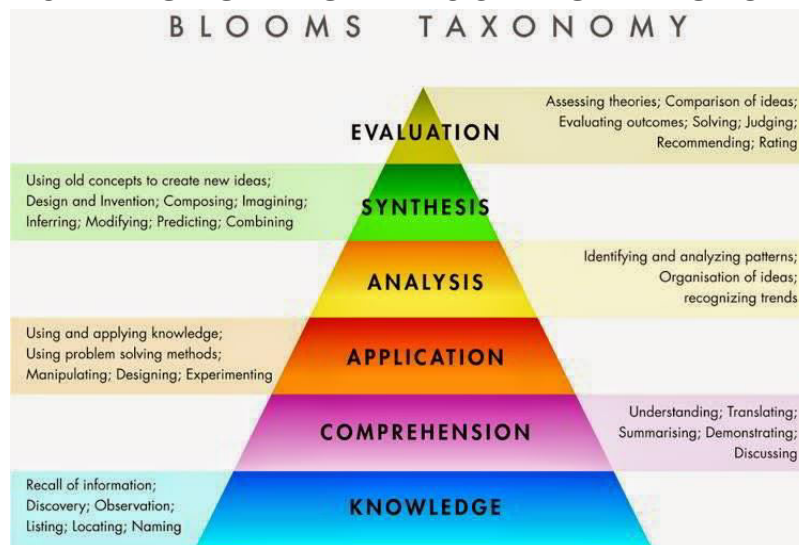
Bloom's taxonomy refers to a classification of the different objectives that educators set for students (learning objectives). It divides educational objectives into three "domains": cognitive, affective, and psychomotor (sometimes loosely described as "knowing/head", "feeling/heart" and "doing/hands" respectively). Within the domains, learning at the higher levels is dependent on having attained prerequisite knowledge and skills at lower levels. A goal of Bloom's taxonomy is to motivate educators to focus on all three domains.

There are three taxonomies. Which of the three to use for a given measurable student outcome depends upon the original goal to which the measurable student outcome is connected. There are knowledge-based goals, skills-based goals, and affective goals (affective: values, attitudes, and interests); accordingly, there is a taxonomy for each. Within each taxonomy, levels of expertise are listed in order of increasing complexity. Measurable student outcomes that require the higher levels of expertise will require more sophisticated classroom assessment techniques.

When developing instructional objectives, providing instruction, and evaluating student performance, it is important to keep in mind that there are different levels or outcomes of learning. Distinguishing among different

levels and outcomes of learning is important. If teachers are unaware of different levels of learning, they are likely to focus on one level to the detriment of others. For example, a teacher may teach a vast amount of factual information but never get around to teaching students to apply and synthesize this information. Or a teacher may teach higher level thinking skills without realizing that these skills require the prior learning of basic skills that must be integrated into these higher order skills.

## BLOOM'S TAXONOMY OF EDUCATIONAL OBJECTIVES



### Cognitive Domain

- 1. Knowledge** (Remembering previously learned material)  
 Mathematics: State the formula for the area of a circle.
- 2. Comprehension** (Grasping the meaning of material)  
 Mathematics: Given the mathematical formula for the area of a circle, paraphrase it using your own words.
- 3. Application** (Using information in concrete situations)  
 Mathematics: Compute the area of actual circles.
- 4. Analysis** (Breaking down material into parts)  
 Mathematics: Given a math word problem, determine the strategies that would be necessary to solve it.
- 5. Synthesis** (Putting parts together into a whole)  
 Mathematics: Apply and integrate several different strategies to solve a mathematical problem.
- 6. Evaluation** (Judging the value of a product for a given purpose, using definite criteria)

Mathematics: When you have finished solving a problem (or when a peer has done so) determine the degree to which that problem was solved as efficiently as possible.

**Knowledge** (recalling information) represents the lowest level in Bloom's taxonomy. It is "low" only in the sense that it comes first - it provides the basis for all "higher" cognitive activity. Only after a learner is able to recall information is it possible to move on to **comprehension** (giving meaning to information). The third level is **application**, which refers to using knowledge or principles in new or real-life situations. The learner at this level solves practical problems by applying information comprehended at the previous level. The fourth level is **analysis** - breaking down complex information into simpler parts.

The simpler parts, of course, were learned at earlier levels of the taxonomy. The fifth level, **synthesis**, consists of creating something that did not exist before by integrating information that had been learned at lower levels of the hierarchy. **Evaluation** is the highest level of Bloom's hierarchy. It consists of making judgments based on previous levels of learning to compare a product of some kind against a designated standard.

<i><b>Bloom's Taxonomy of Educational Objectives for Knowledge-Based Goals</b></i>		
<b>1. Knowledge</b>	Recall, or recognition of terms, ideas, procedure, theories, etc.	When is the first day of Spring?
<b>2. Comprehension</b>	Translate, interpret, extrapolate, but not see full implications or transfer to other situations, closer to literal translation.	What does the summer solstice represent?
<b>3. Application</b>	Apply abstractions, general principles, or methods to specific concrete situations.	What would Earth's seasons be like if its orbit was perfectly circular?
<b>4. Analysis</b>	Separation of a complex idea into its constituent parts and an understanding of organization and relationship between the parts. Includes realizing the distinction between hypothesis and fact as well as between relevant and extraneous variables.	Why are seasons reversed in the southern hemisphere?
<b>5. Synthesis</b>	Creative, mental construction of ideas and concepts from multiple sources to form complex ideas into a new, integrated, and meaningful pattern subject to given constraints.	If the longest day of the year is in June, why is the northern hemisphere hottest in August?
<b>6. Evaluation</b>	To make a judgment of ideas or methods using external evidence	What would be the important

	or self-selected criteria substantiated by observations or informed rationalizations.	variables for predicting seasons on a newly discovered planet?
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<b>Bloom's Taxonomy of Educational Objectives for Skills-Based Goals</b>		
<b>Level of Expertise</b>	<b>Description of Level</b>	<b>Example of Measurable Student Outcome</b>
<b>Perception</b>	Uses sensory cues to guide actions	Some of the colored samples you see will need dilution before you take their spectra. Using only observation, how will you decide which solutions might need to be diluted?
<b>Set</b>	Demonstrates a readiness to take action to perform the task or objective	Describe how you would go about taking the absorbance spectra of a sample of pigments?
<b>Guided Response</b>	Knows steps required to complete the task or objective	Determine the density of a group of sample metals with regular and irregular shapes.
<b>Mechanism</b>	Performs task or objective in a somewhat confident, proficient, and habitual manner	Using the procedure described below, determine the quantity of copper in your unknown ore. Report its mean value and standard deviation.
<b>Complex Overt Response</b>	Performs task or objective in a confident, proficient, and habitual manner	Use titration to determine the $K_a$ for an unknown weak acid.
<b>Adaptation</b>	Performs task or objective as above, but can also modify actions to account for new or problematic situations	You are performing titrations on a series of unknown acids and find a variety of problems with the resulting curves, e.g., only 3.0 ml of base is required for one acid while 75.0 ml is required in another. What can you do to get valid data for all the unknown acids?
<b>Organization</b>	Creates new tasks or objectives incorporating learned ones	Recall your plating and etching experiences with an aluminum substrate. Choose a different metal substrate and design a process to plate, mask, and etch so that a pattern of 4 different metals is created.

<i>Bloom's Taxonomy of Educational Objectives for Affective Goals</i>		
<b>Level of Expertise</b>	<b>Description of Level</b>	<b>Example of Measurable Student Outcome</b>
<b>Receiving</b>	Demonstrates a willingness to participate in the activity	When I'm in class I am attentive to the instructor, take notes, etc. I do not read the newspaper instead.
<b>Responding</b>	Shows interest in the objects, phenomena, or activity by seeking it out or pursuing it for pleasure	I complete my homework and participate in class discussions.
<b>Valuing</b>	Internalizes an appreciation for (values) the objectives, phenomena, or activity	I seek out information in popular media related to my class.
<b>Organization</b>	Begins to compare different values, and resolves conflicts between them to form an internally consistent system of values	Some of the ideas I've learned in my class differ from my previous beliefs. How do I resolve this?
<b>Characterization by a Value or Value Complex</b>	Adopts a long-term value system that is "pervasive, consistent, and predictable"	I've decided to take my family on a vacation to visit some of the places I learned about in my class.

To determine the level of expertise required for each measurable student outcome, first decide which of these three broad categories (knowledge-based, skills-based, and affective) the corresponding course goal belongs to. Then, using the appropriate Bloom's Taxonomy, look over the descriptions of the various levels of expertise. Determine which description most closely matches that measurable student outcome.

### **MAXIMS / PRINCIPLE OF TEACHING**

Every teacher wants to make maximum involvement and participation of the learners in the learning process. He sets the classroom in such a way so that it becomes attractive for them. He uses different methods, rules, principles etc in order to make his lesson effective and purposeful. He uses general rule or formula and applies it to particular example in order to make teaching – learning process easy and upto the understandable level of students.

These settled principles, tenets, working rules or general truths through which teaching becomes interesting, easy and effective are called the maxims of teaching. They have universal significance. Every person who is expected to enter into the teaching profession have to familiarize himself with the maxims of teaching. Their knowledge helps him to proceed systematically.

The different maxims of teaching are briefly explained below. The teacher should always proceed keeping them in view.

### **1. From known to unknown:-**

When a child enters into school, he possess some knowledge and it is the duty of teacher to enlarge his previous knowledge . Whatever he possesses should be linked with the new knowledge. If we link new knowledge with the old knowledge our teaching becomes clearer and more definite.

This maxim facilitates the learning process and economises the efforts of the teacher and the taught. For example is teaching English to the children and he is to teach the word 'water'. He reminds them the Kashmiri word 'Aab' which they already know and then tells them that in English we say 'water'. This way of teaching helps the learners to understand things fully. This way the teaching becomes definite, clearer and more fruitful.

### **2. From simple to complex:-**

The main objective of teaching is to teacher and the learners objective is to learn something. In this process of teaching and learning, simple or easy things should be first presented to the students and gradually he should proceed towards complex or difficult things. The presentation of simple material makes the learners interested, confident and feel encouraged. As they will show interest towards the simple material, they becomes receptive to the complex matter. On the other hand, if complex matter is presented first, the learner becomes upset, feel bored and finds himself in a challenging situation. For example in mathematics we first present the idea of +, - , x and then division.

When the child gets admitted to 9th and 10th class we introduce algebra, surds, trigonometry, geometry etc. As he proceeds further he becomes familiar with the complex material like matrices, integration, differentiation etc. In this way a learner shows interest by proceeding from simple mathematics to complex one. But if we reverse the situation, he will find himself in a challenging situation and will left his studies due to complexity of matter. Simplicity or complexity of the subject matter should be determined according to the view point of the learners. It makes learning convenient and interesting for the students.

### **3. From concrete to abstract:-**

Concrete things are solid things and they can be visualized but abstract things are only imaginative things. The child understands more easily when taught through their senses and never forget that material. On the other



hand if abstract things or ideas are presented, they forget it soon. As **Froebel** said, "Our lessons ought to start in the concrete and end in the abstract". For example when we teach the solar system, we first visualize the sun through our senses and gives the concept of eight planets, galaxies, meteorites etc. Through this process, the learners understand the materials more easily. Some power of imagination also develops in them .But if we reverse the situation, it will become difficult for learners to understand anything. Another example, when we teach counting to the students we should first take the help of concrete objects like beads, stones etc. and then proceed to digits and numbers.

#### **4. From analysis to synthesis:-**

When we divide a thing into easy parts or separate elements in order to understand it easily is called analysis. It is the process which helps in understanding the hidden elements of a thing or the cause of some incident or behavior. For instance, in order to tell about the structure or functions of heart, the parts of the heart are shown separately and knowledge of every part is given. After it the students are made to understand the structure or system of working of the heart. In this way, even a very difficult thing can be easily understood. Synthesis is just opposite of analysis. All parts are shown as a whole. The process of analysis is easier than synthesis for understanding a thing. This process develops the analytical power of the students. It is the best method of starting the teaching process. For example while teaching digestive system, we should first analyse the different parts of digestive system one by one and then gives the synthetic view of it. Hence a good teacher always proceeds from analysis to synthesis.

#### **5. From particular to general:-**

A teacher should always proceed from particular to general statements. General facts, principles and ideas are difficult to understand and hence the teacher should always first present particular things and then lead to general things. Suppose the teacher is teaching continuous tense while teaching English, he should first of all give few examples and then on the basis of those make them generalize that this tense is used to denote an action that is going on at the time of speaking. Hence a teacher should proceed from particular to general.

#### **6. From empirical to rational:-**

Empirical knowledge is that which is based on observation and first hand experience about which no reasoning is needed at all. It is concrete, particular and simple. We can feel and experience it. On the other hand rational knowledge is based upon arguments and explanations. For example suppose the students are to be taught that water boils on heating. They should first be made to heat the water and see it boiling. Then the teacher should explain that when water is heated, the molecules gain kinetic energy and there is thermal agitation of the molecules which make the water boil. This maxim is an extension of some of the previous maxims, namely proceed from simple to complex proceed from concrete to abstract and from particular to general.

**7. From induction to deduction:-**

The process of deriving general laws, rules or formulae from particular examples is called induction. In it if a statement is true in a special situation, it will also be true in other similar situations. It means drawing a conclusion from set of examples. For example when hydrogen reacts with boron, it gives Boron hydride, potassium reacts hydrogen, it gives potassium hydride, we come to the conclusion that all elements when reacts with hydrogen they form hydrides. While using this process in teaching, a teacher has to present particular examples or experiences and tell about similarity of their attributes. Deduction is just opposite of induction. In it, we derive a certain particular conclusion from general laws, rules or principles. For example in language teaching, before giving the definition of noun, the students are acquainted with the example of noun like man, chair, Delhi etc and then they are led to general definition of noun. So a good teacher always proceeds from induction and finishes at deduction.

**8. From psychological to logical:-**

Modern education gives more emphases on psychology of the child. The child's psychological development is of utmost important than any other thing. A teacher while teaching should follow this maxim viz from psychological to logical. Psychological approach takes into consideration the pupil his interests, abilities, aptitudes, development level, needs and reactions. The teacher should keep in mind the psychological selection of the subject matter to be presented before the pupils. Logical approach considers the arrangement of the chosen content into logical order and steps. It is child centered maximum. For example a teacher tells the story of a poem to students when they are not interested in reading, with this a teacher proceeds from psychological to logical sequence.

**9. From Actual to Representative:**

First hand experiences makes learning more vivid and efficient than to give them representative ones. A teacher while selecting the content for presentation should make all efforts possible to present it through actual, natural or real objects than from their improvised representative one's like pictures, models etc. For example to teach about 'Golden Temple Amritsar', a teacher should try his best to visit the actual place and that learning will be more vivid and the pupils will retain it for a long time inspite of teaching through sketches, model or a picture. Representative forms should be used at the higher classes than in lower classes.

**10. From Whole to Parts:**

This maxim is the offshoot of gestalt theory of learning whose main emphasis was to perceive things or objects as whole and not in the form of parts. Whole is more understandable, motivating and effective than the parts. In teaching, the teacher should first give a synoptic view of lesson and then analyze it into different parts. For example the teacher while teaching the pollination in plants, he should first take the flower then analyze it into

different parts and give detailed information about each and every part like the sepals, petals, androceium, gynoceium etc. In this way, maximum learning is possible. It is actually the reverse of the maxim “analyses to synthesis”.

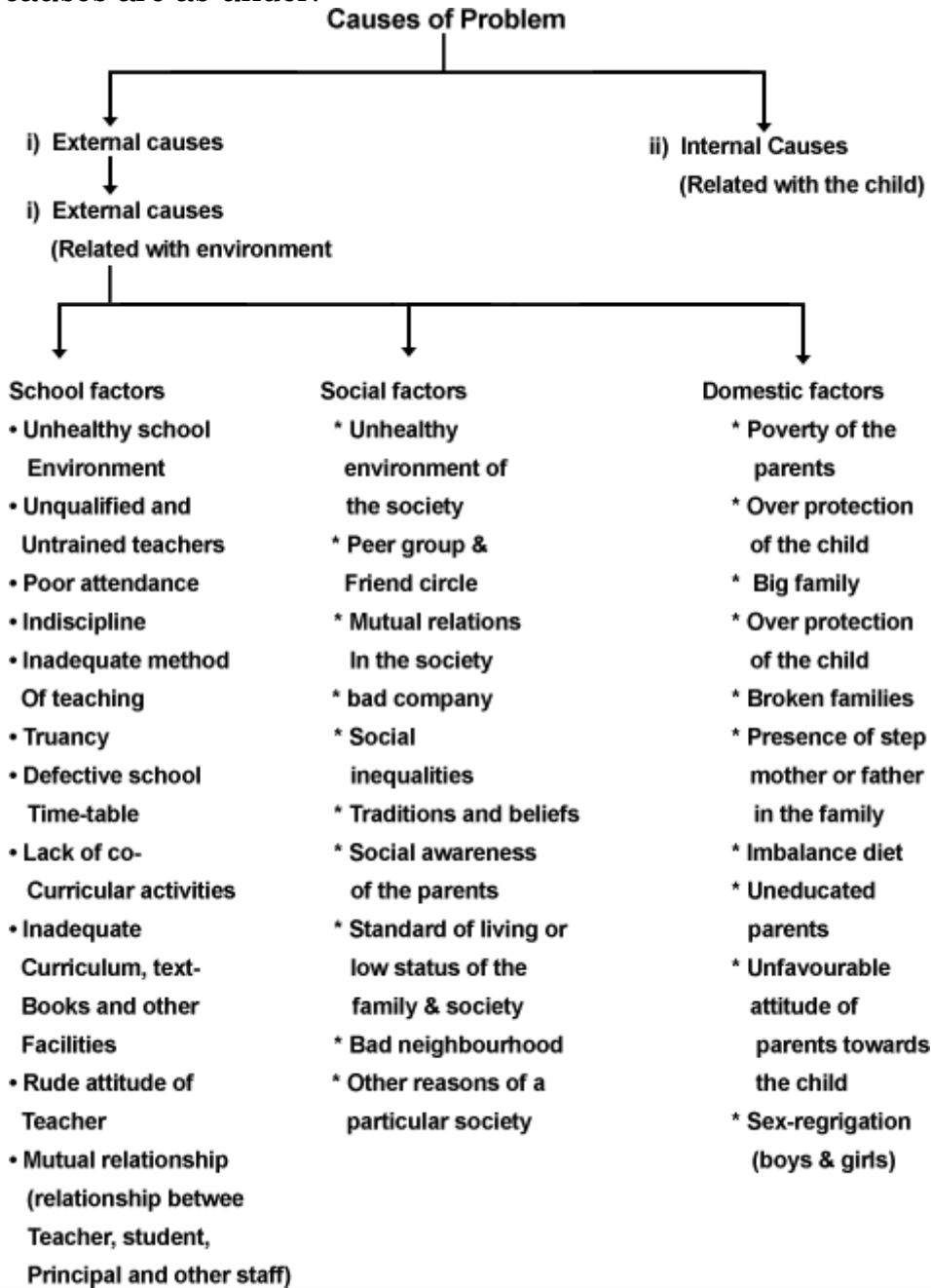
**11. From definite to indefinite:**

A teacher should always start from definite because definiteness has its limited boundaries and jurisdiction than indefinite things. We always have confidence on definite and tested things. We learn easily indefinite things on the basis of definite things.

**PROBLEMS OF TEACHING IN MATHEMATICS**

Mathematics which is an interesting subject is considered as a dry, hard and uninteresting one by the common persons and students. The main reason behind it is the lack of interest in the learners to the subject and tendency to memorize the content without comprehension. The content memorized or learnt without comprehending it, is generally forgotten. Therefore, to arouse and maintain the student’s interest in mathematics is a major problem for the teacher.

Problems of teaching in mathematics arise due to various factors. Details of factors/causes are as under:



**Internal Causes**

<b>Physical Causes</b>	<b>Psychological Causes</b>
<p><b>(a) Schonell</b> found that about 75% backwardness is due to the various types of physical diseases and defects. Burt also investigated that about 30% of backwards were poorly nourished, 10% very seriously ill nourished, 37% were suffering from tensils, speech defects.</p>	<p><b>(b) According</b> to Burt 9% back ward children suffer with neurotic condition and 2% were very excitable and emotional.</p>

Dumbness	Emotional instability
Defective eye sight	Lack of interest
Hard of hearing	Mental retardedness
Speech defects	Poor intelligence
Chronic diseases	Low I.Q. (according to Burt the backward children have I.Q. less than 85)
Physical ailment	Nervousness
Other physical defects	Anxiety
Postural defects	Emotional maladjustment
Immature birth	Negative attitude of the child
Hurt at birth	Mental hurt
Other causes	Other psychological causes

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It is a well known fact that students work most effectively at task in which they are genuinely interested. Students readily become interested in a thing which is new or exciting and perceived by them to be useful in their life. So, the teaching can be made more effective and interesting by correlating the subject matter with the things already studied or known by the students. Thus, the elements of novelty, usefulness, curiosity and relatedness are primary stimuli for awakening the interest. Some special devices and activities may also be adopted to arouse and maintain the interest in the subject.

### **Maintaining Interest in Mathematics**

The most important task of a mathematics teacher, especially at secondary level, is the creation of interest in the students towards the mathematics and to maintain it. This is not an easy task. The teacher has to do a purposeful planning for it. The use of stimuli is also essential for it. Novelty, utility, curiosity and relatedness are basic stimuli for awakening the interest in the subject. It is easier to develop interest in the student to their work but it is difficult task to keep them interested after the novelty work is worn off. So, the teacher should always try to keep interest alive by making the teaching interesting.

**Activities to be employed to maintain the interest in Mathematics:**

- Intellectual Activity
- Motivation
- Multi-sensory aids and devices
- Knowledge of practical utility
- Correlation with other fields of study
- Emphasis on vocational value
- Emphasis on recreational value
- Practical work
- Follow the principle of change
- Provide the psychological conditions for study
- Precision of suitable physical conditions for study
- Individual attention.

**Maintaining Effective Learning in Mathematics**

Learning is a dynamic process. It takes place through so many activities and avenues. The learning of mathematics involves various activities such as reading, writing, computing, comparison, analysing, interpreting, thinking, questioning, working with material objects etc. In all these activities reasoning and logical thinking is common. The suitable planning of these activities leads to desired understanding of the subject.

The effective or meaningful learning is a product of effective teaching. It can also be said that effective teaching induces effective learning. It is very difficult to give a specific formula for effective teaching but certain measures and techniques can be adopted to make the teaching, effective. Some important suggestions in this regard may be:

- Selection and organisation of content of mathematics according to age and mental level of students.
- Adoption of simple and interesting method for presenting the content.
- Providing sufficient opportunities for exercises and practice.
- Frequent application of knowledge and skills learnt by the students to avoid forgetting.
- There should be a provision for individual differences in the instructional procedure.
- The aims and objectives of teaching the subject and its particular topic should be very clear.
- Efforts for transfer of learning to other fields.

In view of organisation and application, mathematics is a cumulative and continuously expanding subject. While presenting a new content, a teacher has to face four main instructional problems:

- To help the students in achieving the initial understanding of new concepts and their relations.
- To help the student in making the threshold understanding into a sound and comprehensive understanding.
- To help in maintaining the attained knowledge and skills.



- To help in preparing the background for significant transfer of attained knowledge and skills to their physical, social and intellectual environment.

### Errors Analysis in Mathematics

#### What is an error?

A systematic step by step procedure is known as algorithm. When students are asked to solve a problem, they try to bring to their mind to the procedure, the algorithm that they have learnt in their classes.

In doing so some gaps arises as mentioned below:

- Concept and definition
- Rules for carrying out the steps
- The flow of and relation between the steps leading to the procedure as a whole.
- These gaps or error are called bugs.

#### Types of Errors

Some of error are easy to correct because they do not have a deeper, alternative conception behind them. This type of errors called as bugs, for example, students often interchange H.C.F & L.C.M. This error can be remove easily.

Some times it's very hard to correct because they are rooted in alternative conceptions. This type of errors called as stereotypes.

For example, students take the H.C.F. of numbers which are relatively prime such as 8 & 9, to be 0 not, due to common factors because absence of what one is looking for shown by the zero.

Questions: Give examples of prime numbers

Answer: 7, 9, 11, 13, 15,.....

Error: Students takes 9, 15,.... Etc (odd composite number) as prime.

Type: stereotype, replacement of more complex by a similar concept.

Discussion: The students has forgotten that prime number is not divisible my any other number than 1 and itself. Students fail to notice that 9 is divisible by 3 and 15 id divisible by 3 and 5.

Students replace the concept of prime by a relatively simpler, easier to remember concept of odd.

Remedy:

- Student should be confirmed that 9, 15, are odd, but not prime.
- Now student can conclude the primeness of natural number by checking whether the number is divisible by all primes less than it.

Student fail to comprehended that number may be classified in two different ways.

1. Odd/Even

2. Prime/Composite

An odd number can be neither a prime or student may ask to enter the numbers beginning with 2 in appropriate position as indicated

Odd

Prime 3, 5, 7, 11,

Composite 9, 15, 21,

Even

Prime 2

Composite 4, 6, 8, 10,

### **Speed and Accuracy**

Speed and Accuracy both are interlinked terms used in Mathematics. Speed without accuracy is of no use. An expert teacher is he who is able to solve the problems with the wink of an eye. So in teaching learning process. Firstly the students are taught how to solve the problems correctly and then they are learnt to enhance their speed by drill and practice. Speed and accuracy plays a vital role in every work of life not single in mathematics, e.g. a typist first learn identification of letters in key-board and then he types them slowly. After regularly practice, he gains speed with no faults in typing. His fast typing is speed and typing correctness is accuracy. Hence, term speed and accuracy runs altogether in every field where value is the main aims. Value refers to quality here. Here same principle is applied to the engineers who prepare softwares. The engineers can only when he said skilled in their field, if their product out put serves both speed and accuracy, their product will be appreciated and soon well bring a good name. Similarly, teachers, doctors, bakers, engineers, customers, shopkeepers etc. and even housewives should have both speed and accuracy in mathematical skills. For example if a mathematical teacher is unable to solve the problems in the class with speed and accuracy, he cannot be an effective teacher for his students. Generally, housewives go for shopping and they have to calculate whether the price and total cost of brought things are correct or not speedily and accurately because if they take more time to calculate, then the shopkeeper might get busy with other customers and then after it is not possible to realize his mistake despite of nagging. Thus speed and accuracy is in mathematics are important every where.

If a child solves a problem with speed but not accurately then it is of no use. Therefore, priority should be given to accuracy and then through drill and practice speed should be increased. Speed and accuracy are the symbol of intellectual abilities of an individual. In this support Locke has well remarked that, Mathematics is a way to settle in the mind of the children a habit of reasoning. Thus, speed and accuracy occupy a very important place in mathematics as well as in our daily life. So a mathematics teacher should try to train his students in acquiring both speed and accuracy.”

### REASONS BEHIND DROPPING IN SPEED AND ACCURACY IN MATHEMATICS:

For better result or output fully devotion to anything is the must thing. This can only when be gained if we are not falling victim distraction. Distracting attention from real aim will certainly drop both the speed and accuracy. It is obvious that fast speed, falls somewhat accuracy, but these both can be maintained if whole attention is to the aim to which we are involved. In job work, a machinist pays full attention to job, all distracting elements are kept away from him to gain speed and accuracy both. There are several reasons for a lack of speed and accuracy in mathematics. Some of the reasons are as follows:

- Untimely accomplishment of the work.
- Lack of imagination and power of memorization
- Lack of capacity to take quick decision
- Negative attitude towards maths
- Readiness and concentration deficiency
- Less ability to analyses the problem
- Weakness in calculation skills
- Weakness in oral work
- Overwriting and cutting in calculation work
- Wear blinkers while examining the work
- Not to represent rough work in right manner
- No chance to improve faults
- Lack knowledge of fundamental operations, rules and formulas of mathematics
- Wrong representation of digits and numbers on black board and answer sheets
- Want of alertness towards mathematics
- Untimely observation and unfit direction to students work
- No encouragements to students at right work
- Lack of self confidence and self dependability
- From the above points we can conclude that mathematical is such subject that needs both speed and accuracy to give outcomes in better proportion. Both the teacher and student are responsible to maintain it.

Means Adopted to Develop Accuracy in Mathematics: one things can do nothing it is common fact. Great men have also shared their experiences saying that, "It takes two to make quarrel." Then in mathematics, what does alone speed can do? Same is the case in life or universe, it needs couple to bring necessary change with speed, accuracy is also necessary to bring a change. If there is no change, there is no progress. If a person is on in his action, but he gain no quality or accuracy in work, his gain is considered useless. Specially in mathematics accuracy has the major place in every step as to create good interest in completion of the work. Below are given important suggestions adopting them a teacher can serve his purpose and desired output can also be obtained.

- Encouraging a child to make exact calculations.

- Developing a child habit of verifying calculation.
- Discouraging the students on wrong calculation and removing their mistakes.
- Providing the students remedial teaching finding their faults.
- Teaching the child to write correct words, numbers and sentences.
- Examining the students in fundamental operations, rules and formulae to develop their mechanical skills.
- Applying diagnostic approach to determine students faults.
- Developing in students the habits of analyzing and grasping the problem.
- Developing in students the habit to write down or to copy on from the black board.
- Clarifying the students that what is given? What is to determine? And how is it to be determined? In a question, before solving it.
- Emphasizing the students for drill work.
- Suggesting the students to write the method of calculation as to find the committed fault of any.
- Developing in students habit to draw figures and diagrams head in mathematics.
- Giving more emphasis on accuracy than speed.
- Developing in students habit to grasp question exactly them to solve.

From the above discussion it is clear that purpose of teaching in mathematics can only when be served, if a mathematics teacher knows all the measures how to develop speed and accuracy. Undoubtedly, Speed and accuracy in mathematics can bring system of teaching to a great height and thus, present increasing burden of study can be served by taking speed and accuracy together.

**Evaluation:**

Evaluation, particularly educational evaluation, is a series of activities that are designed to measure the effectiveness of the teaching-learning system as a whole. We' are already familiar with the fact that the teaching-learning process involves interaction of three major elements i.e., Objectives, learning experiences and learner appraisal. Evaluation takes care of all the interactive aspects of three major elements i.e., the whole teaching-learning system.

*“Evaluation is the collection, analysis and interpretation of information about any aspect of a programme of education, as part of a recognized process of judging its effectiveness, its efficiency and any other outcomes it may have.”*

**The above Definition offers the following**

*Evaluation is not just another word for assessment. The quality of our learner's learning may well be one of the outcomes we need to evaluate. But many other factors may be equally worth looking at.*

**Assessment:**

By assessment, we mean the processes and instruments that are designed to measure the learner's achievement, when learner are engaged in an instructional programme of one sort or another. It is concerned with ascertaining the extent to which the objectives of the programme have been met. The term assessment/is often used interchangeably with the terms evaluation and measurement. However, assessment has a narrower meaning than evaluation but a broader meaning than measurement. In its derivation, the word assess means "to sit beside" or "to assist the judge". It, therefore, seems appropriate in evaluation studies to limit the term assessment to the process of gathering the data and fashioning them into an interpretable form; judgement can then be made on the basis of this assessment.

Assessment as we define it, precedes the final decision-making stage in evaluation e.g., the decision to continue, modify, or terminate an educational programme.

**Measurement:**

It is mainly concerned with collection or gathering of data e.g., students scores in an examination. It is an act or process of measuring physical properties of objects such as length and mass. Similarly, in behavioural sciences, it is concerned with measurement of psychological characteristics such as neuroticism, and attitudes towards various phenomena.

Evaluation involves assessment and measurement it is a and more inclusive term than assessment and measurement.

Hence evaluation process is quite comprehensive and it is very much desired for effective teaching and learning.

**Types of Evaluation****Formative Evaluation**

The goal of formative Evaluation is to monitor student learning to provide ongoing feedback that can be used by instructors to improve their teaching and by students to improve their learning. More specifically, formative Evaluations:

- help students identify their strengths and weaknesses and target areas that need work
- help faculty recognize where students are struggling and address problems immediately

Formative Evaluations are generally low stakes, which means that they have low or no point value. Examples of formative Evaluations include asking students to:

- draw a concept map in class to represent their understanding of a topic
- submit one or two sentences identifying the main point of a lecture
- turn in a research proposal for early feedback

**Summative Evaluation**

The goal of summative Evaluation is to evaluate student learning at the end of an instructional unit by comparing it against some standard or benchmark.

Summative Evaluations are often high stakes, which means that they have a high point value. Examples of summative Evaluations include:

- a midterm exam
- a final project
- a paper
- a senior recita

**Continuous and Comprehensive Evaluation**

Continuous and comprehensive evaluation is an education system newly introduced by Central Board of Secondary Education in India, for students of sixth to tenth grades. The main aim of CCE is to evaluate every aspect of the child during their presence at the school. This is believed to help reduce the pressure on the child during/before examinations as the student will have to sit for multiple tests throughout the year, of which no test or the syllabus covered will be repeated at the end of the year, whatsoever. The CCE method is claimed to bring enormous changes from the traditional chalk and talk method of teaching, provided it is implemented accurately.

**BASIC FEATURES OR CHARACTERISTICS OF A GOOD EVALUATION PROCESS**

● **Validity:** A valid evaluation is one which actually tests what is sets out to test i.e., one which actually measures that behaviour described by the objective(s), under scrutiny. Obviously, no one would deliberately. Construct an evaluation item to test irrelevant material but very often non-valid test items are in fact used e.g., questions that are intended to test recall of factual material but which actually test the candidate's powers of reasoning, or questions which assume a level of pre-knowledge that the candidates do not necessarily possess.

● **Reliability:** The reliability is a measure of the consistency with which the question, test or examination produces the same result under different but comparable conditions. A reliable evaluation item gives reproducible scores with similar populations of students. It is therefore, independent of the characteristics of individual evaluations. In order to maintain reliability, one evaluative question should test only one thing at a time and give the candidates no other option. The evaluation should also adequately reflect the objectives of the teaching unit.

● **Practicability:** Evaluation procedure should be realistic, practical and efficient in terms of their cost, time taken and ease of application. It may be an ideal procedure of evaluation but may not be put into practice,



● **Fairness:** Evaluation must be fair to all students. This can be possible by accurate reflecting of range of expected behaviours as desired by the course objectives. To keep fairness in evaluation, it is also desired that students should know exactly how they are to be evaluated. This means that students should be provided information about evaluation such as nature of the materials on which they are to be examined (i.e., Context and Objectives), the form and structure of the examination, length of the examination and the value (in terms of marks) of each component of the course.

● **Usefulness:** Evaluation should also be useful for students. Feedback from evaluation must be made available to the students and weakness. By knowing their strength and weakness, Students can think of further improvement. Evaluation should suggest all the needful requirements for their improvement.

● **Interpretation of Results:** Another factor which must be considered in the choice of a test is the ease of interpretation of test results. A test score is not meaningful unless the teacher or counselor is able to decide what significance or importance should be attached to it and to make some judgment concerning its relationship to other kind of information about the student. Nearly all test publishers produce manuals designed to aid the teacher in interpreting test results.

But these manuals vary greatly on quality and in the thoroughness with which they do this important job. From the point of view of the teacher, principal, or counselor, the quality of the test manual should be just as important a factor in the choice of a test as the quality of the test itself

### **CONTINUOUS AND COMPREHENSIVE EVALUATION (CCE)**

This content refers to a system of school – based evaluation of student that covers all aspect of students development. As the nomenclature also suggests, this new pattern in evaluation is not one, two, three times a year but continuous one. It is a developmental process of assessment which emphasizes on two fold objectives and these objectives are continuity in evaluation and assessment of abroad based learning and behavioural outcomes on the other.

It is a total teaching-learning process and spread over the entire span of academic session. It means regularity of assessment, frequency of unit testing, diagnosis of learning gaps, use of corrective measures, refreshing and feed back to evidence to teacher and students for their self evaluation.

Second term comprehensive that the scheme attempt to cover both the scholastic and the co-scholastic aspects of students growth and development, CCE therefore a paradigm shift in evaluation, shifting the focus from testing to holistic learning. It aims to create good citizens possessing sound health, appropriate skills and desirable qualities besides academic excellence.

**Aims of CCE**

- To help develop cognitive, psychomotor and affective skills
- To lay emphasis on thought process and de-emphasize memorization.
- To make evaluation an integral part of teacher learning process.
- To use evaluation for improvement of students achievement and teaching-learning strategies on the basis of regular diagnosis followed by remedial instruction.
- To use evaluation as a quality control device to maintain desired standard of performance.
- To determine social utility, desirability or effectiveness of a programme and take appropriate decisions about the learning, the process of learning and learning environment.
- To make the process of teaching and learning a learner-centred activity.

**IMPORTANT FUNCTIONS OF CONTINUOUS AND COMPREHENSIVE EVALUATION**

● Continuous evaluation helps in regular assessment to the extent and degree of students progress (ability and achievement with reference to specific scholastic and non-scholastic areas).

● Continuous evaluation serves to diagnose weakness and permit the teacher to ascertain an individual pupil's strengths and weakness and his needs. It provides immediate feedback to the teacher, who can then decide whether a particular unit or concept needs re-teaching into the whole class or whether a few individuals are in need of remedial instruction.

● It helps the teacher to organize effective teaching strategies,

● Mainly times, because of some personal reasons, family problems or adjustment problems, the children start neglecting their studies, resulting in a sudden fall in their achievement.

If the teacher, child and parents do not come to know about this sudden fall in the achievement and the neglect of studies by the child continues for a longer period then it will result in poor achievement and a permanent deficiency in learning for the child.

The continuous evaluation helps in bringing awareness of the achievement to the child, teachers and parents from time-to-time. They can look into the probable cause of the fall in achievement, if any, and may take remedial measures in time, to help the child overcome it at their own level.

● By Continuous evaluation, children can know their strength and weakness. It provides the child a realistic self-picture of how he and she studies. It can motivate children to develop good study habits, to correct errors, and to direct their activities towards the achievement of desired goals. It helps an individual to determine the areas of instruction in which more emphasis is required.

● Continuous and comprehensive evaluation ascertains areas of aptitude and interest. It helps in identifying changes in attitude, character and value pattern.

● It helps in making decisions for the future, regarding choice of subjects, courses and careers.

● It provides information/report on the progress of students in scholastic and non-scholastic areas and thus help in predicting the future successes of the learner.

### **Formative Evaluation**

The goal of formative Evaluation is to monitor student learning to provide ongoing feedback that can be used by instructors to improve their teaching and by students to improve their learning. More specifically, formative Evaluations:

- help students identify their strengths and weaknesses and target areas that need work
- help faculty recognize where students are struggling and address problems immediately

Formative Evaluations are generally low stakes, which means that they have low or no point value. Examples of formative Evaluations include asking students to:

- draw a concept map in class to represent their understanding of a topic
- submit one or two sentences identifying the main point of a lecture
- turn in a research proposal for early feedback

This process is used to measure and monitor the learning of students during the period of instruction.

**Objective:** Its main objective is to provide continuous feedback to both teacher and student concerning learning success and failures while instruction is in process. Feedback to students provides reinforcement of successful learning and identifies the specific learning errors that need correction.

Feedback to teacher provides information for modifying instruction and for prescribing group and individual remedial work. Formative evolution depends on tests, quizzes, homework, classwork, oral questions prepared for each segment of instruction. These are usually mastery tests that provide direct measures of all the intended learning outcomes of the segment.

**Methodology** The tests used for formative evaluation are mostly teacher-made. Observational techniques are also useful in monitoring student progress and identifying learning errors. Since formative evaluation is used for assessing student learning progress during instruction, the results are not used for assigning course grades.

### **Summative Evaluation**

It is used to find out the extent to which the instructional objectives have been achieved particularly at the end of a terminal period. The goal of summative Evaluation is to evaluate student learning at the end of an instructional unit by comparing it against some standard or benchmark.

Summative Evaluations are often high stakes, which means that they have a high point value. Examples of summative Evaluations include:

- a midterm exam
- a final project
- a paper
- a senior recita

**Objective/Purpose:** It is used primarily for assigning course grades or for certifying student mastery of the intended learning outcomes at the end of a particular course programme. Although the main purpose of summative evaluation is assigning grades, It also provides information judgment the appropriateness of the course objectives and the effectiveness of instruction.

**Methodology/Technique:** The techniques used for summative evaluation are determined by the instructional objectives. For this evaluation, there are external examination as well as teacher-made tests, ratings etc.

### DIFFERENCE BETWEEN SUMMATIVE AND FORMATIVE EVALUATION

● Summative evaluation refers to the assessment of worth whileness of the instructional programme which has already been completed, while formative evaluation refers to the assessment or worth of the instructional programme which is still going on and can still be modified.

● A formative evaluator is a partisan of the instructional sequence and does everything to make teaching-learning better. A summative evaluator is an uncommitted non-partisan person who is to pass judgment on an instructional endeavour.

● A summative evaluator gathers information and judges the merit of overall instructional sequence to adapt that sequence. The audience of summative evaluation is the consumer of the instructional programme in contrast to the formative evaluator whose audience is the designer and the developer of the programme.

● Summative evaluation, judgmental in nature. Its purpose is to appraise the teaching-learning process and to distinguish it from-formative evaluation. It is an end of the course activity concerned with assessment of the larger instructional objectives of a course or a substantial chunk of the course.

● Formative evaluation is developmental, not judgmental in nature. Its purpose is to improve students learning and instruction. Therefore, its major function is feedback to the teacher and student to locate strengths and weaknesses in the teaching-learning process in order to improve it.

● Summative evaluation is thus a judgmental activity focused on certification of students achievement But formative evaluation is a means of

determining what the pupils have mastered and what is still to be mastered, thereby indicating the basis for improvement of students learning.

### **DIAGNOSTIC TESTING AND REMEDIAL TEACHING**

Your main role as a teacher is to promote quality learning among the students. This is possible only when you act as a guide and the students actively participate in the process of learning. During the teaching-learning process, you have to locate and identify the areas where the learner commits mistakes. It is the crucial stage of the teaching-learning process where you have to DIAGNOSE and prepare instructional material for REMEDIAL TEACHING to ensure the desired quality of learning.

At this stage the role of a teacher is just like a doctor's. The doctor takes all the steps necessary to diagnose the disease by performing different tests and then prescribes medicines for the particular disease. In the case of education the process of Diagnostic Testing is the STEP and REMEDIAL TEACHING is the PRESCRIPTION. Hence diagnostic testing and remedial teaching are very essential for ensuring effective learning and in improving the quality of education. In this article an attempt is being made to discuss the organization of Diagnostic Tests in teaching learning process and undertaking appropriate remedial measures.

In general, after completing a particular unit/topic you conduct a test to assess the achievements of learners. After evaluation you draw some conclusions and you find that some of the students have fared very well and a particular group of students have achieved below your expectations. Now you will have to find out the causes for this low achievement or slow learning. There would be certain reasons for this low achievement. Now it is very essential to find out the particular area where the difficulty lies or the particular concept where the learner commits errors. To locate and identify the areas of learning difficulties leads to Diagnostic Testing.

After identifying the areas where the error lies, you have to find out the reasons due to which the particular child/group of students have not responded well. At this stage you have to play the role of a doctor. If a patient visits the doctor's clinic he suggests different tests relevant to the symptoms observed by him. After getting reports he is in a position to identify and diagnose the disease and then prescribe the medicine for it.

Likewise, as a teacher, you have to first identify and locate the area where the error lies. The process adopted for this purpose in educational situations is known as Diagnostic Testing. We may say that Diagnostic Testing implies a detailed study of learning difficulties.

#### **In diagnostic testing the following points must be kept in mind:**

- i) Who are the pupils who need help?
- ii) Where are the errors located ?
- iii) Why did the error occur ?

While performing a Diagnostic Test you have the specific aim to analyze the exact nature of the progress made by the learner in a particular topic/unit and to know the particular area of weakness/error which requires a series of carefully graded tests. The main aim of Diagnostic Testing is to analyze not to assess.

If we consider arithmetical attainments from both a qualitative and quantitative standpoints, we can distinguish four main points (i) accuracy (ii) speed of writing (iii) methods of work and (iv) extent of the arithmetic process mastered.

It is obvious that you will try to find the feedback through the medium of class work or through weekly or monthly tests which indicate pupils' ability in each of the four aforesaid directions. But it is not enough for teaching purposes particularly with those pupils/learners who are slow learners. With this group of learners you are required to have a more analytical estimate of their achievements.

#### **THE ESSENTIAL STEPS IN EDUCATIONAL DIAGNOSIS ARE:**

- i) Identifying the students who are having trouble or need help.
- ii) Locating the errors or learning difficulties.
- iii) Discovering the causal factors of slow learning.

#### ***i) Identifying the students who are having trouble or need help***

First, one must know the learners who require help. For this you can administer a general achievement test based on the topics already taught. After evaluation you will be in a position to make lists of students who are below average, average or above average. Next, one has to locate the area where the error occurs in order to have a deeper insight into the pupils' difficulties.

#### ***ii) Locating the errors or learning difficulties***

After identifying the students who need help and visualising the necessity of additional instructional material to improve the quality of learning, your main role is to find out the area where the learner commits mistakes or which is the area where learning difficulties lie.

In some cases of learning difficulties, the causal factors are relatively simple. A student may be inattentive during teaching-learning or may be committing errors due to insufficient practice or irregular attendance.

#### ***iii) Discovering the causal factors of slow learning.***

Sometimes the cause is ill-health or faulty work habits etc. It has also been observed sometimes that the basic cause of low achievement is a feeling of helplessness or the complexity of the subject-matter which perhaps is much above the level of their comprehension.

#### **REMEDIAL TEACHING**

While diagnosis is the process of investigating the learners' difficulties and the reasons for this, its follow up leads to actions that may help children



make up their deficiencies. This step is generally termed **Remedial Teaching**. So you have to be skilled in preparing or arranging for such materials which may be used to undertake corrective instruction and thus enhancing the quality of learning.

***The following points should be kept in mind while selecting appropriate instructional material:***

- i) The corrective material should be designed to correct the students' individual difficulties.
- ii) You have to analyze the work of slow learners by means of observation, interview and Diagnostic Testing. A careful consideration of the three may help decide what kind of corrective material is to be designed and whether material will be adequate to correct the specific difficulties of learners.
- iii) The corrective material should be graded, self-directive and should permit students to work independently. Written directions, which accompany the material, should be easily readable and comprehensible by the students.
- iv) The corrective material must permit individuals to progress according to their pace.
- v) The material should encourage systematic recording of evidence of pupils' progress.

The diagnosis made on the basis of a graded test provides a definite direction to remedial teaching. The teaching-learning strategy should of course, put emphasis on exercises in the relevant area of difficulty until mastery is achieved. Further testing would be desirable to examine the impact of remedial teaching.

### **Conclusion:**

In this article you have learnt about Diagnostic Testing which is the most important part of the teaching-learning process. It implies a detailed study of learning difficulties. Its aim is to analyze, not to assess.

The nature and purpose of Diagnostic Testing is to identify the areas of difficulties where the learner commits errors. The stages of diagnostic testing are:

- i) Identifying the students who need help.
- ii) Locating the error/learning difficulties.
- iii) Discovering the causal factors.

After locating the area where the difficulty lies, as a teacher you will devise some strategy to remove problems in learning and the causes due to which the learner has faced the difficulties. The strategy used by you to remove the weakness of the learner is known as remedial teaching. Diagnostic Testing leads to remedial teaching in which you have to prepare instructional

material for quality learning, adopting different methodologies as per needs of the individual or a particular group.

### **ACHIEVEMENT TEST**

Teachers teach and help the learners to learn. The learning that takes place is assessed or evaluated not only for the learner's benefit but also for the teacher to evaluate his /her own work. At the end of a lesson or a group of lessons, the teacher needs to get feedback on what the learner has achieved, as a result of the teacher's efforts and also, indirectly to assess his/her own achievement as a teacher. This feedback comes with the help of a tool, generally an achievement test. An achievement test is designed to evaluate a unit during the teaching-learning process.

### **PURPOSE OF ACHIEVEMENT TESTS**

Achievement tests are universally used in the classroom mainly for the following purposes :

- To measure whether students possess the pre-requisite skills needed to succeed in any unit or whether the students have achieved the objective of the planned instruction.
- To monitor students' learning and to provide ongoing feedback to both students and teachers during the teaching-learning process.
- To identify the students' learning difficulties- whether persistent or recurring.
- To assign grades.

### **TYPES OF QUESTIONS**

There are mainly three kinds of questions - essay, short answer and objective type.

#### **Essay Type**

The essay type questions are still commonly used tools of evaluation, despite the increasingly wider applicability of the short answer and objective type questions. There are certain outcome of learning (e.g. organising, summarising, integrating ideas and expressing in one's own way) which cannot be satisfactorily measured through objective type tests. The importance of essay tests lies in the measurement of such instructional outcomes.

An essay type question may give full freedom to the students to write any number of pages. The required response may vary in length. Limit may be imposed by restricting the content and the length of student's response in the statement of a question. Restricted response type items are quite useful for testing learning outcomes which require interpretation, application of outcomes which are specific and clearly defined in nature. Such types of

questions help to reduce subjectivity in marking, which is considered to be the major drawback of essay tests.

In extended response type questions full freedom is given to the student to exercise his-her competence and demonstrate the best he/she possesses, of course, pertaining to the area of the subject. There is freedom to select, organise, integrate, evaluate and express in any way one likes or deems appropriate. Such questions, although useful for measuring global type of abilities, are not suitable for measuring specific learning outcomes, besides being difficult to grade.

### Short Answer Questions

Short answer questions generally require exact answers and, although taking many forms, they share the following distinctive features.

- i) They usually take less than five minutes to read and answer, many take less than a minute.
- ii) They include some guidance on the extent of the answer required c.g. the size of answer, space or specific instruction such as "In not more than 20 words ..."

iii) The answer is supplied by the pupil, not pre-selected as in objective questions.

They can be grouped into two broad categories :

- a) extended answer
- b) insert and completion

### **Extended Answer Type**

The extended answer version includes questions which require pupils to write a brief description, draw a map, make a list, perform a calculation, translate a sentence, write down a definition or formula and so on. They are probably the commonest form of questions used in schools and are frequently used by examining Boards. They are deceptively easy to set and usually difficult to mark with any degree of speed and consistency.

### **Completion Type**

The commonest form of completion questions is one where the pupil is required to add one or two words to complete an incomplete statement correctly. Where the missing words are in the body of the statement to be completed it is usually called an insert type. A completion type is where the words are required at the end of the statement. The use of insert or completion questions is not, however, limited to written statements and can be used to prepare extremely good questions based on incomplete maps, drawings, diagrams, formulae, calculations, and the like.

### Objective Type Questions

What is an objective question? Simply, an objective question is one which is free from any subjective bias - either from the tester or the marker. Confusingly, in educational jargon, the adjective 'objective' usually means 'not subjective' while the noun 'objective' usually means an aim, a goal, target or intention. This sub-section is not about course objectives-aims, intended learning outcomes, etc. -but about testing which is free from subjective elements. There can only be one right or objective answer to an objective question. Objective questions can take various forms, but invariably they require brief answers with little or no writing. A simple tick or a quick oral answer may be enough.

### ***Simple Recall***

The most common used objective type question by teachers as part of their day-to-day teaching is simple recall. The teacher asks a short question, expecting a quick one-word answer or a simple statement completed.

### ***Multiple Choice***

A Multiple choice-item consists of three parts -a stem, a key and a number of distractors. The key and distractors together are often referred to as options. The stem can be either a direct question or an incomplete statement; the key is the correct answer and the distractors are plausible but incorrect answers.

### ***True-False***

As its name implies, the basic true-false item requires the pupil to select either 'true' or 'false' as the answer. It is usually written in the form of a statement which the pupil must decide as being either 'true' or 'false' or alternatively choose between other word pairs relating to the statement such as greater than-less than, plus-minus, often-rarely, same different, 'faster slower' and so on. It is the possibilities offered by these other pairs which make the true false form a particularly useful one.

### ***Matching Block***

The matching block format consists of two lists and the pupil is required to correlate correctly one or more entries from one list with one or more entries from the other so that correct matching by elimination is not possible.

Audio Visual Aids/ Instructional Media/ Teaching Aids In Teaching

### **Introduction:**

Audio visual material must be seen in their relationship to teaching as a whole and to the learning process as a whole, until the teacher understands the relationship between audio visual material and teaching learning process.

Audio visual materials are produced, distributed and used as planned components of educational programs. It helps the process of learning that is motivation, classification and stimulation. A.V. aids are multi-sensory materials which motivate and stimulate the individual. It makes dynamic learning experience more concrete realistic and clarity. It provides significant gains in thinking and reasoning.

Audio visual aids are sensitive tools used in teaching and as avenues for learning. These are planned educational materials that appeal to the senses of the people and quicken learning facilities for clear understanding.

#### Definitions:

- 1. According to Kinder S. James:** Audio visual aids are any device which can be used to make the learning experience more concrete, more realistic and more dynamic.
- 2. According to Burton:** audio visual aids are those sensory objects or images which initiate or stimulate and reinforce learning.
- 3. According to Carter.v.Good:** audio visual aids are those aids which help in completing the triangular process of learning that is motivation, classification and stimulation.
- 4. According to good's dictionary of education:** audio visual aids are any thing by means of which learning process may be encouraged or carried on through the sense of hearing or sense of sight.
- 5. According to Edger Dale:** audio visual aids are those devices by the use of which communication of ideas between persons and groups in various teaching and training situations is helped. These are also termed as multi sensory materials.

#### Purposes of Teaching Aids:

- To supplement and enrich teachers own teaching to make teaching-learning more concrete.
- To serve an instructional role in itself.
- To create interest among the group.
- To make teaching as an effective process.

#### Advantages of Teaching Aids :

1. Teaching Aids helps in effective perceptual and conceptual learning.
2. Teaching Aids helpful in capturing and sustaining attention of students.
3. Teaching Aids arouses interest and motivates students to learn.
4. Teaching Aids is helpful in new learning.
5. Teaching Aids helps in saving energy and time of both the teacher's and students.
6. Teaching Aids provides near realistic experience.
7. Teaching Aids can meet individual demands.
8. Teaching Aids is useful in for education of masses.

#### Characteristics of good teaching aids:

Teaching aids should be

- Meaningful and purposeful
- Motivates the learners
- Accurate in every aspect
- Simple and cheap
- Improvised
- Large in size
- Up-to-date
- Easily portable

**CLASSIFICATION OF A.V.AIDS:**

The audio – visual aids have been classified in a number of ways according to different approaches,

**1. Technical Approach:-**

They have been classified into two types viz, audio aids and visual aids.

**a. Audio – aids:-**

The aids involving the sense of hearing are called audio – aids e.g; radio, tape-recorder, records player etc.

**b. Visual aids:-**

Those aids which use sense of vision are called as visual aids, e.g; models, pictures, maps, bulletin board, slides, epidiascope, over head projector etc.

**2. According to 2nd approach,**

the audio – visual aids have been classified into two types viz; projected and non- projected teaching aids.

**a. Projected aids:-**

Teaching aids which help in their projection on the screen are called as projected aids. For example, film strips, slides, film projector, overhead projector, epidiascope etc.

**b. Non –Projected aids:-**

Teaching aids which do not help in their projection on the screen are called non-projected teaching aids. For example, chalk board, charts, actual objects, models, taps – recorder, radio etc.

**Non –Projected Aids**

- [ACTIVITY AIDS](#)
- [DISPLAY BOARDS](#)
- [DIMENSIONAL AIDS](#)
- [GRAPHIC AIDS](#)
- [AUDITORY AIDS](#)

**PRINCIPLES FOR THE EFFECTIVE USE OF TEACHING AIDS:**

- Audio visual materials should function as an integral part of the educational program.
- Teaching Aids should be centralized, under specialized direction and leadership in educational programs.
- An advisory committee consisting of representative from all areas of curriculum should be appointed to assist in selection and coordination Teaching Aids.
- An education program should be flexible.
- Teaching Aids should be carefully located to eliminate duplication, easy accessibility and convenient use.



- Teaching Aids should be available whenever and wherever they needed for effective utilization as an integral part of curriculum.
- Budget appropriations should be made regularly for a.v. education programs.
- Periodic evaluation to be done to assess the function of, utilization and expenditure of the program.

### ACTIVITY AIDS

There are certain learning situations in which student participation through direct experiences can be easily incorporated, these are called activity aids. The activity teaching aids are really of great value as they put students in a role of active seekers of knowledge. There are five important activity teaching aids, which are listed below:-

- 1) Field trips
- 2) Demonstrations
- 3) Experiments
- 4) Dramatizations

### FIELD TRIPS

*Types of field trips: -*

Depending on the place of visit and its duration, field trips are mainly of the following four types,-

- a) Local school trips
- b) Community trip
- c) Educational trips
- d) The natural hunt

### Advantages of field trip:

Field trip provides learning experience in the real life situation by direct contact with objects, process, and systems and thus has many advantages which are enumerated as follows:

- It provides accurate information objects, process, and systems in their real life setting.
- It provides meaningful direct experience and hence results in lasting learning.
- The students learning can be easily diverted towards effective learning.
- Field trips are valuable aids to what students are curious about the natural and man-made process and objects.
- field trips can effectively supplement the classroom learning through application and reviewing the experiences of student.

**Limitations of field trip:**

- A field trip may be occasional activity which at best supplement some learning segments of the syllabus.
- They can be expensive and out of reach for many disadvantaged and poor students.
- Field trips require proper and detailed planning to make them meaningful otherwise the trip leads to confusion, and fails to fulfill the requirement

**DEMONSTRATIONS:-**

Demonstration method is a concrete visual aid, because of its wide use in the teaching of science. In nursing education, it is used for this purpose and also for clinics, conferences, laboratory classes, symposia, autopsies, and teaching of health to patients. The demonstration method teaches by explanation and exhibition. In short, it is a performance to show a process or activity to others. When a teacher demonstrates, students observe and imitate to learn

**Advantages of demonstration:-**

The following are the advantages of demonstration method.

- It activates several senses. This increases learning, because it gives a better opportunity for observational learning.
- It clarifies the underlying principles by demonstrating the 'why' or 'how' of the procedure.
- It provokes interest by use of concrete illustrations.
- It correlates theory with practice engages student's attention and concentration.
- It encourages student's participation in learning through questions and answers as the teacher performs.

**EXPERIMENT**

An experiment is a learning activity in which students collect and interpret observations using measuring instruments to reach some conclusions. In science subjects experiments are used invariably used as instructional aid as they encourage learning by doing. While giving a lesson on an experiment, the teacher should organize the instruction so as to make the students aware of the following steps of the experiments:

- 1) Objectives of the experiments
- 2) Apparatus required
- 3) Procedure or methodology
- 4) Observations of data
- 5) Computation (totaling) of the observations made.
- 6) Results or conclusion
- 7) Precautions
- 8) Ideas for future work

## DRAMATIZATION

Dramatization is a very potent method of keeping the class room instruction lively and interesting. When a teacher dramatizes a lesson, the students become both the spectators and participants. This makes learning easy and permanent.

### ***Types of dramatizations suitable for class room instruction:-***

- 1) Role-play
- 2) Play lets
- 3) Pageant
- 4) Pantomime
- 5) Tableaux

### **Advantages of dramatization:**

- Dramatization gives an added advantage of students working as both observers (spectators) and doers (participants) unlike in experiment where there are just doers and in demonstration where there are just observers.
- Dramatization makes learning a pleasure children love to act and show off.
- Dramatization involves students totally and they appreciate the lessons remember it better
- Dramatization develops the social skills required for them such as cooperation, co-ordination, punctuality, and human relations etc.
- Dramatization makes students creative, sensitive, and alert.

## DISPLAY BOARDS

### CHALK BOARD

#### DEFINITION

A chalkboard or blackboard is a reusable writing surface on which text or drawings are made with chalk or other erasable markers. Blackboards were originally made of smooth, thin sheets of black or dark grey slate stone. Modern versions are often green or brown and are thus sometimes called a green board or brown board instead.

A blackboard can simply be a piece of board painted with matte dark paint (usually black or dark green). A more modern variation consists of a coiled sheet of plastic drawn across two parallel rollers, which can be scrolled to create additional writing space while saving what has been written. The highest grade chalkboards are made of a rougher version porcelain enameled steel (black, green, blue or sometimes other colours). Porcelain is very hard wearing and chalkboards made of porcelain usually last 10-20 years in intensive use.

**Blackboards have Disadvantages:**

- They produce a fair amount of dust, depending on the quality of chalk used.
- Some people find this uncomfortable or may be allergic to it, and there has been speculation about links between chalk dust and respiratory problems.
- The dust also precludes the use of chalk in areas shared with dust-sensitive equipment such as computers. However, these alternative methods of displaying information have drawbacks of their own.
- The scratching of fingernails on a blackboard is a sound that is well-known for being extremely irritating.

Blackboards are also used in many establishments (typically public houses) as a form of advertising often for upcoming events and menus - as well as to keep the score in darts matches

**FLANNEL BOARD**

Sometimes called a flannel graph.

This teaching tool is called by different names: Visual Board , Frick Board, Slap Board, Felt Board, Coherograph, Video graph. Flannel graph is a storytelling system that uses a board covered with flannel fabric, usually resting on an easel. It is very similar to Fuzzy felt, although its primary use is as a storytelling medium, rather than as a toy

**How to use**

The principle involved is the inter looking of fibers of two rough or bairy surfaces, so that the pieces pressed on to a background which is hard and vertical will stay. It can be illustrated on a larger scale by pressing two tooth brushes or hair brushes together, so the bristle inter-look. In case of flannel graph similar principle of friction helps an object to cling to the surface of the board.

The flannel board is usually painted to depict a background scene appropriate to the story being told. Paper cutouts of characters and objects in the story are then place on the board, and moved around, as the story unfolds. These cutouts are backed, either with flannel, or with some other substance that adheres lightly to the flannel background, such as coarse sandpaper.

**Advantages:**

- Permits numerous and varied arrangements of visual materials.
- Permits the use of either chart or small pieces of material Materials can be packed and transported complete notes. 3) Permits the development of a complete story.
- Promotes conscientious planning, which must precede the development of the material in the first place.
- Challenges one to develop symbols to portray such things as abstractions.

- Easier to construct materials for flannel board than to make slides or movies.

**Disadvantages:**

- Transportation and storing of boards and materials is a problem. Suitable tables to support boards must be available.
- Time and cost of making material for presentation present a problem.
- Cost of boards themselves can't be overlooked.
- Presentation is limited a new idea involves a lapse of time before the new material can be added
- Might tend to deter one from using other more effective methods and techniques when it is evident that other methods might be more appropriate.
- To tell a complete story it often takes either too much board space or smaller designs and materials some of which cannot be seen well.

**BULLETIN BOARD****DEFINITION**

It is a soft board which will hold pins or tags almost suitable. Simple device placed either indoor or outdoor. Items generally displayed are photographs, publications, posters, news paper cut outs.

**Advantages**

- Explains important events Reports special activities

**Disadvantages**

- Not effective for illiterate group.
- Takes lot of pre-planning and preparation

A bulletin board (pinboard, pin board or notice board in British English) is a place where people can leave public messages, for example, to advertise things to buy or sell, announce events or provide information. Dormitory corridors, well-trafficked hallways, lobbies, and freestanding kiosks often have cork boards attached to facilitate the posting of notices. At some universities, lampposts, bollards, trees, and walls often become impromptu poster sites in areas where official boards are sparse in number.

**PEG BOARD**

It is a type of board which contains small holes to fix certain letters into the holes which is used especially in the offices to display certain items, name of the personal or faculty member.

**MAGNETIC BOARDS**

It is a framed iron sheet carrying porcelain coating in some dark color generally black or green. It can be used to display pictures, cutouts and light objects with disc magnets or magnetic holders.

**DIMENSIONAL AIDS**

## MODELS

**Definition:** a model is a recognizable representation of a real thing three dimensionally, that is height, width, and depth is felt as reality.

### **Types of models:**

**1. Solid models:** it is the replica of an original thing made with some suitable material like clay, plaster of Paris, wood, iron etc. to show the external parts of the things. Ex: globe, clay model of human and animal.

**2. Cutaway and x-ray models:** are the replicas of the original things to show internal parts of a thing. Cross sectional models are difficult to make in the class room or institutions as they require expertise to construct them. Ex: cross sectional model of human body.

**3. Working models:** these models are either actual working things or their miniature replicas. For illustrating an operation. Ex: a motor, a generator.

**4. Sand models:** made by using sand, clay, saw dust, ex: a tribal village, a forest area.

### **Advantages:**

- Models heighten reality of things and make learning direct and meaningful as they are three dimensional.
- Models illustrate the application side of certain principles and laws.
- Models explain the complex and intricate operations in a simplified way and thus make comprehension easier.
- Models are lasting and ultimately work out to be cheaper teaching aids.
- Still models are easy to make with the help of discarded materials like empty boxes, pins, clips, nails, and clay.
- Models are to reasonable size and convenient to handle.
- Models involve the use of all the five senses and thus make learning effective.

### **Limitations:**

- It requires expertise to make.
- Time consuming.
- Some of the models may be very expensive.

## OBJECTS AND SPECIMENS

### **Definition:**

A collection of real things for instructional use refers to objects.

A specimen is a sample of the real object or a material.

### **Using objects and specimens:**

while using the specimen and objects as teaching aids, a teacher must keep the following points in her mind.

- Plan your teaching with certain simple and direct observations of the object or specimen being referred to.
- Ask questions from the students to elicit more details of the features of the object or specimen under observation.
- Clarify and emphasize important structural details of the object or specimen under observation



- Provide review and practice to make learning permanent.

**Sources of objects and specimens:**

- Local markets
- Manufacturers and factories
- Discarded material from the houses
- Specimen found in the nature can be collected by students from field trips and nature hunt
- Plasters casts can be purchased
- Wild flowers, leaves shells, stones butterflies moths, insects can also be procured.

**Mounting the objects and specimens:**

Objects and specimens should be mounted in shallow boxes in an artistic way and the boxes should be covered with cellophane paper. Also label each object or specimen using self adhesive paper.

**Advantages of objects and specimens:**

- Collection of objects and specimens by students requires interaction with others leading to development of social skills and values.
- Students when collect and display objects and specimens derive satisfaction of contributing to the school and teacher something worthwhile.
- Student's power of observation and first hand experiences is enhanced by collection of objects and specimens.
- Student's personal collection of objects and specimens can be good source of doing investigatory projects.
- Collection of objects and specimens become an interesting educational pursuit of the teacher and students alike.
- It arouse some interest among students in learning
- Objects and specimens involve all the five senses in the process of learning
- It heighten the reality in the class room
- It makes teaching lively.

**EXHIBITIONS**

Many times in the school, a department of the school or a class put up their work for showing it to the people out side the school, and such a show called exhibitions.

The pieces of work done by the students for an exhibition are called exhibits.

**Requisites for exhibition:**

- The exhibition should have a central theme with a few sub themes to focus attention to a particular concept
- The exhibits should be clean , labeled properly
- The concepts of contrast in color and size should be used for lying out the exhibitions
- The exhibits should be so placed so the most visitors , can see them
- The place and exhibits should be well lighted
- To capture attention and interest of visitors , both motion and sound should be utilized

- The exhibition should have some exhibits with operative mechanism such as switches, handles, to be operated by the visitors to observe some happenings.
- The exhibition should include lot of demonstrations as they involve deeply the students and the visitors
- The exhibition should be able to relate various subjects' areas to provide integrated learning.

**Advantages:**

- Exhibitions inspire the students to learn by doing things themselves and they get a sense of involvement
- Exhibitions give students a sense of accomplishment and achievement
- Exhibitions develop social skills of communication , cooperation, coordination
- Exhibitions foster better school community relations and make community members conscious about the school
- Exhibitions couple information with pleasure
- Exhibitions foster creativity among students.

**Disadvantages:**

- Requires thorough preparation
- Time consuming
- Require funds or budget.

**MUSEUMS****Definition:**

A museum is a building displaying a collection of historical relics, antiques, curiosities, works of arts, works of science, literature and other artifacts of general interest.

Museums can be useful both for public education and specific class room instructions.

**Setting up school museum:**

- School should have enough space
- Take the help of students, collect old and new objects and articles
- Accept donations from various organizations who donates the articles
- Students can be guided to prepare the exhibits
- All the collected and prepared articles should be displayed and labeled
- A detailed report book should be maintained giving a brief description of each museum pieces
- The museum rooms should be well lighted
- It should be cleaned and maintained timely.

**Dioramas:****Definitions:**

A diorama is a three dimensional arrangement of related objects, models, and cut outs to illustrate a central theme or concept.

The objects and models are generally placed in a big box or show case with a glass covering and background printed with a shade or a scene. Ex: a harvest scene, a planting scene etc.

**Advantages:**

- Provide a good opportunity to learn
- It gives the appearance of actual things which can not be brought to the class room
- Interesting and enhance creativity
- Live things also can shown in diorama ex: aquarium
- Provides students to do project works

**Disadvantages:**

- sometimes cost effective
- Needs expatriation for the preparation
- Require budget
- Sometimes it may misguide the student if is not the replica of actual thing.

**MOCK UPS**

It emphasizes the functional relationship between the device reality and its workability. Certain element of the original reality is emphasized to make it more meaningful for the purpose of instruction.

In common usage, a mockup is a scale model of a structure or device, usually used for teaching, demonstration, testing a design, etc.

Mockups are also used in the Consumer goods industry, as part of the product development process, when the size, impression and/or artworks have to be tested and approved.

Mockup is also a frequently used term when talking about an early layout or sketch of a Web site or GUI program.

**PUPPETS**

One of the old and popular arts in Indian villages is puppetry. Puppetry is an education cum entertaining aid in which puppets manipulated by the performer is a person termed as a characters in a story to be depicted.

**Definition:**

A puppet is a manipulative doll dressed as a character and the performer is a person termed as a puppeteer. A good puppeteer has to blend his art with dramatization to produce the desired effect. It is used as an effective teaching aid for languages and social sciences.

**Types of puppets**

**1. String or marionettes puppets:** Marionettes consist of puppets with hinged body parts which are controlled by nine strings produces required movements in the puppet. These puppets are mainly manipulated by professional puppeteers.

**2. Stick puppets:** - stick puppet are the painted cutouts attached by sticks. The actions of these puppets are manipulated by the teacher and students by hiding behind a screen so that only puppets are visible to the audience or the class.

**3. Shadow puppets:** - shadow puppets are silhouettes of cardboard which produce shadows on white screen. The motion of these silhouettes is manipulated by the teacher and students.

**4. Finger of hand puppet:** - Hand puppets are round balls painted as heads with overflowing colorful costumes. These are worn on fingers which operate their movements. These are operated from below the stage.

**Advantages:**

- 1) Creates interest
- 2) Gives the knowledge in a brief period
- 3) Puppet is an effective method in teaching.
- 4) Motivate students
- 5) Easy to carry and operate

**Disadvantages**

- 1) Needs group cooperation and coordination
- 2) Requires skills in preparation and supply
- 3) Skills needed in presentation

**NON PROJECTED A.V. AIDS (GRAPHIC AIDS):**

It is a combination of graphic and pictorial material designed for the orderly and logical visualizing of relationships between key facts and ideas ex: comparisons, relative amounts developments, processes, classification or organization. It includes the following:

**CHARTS**

These visual symbols used for summarizing, comparing, contrasting or performing other services in explaining subject matter. A chart is a combination of pictorial, graphic, numerical or vertical material, which presents a clear summary.

**Purposes:**

- Ø To visualize an item, it is otherwise difficult to explain only in words.
- Ø To highlight important points.
- Ø To provide outline for materials covered in presentation.
- Ø To show continuity in process.
- Ø For creating problems and stimulating thinking.
- Ø For showing development of structure.

**Types of charts:**

Ø **Narrative chart:** Arrangement of facts and ideas for expressing the events in the process or development of a significant issue to its point of resolution or we can show an improvement over a period of years.

Ø **The cause and effective chart:** Arrangement of facts and ideas for expressing the relationship between rights and responsibilities or between a complex of conditions and change or conflict.

Ø **The chain chart:** arrangement of facts and ideas for expressing transitions or cycles.

Ø **The evolution chart:** facts and ideas for expressing changes in specific items from beginning data and its projections in to future.

Ø **Strip tease chart:**

- it enables speaker to present the information step by step
- It increases the interest and imagination of the audience.
- The information on the chart is covered with thin paper strips to which it has been applied either by wax, tape or sticky substance or pins.
- As the speaker wishes to visually reinforce a point with words or symbols, he removes the appropriate strip or paper.
- It produces interest.
- It increases learning and aids recall.

Ø **Pull chart:** it consists of written messages which are hidden by strips of thick paper. The message can be shown to the viewer, one after another by pulling out the concealing strips.

Ø **Flow chart:** diagrams used to show organizational elements or administrative or functional relationships. In this chart lines, rectangles, circles, are connected by lines showing the directional flow.

Ø **Tabulation chart:** it shows the schedule of an activity or of an individual ex: time-table of a class. These are very valuable aid in the teaching situation where breakdown of a fact or a statement is to be listed. Also it is a useful aid for showing points of comparison, distinction, and contrasts between two or more things. While making the table charts the following points must be kept in the mind.

The chart should be 50 X 75 cm or more in size.

The chart should be captioned in bold letters.

The vertical columns should be filled in short phrases rather than complete sentences.

Ø **Flip chart:** a set of charts related to specific topic have been tagged together and hang on a supporting stand. The individual charts will carry a series of related materials or messages in sequence. The silent points of specific topic will be presented.

Ø **Pie chart:** a circle will be drawn and divisions will be made into different sections, each section will be coded differently and code key will be given at right corner of the chart as legend. The circumference is divided into suitable sections.

## FLASH CARDS

**Definition:**

“Flash cards are a set of pictured paper cards of varying sizes that are flashed one by one in a logical sequence.”

**Purposes:**

1. To teach the students.
2. To give health education.
3. Useful for small group.
4. Used in group discussions.

**Principles:**

- The messages can be brief, simple line drawing or photographs, cartoons and the content will be written in few lines at the back of the each card.
- 10” X 12” or 22” X 28” is commonly used size.
- 10-12 cards for one talk can be used. It should not be less than 3 and more than 20.
- Prepare a picture for each idea which will give visual impact to the idea.
- The height of writing on the flash card is to be approximately 5cm for better visualization.

**Using the flashcards:**

For class room instruction, the flash cards is to be properly used. The following steps are used while displaying flash cards.

1. Give brief introduction about the lesson to students.
2. Give instructions to students about their actions while you flash the cards.
3. Flash the card in front of the class by holding it high with both your hands so that all the students can see it.
4. Let the student respond as per instructions already given.
5. Review the lesson by selectively using flash cards.

**Advantages:**

- Flash cards can be used to introduce and present topics.
- It can be used to apply information already gained by students to new situations
- It can be used to review a topic.
- Can be used for drill and practice in elementary classes
- To develop the cognitive abilities of recognition and recall of students.
- It can work as a useful supplementary aid and can be effectively used with other material.

**Disadvantages:**

- Can not be used for a large group
- Prone to get spoiled soon
- Preparation is time consuming.

**POSTERS****Definition:**

“Posters are the graphic aids with short quick and typical messages with attention capturing paintings.”



**Purposes:**

- To provide general motivation.
- To create an esthetic or atmospheric effect.
- To communicate a more general idea. To thrust the message for leading to action.
- For the class room and community.

**Preparation and rules:**

- To do a special job.
- To promote one point.
- To support local demonstration.
- Planned for specified people
- Tell the message at single glance.
- Use bold letters.
- Use pleasing colors...
- It should place, where people pass or gather.

**Features of a good poster:**

- Brevity: message should be concise
- Simplicity: message should be easily understandable
- Idea: should base on single idea and it should be relevant.
- Color: suitable color and combination should be used to make the poster attractive and eye catching.
- Display: while displaying one should be sure to find a place where there is adequate light and where the larger population will see it.

**Advantages:**

- It attracts attention.
- It conveys the message very quickly.
- It does not require a detailed study.
- Good poster leads to action with good motivation
- It can stand alone and is self explanatory.

**Disadvantages:**

- Poster does not always give enough information
- When a poster is seen for longer time it may not attractive. So it should be dynamic

**GRAPHS****Definition:**

Graphs are the visual teaching aids for presenting statistical data and contrasting the trends or changes of certain attributes.

**Method of preparation:**

- Before making the bar chart makes a rough sketch of it in a note book.
- For drawing the bar graph use the chart paper of 50x 72 cm size.

- Use two different color shades for the two contrasting groups.
- The bars should be equi-spaced.
- Write the key to the bar graph in a box on the right hand side corner of the chart paper.
- Numbers specifying the magnitude of the bars should be on the top on the bars.

**TYPES:****Pie graph:**

- These are called as circle diagram. The data are presented thorough the sections of portions of a circle.
- In determining the circumference of a circle we have to take in to consideration a quantity known as pie.
- The surface area of a circle is to cover 360 degree.
- The total frequencies or value us equated to 360 degree and then the angles corresponding to component parts are calculated.
- After determining their angle, the required sectors in the circle are drawn.

**Bar graph:**

The graphic presentation extends the scale horizontally along the length of bars. Each bar must be of the same width, height of the bar over a period represents the corresponding time of the variable. Graphs are available in 2 forms that is vertical and horizontal

**Line graph:**

To show the trends and relationships ex: single line shows the relation and the variation in the quantity. Quantitative data are plotted or when the data is continuous. The concepts are represented with the help of lines drawn either horizontally or vertically. The plotted points are connected to one another, instead of the base thus producing the curve.

**Pictorial graph:**

It is an out standing method of graphic representation. Pictures are used for the expression of ideal; they are more attractive and easily understood. Vivid pictures will be used to create rapid association with the graphic message; each visual symbol may be used to indicate quantity.

**MAPS****Definition:**

A map is a graphic aid representing the proportionately as a diagram, the surface of the earth, world or parts there of. It conveys the message by lines, symbols, words and colors.

**Types of maps:**

Ø **Political maps:** these maps show political divisions of the world, a continent, a nation.

Ø **Physical maps:** shows the physical contour of a place, area, and region.

Ø **Relief maps:** it shows the actual elevations and depressions in a place, area, and region.

Ø **Weather maps:** shows the amount of rains, temperature extremes, humidity in an area, region country.

Ø **Population maps:** shows the distribution of population in various parts of region, country.

Ø **Picture or tourist maps:** shows historical spots monumental sites.etc..

Ø **Road maps:** shows the roads of a region connecting various parts and points together.

Ø **Railway maps:** shows the railway links between various points.

Ø **Air maps:** shows the air routes between various points.

Ø **Sea root maps:** shows the sea routes between various sea ports

**CARTOONS**

The word cartoon has various meanings, based on several very different forms of visual art and illustration. The term has evolved over time. The original meaning was in fine art, and there cartoon meant a preparatory drawing for a piece of art such as a painting.

**Principles:**

- The quality of the drawing should be high primarily for visual effectiveness.
- The symbols used should be familiar and represent a concept or idea to which students can react intellectually.

**Advantages:**

- A cartoon can be effectively used to initiate certain lesson.
- It can be used for making a lesson lively and interesting.
- Fantasy
- Satire
- Exaggeration.

**NEWS PAPERS**

It can furnish health messages in local languages which can reach to the public easily. The information will be available in low cost, easy to read and understand simple language .the people may learn to read and interpret the contents along with pictures to enhance easy grasping.

**Advantages**

- Ø Best method to reach a large group
- Ø Pictures will help in easy understanding
- Ø Attractive and easy to understand
- Ø Lot of information can be obtained in various fields

**Disadvantages**

- ∅ useful for literates only
- ∅ detailed information cannot be produces

**COMIC STRIPS****Definition:**

A comic strip is the graphic depiction in a series of pictures or sketches of some character and events full of action. This medium of communication is found very interesting and exciting by children.

**Uses:**

- Comic strips fire the imagination of children
- It boosts the courage of children and builds up the spirit of adventure.
- It communication detailed and vivid.
- It stimulates reality and involvement.

**Limitations:**

- Comic strips misguide children by depicting characters with supernatural powers divorced from the hard realities of life.
- Comic strips hamper the development of language of children.
- Classics brought out in the form of comics develop the tendency in children to ignore or by pass the original work.
- Comics can soon become an obsession with young children and they tend to avoid serious studies

**Auditory Aids in Teaching-Learning Process**

These are also an effective aid, usually radios, recorders, gram phones come under this category.

**Using a record player for teaching:**

1. A record player can be used in the following ways in the actual class room situation
2. A record player can be used to supplement a lesson.
3. A record player can be used for an appreciation lesson in music.
4. A record player can be used for an appreciation lesson in literature.
5. A record player can be used for students to acquire the singing ability, deliver a speech properly, and recite a poem in the right way.
6. The player can be used to end or conclude a lesson;
7. Introduce a lesson and review a lesson.
8. A record player can be used for physical exercises accompanied with music

**TAPE RECORDER:**

A tape recorder is a portable electronic gadget to record, reproduce, erase and re record sound on a magnetic tape. This device can be used without

much fuss by any body by operating the following press buttons attached to the recorder, viz, stop, play, wind, rewind, record, pause, and eject.

### **Advantages of Tape-Recorder**

1. It can be used to improve pronunciation and recitation, prose reading stress, intonation etc.
2. A series of recorded tapes on English pronunciation, conversation, speech and other language exercise are available. These can be used for giving required training to the students.
3. The great advantage of a tape recorder is that the habitual mistake maker can hear his speech and can improve it.
4. It records the voices of pupils and it before him reproduces. Then teacher tells him where he has committed a mistake.
5. Even the best speech models can also be recorded and preserved in a tape and reproduced at will. A tape recorder thus serves a linguistic refrigerator.
6. A tape recorder can be used record a story, a talk, a song or a play from the radio.
7. Moreover, the same tape can be used indefinitely, if the recording is not meant to be permanent for any material, can simply be erased by recording again on it.
8. It can also be used for giving drills to the students.
9. Tape-recorder can also be used for learning spellings of the words. In the class room, the students may be ear-minded.
10. It can be sent from one place to another.

Thus, a tape recorder has many uses as an essential language tool. It is a very useful aid for self examination, self criticism and self-education.

### **Radio**

Radio is the most prominent audio teaching aid used for teaching purpose. Through radio broadcast, educational, cultural and social knowledge can easily be communicated. Seminars, lectures, workshops can be disseminated through the radio channel effectively

### ***There are a number of merits and demerits of radio as instructional materials which include:***

The advantages of radio as an instructional medium include:

- a) It is far less expensive than T.V,
- b) A very wide coverage of audience is possible through radio lectures,
- c) It can broadcast events immediately as they happen.

The disadvantages of radio as an instructional medium include:

- a) It does not allow students the opportunity to ask questions during educational broadcasts,
- b) Radio speakers talk at their own speed without knowing if the listeners

are following,  
c) Educational broadcasts usually come on at odd times

### **PROJECTED A.V. AIDS**

#### **OVER HEAD PROJECTOR:**

The over head projector is the most used in all a.v. aids. It projects transparencies with brilliant screen images suitable for use in a lighted room. The teacher can write or draw diagrams on the transparency while he teaches; these are projected simultaneously on the screen by the OHP.

#### ***During presentation:***

- Ø Keep the screen above the heads of the participants.
- Ø Keep the screen in full view of participants
- Ø Make sure you are not blocking any ones view when presenting.
- Ø Darken the room appropriately by blocking out sunshine and dimming near by.
- Ø Turn the screen off between slides if you are going to talk for more than two.
- Ø Talk to the audience, not to the screen

#### ***Purposes:***

- Ø To develop concepts and sequences in a subject matter area.
- Ø To make marginal notes on the transparencies for the use of the teacher that can carry with out exposing them to the class.
- Ø To test students performances, while other classmates observe.
- Ø To show relationships by means of transparent overlays in contrasting color.
- Ø To give the illusion of motion in the transparency.

#### ***Advantages:***

- Ø It permits the teacher to stand in front of the class while using the projector, thus enabling her to point out features appearing on the screen by pointing to the materials at the projector it self and at the same time, to observe the students reactions to her discussion.
- Ø Gains attention of the student

#### **OVER HEAD TRANSPARENCIES:**

Transparencies are popular instructional medium. They are simple to prepare and easy to operate with the over head projector which is light weight.

A 10\*10 inches sheet with printed, written or drawn material is placed on the platform of the projector and a large image is projected on a screen behind you. The projector is used from near to the front of the room with the teacher standing or sitting beside, facing the student.

#### ***Guidelines for making effective transparencies:***

- Have one main idea an each transparency.
- Include only related figures and diagrams.
- Use simple lettering style in writing.



- Use diagrams in proportion to its lettering.
- Keep the message clear and simple.
- Emphasize the key messages.
- Use color and lettering with discretion.

**Advantages:**

- Permits face to face interaction with the students.
- Can be used in daylight conditions.
- Can present information in systemic developmental sequences.
- Requires limited planning and can be prepared in variety of inexpensive methods.
- Easily available.

**THE OPAQUE PROJECTOR**

Opaque projector is the only projector on which you can project a variety of materials ex: - book pages, objects, coins, postcards, or any other similar flat material that is non-transparent.

The opaque projector will project and simultaneously enlarge, directly from the originals, printed matter, all kinds of written or pictorial matter in any sequence derived by the teacher. It requires a dark room, as projector is large and not reality movables.

**Advantages:**

- Stimulates attention and arouses interest.
- Can project a wide range of materials like stamps, coins, specimen, when one copy is available.
- Can be used for enlarging drawings, pictures and maps.
- Does not require any written or typed materials, hand-written material can be used.
- Helps students to retain knowledge for longer period.
- Review instructional problems.
- Test knowledge and ability.
- Simple operation.

**Disadvantages:**

- Costly equipment.
- Needs to use it with care.
- Needs a dark room for projection

**SLIDE PROJECTOR**

A slide is a small piece of transparent material on which a single pictorial image or scene or graphic image has been photographed or reproduced otherwise.

Slides are a form of projected media that are easy to prepare. They are still pictures on positive film which you can process and mount individually yourself or send to a film laboratory. The standard size of the slides is 2" X 2" any 35mm camera will make satisfactory slides.

### ***Types of slides***

1. Photographic slides: 2" X 2"  
3" X 4"
  - a) Black and white
  - b) Colored
2. Hand made slides: can be made with
  - a) Acetate sheet
  - b) Cellophane
  - c) Etched glass
  - d) Plain glass
  - e) Lumarith

Slides can be made from photographs and pictures by teachers and pupils taking photographs and snapshots when they go on fieldtrips for historical, geographical, literacy or scientific excursions.

The arrangement of slides in proper sequence, according to the topic discussed, is an important aspect of teaching with them.

### ***Advantages:***

1. Requires only filming, processing and mounting by self or laboratory.
2. Results in colorful, realistic, reproduction original subject.
3. Preparation with any 35mm camera for most uses.
4. Easy to revise and up-date.
5. Easily handled, stored and re-arranged for various uses.
6. Can be combined with tape narration or can control time for discussion.
7. May be adapted to group or individual use

### **FILMSTRIPS**

Film strips are sequence of transparent still pictures with individual frames on 35mm film. A tap recorded narration can be synchronized with film strip. Each strip contains from 12 to 18 or more pictures. It is a fixed sequence of related stills on a roll of 35mm film or 8mm film.

### **PRINCIPLES**

1. Preview filmstrips before using them and selected carefully to meet the needs of the topic to be taught.
2. Show again any part of the filmstrip needing more specific study.
3. Use filmstrip to stimulate emotions, build attitudes and to point up problems.
4. It should be introduced appropriately and its relationship to the topic of the study brought out.
5. Use a pointer to direct attention, to specific details on the screen.

**Types of filmstrip:**

- 1) **Discussion filmstrip:** it is continuous strip of film consisting of individual frames arranged in sequence usually with explanatory titles.
- 2) **Sound slide film:** it is similar to filmstrip but instead of explanatory titles or spoken discussion recorded explanation is audible, which is synchronized with the pictures.

**Advantages:**

- 1) Are compact, easily handled and always in proper sequence.
- 2) Can be supplemented with recordings.
- 3) Are inexpensive when quantity reproduction is required.
- 4) Are useful for group or individual study at projection rate are controlled by instructor or user.
- 5) Are projected with simple light weight equipment.

**LEARNER-DIRECTED INSTRUCTIONAL INPUTS**

Learner-directed instructional inputs refer to those methods, strategies or techniques in which learners organise the instructional environment with less intervention from the teacher.

According to **Woolever and Scott (1988)**, "An activity is student-directed (or independent) when each student is left to work alone or with a small group of other students with a minimum of teacher supervision or interruption." A student-centered approach is also associated with positive effects on student creativity, self-concept, attitude towards school, and curiosity (**Walbergs 1979**).

Although the learner assumes a significant role in learner-directed instructional inputs, the teacher plans and designs the instructional activities. Learner-directed instructional inputs may be broadly divided into individualised instructional inputs and group-directed instructional inputs.

**PLAY-WAY METHOD**

Play is an innate, creative, joyful, non-serious, interesting and recreative activity. It is the activity in which natural urges of the child find spontaneous expression. It is regarded as the language of the child. What he cannot express through language, he expresses that through his behaviour and that behaviour is play.

**According to Froebel**, "Education is a development from which man's life broadens until it has related itself to nature, until it enters sympathetically into all activities of society, until it participates in the achievements of the race and aspirations of humanity. It is a process of unfolding child's innate powers and to awaken his spiritual nature which may enable him to realize his inner unity, achievements of race and aspirations of humanity. He clearly emphasized on natural release of the child's physical and mental powers through which he will develop a balanced personality. As he said,

“play is the highest phase of child development and the source of all that is good.”

All the educationists made efforts in order to bring play into the field of education. The Play-way was first used as a method of teaching by **Cadwell Cook**. This was first used for teaching the different plays of Shakespeare by Cook. He noticed that they took more interest in those plays where they themselves were involved in the activity. He said, “good work is more often the result of spontaneous effort and free interest than of compulsion and forced application. Effectiveness of learning lies not in reading and listening, but in action, performance and experience”. He further said, “the core of my faith is that only work worth doing is done in play; by play I mean doing anything with one’s heart in it. Only that child learns best who learns with interest and with a purpose and sees significance in what he does.”

### Definitions:

- a. Ross:** “Play is joyful, spontaneous and creative activity in which man finds fullest self-expression.”
- b. Thomson:** “Play is impulse to carry out certain instinctive actions.”
- c. Crow and Crow:** “Play is the activity in which a person engages himself when he is free to do what he wants to do.”
- d. Froebel:** “Play is the highest phase of child development and the source of all that is good.”

### Principles of play-way methods:

The following are the underlying principles of play-way method:

#### **a. Learning by Doing:**

Training of five senses makes all round development in an individual. The principle of learning by doing involves maximum usage of these senses. Any knowledge which a child gains through his head and hands becomes interesting and purposeful for him. The children experiment and discover themselves the required knowledge by means of play-way method.

#### **b. Principle of individual differences:**

The play-way method takes into account the individual differences of the learners. Every individual works according to his differences in different spheres like interests, attitudes, sentiments, capabilities, intelligence level etc. It makes the learning easy and understandable by involving every learner according to his differences.

#### **c. Sympathetic Attitude:**

Play-way method develops a congenial environment in teaching-learning process. It does not create artificial environment or any compulsion on the learners. Everyone is free to do and act according to his interests. Whenever children need suggestions, they accept them without any hesitation.

### Procedure:

When we review all the progressive methods of teaching, we find that they contain the principles of play. All the progressive methods viz. Kindergarten, didactic method, project method, Dalton plan involves the procedure which

is of play-way in nature. For example the Dalton plan follows the procedure like assignments or contracts, subject teacher, subject rooms, records, conferences, time budgeting and daily time schedule; involves the play-way principles in each step. Every activity is done according to the capabilities, needs and interests of the learners. They are at liberty to move from one room to another according to their wishes. So, all the progressive methods follow the play-way procedure in their completion.

### ***Practical applications of play-way method in progressive methods of teaching:***

#### **1. Kindergarten Method:**

Kindergarten means 'garden of children'. In this method, children are provided with seven gifts called apparatus in order to develop the different ideas like shape, colour, number, weight etc. Children learn while playing and singing in a happy atmosphere of kindergarten. It is based upon the play urge of the children. Every activity is designed according to their interests.

#### **2. Didactic Method:**

This method was developed by Maria Montessori. It provides sense training to the individuals, because senses are the gateways of knowledge. In it, the children enjoy, play and learn.

#### **3. Project Method:**

As a method of teaching, it was used by J.A. Stevenson. In it the children choose their projects according to their interests, urges and capabilities and complete their projects only when they follow certain psychological principles of learning like law of readiness, law of effect etc. they learn in real life situations which becomes significant for them.

4. Dalton Plan: This method was devised by Miss Helen in Dalton USA. In it, complete freedom is given to children to complete their school work according to their interests and capacity.

#### **5. Heuristic Method:**

This method was devised by Prof. Armstrong. In it, the children discover things

themselves. He experiments and finds out different principles or rules for himself. The child struggles to find out conclusions for an investigation which he chooses voluntarily and happily.

### **Play-way in teaching different subjects:-**

**a. Languages:** Play-way method helps the children to acquire the free use of language. Debates, discussions, tutorials, class-meetings, school assemblies provides sufficient opportunities for expressing one's ideas thus help in acquiring control over the use of languages in different situations. Even pronunciation can be well taught in play-way spirit. The little children recite nursery rhymes in a singing manner even if they do not understand its meaning. So play-way method is very effective and significant at elementary level in order to make the use of language in different situations.

**b. Mathematics:** Different mathematical operations like addition, subtraction, multiplication and division can be taught through play-way method. Counting and simple calculations can be taught by organizing projects like running a shop, managing a post-office, opening a co-operative store etc.

**c. Social studies:** It can be taught through dramatics, stamp collecting, drawing of maps, graphs, charts, pictures, globe-making, models, historical and cultural excursions and tours.

**d. Science:** Science can be best taught through play-way method. Different experiments, collection of specimens, manufactured articles, minerals, preparation of charts, models and graphs, photography, soapmaking, chalk making, preparation of squashes, jams etc. can be best taught through play-way spirit. Children love to make things for themselves so they should be given ample opportunities for activity and play.

### PROJECT WORK

Project work, as a self-learning method, is less structured as compared to PLM, PSI and CAI. It is also called "project method". In schools, you may be giving assignments of various kinds to your students. Sometimes, certain assignments demand that students work on them for a longer period, say one week or two weeks, and produce something concrete or describe the process of certain experiences in the form of a report. Such assignments are called project work or project method.

The dictionary meaning of the project is a scheme or design. Through project works students get experiential learning. This provides the students an opportunity to learn at their own pace and time, while they do certain activities more or less independent of the teacher. A project is an enquiry, conducted personally by a student who is expected to use a variety of methods (e.g. analysis, interpretation, planning, etc.) to undertake a task or study a subject (in terms of knowledge, skill or attitude) and to write a report, or design and make a product, or organise an activity, or solve a problem, etc., in line with the objectives of the project. Thus, project work helps students plan, observe, analyse and synthesize. It tends to develop self-learning habits in the students. It provides real-life experiences to them. It aims at problem solving by them.

### Aims of Project Work

The aims of the project work can broadly be classified into the following categories:

- Knowledge
- Skills
- Personality attributes



**Knowledge** : Project work helps the learner develop knowledge of the topic and learn the various techniques used in the area of study.

**Skills** :Project work develops the following skills in the students:

- Skills for independent work which includes planning one's work, hunting for sources, collecting data, selecting relevant materials, fabricating experiments, manipulating instructions, making keen observations, analysing results, synthesising findings, making generalisation and presenting findings for use and necessary action.
- skills for group work include working in a group, developing the ability to cooperate with others, developing fellow feeling and democratic spirit.
- Skills for communication include development of oral skills by argument and discussion with colleagues and supervisor (teacher in our case).

**Personality attributes**: Project work also develops personality attributes which may be higher mental abilities such as critical thinking, creative thinking, evaluative ability, analytical thinking, etc., and certain affective attributes like interest in the area of study, social Sensitivity, etc.

### Types of Project Work

Project work may be of different kinds. In school context, it may broadly be classified as laboratory work, field work, and library work.

#### ***i) Laboratory work :***

Laboratory work aims at developing certain skills in the student through activities conducted in controlled conditions. Such project work is carried out in science and science-related subjects. The students are required to undertake mini research projects, for example, carrying out small laboratory experiments, like preparation of oxygen, dissection of a frog, etc. Laboratory work involves skills of manipulation, organisation, experimentation and interpretation. Through lab work, students get real-life experiences, of course, in controlled conditions. The students get the opportunity to apply theoretical knowledge into practice.

#### ***ii) Field work:***

Unlike laboratory work, field work is conducted in real-life conditions, and not under controlled conditions. The students are expected to go to the real-life situations where they observe a phenomenon, collect the relevant data, process and analyse the data and arrive at conclusions. Field work is appropriate for both the physical and the social science subjects. Community projects also come under field work. Students may be motivated to take up field work to gain first hand knowledge of the subject. Organising a literacy campaign in the community, visiting a nearby factory, visiting to a nearby slum, etc., are some examples of field work.

#### ***iii) Library work :***

Sometimes students may be asked to undertake project work related to library studies. Such a project has potential to promote individualised learning. Though the students are not habituated to library work in schools,

you can encourage them for it by assigning library projects. Library projects may be conducted in two ways:

- After introducing the topic and providing necessary information to the student in the class, you may tell them about the relevant books which concern the topic selected for the project work. Students should go through those books and develop a report on their work.
  - Another way of conducting library projects is first to ask the students to read the relevant books on the topic and then ask them to come with small reports on the basis of which you can hold discussions with them.
- Thus library project can develop the habit of self-study among the students.

### How to Organise Project Work ?

Project work is an effective instructional method which requires participation of both the teacher and the students. Your role in project work as a teacher is very important because students at the secondary school level may not be competent enough to undertake project work on their own. With your initiative and direction the students can be fruitfully engaged in the project work. Let us discuss what is expected of you as a teacher while organising project work.

#### ***Preparation for project work:***

When preparing for the project work, you should help the student perform the following tasks:

- Selection of appropriate subjects/skills/procedures/problems/topics for the projects.
- Offering students a choice of subject/skill/procedure/problem/topic (if feasible).
- Formulating or rather helping to formulate clear objectives of the project.
- Listing the resources and guiding how to locate and use those resources.
- Sequencing the work efficiently.
- Timetabling the project realistically.
- Organising an adequate record system.
- Organising and explaining the assessment schedule.
- Formulation of evaluation criteria.
- Outlining evaluation procedures.

With the preparation of the above tasks, you should be able to set the stage for implementation of the project. At the implementation stage also, you are expected to perform a number of tasks.

#### ***Tasks at the implementation stage:***

The tasks performed by you during the implementation of the project are as follows:

- Organising a preliminary briefing session for the students.

- Forming groups for group projects.
- Helping every students select a topic/subject for the project
- Assisting every student to plan the project by checking the plan outline, eliminating weaknesses, correcting work sequences, suggesting optimal use of resources, checking feasibility of the timetable, suggesting appropriate sources of information, etc.
- Checking every student's progress regularly.
- Suggesting modifications to plans when necessary.
- Encouraging and assisting individual student frequently.
- Checking student's evaluation procedures.
- Assessing the project in accordance with the planned scheme.
- Evaluating the whole project with other students including the project report, project product or procedure.
- Organising an effective group debriefing session.
- Evaluating the efficiency and effectiveness of the project as a learning activity.

### ***Evaluation of Project Work***

Evaluation Of project work involves both the processes and the product of the project. The product of the project may be some concrete material or the project report.

### **Role of a Student in Project Work**

The student has to play an important role in project work. Though you are there to help him throughout, the main responsibility of carrying out the project work lies with the student. There are three major stages the student has to work through while carrying out project work.

These are:

**i) Planning stage :**At the planning stage, the student has to consider the following tasks:

- The student should have a clear idea of the objectives and the criteria of the project
- If there is any ambiguity, he should seek your help.
- He should understand the scope and limitations of the project.
- He should carry out a task analysis of the project in terms ,pf skill(s), problem(s) or procedure(s).
- He should design a suitable plan, strategy or method for dealing with the project.
- He should arrange the tasks in a sequence and fix a target date to complete the project .
- He should discuss with you various aspects of planning.

**ii) Implementation stage :**At the implementation the student should carry out the following tasks at this stage :

- Collect all necessary information .
- Decide about suitable methods of enquiry.

- Use resources such as equipment, materials, available expertise, etc., effectively.
- Cooperate with other students in case of group project
- Carry out the processes involved in the project, namely, analysis, synthesis, application, decision taking, problem solving, etc.
- Stick to time schedule prescribed for the project.
- Secure help and guidance from the teacher throughout the implementation stage.

**iii) Reporting/presentation stage:** The student is expected to carry out the following tasks at the reporting stage:

- Interpret information and use materials properly .
- Draw appropriate conclusions.
- Compile an effective project report.
- Present the report, product, procedure, decision or solution effectively.

### **Field Work / Excursions**

Field work / Excursions is an important instructional method in social studies, It means taking the class into the "real" world. It is conducted in real life situation's where they observe a phenomenon, collect the relevant data, process and analyse the data and arrive at conclusions.

Field work should be related to an ongoing unit of work. For example, while teaching the means of production, the teacher can take students to a nearby factory where students observe the various processes involved in the production of goods. Field work / Excursions provides students first- hand knowledge and enables them to see how a number of skills and processes are integrated. The experiences which students get from field work contribute towards effective and permanent learning.

### **The Requisites of Travels and Excursions**

While taking out the students for travels and excursions the teacher should keep the following points in mind.

(i) Discipline should be maintained while the students are going out. It can be done easily if the teacher continues to direct students properly and provide them an opportunity to see things in the proper perspective. If the students get interested in their observation they shall not be undisciplined.

(ii) While the students are being taken out to excursions they be made comfortable. For this they should be lodged properly and given proper food. If the students are not physically comfortable their mind shall not work properly and it shall not be possible for them to acquire knowledge in the proper manner.

(iii) The teacher should direct the students in proper manner. He should explain the importance of each and everything that the students have seen. He may also explain which things are used for map drawing and which things are useful for charts etc.

(iv) After the excursions or travels the teacher should point out the particular chapter that may have bearing on the excursion or the travel. Such a reading will strengthen the experience and give a solid foundation to the knowledge.

(v) Students should invariably be asked and encouraged to carry a note book with them while they go out on excursions. They should also be encouraged to note down important things. Such things shall be useful in the classroom and proper study of the subject.

### Organisation of Excursions

For organisation of successful excursion the following points are kept in mind:

- The excursion should be carefully planned and well in time. Such planning is done by teacher-in-charge with active participation of students.
- It is worth consideration that the journey is not too long, tiresome etc.
- A list of items to be carried by each student be got typed and distributed amongst the students. A broad programme of excursion is also included in it.
- Prior arrangements/approval etc., for places to be visited, conveyance, meals etc. are made.
- During excursion students be given enough freedom for self-study and observation so that they could derive reasonable entertainment and pleasure from these activities
- Committees are formed to look after various organisations work such as boarding, loading, photography conveyance etc.
- Proper accounts are maintained for the expenses incurred during excursions.
- Teacher should try to draw maximum educational advantage out of the excursion.
- Every excursion should have a definite follow up programme.
- Proper evaluation is made at the end of each excursion.

### **In this regard Prof. E. F. Macnee has rightly remarked:**

"It is essential that the foundations of Geographical knowledge shall be laid in the field. No amount of reading from books can make up for a practical knowledge gained by looking at the earth which the child is studying. It follows that from the very early stages expedition should form part of the Geography course. In the lower schools there is usually plenty of time and many simple excursions can be made."

During such an excursion teacher should make an effort to show to students the various sources of supply of raw materials and also explain the significant contribution and impact of goods, exported to other countries.

Such an excursion will help the students to get an idea of the exact location of dams, projects, industries, ports and harbours etc. It also helps the students to properly assess resources of our country and the students become more aware of availability of plenty of materials inside the country and their contributions on the revenue of the country as also about foreign exchange. Students also get an idea of how a particular region contributes in solving the problem of unemployment.

### ***(c) Visits to Museum***

It is no exaggeration to say that National museums and laboratories are excellent centres for giving real knowledge to students in various areas of learning. Planetariums such as Birla Planetarium at Calcutta provide good knowledge about heavenly bodies like the sun, the moon and other planets. Such knowledge is more stable and permanent.

#### **Some of the important advantage of excursions is as under:**

- (i) They provide direct source of knowledge and acquaint the student with first hand information.
- (ii) They provide an opportunity to the student for development of his aesthetic sense.
- (iii) By such excursion students become interested in the exploration of their environment.
- (iv) They help to develop in students a love for nature and to acquaint them with the real happiness in the outside world.
- (v) It helps in development of power of observations, exploration, judgment and drawing inferences, problem solving ability of students.
- (vi) It helps in developing qualities of resourcefulness, self- confidence, initiative and leadership amongst students.
- (vii) It helps in developing cooperative attitude and various others
- (viii) It helps in proper utilisation of leisure.
- (ix) It motivates the students for self-study and self-activity.
- (x) It helps in the development of creative faculties of the students.

### **Laboratory ( Experiment ) Method**

In laboratory method students perform laboratory experiments by their own hands individually or in small groups, under the supervision and guidance of their science (Physics, Chemistry, Biology) teacher. So here students are more active and involved as compared to lecture - demonstration method, where teacher was performing experiments and most of the students in the class were just passive observers.

The role of the teacher when using this method in teaching science is that of a facilitator. The teacher goes to different individuals or small groups,



observes them what they are doing, corrects them if they are doing something wrong, and he is always available to students when they really need him for any guidance. Unless students perform experiments themselves, they will never get to know what science really is. In this method they get an opportunity to do experiments individually or in small groups.

#### Generally lab experiments are of five kinds:

1. Experiments to illustrate scientific principles.
2. Experiments to find numerical results.
3. Experiments to produce something such as preparation of gases or biological slides.
4. Experiments to verify experiments carried out by other scientists like verification of Ohm's law.
5. Original work like investigatory science projects or open ended experiments.

In our science courses there are usually the first four types of experiments. Presently little importance has also been given by CBSE to the 5th type- investigatory science project at senior secondary level.

#### ***When teaching science by laboratory method, the following objectives should be kept in mind.***

1. to develop manipulative skills
2. to arouse and maintain interest in science.
3. to encourage accurate observations and careful recording
4. to make biological, chemical and physical phenomena more real through actual experience
5. to train students in science processes
6. to give training in problem solving
7. to verify facts and principles already taught in theory
8. to give training in open ended experiments, scientific method and investigatory science projects

1. Equipment must be accessible to the students when needed
  - (a) waiting time should be minimum.
  - (b) material should be placed in such a manner that they can be easily found by students.
2. There should never be shortage of equipment and material needed for practical work.

#### **Merits of Laboratory Methods:**

- a. Through this method, a science teacher can provide various kinds of learning experiences\to the students, as a result of which information gained by them turns out to be of permanent kind.

b. In this method, individual differences and interest of all the students are taken into consideration, as a result of which, it is considered to be one of the psychological method of teaching. As more importance is assigned to students in this method, as a result of which, it is considered as child centred method. As no student is require to accept the beliefs and orders of the teacher and full freedom is provided to them to participate in the laboratory activities, as a result of which they begin to learn various information by doing works themselves.

c. Through this method, students learn to explore various things on their own. They also learn to verify various scientific facts and principles. Such students become able to solve out various kinds of problems arising in their life own their own, as they possess of high level of self-confidence.

d. As the students directly get indulged in the experimental functions and handle the various complex instruments themselves, thus various kinds of practical skills and proficiency get developed in them to considerable extent, with the help of which they prove to be successful in earning their livelihood in the future.

e. Through this method, an intimate relationship got developed in between the students and teacher, as students are required to acquire necessary guidance for performing practical work from the teacher while the teacher provides proper individual attention to them, by which all of them come closer to each other.

f. With this method, teacher can develop various good habits among the students because of which it is known for inculcation of good virtues among the students by a majority of experts. An important good habit which gets developed among the student is that they learn to perform their work on their own and independently. Not only this, they have to work while maintaining cooperation with other students also, as a result of which habit of team work gets developed in them. In addition of these, qualities of honesty, sincerity and truthfulness also get developed among the students through this method.

g. When students get success in their experimental work, then they attain a sense of achievement, which helps them in improving their performance to considerable extent in all spheres of life.

#### **Demerits of Laboratory Methods:**

a. There are some kinds of knowledge which cannot be verified through experiments, as a result of which this method has limited applicability. Not only this, generally it is found that teachers do not allow the students to make experiments independently, as it involves certain kind of risk of occurrence of accident.

b. As all the students get involved in experiment works because of which it becomes necessary to provide them with separate equipment's and other materials, but it is not possible for the teachers to do so as the main problem in our nation is shortage of resources. It is an important reason that why this method is used to limited extent in schools.

c. For procuring the essential materials and facilities, a huge amount of funds are required, because of which this method is considered to be expensive. It is not possible to make use of such method in schools of our nation, especially in government schools.

d. As every student in expected to learn by performing experiments, thus it is felt by some experts that this method expects too much from the students. In this method, students feel heavy burden on themselves as a result of which they do not get involved in the exploration and investigation processes with their fullest capacities.

e. Not only the students feel lot of burden on them, but teacher also have the same kind of tendency. Sometimes, teacher find it difficult to attend to the individual needs of the students, as they differ from each other to considerable extent. As a result of this, students get discouraged, as a result of which, it becomes very difficult for teacher to provide timely help and guidance to them.

f. This method can only be used by experienced and well qualified teacher otherwise, probabilities of getting failure can be increased.

### **INDUCTIVE-DEDUCTIVE METHOD**

Two very distinct and opposing instructional approaches are inductive and deductive. Both approaches can offer certain advantages, but the biggest difference is the role of the teacher. In a deductive classroom, the teacher conducts lessons by introducing and explaining concepts to students, and then expecting students to complete tasks to practice the concepts; this approach is very teacher-centred. Conversely, inductive instruction is a much more student-centred approach and makes use of a strategy known as 'noticing'. Let's take a closer look at the differences between inductive and deductive instruction,

#### **What is deductive instruction?**

A deductive approach to instruction is a more teacher-centered approach. This means that the teacher gives the students a new concept, explains it, and then has the students practice using the concept. For example, when teaching a new grammar concept, the teacher will introduce the concept, explain the rules related to its use, and finally the students will practice using the concept in a variety of different ways.

**According to Bob Adamson,** "The deductive method is often criticized because: a) it teaches grammar in an isolated way; b) little attention is paid to meaning; c) practice is often mechanical." This method can, however, be a

viable option in certain situations; for example, when dealing with highly motivated students, teaching a particularly difficult concept, or for preparing students to write exams.

### What is inductive instruction?

In contrast with the deductive method, inductive instruction makes use of student "noticing". Instead of explaining a given concept and following this explanation with examples, the teacher presents students with many examples showing how the concept is used. The intent is for students to "notice", by way of the examples, how the concept works.

Using the grammar situation from above, the teacher would present the students with a variety of examples for a given concept without giving any preamble about how the concept is used. As students see how the concept is used, it is hoped that they will notice how the concept is to be used and determine the grammar rule. As a conclusion to the activity, the teacher can ask the students to explain the grammar rule as a final check that they understand the concept.

### Teaching methods can either be inductive or deductive or some combination of the two.

The inductive teaching method or process goes from the specific to the general and may be based on specific experiments or experimental learning exercises. Deductive teaching method progresses from general concept to the specific use or application.

- These methods are used particularly in reasoning i.e. logic and problem solving.
- To reason is to draw inferences appropriate to the situation.
- Inferences are classified as either deductive or inductive.

For example, "Ram must be in either the museum or in the cafeteria." He is not in the cafeteria; therefore he must be in the museum. This is deductive reasoning.

As an example of inductive reasoning, we have, "Previous accidents of this sort were caused by instrument failure, and therefore, this accident was caused by instrument failure.

The most significant difference between these forms of reasoning is that in the deductive case the truth of the premises (conditions) guarantees the truth of the conclusion, whereas in the inductive case, the truth of the premises lends support to the conclusion without giving absolute assurance. Inductive arguments intend to support their conclusions only to some degree; the premises do not necessitate the conclusion.

Inductive reasoning is common in science, where data is collected and tentative models are developed to describe and predict future behaviour, until the appearance of the anomalous data forces the model to be revised.

Deductive reasoning is common in mathematics and logic, where elaborate structures of irrefutable theorems are built up from a small set of basic axioms and rules. However examples exist where teaching by inductive method bears fruit.

### EXAMPLES: (INDUCTIVE METHOD):

#### 1) MATHEMATICS:

A) Ask students to draw a few sets of parallel lines with two lines in each set. Let them construct and measure the corresponding and alternate angles in each case. They will find them equal in all cases. This conclusion in a good number of cases will enable them to generalise that "corresponding angles are equal; alternate angles are equal." This is a case where equality of corresponding and alternate angles in a certain sets of parallel lines (specific) helps us to generalise the conclusion. Thus this is an example of inductive method.

B) Ask students to construct a few triangles. Let them measure and sum up the interior angles in each case. The sum will be same ( $= 180^\circ$ ) in each case. Thus they can conclude that "the sum of the interior angles of a triangle  $= 180^\circ$ ". This is a case where equality of sum of interior angles of a triangle ( $=180^\circ$ ) in certain number of triangles leads us to generalise the conclusion. Thus this is an example of inductive method.

C) Let the mathematical statement be,  $S(n): 1 + 2 + \dots + n = \dots$ . It can be proved that if the result holds for  $n = 1$ , and it is assumed to be true for  $n = k$ , then it is true for  $n = k + 1$  and thus for all natural numbers  $n$ . Here, the given result is true for a specific value of  $n = 1$  and we prove it to be true for a general value of  $n$  which leads to the generalization of the conclusion. Thus it is an example of inductive method.

### EXAMPLES: (DEDUCTIVE METHOD):

#### 1) MATHEMATICS:

A) We have an axiom that "two distinct lines in a plane are either parallel or intersecting" (general). Based on this axiom, the corresponding theorem is: "Two distinct lines in a plane cannot have more than one point in common." (Specific). Thus this is an example of deductive method.

B) We have a formula for the solution of the linear simultaneous equations as and (general). The students find the solutions of some problems like based on this formula (specific). Thus this is an example of deductive method.

**Logic and Problem solving are two more areas where these methods find extensive usage.**

The major task of logic is to establish a systematic way of deducing the logical consequences of a set of sentences. In order to accomplish this, it is necessary first to identify or characterize the logical consequences of a set of sentences. The procedures for deriving conclusions from a set of sentences then need be examined to verify that all logical consequences and only these are deducible from that set.

From its very beginning, the field of logic has been occupied with arguments, in which certain statements, the premises, are asserted in order to support some other statement, the conclusion. If the premises are intended to provide conclusive support for conclusion, the argument is a deductive one. If the premises are intended to support the conclusion, only to a lesser degree, the argument is called inductive.

A logically correct argument is termed "valid", while an acceptable inductive argument is called cogent. The notion of support is further elucidated by the observation that the truth of the premises of a valid deductive argument necessitates the truth of the conclusion. It is impossible for the premises to be true and the conclusion false. On the other hand, the truth of the premises of a cogent argument confers only a probability of truth on its conclusion: it is possible for the premises to be true but the conclusion is false. For example let the premise is: "All teachers are scholars" and the conclusion be: "There are some scholars who are not teachers". Let the premise be true then obviously, the conclusion is false. Hence it is a cogent. Again let the premise is "no policeman is a thief" and the conclusion be "no thief is a policeman". Let the premise be true then the conclusion is also seen to be true. Thus it is a valid (deductive) argument.

**Problem solving is another area where inductive and deductive processes may be used.**

In inductive thinking, one considers a number of particular or specific items of information to develop more inclusive or general conceptions. After aspirin was synthesized, for example, some people who swallowed the substance reported that it relieved their particular headaches. Through induction the reports of these specific individuals were the basis for developing a more inclusive notion: "aspirin may be helpful in relieving headaches in general".

"Deduction" is reasoning from general propositions –or hypotheses–to more specific instances or statements. Thus, after the general hypothesis about the effectiveness of aspirin had been put forward, physicians began to apply it to specific, newly encountered headache cases. The deduction was that, if aspirin is generally useful in managing pains in the head, it might also be helpful in easing pains elsewhere in the body.

Although a person may deliberately choose to use induction or deduction, people typically shift from one to the other depending on the exigencies of the reasoning process.



## Heuristic ( Discovery ) Method

### Meaning and Significance:

The word "heuristic" is derived from the Greek word **heurisko** meaning "I find out" and the "Heuristic Method" is one in which the pupils are left to find out things for themselves. Children are placed, as far as possible, in the position of discoverers and instead of being told the facts; they are led to find out things for themselves.

Through this method the pupils are made to learn. The Heuristic method was, for the first time, coined by **Dr. H. E. Armstrong (1888-1928), Professor of Chemistry at City and Guild Institute Kensington**. This method of teaching is of a very recent origin. First it was used in Science and its success led it to be adopted in the teaching of all subjects in the School Curriculum.

The aim of this method is to develop the scientific attitude and spirit in pupils. The spirit of enquiry prompts the pupils to learn. This method insists on truth, whose foundation is based on reason and personal experiences.

As a matter of fact there is no spoon-feeding or more acceptances of facts which are given by the teacher. An eminent educationist has pointed out that the object of the heuristic method is "to make pupils more exact, more truthful, observant and thoughtful to lay this solid foundation for future self-education and to encourage this growth of spirit of enquiry and research."

All the children in a class may be set to work simultaneously at this same problem in adopting the heuristic method. Each child with all attention strives to find out something for himself. Heuristic method aims at the pupils' own observations to satisfy as many questions as possible to be raised in the teaching- learning situation.

Much is demanded of the teacher in the heuristic method of teaching. He should be a great reader of books in order to obtain varied information. The teacher should possess much curiosity, observation, interest and spirit of scientific investigation, because these are the qualities he wishes to develop in pupils. The teacher should realize the responsibility of fostering in this pupils good habits of reading and collecting various information from books.

In the heuristic method, the teacher is a guide and also a working partner. As a friend of pupils, this teacher should proceed on the way to discover facts. He is to see that this class room is pervaded by an atmosphere of freedom and that the work provided to the children encourages self-development, spontaneity and self-expression.

This method is used not only in teaching scientific subjects like Mathematics, Physics, Chemistry and Nature Study, but in all subjects of

the curriculum. A close study of this method reveals that it is in reality this heuristic attitude which should characterize teaching of all subjects. It is opposed to dogmatic techniques of teaching, where pupils are passive learners. This may be applied to inductive as well as deductive lessons and thus heuristic method is problem- solving.

According to its author **Prof. Armstrong**, "Heuristic methods of teaching are methods which involve placing students as far as possible in the position of discoverers,—methods which involve their finding out instead of being merely told about things." This statement speaks very Clearly that telling is in no teaching. The Heuristic method tends to set the learner himself on the track of invention and to direct him into the paths in which the author has made his own discoveries. Heuristic Method is learning by doing.

### **Psychological Basis or Principles of Heuristic Method.**

The heuristic method is based on the following principles:

1. Principle of activity or learning by doing.
2. Principle of experience.
3. Principle of freedom.
4. Principle of play-way.
5. Principle of purpose.

**History:** Students may examine the sources and then complete an account of a historical event.

**Geography:** Students may observe different phenomena like days and ,nights-their duration at different times in the season and formulate general principles. .

This method can be used in other subjects where inductive deductive approach has to. be followed.

### **Merits of the Heuristic Method.**

- It develops scientific and critical attitude of mind in the students.
- It arouses the spirit of enquiry in the students.
- It develops habits of hard work among the students by keeping them busy to find out the required solutions.
- It fosters self-activity in the students.
- It helps to develop the power of initiative, self-confidence and self-reliance among the students by encouraging them to draw their own conclusions through their own efforts.
- The students learn the art of planning their programmes.
- It makes learning more effective and permanent. The students learn facts through their own labour and. therefore. retain them much longer.
- It helps to develop good relationship between the teacher and pupils and among pupils themselves.

- This method provides enough training to the students to prepare themselves for life. The students learn how to handle different situations and how to arrive at certain conclusions. This experience helps them in later life.
- The fear of the home task diminishes. The students are not to memories-facts at home but to find facts in the classroom or the laboratory.
- The students feel the pleasure and joy of achievement and sense of originality.
- The problem of discipline is solved as the students remain busy in their work.

### **Limitations of the Heuristic Method.**

Following are some of the main demerits of the heuristic method:

- The pupils are immature and we cannot always put them in the position of discoverers or inventors.
- It is a very slow method and it is not possible to finish the syllabi in time.
- This method requires teachers who are very enthusiastic in their work and who are very resourceful and hardworking. But this is a scarcity of such teachers.
- This method cannot be used in large classes as it involves a close supervision on the part of the teacher.
- This method is not suitable for primary classes.
- This method cannot be used at all occasions and all the time. There will be numerous occasions when it becomes absolutely essential for the teacher to give direct information.
- We cannot expect all the children to become discoverers and inventors because there are many children who are mentally deficient.
- Wrong generalisations may be arrived at and thus a lot of time and energy may be wasted.

### **Enquiry/Empirical Evidence**

Inquiry based learning is mainly involving the learner and leading him to understand. Inquiry here implies on the possessing skills and attitude of yours, which allows you to ask questions about new resolutions and issues while you are gaining new information.

**Dictionary** meaning of Inquiry is seeking knowledge, information, or truth through questioning. All the people carry on with this process throughout their life, even if you might find it not very much reflecting. For example, infants use inquiry to build their sense of the world, the babies turn towards voices, put things in their mouths, grasp things, and observe faces that come near. The inquiry process is mainly the gathering of data and information and applying them to senses like smelling, tasting, touching, hearing and seeing.

Very sadly, our traditional ways of teaching discourage the process of inquiry. It makes the student get less prone to asking questions as they move through their grade levels, they are just expected to listen and repeat the expected answers. This is due to the lack of understanding of inquiry based learning. Inquiry based learning is not just asking questions, but it is a way of converting data and information into useful knowledge. A useful application of inquiry based learning involves many different factors, which are, a different level of questions, a focus for questions, a framework for questions, and a context for questions.

Much mesmerizing information and facts are readily available, which needs an understanding of how to make sense out of it and turn it into useful knowledge. The teachers must be able to analyze that he or she does into only have to accumulate information and data but also have to generate it into useful knowledge, which can be easily done through inquiry based learning. Our country's success depending upon natural resources is the past; the future of our country's success now depends upon the workforce which works smarter.

Inquiry based learning can be applied on all disciplines which has been confirmed through different researches. Learners have different perspectives of viewing the world like economic, historic, scientific, artistic, etc. The disciplines can be interrelated through inquiry based learning, which ensures the integrity of different disciplines and the world views about them.

### **What is Inquiry-Based Teaching?**

Inquiry-based teaching is a teaching method that combines the curiosity of students and the scientific method to enhance the development of critical thinking skills while learning science. As learners encounter problems they do not understand, they formulate questions, explore problems, observe, and apply new information in seeking a better understanding of the world. The natural process the learners follow when seeking answers and deeper understanding closely follows the generally accepted scientific method. Often, the answers proposed by learners lead to even more questions—much like the outcomes of research.

Students engage in five activities when they engage in inquiry learning and use the scientific method, as noted in the *National Science Education Standards* published by the National Academy of Sciences. Although these tasks occur in a logical progression, inquiry is a fluid process, and one task may lead back to a previous task. This process is illustrated in given picture.

According to the National Academy of Sciences (1995), when students learn through inquiry, they:

1. question;
2. investigate;
3. use evidence to describe, explain, and predict;

4. connect evidence to knowledge; and
5. share findings.

**Source Method:-**

Source method means the teacher will tell the different sources from where some information can be received or collected. It is an activity method of teaching social sciences and sciences. It provides first hand experiences and lead to better understanding of the subject.

It means the utilization of the available human and material sources capable of providing useful information and knowledge related to a particular subject or topic for the realization of the stipulated teaching – learning objectives in a particular teaching – learning situation. The different sources which are available for making content interesting and fruitful include written records, institutions of social interest, building and monuments, tools, rocks, metals and stone inscriptions, coins, literature etc.

Source method is an activity oriented method. It is generally used in social studies subject also.

Generally sources mean a person, books or document or picture or actual objects that can provide information for learning. It is learning directly from the actual sources for examples for social studies they can be- A contract with the bank – or studying the sample of stone collected from the moon or an object found from any ancient place can also be studied. One can also take students to museums to find the objects to study.

**Education Significance:-**

- It is helpful in the sense that it develops the habit of self-study, self – evaluation, i.e, it makes the learners research minded.
- It is very useful in the learning and teaching of the concepts, facts, principles, events, phenomenon related to different subjects.
- It develops the skills of collecting data, shifting the relevant and organizing the same.
- They get first hand experiences about different sources which retains for long time.
- It makes the teaching more realistic, more interesting and more vivid.

**Types of Sources**

There are three types of sources in this method.

- 1 Material resource: Ideas, machines, weapons etc.
- Oral resources: Songs, folk stories, traditions, customs etc.
- Written and printed resources: Records, reports, letters etc.

**STEPS FOLLOWED TO USE SOURCE METHOD:**

- 1 Demonstration or presentation by the teacher.
- 2 Locate related reading material and assign reading to the study.
- 3 Problem solving by students; with group discussion among the students.

**ADVANTAGES OF SOURCES METHOD:**

- It provides direct, first hand experience.
- It develops a sense of reality
- It creates motivating and interesting ambience in the class.
- It develops skill of data collection, thinking skill and observation skill.
- It makes the subject meaningful.

**Observation Method**

It is rightly believed that the observation under the careful guidance of a social studies teacher proves very effective in the process of learning, and facts, skills, and behaviour learnt are retained for a longer period. observation or direct experience or visits to actual places, say, a monument, a fort, a field, a river, a temple, an institution, etc. provide ample opportunities to students, for 'seeing; 'hearing', 'examining', 'gathering data' and 'asking' questions.

Visits to hospitals, telephone exchanges, telegraph offices, study trips to airports, etc. show how people and goods are transported from one place to another. Pupils understand better the working of markets, co-operative stores, and factories when they see their working and thus acquaint themselves with the processes of production, distribution, exchange, and consumption. Such experiences are most conducive to learning. The concrete data on cultural, industrial, political and geographical facts and relationship being more 'tangible: 'visible: and 'describable' serve as a great motivating force for further enquiry in social sciences. The observation lends vitality to the subject-matter of social studies.

**Techniques of the Observation Method**

The following techniques are adopted in the observation Method:

- Field trips of educational excursions.
- Community surveys.
- Community service projects.

It is not a specific method of teaching science. As a matter of fact, almost all science begins with observation. Several hundred years were devoted to accumulating a large amount of observed descriptions of nature. To the scientist, however, goes on to determine relationship between some of the observations made and the information's obtained through the success. The result of this process is an abstract mental picture which tends to see nature in an orderly man-made pattern, which comes under the purview of science of observation. This is the substance of which scientific theories are made. The scientist is mainly regarded as a person, who describes nature by careful observations. The descriptions which are based on direct observation represent correct facts.

The training of pupils in observation is really storing his mind with suitable experiences all thoroughly classified and digested. Science provided remarkable training in observation and reasoning. Learners reason from the



once established facts and form concepts about further observed phenomena.

**Educational Significance:-**

- It is useful in the sense that students make new discoveries and conduct researches in the field of science.
- It develops the power of imagination, thinking, reasoning and drawing conclusions etc.
- It helps the students in clarifying and removing of doubts by obtaining empirical knowledge.
- It develops the different qualities in an individual like planning, organizing, executing and evaluating.
- It gives opportunities to the students to become a part of teaching – learning process. They do not remain passive listeners and indifferent observers.

**Merits of Observation Method:**

Students get direct experience through direct method. It activates and energizes their knowledge. It avails much information through easy direct contact. Students actively participate in direct observation. It also helps in presenting the bookish knowledge in an interesting way by mixing one's direct experiences with it. It is also interesting one.

**Demerits of Observation Method:**

This method is costly, time-consuming and not for all topics. Teacher's facility, skill, time is also a factor. Sometimes indiscipline may develop out of observation. But this method is more scientific that make geography teaching a concrete base in schools.

**Programmed Instruction**

Programmed instruction or programmed learning emerged out of the research conducted by B.F. Skinner on operant conditioning. Although Skinner's name is always associated with programmed learning, there were several efforts made earlier by some people in this direction. The Law of Effect propounded by E.L. Thorndike (1874-1949) has direct relevance to programming.

According to this law, learning which is associated with satisfaction is likely to be more permanent than learning not accompanied by satisfaction. Satisfaction in the form of reward reinforces the behaviour of the student to take interest in his/her learning. This is an important aspect in programming. In 1926, Sydney L. Pressey devised a teaching machine which required students to press keys to answer multiple-choice questions and the next question was presented only after the correct key had been pressed by the student. The idea behind such a teaching machine was that after being exposed to instruction, the student would go through a test presented by a

machine and achieve mastery on all the questions (content) till (s)he ceased making mistakes.

The real landmark in the development of programmed learning was the work of B.F. Skinner. After conducting extensive research on rats and pigeons, Skinner developed a theory of learning called operant conditioning.

### Styles of Programmed Instruction:

There are mainly two styles of programmed instruction - linear and branching. These styles aim at programming of subject matter and are widely used in instructional situations all over the world. However, there is yet another style which is used for programming of behaviour. This style is called mathematics. In our discussion, we focus on the first two styles.

#### **Linear style:**

The linear style of programming developed by B.F. Skinner is otherwise known as **Skinnerian style**. According to this style, the subject matter is broken into small pieces of information (steps) and is presented in a logical sequence of small steps. These small steps are called frames. The student is required to go through frames containing a bit or bits of information and respond to the question given at the end of each frame. The feedback in the form of correct answer is provided in the next frame. The frames are so designed and arranged that students' errors are kept to a minimum. In other words, programmed instruction ensures that the student makes/commits minimum errors.

#### **Branching style :**

The branching style of programming was developed by Norman, A. Crowder. His intention was to use the errors to direct the students to an appropriate explanation or remedial sequence. Therefore, he gave students some information followed by a multiple-choice question and provided a different response for each apparently correct answer (distractor) chosen. Students proceed through such a programme, following different routes or branches and care is taken to ensure that they understand each point before they proceed to the next. There are many similarities between linear style and branching style. However, branching style is different from the linear style.

### Difference between linear style and branching style:

There are two main differences between the linear style and the branching style of programmed instruction.

- In branching style the student is presented with multiple-choice questions and (s)he has to select the correct response out of the given choices. Then he is routed through branches according to his response.
- This style is based on explanation and reasoning. Therefore, it has been more effective with brighter students.

### Personalised System of Instruction

The personalised system of instruction (PSI) is another self-learning technique which emphasizes individualisation of instruction and learner-controlled instruction. It is also known as **Keller Plan** and is widely used all over the world.

This technique is called PSI because instruction is designed according to the need and ability of the student. Like other individualised instructional methods, PSI also allows the student to move through course material at his/her own pace and requires mastery learning by him/her.

#### **Features of PSI:**

**Keller (1968)** identified five main features which distinguish PSI from conventional methods of instruction. These are:

- PSI is a mastery oriented learning technique.
- It is individually paced technique of teaching-learning.
- It uses a few lectures to stimulate and motivate the students.
- It uses printed study guides to communicate information.
- It uses tutors (or a teacher like you) to evaluate attainment of the objectives by the student.

#### **Description of the technique:**

In PSI, the student is given carefully prepared assignments which generally include programmed learning material, handouts and materials which are available in the library or at the learning resource centres. The materials include questions and exercises. The student is told about the nature of assignments. The student is also instructed about how to read and what to read. At a time, the student is expected to work on one unit only.

The tutors (not necessarily professional teachers) ensure that the student is provided with proper reading material, remedial material and necessary help whenever he faces any difficulty. When a student thinks that he/she has completed the material, he/she can come to you. You can conduct a short quiz or test in order to evaluate the student's mastery over the material. If you are not satisfied with the performance of the student, you should ask the student to re-study the course material. If you are satisfied, you should direct the student to proceed on to the next unit. The students should not be given punishment if s(he) commits errors or secures low score/grade in the assignment. Since the student in this technique learns at his/her own rate (self-pacing) in order to meet the individual differences in learning, a multimedia approach is followed in addition to written material.

As an instructional technique, PS I has proved to be a better technique in comparison to conventional teaching. Research evidence shows that PSI facilitates better performance, increases retention and promotes transfer of training.

#### **COMPUTER-ASSISTED INSTRUCTION**

One of the most important contributions of modern technology in the field of individualised instruction is the introduction of computers in the teaching-learning process. Although, its use has not yet been extended on a mass scale to our schools, the future years may witness fast computerisation of the teaching-learning activities.

As teachers, we should know the role of computers in the teaching-learning process. A computer can record, analyse and react to students' responses. It can store and manipulate information on an extensive scale; it can control and manage a wide variety of learning materials; and it can simultaneously cope with learning requirements of many individuals. It can make a number of planning decisions also.

**Computer-assisted instruction:**

Computer-assisted instruction (CAI) is, in a sense, an extension of programmed learning material and the personalised system of instruction. In CAI, there is flow of information and interaction between the computer and the student. The computer provides instruction directly to the student and allows him/her to interact with it through the lessons programmed in the system. The student puts questions to the computer and feeds answers into it with the help of the keyboard. The computer provides feedback to the student on the basis of his/her performance. On the whole it may be said that the computer acts as a teacher to the student.

In order to carry out this teaching/learning function, the computer utilizes various instructional modes. Let us discuss these modes in brief.

**Drill and practice:** In this mode, the computer presents to the student a series of exercises which he or she attempts by giving some responses. It provides the student feedback on his/her answers in the form of congratulatory message, if it is right, or a corrective comment, if it is wrong. Thus, computer-assisted instruction provides endless drill and practice with repetition at a pace that can be controlled by the student. The computer allows the students to proceed further only when mastery has been achieved by him/her.

**Tutorial mode:** In the tutorial mode, as in programmed instruction, information is presented in small steps followed by a question. The student's response is analysed by the computer and appropriate feedback is given.

**Simulation mode:** Learning experiences related to the real life phenomena are provided to the student through this mode. For example, the study of genetics, experiments in town planning, the operation of a system, etc., can be shown to be student through the computer simulation

**Discovery mode:** This mode uses inductive approach to learning wherein the problems are presented and the student solves them through trial and error.

**Gaming mode:** In gaming mode teaching can be imparted through a playway mode.

**Computer-managed instruction:**

Computer-managed instruction (CMI) is another contribution of the computer to the domain of instruction. In CMI, the computer gathers, stores and manages information to guide the student through individualised learning experiences. The computer helps the student move through checkpoints (in the form of definite activities) in the education process at different times via different paths matching the individual capabilities. CMI achieves this individualised instructional process by a series of activities administering diagnostic tests, scoring them, prescribing the appropriate paths and monitoring the progress of individuals all along the route

**GROUP-DIRECTED INSTRUCTIONAL INPUTS**

Instructional techniques involving group-directed instructional inputs provide room for the learner's self-development and active participation in the teaching-learning process. In group directed instructional inputs, the learner is not only influenced by the stimuli, that is a part of the environment around him, but he can also in turn influence them as he too has a role in generating the stimuli. Group-directed instructional inputs, apart from the development of various higher cognitive abilities, do help in the development of affective attributes.

**DISCUSSION**

The simplest form of group based learning technique is the discussion, which can be used in a variety of situations in the secondary school context. Its value lies chiefly in the fact that it represents a type of intellectual teamwork, resting on the principle that the pooled knowledge, ideas, and feelings of several persons have greater merit than those of a single individual (**Jarolimeck, 1986**). The strength of discussion lies in the broad participation of members of the group. It is a process of thinking together that breaks down if one member or group dominates it. It is the responsibility of the teacher to encourage the more relevant students to participate. For example, situations like giving feedback on the responses of a class test, Clarifying the doubts of students at the end of a lecture, resolving the debatable issues raised during the lecture, generating alternative solutions to a classroom problem, and breaking the monotony of "teacher talk" are some of the situations in which the discussion technique could be used.

**Organisation :**

For effective utilization of this technique, the teacher should give sufficient background information so that they already possess it and are ready to use

it in the discussion. This is a primary requisite for a discussion to take off. A discussion cannot operate in a vacuum of information. The ability of the teacher to initiate a discussion often decides the ability to postpone. He may give his judgment later on the issue being discussed and the responses of individual students. The teacher's judgment, through even a non-verbal clue, can affect the nature and pattern of responses.

**Instructional potential :**

It can develop higher cognitive abilities effectively apart from reinforcing knowledge. The uniqueness of this alternative lies in its simplicity, but its effectiveness is related to the abilities of the moderator or leader.

**Skills associated with discussion :**

**Jarolimek (1986)** has suggested certain skills which a teacher of social studies should develop in the learners participating in discussions. These skills are as follows:

- Listen attentively when others are speaking.
- Remain objective and do not become emotional.
- Be open-minded, respect and accept the contributions of others, but think independently.
- Assume responsibility for the discussion and be able to support ideas with factual evidence.
- Speak loudly and clearly enough for all to hear.
- Do not dominate the discussion; contributions should be stated concisely and briefly.
- Ask for clarification of ideas that are not understood; ask for evidence to substantiate statements.
- Recognise the problem of semantics in arriving at group decisions or in discussing a controversial issue.
- Assume responsibility for moving the group towards its goal.
- Have confidence in the ability of the group to come to a satisfactory decision and support the decision of the group once it has been made.

**DEBATE**

This alternative is specially suitable for controversial themes or issues and for developing certain skills like logical arguing, weighing evidence, &c., in students. In social studies, debate may be organised for topics like:

- Is liberalisation necessary for the economic development of a country?
- Is the Presidential form of government better than the parliamentary form of government?
- British rule in India was a boon for Indians.
- Should India go for a capitalistic economy?

**Organisation :**

The participating students could be divided into two groups, one for a proposition and the other against it. The remaining students can form the



audience. Towards the end, the audience can involve themselves in a short discussion.

**Instructional potential :**

The uniqueness of this alternative lies in its ability to involve the students to a very high degree in terms of gathering information, processing it and presenting to the audience, proposing, arguing and counter arguing, specially by noting the points raised by the previous speakers.

**SYMPOSIUM**

This alternative is suitable for teaching topics or themes having various dimensions. In social studies, a symposium may be arranged on such topics as:

- Lord Buddha and his thoughts
- Co-operative movement in India
- Coalition. governments in India

**Organisation :**

Selected students and different staff members can form teams to make presentations. Each team would present a different dimension of the same theme, one by one, in a pre-planned sequence. It would then be thrown open to the "floor" for discussion. A chairman initiates and regulates the proceedings.

**Instructional potential :**

As mentioned earlier, the uniqueness of this alternative lies in its suitability for teaching multidimensional themes or topics and thus it provides a wider perspective to the learners.

**PANEL DISCUSSION**

When the themes or topics are of a very complex or controversial nature, a panel discussion is a good choice as it brings out difficult aspects in a constructive manner. In social studies, panel discussions may be organised on such topics as:

- Communism and its debacle in the world
- Future of the United Nations
- If Hitler had succeeded in conquering the entire world

**Organisation :**

Members of a panel could be selected students or teachers or both. Questions regarding a topic or a series of topics could be collected in advance from among the students. The questions are given to the panel members in advance depending on their expertise on the sub-themes or sub-topics so that they come prepared with answers/evidence etc. A moderator initiates the discussion by explaining the purpose and scope and raises questions in a predetermined order to various members of the panel, then the members of the panel present their views one after the other. Later

on each member may also react to others' views. In the end, the different viewpoints and interactions are synthesised and summarised by the moderator.

### **Instructional potential :**

The uniqueness of this alternative lies in its ability to resolve issues and seek clarifications of controversial and multidimensional topics and themes.

### **BRAINSTORMING**

This alternative is useful in developing the creative abilities of students. Problems which demand creative or innovative solutions can be presented by the teacher to the students of brainstorming. For example, the social studies teacher asks students to watch a television programme on "Population Problem". The next period he says to students, "we have watched the TV programme and can now find out certain solutions to the population problem of our country". The students come out with a *list* of solutions to overcome the population problem. The teacher lists them on the blackboard and does not give any judgement on the list. He asks students to select appropriate solutions from the list.

### **Organisation :**

In a classroom, the teacher can select a problem-oriented topic and ask students to express themselves freely on various aspects of the topic. The teacher assures students that their expressions will not be criticised or commented on in a negative way. Students should be encouraged to freely come out with their viewpoints. The teacher takes note of all these expressions. After the session, or preferably on another day, the teacher may evaluate, elaborate and integrate the ideas exposed in order to encourage further thinking among the students along newer dimension.

### **Instructional potential :**

This technique helps students to think creatively and is suitable for problem-oriented themes.

### **Lecture Method**

The lecture is one of the most common teaching methods used by teachers of subjects at the secondary level. It is an example of "expository" teaching, in which the input is directly provided by the teacher who communicates the new information or process. Apart from its major function of giving information, it plays certain unique functions which cannot be performed by other inanimate sources. Firstly, the teacher may use it to motivate the students. It is through listening to lectures that students are attracted to different areas of studies in social sciences. Secondly, the teacher may use it to integrate various

sources of information. The lecture follows some specific steps through which it is carried out. These are planning and delivery. The delivery of a lecture is again divided into three phases : introduction, development and consolidation.

**Educational Significance:-**

- It is an economical teaching device. No laboratory, apparatus, gadgets etc are required
- It can be used for a very large group of students without the use of other aids.
- It provides training to the pupils in listening and taking rapid notes.
- It is used to achieve the cognitive and affective objectives.
- It gives students good training and experience in the development of certain skills like learning by hearing, writing while taking notes, attending the auditory and visual presentation.
- It provides the opportunity to the teacher to use different techniques and methods like question –answer technique, discussion method etc. in order to capture their attention towards the lecture.

**Planning of a lecture**

Unlike what is commonly believed, the lecture does require systematic planning. Planning a lecture entails a number of activities. The teacher must prepare a lesson plan for the lecture to be delivered. This contains the instructional objectives to be achieved, the amount of -content to be covered, the kinds of additional interactional modes to be used, the feedback mechanism to be used, the kinds of audio-visual aids to be used, etc. Thus, planning a lecture boosts the confidence of the teacher in handling the class. He knows in advance what to do when, and what not to do. Sometimes, the teacher can plan for humorous interludes, jokes, etc; to make the lecture more interesting.

**Delivery of a lecture**

Delivery of a lecture may be done in three phases as follows:

**Introduction of a lecture :** Sometimes, the introductory phase is also called the warm up phase. The main task of the teacher here is to establish rapport with the students, create interest and motivation among them and gradually lead the learners to the next phase. At this stage the teacher relates the new topic to the one already taught and to the previous experience. The main function here is to arouse interest and motivate the students. The teacher also uses the blackboard or any other visual medium to highlight the theme.

**Development phase :** This is the most important phase of a lecture. The transaction of ideas and information between the teacher and the learner takes place at this phase. This is also called the presentation phase. The teacher explains the concepts and principles, provides facts, furnishes data, quotes figures, etc., to the learners. In order to explain the content

matter, the teacher cites examples, uses communication aids, gives analogies and illustrations, etc. Where required, the "teacher also adopts different non-verbal communication techniques such as gestures, postures, etc., to facilitate teaching.

**Consolidation phase :** This is the concluding phase of a lecture. Here the teacher recapitulates whatever he has explained; then summarizes the main teaching points of the lecture either verbally or by writing them on the blackboard or by using an overhead projector (OHP). The teacher also asks a few questions on the content matter covered in order to evaluate the students' understanding of the lecture. Thus, the teacher gets to know the learning difficulties of students and accordingly modifies his teaching. The teacher also gives some assignments to the students which they are expected to complete and bring back for the teachers remarks. The teacher also informs the students what the next lecture would deal with.

### **Advantages of lecture method**

The lecture method has certain merits for which it can be used in teaching subjects. Some of these are mentioned below:

- Lecturing can be used to impart knowledge pertaining to all branches of subjects.
- Lecturing is a method that can easily adapt itself to suit a wide range of personality characteristics.
- This alternative is adaptable to a variable teacher-student ratio.
- The lecture technique is very economical and can be made very effective with proper planning and execution.

### **Disadvantages of lecture method**

- It provides little scope for pupil's activity.
- It does not take into consideration the individual differences of pupils.
- It is against the principle of 'learning by doing.'
- It spoon feeds the students without developing their power of reasoning.
- Speed of the lecture may be too fast for learners to grasp the line of thought.
- An average student may not be able to fix up his attention to a lecture.
- A lecture may become monotonous to students after a while.

### **Question Answer Method**

Questioning is a powerful technique of teaching subjects. Through this technique, the teacher transacts lot of learning experiences. The teacher asks questions and the responses given by the students are strengthened and elaborated.

**According to Lorber and Pierce ( 1990),** Instructional Inputs in Subjects questions can be used to find out how well students understand a particular block of information, to shift student's attention from one point to another, to increase retention of important points by isolating and

emphasizing them, and to put students in the right direction before starting assignments. Questioning facilitates high order thinking skills like analysis, synthesis and evaluation in the students.

***In order to increase the effectiveness of questions you may take the following steps:***

- **Stat the question clearly and precisely :**A question must be clear and precise. There should not be any ambiguity in the question. For example, a question like "What about Buddhism?" does not convey any meaning to the students. It would be better to ask "How does Buddhism differ from Jainism?"
- **Pause after asking the question and allow it to "hang overhead":** The teacher should ask the question clearly and then pause before calling on someone to respond. This helps students to think about their answer.
- **Call on students at random :** While calling on students, the teacher should not follow any specific pattern such as seating arrangement, alphabetical arrangement, etc. Rather, he should call on students at random.
- **Provide immediate feedback to students :**The teacher should give immediate feedback after receiving students' responses. He should tell the students if the response is partially correct or wholly correct.

**Questions could also be categorized according to their essential functions:**

***i. Probing questions :***

Probing questions are meant for motivating students to go beyond their initial responses and help themselves in solving the problem. For example, to a response, like "Barter economy means exchange of goods for goods." the teacher may say "Good" and ask the student to provide an example of "barter economy".

***ii. Open-ended questions :***

These questions have definite right or wrong answer; Students are free to think on their own and provide answers with a logic. A question like "What will happen to the Island country of Maldives if the temperature on the earth increases ?" may be asked of the students.

***iii. Convergent questions:***

Convergent questions are designed to "converge" on a particular idea or point and are meant for inducing a principle or deducing an answer. An example of a convergent - 'How do farm subsidies affect consumer prices?'

***iv. Divergent questions:***

Divergent questions are helpful to draw a student's attention away from one point and allow it creative freedom to settle on a different but related point. "What present day parallels do we have, if any, to the Indus Valley Civilization?" is a divergent question which inspires students to think

divergently on two analogous situations.

### Advantages of Question-Answer Method

- (i) It can be used in all teaching situations.
- (ii) It helps in developing the power of expression of the students.
- (iii) It is helpful to ascertain the personal difficulties of the students.
- (iv) It provides a check on preparation of assignments.
- (v) It can be used to reflect student's background and attitude.
- (vi) It is quite handy to the teacher when no other suitable teaching method is available.

### Disadvantages of Question-Answer Method

- (i) It requires a lot of skill on the part of teacher to make a proper use of this method.
- (ii) It may sometime mar the atmosphere of the class.
- (iii) This method generally is quite embracing for timid students.
- (iv) It is time consuming

### Teaching Method: Guest Speakers

Inviting guest speakers to the classroom is another effective teaching strategy in subjects. In social studies, there are a number of experts whose rich experience, of knowledge and skills could be made use of in instructional activities. They not only provide students the experience of the real world but also motivate them for effective learning. For example, a political worker may be invited to talk on the national character of India and on the forces which act against the unity of the country. Similarly, an economist, when invited as a guest speaker, would provide comprehensive knowledge on the factors responsible for the economic growth of the country.

Though textbooks and classroom teaching in subjects do provide students knowledge on various content areas, lectures given by guest speakers strengthen the knowledge acquired by. Students from textbooks and classroom teaching.

Sometimes, guest speakers can also serve as role models for students. For example a freedom fighter, if invited to speak on the role of freedom fighters during the independence movement, would certainly act as a role model for students. Students would, thus, learn the virtue of patriotism and mould their character for the cause of the nation. Guest speakers could be chosen from any discipline or from any human occupations. They may be academicians, social workers, businessmen, religious workers, political workers, parents, etc.

**Woolever and Scott (1988)** have given certain guidelines which may be followed while selecting and preparing for an outside speaker. These are:



- Determine specific instructional objectives for the guest speaker person.
- Choose a speaker with acknowledged expertise.
- Select a speaker who can be effective with students and who won't talk over their heads or down to them.
- Communicate the expected learner outcomes to the speaker, and encourage him or her to tell you what is planned; make suggestions or additions or changes as appropriate.
- Encourage your guest to use audio-visual. and tactile materials to enhance the value of the .presentation.
- Check with the guest speaker to determine if any special equipment or material (overhead projector, paper and crayons, slide projector, etc.) will be required,
- Reconfirm the date and time a day or two before the scheduled visit.
- Prepare students for the speaker; establish motivation and a focus for learning from the guest.
- Follow up with one or more lessons to ensure that expected outcomes have been achieved.
- It is customary to send a classroom guest a thank you letter.

### **Demonstration Method**

Demonstration is another useful instructional technique which is employed in teaching subjects. What is the meaning of demonstration? Demonstration means showing how something is to be done or not to be done. Through demonstration, a teacher models the behaviors of presentation, analysis and synthesis. The student's role is that of the observer and recorder of information and skills.

In schools, teachers can adopt this technique especially when something related to the development of skills is required. For example, how to draw a map of a country is a skill which has to be demonstrated. Demonstrations are most effective when followed by a corresponding student activity. A teacher demonstrating a measuring 'technique for determining distances on maps should be followed by students using the same technique in a follow-up activity. Demonstration involves the art of depicting the skills associated with an action. Sometimes, ideas, attitudes, processes and other tangibles are also demonstrated consciously

### **Preparing a classroom demonstration**

While making preparation for a classroom demonstration the teacher has to:

- Plan a demonstration that will create interest among students.
- Plan every step in 'the task of demonstration carefully.
- Relate the task to be. demonstrated.
- Outline the various steps of the task to be demonstrated on the chalkboard.
- Make sure that everyone can see and hear.

- Prepare written materials, handouts etc. on the task to be demonstrated.

### **Performing a classroom demonstration**

The following points should be remembered by the teacher while demonstrating a skill.

- Communicate properly while demonstrating.
- Keep the demonstration simple and precise.
- Do not digress from the main theme.
- Do not hurry through the demonstration.
- Do not drag out the demonstration too much.
- Make sure that the demonstration is observed by all the students.
- Summarize as the demonstration goes on.
- Distribute handouts in the end.

The danger of the demonstration strategy lies in the passive role of the students who may or may not understand the concept or skill the teacher is demonstrating. The solution is to follow up the demonstration with replication by the class. Ideally, the students will perform exactly the same activity the teacher has demonstrated in much the same way the teacher has done. In some cases, however, that is not possible. For example you may, using a chart, demonstrate the flow of wealth in our economic system. The follow-up might comprise record keeping by the students of how they spend money.

### **Advantages of Demonstration Method**

1. This method of teaching serves as model laboratory instruction.
2. Experiment shown as demonstration points out this matter of observation and indicates this inference.
3. It makes the pupils familiar with the nature and use of apparatus.
4. Experiments requiring special skill will merely be shown by the teacher. In this method no time is wasted.
5. Teacher's time is properly utilized in watching the students doing experiments.
6. While doing practical, there remains no necessity for explaining except educating precautions.
7. This method proves more useful if the pupils are told beforehand that they are going to do practical in the laboratory.

### **Disadvantages of Demonstration Method**

1. There is danger of students being dishonest when teacher has to play the main role in the discussion and demonstration of the topic.
2. Teachers may be tempted to lecture rather than to teach.
3. Teachers do not try for more experiments than those given in the text book prescribed.

4. Oral discussion may not be encouraged, since it will go to restrict the demonstration experiment.
5. Practical as required may not go hand in hand with demonstration work.

### STORY-TELLING METHOD

Story-telling is an art and listening to stories is a passion with children. Stories which are woven round the unknown past, human adventures and man's quest for the unknown tickle children's imagination and satisfy their instinct of curiosity.

It has been rightly said by an expert: "As history is story and biography, in junior stage, it is mainly a question of telling the story well. The story should be told in vivid, graphic manner in the vernacular, observing the chronological order."

#### Types of Stories

Stories are of varied nature. Certain stories are matter-of-fact type while others mix curiosity and imaginative details with the known facts. So, we have:

**(a) True Stories.** These are stories which are based on and are replete with historical facts.

**(b) Myths.** Mythical stories are imaginative. These stories are not based on facts. They are the result of the flight of one's imagination. They have for their characters fairies, unknown animals, mythical gods and goddesses. They excite curiosity and heighten emotions.

**(c) Legends.** These are the stories which contain a fair element of historical facts and are based on events and incidents related to historical personalities. The lives of such men of history as Alexander, Ashoka, Chandergupt Maurya, Chanakya, Razia and many more have become legends for posterity. However, such stories lack accuracy of details.

"Historical stories, then, whether they are facts or legends", says **Prof. Jervis**, "must be formulated by a truthfulness which is higher than mere accuracy of incidents."

#### Story-Telling Method (How to Tell Stories?)

Story-telling Method follows well-defined steps of procedure. These steps are:

- (a) Selection of the Story
- (b) Telling of Story
- (c) Use of Aids
- (d) Black-Board Work
- (e) Reading from the Text-Book
- (f) Role of Children
- (g) Role of the Teacher

#### (a) Selection of the Story

(i) Stories should be selected lusciously, with an eye on historical facts or events, (ii) The stories may be about the early man, about historical personages, battles fought, won or lost and so on. (Hi) The selected stories should suit the mental level of the students; (iv) The selected stories should be absorbing and should maintain children's interest.

#### (b) Telling the Story

Story-telling is an art. While telling a story, the teacher must proceed in well-selected manner of articulation. Sometimes he/she should take a pause and sometimes he/she should express excitement. The manner of telling the story should be absorbing. Action is an essential ingredient of story-telling.

**(c) Use of Aids**

With the use of aids, story-telling becomes lively and all the more interesting. Use of flash cards, cut-out pictures, paper- strips showing sequence of events, puppetry, use of transparencies-all such aids create interest in the story. Charts, models and time-line graphs are also useful aids to story-telling.

**(d) Black-Board Work**

Black-board work is done to summaries the main points of the story. Black-board summary also helps the teacher to develop the story with the help of recapitulatory questions. The main points of the story help the children to write answers to the teacher's questions.

**(e) Reading from the Text-Book**

Reading from the text-book is helpful to the children to do revision work. It is likely that certain children miss at certain points on account of their inattentiveness. Text-book reading would compensate children in this regard. An illustrated text-book makes reading all the more interesting.

**(f) Role of Children**

Children play an important role in the success of the lesson an history is presented in the form of story-telling. The teacher should see to it that children also participate in the development of the lesson. They can participate.

(i) by asking questions, and

(ii) by answering teacher's questions. Children may also be called upon to narrate a section of the story or the full story. Certain historical events may also be got dramatised in the class-room by the children.

**(g) Role of the Teacher**

The teacher plays an important role in the story-telling method. He should:

(i) Tell the story in an interesting manner, with appropriate gestures;

(ii) Lend an air of dramatisation to the story;

(iii) Lend an artistic and realistic touch to the story;

(iv) Not skip the main parts of the story. Each new part should automatically emerge out of the previous part;

(v) Take care that the selected stories have rich details which are vividly presented.

**Merits of the Story-Telling Method**

1. Good stories if narrated well tickle the imagination of children. Their historical sensibility is enriched.

2. Story-telling trains the creative faculty of children. Students may be encouraged to prepare models of caves, of battle-lines, historical buildings and so on. This also develops love for the subject of history in their minds.

3. By listening to the details of some of the historical events, students may dramatise them in the class-room or on the occasion of annual function of the school.

4.The students also learn the art of narration. They may be asked to narrate stories related to life histories of such persons as Alexander, Rama, Ashoka, Rana Partap, Shivaji and many other historical heroes.

5.Stories of great men infuse moral sense in the hearts of students.

6.Good historical stories help in producing in the pupils such traits of character as truthfulness, patriotism, valour, discipline, sense of sacrifice etc.

### Limitations of Story-Telling Method

1. This method is not useful for all levels of students. Occasional story-telling is useful for high school students, but not the whole of teaching the subject of history.

2. The social, political and economic issues of different periods of history cannot be presented in narrative form.

3. Children may not always respond to story-telling because all story-telling may not attract children's interest.

4. Every teacher is not a good story-teller. The art of story-telling is acquired only by a few teachers.

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