Teaching of Mathematics

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B.Ed Study Material

Third Semester

BED303

Formerly Govt College of Education Srinagar

IASE SRINAGAR KASHMIR
Unit 1 Meaning of mathematics

The term "Mathematics" is defined in different ways by different writers. To begin with, the word "Mathematics" comes from the Greek word "Mathema" or "Mathic" meaning "inclined to learn". It is an exact science which is related to measure, reasoning and analyzing. Mathematician "means" defined in different ways by different writers. To deal with the help of these tools, Mathematics is able to deal with abstract concepts, reasoning, analyze, and understand. Therefore, "Mathematics" is a science of numbers and space, it has its own tools like logic.

From the above definitions, we conclude that Mathematics in the strict sense is an abstract science which investigates deductively the conclusions implicit in the elementary conceptions of spatial numerical relations. The Oxford Dictionary defines Mathematics as the science of numbers, quantities and measurements.

Different authors have different views, some of them are given as:

1) Locke's View: Mathematics was a way to settle in the mind a habit of reasoning.
2) Whitehead's View: Mathematics is the science of physical science and mathematics.
3) The ancient Hindus called it "Ganita", meaning science of calculations.
4) Lord Rayleigh's View: Mathematics is the science of physical science and mathematics.
5) Court and Robbins' View: Mathematics is an expression of human mind, certainly no more marvelous language ever created in the mind of man.

Thus from the above definitions, we conclude that Mathematics in the real sense is a science of numbers and space, it has its own tools like logic. Mathematics deals with the study of numbers, notations, quantified, measurements, signs, symbols, and terms, operations, it has its own language, its own tools like logic, etc.

Finally, we can say that Mathematics is the science of numbers and space, it has its own language, its own tools like logic, etc.
Aryabhata was the first great Hindu mathematician. He was born in 500 A.D. at Patliputra in Bihar. His work is divided into four parts, three of them are on astronomy, he gives thirty three rules in arithmetic, algebra and plane geometry, He also computed arithmetical tables which contains a table of sines. His work in mensuration was crude and in this respect it somewhat resembled that of Egyptian's.

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Contribution of Mathematicians

Aryabhata and his contributions

Area of circle = \pi r^2

Area of sphere = \frac{4}{3} \pi r^3

He gave the following formulae for summing an arithmetic series, if \( a \) and \( L \) are the first and last term of the series then the sum is given by:

\[ S = \frac{a + L}{2} \times n \]

where \( n \) is the number of terms.

He put more appropriate uses of decimal system. He gave a rule for summing an arithmetic series, if \( a \) and \( L \) are the first and last term of the series then the sum is given by:

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where \( n \) is the number of terms.

He made a notation system in which digits are denoted with the help of alphabet numerals e.g. Ka denotes 1, Kha denotes 2, Cha denotes 3, Chya denotes 4, etc.

He gave the value of \( \pi \) as the ratio of circumference to the diameter is

\[ \frac{\text{Circumference}}{\text{Diameter}} = \pi \]

He gave the volume of a pyramid as half as the product of the base and height.

He gives the volume of a sphere as the product of the base and height.
The area of a trapezium can be calculated using the formula:

\[ \text{Area of Trapezium} = \frac{1}{2} \times (a + b) \times p \]

where \( a \) and \( b \) are the parallel sides, and \( p \) is the height.

Aryabhata provided elegant results for the summation of series of cubes and squares. He had written a book "Siddhantasrimoni" in 1150 A.D. Four chapters of this book are Līlāvatī, Vīgaspatī Saṁhitā, Golōdhaṇya, and Grahagītī. He had written a book "Siddhantasrimoni" in 1150 A.D. Four chapters of this book are Līlāvatī, Vīgaspatī Saṁhitā, Golōdhaṇya, and Grahagītī. He had written a book "Siddhantasrimoni" in 1150 A.D. Four chapters of this book are Līlāvatī, Vīgaspatī Saṁhitā, Golōdhaṇya, and Grahagītī.

Bhaskaracharya was born in 1114 A.D. in Bijjada Bida (presently situated in Bijapur, Karnataka, in the state of Karnataka). His best work, called Bhāṣākara, was written in the village of Shridharmapuri. Bhaskara wrote on astronomy, arithmetic, mensuration, and algebra. His approach was scientific. He was much ahead of his time, much ahead of his time, much ahead of his time, much ahead of his time, much ahead of his time, much ahead of his time.
He beautifully dealt with the subject permutation and combination under the name "Ankpash". One of his formulas is still used in the following terms:

\[
\text{Number of permutations of } r \text{ things} = \frac{r!}{(r-k)!}\]

where \(k\) and \(L\) are different things.

He also dealt with cubic and biquadratic equations in his writings, e.g.,

\[
4x^3 + 3x^2 + 2x + 1 = 0
\]

In the field of differential calculus, he was the first mathematician who presented examples related to differential coefficients. In the field of Trigonometry, he gave a method for deriving signs for angles of every degree. He gave the following formulae:

\[
\sin(\theta) \sin(\theta) + \sin(\theta) \cos(\theta) = \frac{1}{2} \sin(2\theta)
\]

According to him, the earth is round and the 100th part of the circumference of the earth seems to be a straight line. Our earth is a huge sphere, and he derived the following formula:

\[
\sin(\theta) = \frac{r}{\sqrt{1 - (\sin(\theta))^2}}
\]

where \(R\) is the radius of the circle.

Srinivasan Ramanujan was born on 22 December 1887 in Erode, Madras. At the age of 16, he won the Subramanyam Scholarship, which is generally awarded at the age of 16, and then his mathematical talent was noticed. He passed his matriculation at the age of 17 and won the Subramanyam Scholarship, which is generally awarded at the age of 16, and then his mathematical talent was noticed. He worked as a clerk in a government office.

He made his one of the works published in the Journal of the Indian Mathematical Society in 1912 at the age of 25.

This resulted in discontinuing his scholarship, but he could not do well at the college for the proficiency in English and Mathematics. His father, K. Srinivasa Iyenger, worked as a clerk in a government office.

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\[
\frac{d}{dx} \left( x^2 + 3x + 1 \right) = 2x + 3
\]

The name "Ankpash" one of his formulas is still used in the following terms:

Number of permutations of \( r \) things = \( \frac{r!}{(r-k)!} \) where \( k \) and \( L \) are different things.
Gobbacki conjecture is one of the important illustrations of Ramanujan's contribution. The statement is as "Every even integer greater than 2 is the sum of the first two primes that is numbers having no divisors". For example, 4 is the sum of the two primes 2 and 2, 6 is the sum of 3 and 3, 8 is the sum of the two primes 3 and 5 and so on.

Ramanujan has formulated an equation that could be used to solve the infinitely nested radical problem. Hardy was impressed by some of Ramanujan's work relating to infinite series.

Rene-Discrates and His Contribution

Rene-Discrates was born in 1596 in France. He was the son of the wealthy landowner. His Geometry is the main contribution of the Rene-Discrates, in the "La-Geometry". He died in 1650 while in France. He was elected as the fellow of the Royal society. Suddenly, he showed a tuberculosis tendency. He died in 1650 while in France. He was elected as the fellow of the Royal society.
He for the first time gives the proof that $\sqrt{2}$ is an irrational number.

Descrete note.

musical scale, connecting the length of a string and the pitch of its vibrating
Pythagoras or one of his followers discovered the harmonic progression in the
He was the first to discover that the earth is sphere in shape.
the “Earth measurement”
and probably visited Egypt his mastery advice in order to study
Pythagoras little is known of him early life except that he studied under Thales
whose name is found in every text book on geometry today, that name is
He was born between the year 580- 568 B.C a Greek boy was born in Samos

Pythagoras and his contributions

He was died in 1650 in Sweden.
He also had an influential role in development of modern Physics, he gives
negative real roots.

There is two sign changes therefore two
Equation $x^2 + a^2 = c^2$ there is no sign change therefore no real root and
changes or even number less than that number.
number and the number of -ve real roots equal to either number of sign
roots equal to either number of sign changes or even number less that that
of the polynomial, which states that the polynomial has number of real +ve
Descrete most important contribution is determining the +ve and -ve real roots
and if the two lines coincides then there are infinite number of solutions
of the equation, if the two lines are parallel to each other there is no solution
two linear equations intersects at a point then that point is called the solution
two dimensional geometry e.g. in the pair of linear equations if the lines of the
discracte says that the roots of the equations can also be obtained by using the
the other number is called the ordinate.
described by the two numbers in a plane one number is called the abscissa and
He discovered that the sum of the interior angles of the polygon with \( n \) sides is equal to \((n-2)180\) and the sum of the exterior angles of the polygon is equal to \(360\) degrees.

He also gives that the square of a number \( n > 1 \) is equal to the sum of the first \( n \) odd numbers:

\[
2^2 = 1 + 3, 3^2 = 1 + 3 + 5, 4^2 = 1 + 3 + 5 + 7, \ldots
\]

Pythagoras theorem was the most important contribution which states that the sum of the squares of the right triangle is equal to the square of the longest side.

\[
\text{Figure (1)}
\]

An equilateral triangle figure consists of 10 points arranged in four rows of \( 1, 2, 3 \), and \( 4 \) points.

The mathematical idea and mathematical symbol of the Pythagorean is "The Tetractyes".

The figure shows that \( 3^2 + 4^2 = 5^2 \).

He also discovered that the sum of the interior angles of the polygon with \( n \) sides is equal to \( (n-2)180 \) degrees.

The mathematical symbol of the Pythagorean is "The Tetractyes".
Figure (2) He discovered five solids: dodecahedron, and he says that all these solids lie in the sphere which he called a perfect solid.

Pythagoras says that the whole universe is based on the numbers and the planets and stars move with the help of some mathematical equations.

He was murdered about 497 B.C. in Carrato in Western Italy.

Contribution of Euclid

Euclid gives the definitions, some of them are:

1. A point is that which has no part
2. A line is a breathless length
3. The ends of a line are points
4. A straight line is alike which lies evenly with the points on itself
5. A surface is that which has length and breadth only
6. The edges of a surface are lines
7. A plane surface is a surface which lies evenly with the straight lines on itself

Euclid assumed certain properties which were not to prove. These universal truths he divided them into axioms and postulates. Some of the axioms are given as:

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Euclid’s assumption of universality allowed the derivation of geometrical truths without the need to prove them. This approach to geometry was a significant advancement in mathematical thought.
Euclidean and Deductive Method

Methods of Teaching Mathematics

For every subject, method is important. A method is nothing but a scientific way of presenting the subject keeping in mind the psychological and physical requirements of the children. For effective learning of mathematics, the method needs to be as good as the content. It is through method only that it is possible to make a subject interesting and useful. Without a method, teaching would be hard. The arrangement of the subject and its presentation is very important for successful teaching. The term “method” can be taught as the most effective and economical way of teaching to take place among students.

Euclid’s five postulates are:

1. A straight line may be drawn from any one point to any other point.
2. A straight line may be produced indefinitely.
3. A circle can be drawn with any center and any radius.
4. All right angles are equal to one another.
5. If a straight line falling on two straight lines makes the interior angles on the same side of it taken together less than two right angles, the two straight lines if produced indefinitely will meet on that side on which the angles are less than two right angles.

Unit 2

Methods of Teaching Mathematics

Inductive and Deductive Method

Inductive and Deductive Method

Interpreting a subject like mathematics, various methods of teaching based on logical developments of subjects is the most important pre-requisite communication of ideas and developments of concepts is a precise manner most effective and economical way of learning to take place among students. Important for successful teaching, the term “method” can be taught as the very method has to be as good as the content. It is through method only that it is possible to make a subject interesting and useful. Without a method, teaching would be hard. The arrangement of the subject and its presentation is very important for successful teaching. The term “method” can be taught as the most effective and economical way of teaching to take place among students.

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a) Inductive Method

Inductive method is based on the process of induction. It leads from concrete to abstract, particular to general and from examples to general rules. In this, we first take a few examples and then generalize the formula. Certain complex and complicated formulae cannot be generalized in this method. This method is limited in range and is not sustainable for all topics.

Demerits of Inductive Method:
1. It helps in increasing the pupil-teacher contact.
2. It helps in understanding because the students know how a particular formula has been framed.
3. It encourages active participation of students and thus stimulates self-study.
4. It helps in increasing the pupil-teacher contact.

Merit of Inductive Method:

\[
\text{Average} = \frac{\text{Sum of number of terms}}{\text{Number of terms}}
\]

\[
\text{Simple Interest} = \frac{100 \times \text{Simple Interest}}{P \times R \times T}
\]

b) Deductive Method

Deductive method is based on the process of deduction. It takes a few examples and then generalizes. This is a method of constructing a particular to general, from examples to general rules. In this, we first abstract particular to general and then generalize. Thus, it is a method of constructing a formula which will be helpful in obtaining results and be helpful to make generalization to get the required formula. Many other examples can be quoted in support of inductive method. If we wish to frame the formula, for example, if we take the formula \( q + pq + qz = (q - v) \), let the students actively multiply (a-b) x (a-b) and find out the product, they may then be asked to find the answer for \( (p-q) \), \( (l-m) \) etc., by actual multiplication. After that they may then be asked to observe results and be helped to make generalization to get the required formula. Many other examples can be quoted in support of inductive method.
Deductive method is the opposite of the inductive method. It is based on deduction. In this method, we proceed from general to particular and from abstract to concrete. In this method, the rules are given at the very outset. The students are asked to apply these rules to solve more problems. In this method, the formulae is accepted by the students as pre-established and well-established truth. The formula is accepted by the students as pre-established and well-established truth. The formula is also given at the very outset. The students are asked to apply this formula to solve more problems. In this method, deduction is the opposite of the inductive method. It is based on deduction. In this method, we proceed from general to particular and from
1. It is a time consuming and lengthy method, so it is uneconomical.

2. It helps in developing reasoning power of the students.

3. In this method, students participation in encouraged.

4. It develops self confidence in the pupil.

Demerits of Analytical Method:

Thus, diagonals bisect each other.

Thus, $\triangle AOB = \triangle COD$

$AB = CD$ (sides of a parallelogram)

(All interior angles are equal)

(Vert. opposite angles are equal)

Thus, any equal elements in these triangles?

$\triangle AOB$ is congruent to $\triangle COD$.

Thus, $OA \parallel CD$.

If prove that

$\frac{p}{c} = \frac{q}{d}$

The unknown part is

The two congruent triangles $\triangle AOB$ and $\triangle COD.$

We have to prove $OA = OC$ and $OB = OD$.

How can prove $OA = OC$ and $OB = OD$?

Q) What is given?

Q) What is to be proved?

Q) Given two congruent triangles. Thus, we have to prove that triangles $\triangle AOB$ and $\triangle COD$ are congruent. Similary, $\triangle OBD$ and $\triangle ODC$ will be equal if they are the corresponding sides of two congruent triangles. Similarily, $\triangle OAB$ and $\triangle OCB$ will be equal if they are the corresponding sides of two congruent triangles.

Q) How can prove the above, which pairs of the given figure are to be present?

Q) To prove the above, which pairs of the given figure are to be present?

Q) To prove the above, which parts of the given figure are to be present?

Q) Given ABCD is a parallelogram. AC and BC are the two intersecting at O.
2. This method is not suitable for all the topics in mathematics.
3. This method does not find favor with all the students because below average students fail to follow this method.

**Synthetic Method:**

In this method, we proceed from known to unknown, actually synthesis is the complement to analysis. The word 'synthesis' is derived from the together. In this method, we combine together a no. of facts, perform certain mathematical operations and arrive at the solution. In this method we start with the known data and connect it with the bits of information to reach the point where unknown information becomes obvious and true, thus in this method, we proceed from hypothesis to conclusion.

**Example:**

\[
\begin{align*}
\frac{p}{pq-\frac{c^2}{2}} &= \frac{q}{ac} \\
\frac{p}{c} &= \frac{\frac{c}{2} - \frac{q}{2}}{\frac{q}{2} - \frac{p}{2}}
\end{align*}
\]

Subtract on both sides we get

\[
\frac{p}{c} = \frac{q}{q}
\]

**Merits of Synthetic Method:**

1. It saves time and labour.
2. It is a next method in which we present the facts in a next systematic way.
3. It suits majority of students.
4. It can be applied to majority of topics in teaching of mathematics.

**Demerits of Synthetic Method:**

1. It makes the students passive listeners and encourages cramming.
2. It is an unpsychological method.
3. In this method, there is a scope for forgetting.
4. It makes the students passive listeners and encourages cramming.

**Heuristic Method:**

In this method, confidence is generally lacking in the students.
This method involves finding out by the pupils, instead of merely telling of early things by the teacher, this method demands complete self-activity of self-education on the part of the learner. The Word 'Heuristic' has been derived from the Greek word 'Heuresco' which means should be to implies that the attitude of students should be discover and not passive recipient of knowledge, this method was originally introduced by Armstrong for learning of Sciences. This method emphasis experimentation. In this method the teacher becomes and the child tries to move ahead independently without any help or guidance. This method makes the student self-relevant and independent. The teacher's job is not to solve problems for the pupils, but to enable students to solve problems for themselves. His difficult lies more ahead independently without any help or guidance. This method was originally introduced by Armstrong for learning of Sciences. This method involves finding out by the pupils, instead of merely telling of early things by the teacher, this method demands complete self-activity of self. Heuristic Method cannot be used without certain pre-requisite, the teacher has to explain the students beforehand about the method should be perfect, he should have correct knowledge about the method, the students should be guided, this guidance should be learned in a scientific way. The progress of the method is bound to be slow so both the students and teacher need not get discouraged.

**Pre-Requisite or Requisite of the Heuristic Method:**

a) This method is not suitable for the beginners because in the early stages, students need deal of guidance. This guidance should be given in a scientific way.
b) This method is not suitable for the beginners because in the early stages, students need deal of guidance. This guidance should be given in a scientific way.
c) The teacher's knowledge about the method should be perfect. He should be perfect, he should not leave the students all alone without proper guidance. His difficulties at any stage should be attended by the teacher.

**Example:** Find the area of your classroom whose length and breadth are 8 m and 6 m respectively.

Teacher:

Q1: What is the length of the floor of the classroom?
Ans: The length is 8 m.

Q2: What is the breadth of the floor of the classroom?
Ans: The breadth is 6 m.

Q3: What is the formula for finding the area of the floor?
Ans: Area = Length × Breadth.

Q4: What will be the area of the floor by using formula?
Ans: Area = 8 × 6 = 48 sqmts.

Q5: What have you to find in this question?
Ans: Area of the floor of the classroom.

Q6: How many squares in all will be formed?
Ans: No of squares = 8 x 6 = 48 each side representing 1 metric sqm.
Merits of Heuristic Method:

1) This method makes the students active participate in the process of learning and allows them to have independent thinking.
2) It is psychologically a very sound method of learning and above average.
3) The method is appropriate for all types of students, average, below average.
4) Group feeling is developed by this method.
5) Certain mathematics topics can best be understood in a mathematics laboratory method.

Laboratory Method

This is an elaborated and practical form of the inductive method. It makes the subject interesting as it combines play and activating.

Example (1): The teacher will ask the students to draw a quadrilateral to measure the sum of its interior angles.

Example (2): The teacher will ask the students to draw a triangle.

Demerits of Heuristic Method:

1) Too much expected from the students as well as teachers.
2) Difficulty in covering the syllabus.
3) Possibility of wrong conclusions.
4) It is psychologically a very sound method of learning and allows them to have independent thinking.

Merits of Heuristic Method:

1) This method makes the students active participate in the process of learning.
Demerits

1. It is not possible to teach all the mathematical topics in a mathematics laboratory.
2. Mathematical facts are certainly established, but not mathematical reasoning.
3. In lower classes, students may not be able to conduct experiments.
4. A good amount of labour and time is involved in this method.

Merits

1. Students develop interest in the project as the whole work is child centered.
2. No bookish knowledge is learnt by the students, but the whole work is practical in nature.
3. Students are taught to solve problems in daily learning.
4. A lot of valuable experience is gained by students under this method.
5. The principal of utility: As the projects taken are from real life, action and their experience.

Project Method

1. The principal of activity: The method is based on the principle of "Learning by doing." Therefore, the student have to seek a number of learning activities and use the freedom to plane the same.
2. The principal of purpose: The project is to be run by the students within well fixed purpose to be achieved.
3. The principal of freedom: The project is to be run by the students within well fixed freedom of choice and action. Any restriction imposed will kill the spirit.
4. The principal of utility: A lot of valuable experience is gained by students under this method.
5. The principal of activity: The method is based on the principle of "Learning by doing." Therefore, the student have to seek a number of learning activities and use the freedom to plane the same.

Bilard says, "A project is a bit of real life that has been imparted to schools." According to Dr. Kilpartic, "A project is a unit of whole headed philosophy of pragmatism where what is taught, should have a direct relationship with the actual happenings in schools."
3. Students get a lot of satisfaction and pleasure in the completion of the project successfully.

2. The method is psychologically very sound.

1. It develops a healthy attitude in students.

**Demerits of Oral Work:**

1. Oral work and such other works are difficult tasks.

2. It needs a lot of money for the purchase of equipment and other things.

3. No fixed time table is there for completing the project work.

4. Here learning is not uniform in view of some students doing more duties and other doing less.

**Techniques of Teaching:**

- There are many a techniques which can be effectively used for the teaching of mathematics, some of these are:

  **Oral Work:**

  Oral work is done orally (mentally) without the help of pen and paper. Oral work occupies a special place in life and in mathematics. Mathematics is science of figures and writtenwork. Major part of mathematics has to be covered in written form but its application in oral form, if the principles of mathematics can be discussed orally, it is more helpful.

**Precautions To Be Observed In Regard To Oral Mathematics:**

1. Oral work be used as a means to Revision and Test. As far as possible, oral work be used as a means of revision and testing the knowledge of the students unless it is done, it is likely to yield proper results.

2. Oral work should be used only as a means of Revision and Test. As far as possible, oral work should be used only as a means of Revision and Test.

3. As far as possible, this method should not be used in Fractions and decimals.

4. Oral work should be used only as a means of Revision and Test.

5. Oral work should be used only as a means of Revision and Test.

6. Oral work should be used only as a means of Revision and Test.

7. Oral work should be used only as a means of Revision and Test.

8. Oral work should be used only as a means of Revision and Test.

9. Oral work should be used only as a means of Revision and Test.

**Merits of Oral Work:**

1. It develops a healthy attitude in students.

2. It gives an unstructured and help hazy outlook in written mathematics.

3. It is difficult for younger students to choose project for work.
such thing is required. In oralmathematics, there is likelihood of inaccuracy. If oral mathematics is not conducted properly, the mistakes are likely to be cursed because of the speed and haste and lack of any systematic work.

Merits of Oral Work:

1. It trains the pupils in solving day to day problems of life. Oral calculations have to be done in life at many occasions because we are not expected to carry pen and paper all the time with us.
2. It develops mental alertness and quick thinking.
3. It develops speed in solving problems.
4. It helps in learning the written work in mathematics. Once a student has become well at oral mathematics, he enters the field of written mathematics with confidence and is likely to succeed in that field.

Precautions about written Work:

1. The teacher should give proper instructions to the students about the work, time, etc.
2. Written work must keep in mind the mental needs of the students.
3. Written work should be examined thoroughly and properly. As far as possible, the examination should be done in the classroom and checked in the presence of students.
4. Written work leads to accurate, neat and systematic work. Thus, we see that one without the other is vague and purposeless. Written work is the goal of written work. It is not possible to completely isolate oral work from written work because when one is done in the field of mathematics, the other is also required in mathematics.

Merits of Written Work:

1. Written work helps to make clear the thoughts and proper reasoning.
2. Written work is quite helpful in solving lengthy problems and complicated sums which are difficult to be solved orally. Since written work is of permanent nature, we can judge the performance of students in a better way.

Purpose of written work in Mathematics:

Why?
It enables the teacher to know the amount of work done by the students.

ii) Written work helps in testing the knowledge imported orally.

iii) Written work helps in conduct of bigger classes.

Drill Work:

Drill work is a way to revise a lesson that has already been taught. It means practice makes a man perfect. Psychologically, it has been found that learning is followed by forgetting. According to Simpson, “Drill is a serial work activity which has for its purpose the perfection of a skill or the strengthening of association to make them more automatic.” Thus, the teacher should make sure that the students have understood the facts or rules. The drill work should always be based on the facts taught. New facts or rules should not be given in drill work. Thus, the effective drill requires proper planning and careful supervision. Only then will it lead to perfecting skills and maintenance of good results.

Precautions in regard to Drill and Exercises:

1. Drill work should follow understanding. The teacher should make sure that the students have understood the facts or rules.
2. It should be meaningful. The students must know why they are having drill in a particular topic and the purpose behind it.
3. The drill work should always be based on the facts taught. New facts or rules should not be given in drill work.

Demerits of Drill Work:

1. It provides an opportunity to the teacher to sit at least in the class in the class.
2. It helps the students to solve exercises or do the drill in the examination.
3. It gives an opportunity to the teacher and the authorities to award proper position to the students in the class.

Drill work is a way to revise a lesson that has already been taught. Thus, it enables the teacher to know the amount of work done by the students.
Supervised Study:
By supervised study we mean to study under the supervision of the teacher. The students are asked problems or to do some practical work in the school. The teacher gives guidance and direction on the spot. The study may be individual or collective. The students are free to work independently or to consult with their teacher.

How to Make Study more Effective
Students make efforts in the right direction. The teacher is responsible for the teacher to see that the students are free to work independently. The study may be individual or collective. The students and the teacher may be asked to do some practical work in the school. The teacher gives guidance and direction on the spot. The study may be individual or collective. The students are asked problems or to do some practical work in the school. The teacher gives guidance and direction on the spot.
knowledge, tracing out historical background of a mathematical concept, formulating problems on a topic, carrying out a mathematical project and so on. Assignment is a sort of self study which supplements classroom teaching. It puts extra work on the part of teacher who is already overloaded.

**Demerits of Assignments:**

- It may help the teacher to know about the progress of students.
- Provides opportunity to the students to do work according to their convenience.
- Assignment is actual directed study. Merely dictating of questions or problems is not an assignment. Hints have to be given for the successful completion of assignment.
- Work according to the level of the pupils and the time available.
- Assignments arouse attention and interest of the pupil and have motivational value.

**Merits of Assignments:**

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- Work according to the level of the pupils and the time available.

**Various Steps in the Assignment:**

1. Planning of the Assignment Work: The teacher has to select work according to the level of the pupils and the time available.
2. Providing Guidelines: Assignment is actual directed study. Merely dictating of questions or problems is not an assignment. Hints have to be given for the successful completion of assignment.
3. Evaluating the Assignment Work: The assignment work be carefully checked and mistakes pointed out.
Importance of Planning a Lesson

1. It keeps the teacher systematic and orderly in the treatment of the subject matter. He does not follow haphazard and thoughtless teaching.

2. It helps the teacher to proceed with a particular aim in view and thus makes the teacher more interested and enthusiastic about teaching and pupils should be able to participate in the teaching-learning process. Both the teacher and pupils must get some new ideas and knowledge.

3. The lesson is correlated with the social and physical environment of the students, so their interest in the subject is maintained throughout the lesson.

Steps in Lesson Planning

1. Motivation or Introducing the Topic:
   - Planning in this approach starts as follows:
     - Usually, the initial step of lesson planning is the order of the day is most important part of the lesson plan. It pertains to preparing and presenting knowledge of the students. This should not take more than 7-8 minutes.
     - The teacher uses the method of questions and answers having a bearing on the previous knowledge of the students, by arousing curiosity and by appealing their senses. For this, the teacher modifies the knowledge to the lesson content by linking it to their previous knowledge. The pupils are made familiar with the lesson content.

2. Presentation:
   - In this step, the pupils must get some new ideas and knowledge. Both the teacher and pupils should be the active participants in the teaching-learning process.

3. Generalizations:
   - When the topic has been made clear to the students, the teacher should make an effort to draw generalizations with the help of definitions, principles, etc. The generalizations:

   - Knowledge lessons: Generally in the teaching of mathematics, we have knowledge and skill lessons.
   - Skill lessons:
   - Application lessons:

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   - Skill lessons:
   - Application lessons:
students should be encouraged to draw generalizations themselves. In other words, the students must realize that they have got new knowledge and are able to apply it. Applications:

In this step, an effort is made to apply the knowledge gained to certain situations.
Characteristics of Good Unit Plan:

1. It should have clear and well defined aims and objectives.
2. It should be complete integrated whole in the organization.
3. It should provide activities for students.

Purposes/Advantages of Unit Planning

1. It clears the general aims as well as specific aims of teaching.
2. It helps the students towards learning.
3. It develops certain types of skills among the students.
4. It should satisfy some of the future needs of students.

Steps Involved in Developing a Teaching Unit:

1. Preparation of Motivation
2. Knowledge of Previous Experiences
3. Preparation of Motivation
4. Summarization
5. Review and Drill
6. Evaluation

Steps of a unit plan:

1. Subject (mathematics)
2. Topic (Heading of the Unit)
3. Class (To whom the unit is to be taught)
4. Time (No. of Periods)
5. Aids (What are aids to be used during entire unit)
6. Content (Syllabus to be covered)
7. Sub unit (No. and Name)
8. Objectives (To be achieved after completion of unit)

How to Plan a Unit:

1. It should be according to the needs, capabilities and interests of the pupils.
2. It should be start with previous and background of the students.
3. It should be according to the results, capabilities and interests of the pupils.

The following points should be kept in mind while planning a teaching unit:

1. It should be according to the needs, capabilities and interests of the pupils.
2. It should be start with previous and background of the students.
3. It should be according to the results, capabilities and interests of the pupils.

Steps of a Teaching Unit:

1. Preparation or Motivation
2. Knowledge of previous experiences, demonstrations, and projects etc.
3. Preparation of Motivation
4. Summarization
5. Review and Drill
6. Evaluation
Merits of Teaching Unit Plan:
1. The daily lesson plans can be prepared which may be properly linked with each other.
2. The teaching aids are identified and can be managed in advance.
3. Student projects and hobbies are identified and planned.

Yearly Planning

In such type of scheme of planning, a teacher of mathematics tries to take a complete view of what he is to do in the whole session regarding the instructional work of a particular mathematics class. In this way, by a yearly plan, a teacher has to take care with his students. For achieving such a program, a teacher has to take care of the things below:

1. The total number of working days available for the teaching-learning of the subject.
2. The total number of periods or time available for the teaching-learning of the subject.
3. The means and material available for the teaching-learning of the subject.
4. The nature and scope of the subject in relation to the number of topics included in the syllabus, the contents covered in those topics, the type of learning experiences to be provided to the students and objectives of teaching-learning to be realized etc.
5. The means and material available for the teaching-learning of the subject.
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A.V. aids

A.V. aids are those aids which help in learning process. They have three main types: (i) Visual aids, (ii) Audio aids, and (iii) Audio-visual aids. Basically A.V. aids are those aids which help in learning process. They have

1. Visual aids
2. Audio aids
3. Audio-visual aids

Return more lasting...
Cater A. Good defines A.V. aids as “Any device by means of which the learning process may be encouraged or carried on through the senses of hearing and sight simultaneously.

Process of Developing Low-Cost Teaching AIDS:

The different steps involved are:

(i) Defining of Objects: The objective of the teaching aid in terms of knowledge, skills, and attitudes to be developed are defined in light of needs of the user.

(ii) Preparation of a Design: A design for the development of the aids is decided. The aids are available in the local environment.

(iii) Developing of Aids: After having decided the design, the aids are developed by specialists, students, teachers, or community in light of the local environment, its cost, relevance, and the resources available.

(iv) Pilot Testing of the Aids: The pilot testing of the aids is done by the teacher or researchers with selected sample users. On the basis of the feedback, necessary improvements are made in the aids. This also provides a feedback for modifying objectives and designing.

(v) Finalization of aids: If the aid is considered satisfactory after pilot testing, it is finalized.

(vi) Production and Distribution: Adequate number of copies of the aids are produced and distributed to different schools.

Different Kinds of A.V. Aids:

1) Black-Board: It comes under visual aids. As regards the black-board or chalk-board, it is indispensable in any teaching-learning process at or near school. It is indispensible aid in any teaching-learning process at.

2) Other Visual Aids: These aids are considered valuable by users. The final aids are produced, it is distributed to different schools if it is considered valuable.

Production and Distribution:

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Different Kinds of A.V. Aids:

1) Black-Board: It comes under visual aids. As regards the black-board or chalk-board, it is indispensable in any teaching-learning process at.
nearly all stages of education. There are different kinds of blackboards, namely, fixed or glass board, easel board, roller board, bulletin board etc. Among all these types black board is the oldest and an important aid for the teacher and it seems as "the best friend of the teacher". It is convenient and a good vehicle of teaching. A black board should be used carefully for providing new learning material to the class, emphasis important points and words, demonstrate the lessons, draw simple diagrams and finally summarise the essence of the lesson. It is essential in many teaching situations. It is effective, for example, in break-down in to individual departments. The table chart is used with many problems. A knowledge of the organisation of a business, for example, may be of interest and importance to the student. Charts serve as substitute for things which are either not available or not clearly understood. They show proper sequence and relationship. The table chart is indispensable in many teaching situations. It is effective, for example, in problem of situations. They show proper sequence and relationship. The black board should be black, but a green black board can prove more soothing to the eye. The models are realistic in nature, so that they leave a clear impression on the students when they handle them for learning. For the class, models of polygons, circles, trigonometry, flow charts, charts, etc. are used chiefly to analyse the essence of material to the class, emphasis important points and words, demonstrate convenient and a good vehicle of teaching. The teacher and it seems as "the best friend of the teacher". Among all these types black board is the oldest and an important aid for nearly all stages of education. There are different kinds of black boards.
4) **Television:** Television is without doubt one of the most versatile audio-visual aids ever developed. It is however, desirable that charts should be the result of active participation of both the teacher and pupils. The only drawback of films is that there are costly and trained staff is needed which is generally not available.

5) **Films:** Films are the most widely applicable, the most powerful among the resources of teaching and learning. Originally made for entertainment and advertising, now films are more extensively being used for education and training. They have a unique capacity to communicate, to influence people and to inform. They make the concept clear, durable and influence human behavior. They can be divided into many types:

- Classroom films, industrial films, school-made films, documentary films
- and abstractions. To strengthen attitudes and to develop skills that can appeal and have a constructive desirable influence on the emotion of the children. In general, the unique contribution of films is their facts, actions and reactions which can

   Having lots of color, music, action and simple realistic plot which can

   Realistic. It has now been realized to manufacture films for children only

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   improve upon his previous lesson and improvement. He also receives the reactions, criticism and

   suggestions of the class-room teacher. In this way it helps the teacher to

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