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Inductive and Deductive Methods in Mathematics Teaching

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ABSTRACT
Researcher has tried to explore that mathematics as subject has certain aims of teaching which can also be termed as goal of subject. The achievement of goal is ascertained by testing the students' performance at the end of the course for it exporatory research design has used and the results are present study that Inductive and deductive method of teaching in one pack which is the most appropriate and desirable for mathematics teaching.
Keywords: Inductive, Deductive, Observation, Verification Generalization, Merits & Demerits.

I. INTRODUCTION

The teaching of mathematics also involves different methods. The mathematics is taught at different levels of school education. No one single method is fully suitable or appropriate for each level. Thus, different methods are used for the students of different level. There are different methods of teaching mathematics for primary, secondary and higher level education as the students of each level differ in age, maturity, mental abilities, mental development, mathematical understanding etc. therefore, one method cannot be applied to teach mathematics to all the classes. Besides this, with the use of one method, all the students of a class cannot be equipped with equal amount of knowledge because individual difference lies among them. Individual difference is an important psychological phenomenon which affects teaching and its outcome to a great extent. According to Thorndike, "There is a much difference between lower and higher categories of students of the same class. Higher category students learn six times more than the lower category students or lower category students learn only one sixth in comparison of higher category students." Therefore, a teacher has to apply different methods to teach same topic to same class so that every student could understand and learn the given content.
Researcher has delimited only inductive and deductive teaching methods which introduce as.

Inductive Method:-
Inductive Method is based on principle of induction. Induction means to establish a universal truth by showing that if it is true for a particular case and is further true for a reasonably adequate number of cases then it is true for all such cases. Thus, in this method, at first stage a problem is solved on the basis of previous knowledge, thinking, reasoning and insight of the learner. At this stage he does not know about any formula, principle or method for the solving the given problem. When adequate number of similar examples, facts or objects is presented to the learners, they try themselves to arrive at a conclusion for all those. Thus, they arrive at a generalization or derive a formula through a convincing process of reasoning and solving of various similar problems. Thus, in this method rules and formulas are not supplied by the teachers to the students. Here only various facts and examples are presented to the learners and from where they have to find out rules or establish a general formula. Therefore, it is a method of constructing a formula with the help of adequate number of concrete examples.

Thus, inductive method of teaching leads us from known to unknown, particular to general or example to general rule and from concrete to abstract. When a number of concrete cases have been understood, the learner himself is able to attempt for generalization.

Deductive Method:-
Deduction is the process by which a particular fact is derived from some general known truth. Thus, in the deductive method of teaching learner proceeds from general to particular, abstract to concrete and from formula to examples. Here a pre-established rule or formula is given to the learners and they are asked to solve the related problems by using that formula. Therefore, in this method, the learner has to perform only calculation or to simplify the substituted known values in the given formula to get the solution of the problem.
According to Joseph London, "Deductive teaching secures first the learning of definition or law

or rule, then carefully explains its meaning and lastly illustrates it fully by applying to fact."

II. METHODOLOGY

Researcher has used to exploratory research deign for the study of present topic.

Analysis:-

Researcher has analyzed both methods separately-

Inductive Method:-

In this method following steps are-

1. **Presentation of Examples:-** At this step a sufficient number of similar examples of a particular type are presented to the learners.
2. **Observation:-** At this step students observe the various presented examples minutely and try to see relationship among them and seek some general or common elements of findings.
3. **Generalization:-** On the basis of common elements of findings of different similar examples, learner arrives at a general conclusion which leads him towards establishing a general rule or formula.
4. **Verification:-** At the lest step of this method learner himself can verify the truthfulness of general rule or formula by using it to solve another similar problems.

Example 2 :- Derivation of the formula $(a+b)^2 = a^2 + 2ab + b^2$

Step. I- Write an expression on the blackboard in the form of addition of two terms e.g. (x+y), and ask the students to find its square by the method of multiplication. Students will multiply (x +y) by (x +y) and will get the result $x^2 + 2xy + y^2$.

Then give them a number of similar cases e.g. (l + m), (p + q), (a + b), (c + d) etc. and ask them to find the squares in each case by the same method. Students will find the squares in each case.

Step. II- The Teacher will ask the students to tell the square of each expression separately and will put it on blackboard, in the following from.

$$(x + y)^2 = x^2 + y^2 + 2xy$$
$$(l + m)^2 = l^2 + m^2 + 2lm$$
$$(p + q)^2 = p^2 + q^2 + 2pq$$
$$(a + b)^2 = a^2 + b^2 + 2ab$$

Step. III- Teacher will tell the students to observe the square of them.

Deductive Method:-

In this method following steps are-

1. **Presentation of Rule of Formula for the Problems or Topic to be Taught:-**
   Just after presenting the problem to be studied, teacher provides the relevant formula or rule to solve it. He explains the formula and its use.

2. **Application of the Formula:-**
   Teacher solves few problems on the blackboard to explain the application of formula to problems on the blackboard to explain the application of formula to problems. Thus, students learn how the formula can be applied to solve the related problems. Then a few problems are given to the students. They apply the formula to the problems and solve them according to the procedure explained by the teacher.

3. **Inference:-**
   After getting proper solution of the problems with the help of given formula, the students come to understand that this formula is the key to solve these types of problems.

4. **Verification:-**
   On reaching to the conclusion, the learner needs the verification of the conclusion or inference. Then he applies the formula to solve any other problem and thus he rechecks or verifies the validity of conclusion.

Example 2 :-

Topic:- To know the area of four walls of a room.

Formula:- The teacher will tell the students, if length, breadth and height of a room is given the area of four walls of the room can be calculated from the formula.

Area of four walls = (Length + Breadth) x 2 x Height

Or

A = (L + B) x 2H

Application of Formula:- The measures of length, breadth and height of a room are 5 metres, 4 metres and 3 metres respectively. Find the area of four walls of this romm.

Accordind to given formula:

Area of four walls = (Length + Breadth) x 2 x Height

Here, Length = 5 metres
Breadth = 4 metres
Height = 3 metres

Area of fpur walls = (5 + 4) x 2 x3
= 9 x 2 x 3 = 54 Sq. Mts.
Answer = 54 Sq. Mts.

Then teacher will ask students to solve the problems of this type given in his text book of arithmetic. The students will solve them on the same line as explained on the blackboard.

Inference: After solving few problems with the help of given formula, the students will infer that this formula holds true and can be used to solve another relevant problems.

Verification : Students may verify the validity of formula by using it to solve the another problem related with the area of four walls and then memorize this formula for use in future.

Comparison:-

S.N.	Conten	Inductive method	Deductive method
1-	Concep	Particular cases or examples are dealt with and from findings of these particular cases the general law or formula is inferred.	General rule or formula is first enunciated. Then this formula is applied to solve particular problems.
2-	Maxims	It is uses following maxims of teaching: 1. From known to unknown. 2. From particular to general. 3. From concrete to abstract. 4. From example to formula or rule.	It is uses following maxims of teaching: 1. From formula to exaple. 2. From general to particular. 3. From abstract to concrete.
3-	Movement	It is an upward movement of thought leading to definitions, principles and rules.	It is a downward movement of thought leading to a more perfect comprehension of the principle, rules or formula.
4-	Method	It is a method of generalisation, so its aim is to enable the pupil for general preparation for future life.	It is a method of specilization so here pupil acquire some special knowledge to be useful for some specific purpose.
5-	Activeness	Here child is more active and works as a discoverer. He discovers various formula, rules and definitions etc. thus,, it is a method of discovery and so provides education.	Here child gets formula, rules or definitions from others (specially from teacher) and verify them by applying on solving the revevant problem. Thus, it is a method of verification and explanation, so it provides instruction.
6-	Useful	It is useful for the beginners.	It is useful for students of higher classes.
7-	Realization	It is a method which fosters self-reliance as the children are trained to depend on their own oservations and judgment. So, the knowledge is assimilated.	It is a method which encourages dependence on others and so the knowledge acquired may be soon for gotten.
8-	Scientific	It is a scientific method and helps to develop scientific attitude in the students.	It is not a scientific method, so it does not develop scientific attitude.
9-	Leads	It leades to new knowledge but depends on deduction for verification.	It does not lead to new knowledge. It depends upon induction for new knowledge.
	mathematically		

10-		Mathematically it is much training + little information.	Mathematically it is much information + little training.

III. CONCLUSION

Researcher has concluded that From the comparative study of inductive and deductive method it seems that these are opposite to one another and inductive method is superior and more useful. But is not correct. If we have a view on the entire discussion of the scope, process, merits and demerits of these two methodes, it can easily be seen that inductive method is the forerunner or predecessor of deductive method. The deductive method is more fruitful as a follow up, if it is preceded a good understanding through inductive method. Actually, the teaching of mathematics comprises two clear-cut parts viz. establishment of formula or rule and application of that rule to solve the problems. The former part is the work of induction and the latter the work of deduction. Thus, mathematics in the making is inductive and its finished from is deductive. In other words, mathematics is understood inductively and applied deductively.

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