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LEARNING MATHEMATICS BY DISCOVERY

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Abstract

Discovery learning can be effectively used to stimulate and maintain interest in mathematics. Furthermore, such an approach promotes creativity and originality in students which are important for a student's future success in mathematics. This paper highlights and illustrates learning by discovery.

Keywords

Pure discovery, guided discovery, exploration, verification, generalization

Introduction

Discovery learning occurs as a result of learner's manipulating, structuring and transforming information so that he or she finds new information. In discovery learning, the learners make a conjecture, formulate a hypothesis or find a mathematical truth by using inductive or deductive processes, observations and extrapolation. The essential element in discovering new information is that the discoverer must take an active part in formulating and attaining the new information (Bell, 1978).

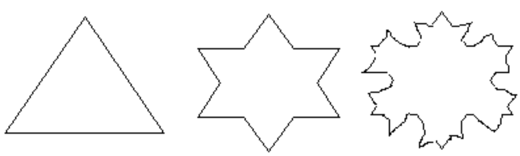
Students' discovery can be made either inductively or deductively. Induction is the process of finding a generalization as a sequence of observing and manipulating specific instances. Many arthimatic generalizations can be discovered by solving sets of problems and observing general properties and procedures embodied in all the problems. Deduction is the manipulation of ideas through the use of logical rules in order to formulate generalizations. In geometry, corollaries can be deduced by using logical rules to analyze certain implications of theorems (Sobel & Maletsky 1975).

There are two kinds of discovery, namely pure discovery and guided discovery:

Pure discovery

In pure discovery, where in a teacher presents a situation to a class and allows the students to explore on their own, using their intuition and past learning, with little or no guided direction. Such an approach is especially well suited for the gifted student and provides him with the type of experience that is necessary for later independent research. The following procedure is to be employed while teaching mathematics by this method: presentation of problem, environment to discover, exploration, verification and generalization.

As an example of such an approach, consider the infinite snow flake. It hits the ground in the shape of an equilateral triangle. Thereafter, each second a new equilateral triangle emerges in the middle third of each side, continuing forever. This is what the first cages look like:



Once again the student is asked to discover whatever he can about the infinite snowflake, with no teacher. Among the many interesting facts that can be discovered is that there is no limiting perimeter to this curve but that there is a limiting area. $2/5n^2\sqrt{3}$ square units, where 'n' is length of the side of the original equilateral triangle.

Guided discovery

Guided discovery strategy is a sequence of moves in which assertions move, if it appears at all, appears late in the sequence. The strategy of guided discovery encourages students to think on their own, to learn on their own and to become independent of the teacher.

In guide discovery, the teacher leads a class along the right path, rejecting incorrect attempts, asking leading questions, and introducing key ideas as necessary. It is a cooperative venture that becomes more and more exciting as one approaches a final result. The following procedure is to be employed while teaching mathematics by this method: presentation of problem, exploration under the guidance of teacher, verification and generalization. To illustrate this approach a class is asked to find this sum:

$$\frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \dots + \frac{1}{99.100}.$$

The task appears to be impossible. The teacher suggests that one approach to problem solving is to consider a small part of the problem at a time. Thus the class is led to consider the first term. The first two terms, the first three terms, and so on.

$$\frac{1}{1.2}=\frac{1}{2},\ \frac{1}{2.3}=\frac{1}{6},\ \frac{1}{3.4}=\frac{1}{12},\ \dots\dots\dots\ \frac{1}{99.100} = \frac{1}{9900}$$

At this point the teacher asks the class to guess the sum of first four terms, pointing out the pattern as necessary. Hopefully there be members of the class to guess that it will be 4/5. This answer is confirmed by actual computation. Finally, the class should be ready to guess that the answer to the given problem is 99/100. Of course it is important to point out that this is just a conjecture and not a proof.

The series can be proved to have a sum of 99/100 by elementary methods. First we need recognize these relationships, which also lend themselves to discovery approaches :

$$\frac{1}{1.2}=\frac{1}{2}=1-\frac{1}{2},\ \frac{1}{2.3}=\frac{1}{6}=\frac{1}{2}-\frac{1}{3},\ \frac{1}{3.4}=\frac{1}{12}=\frac{1}{3}-\frac{1}{4},$$

$$\dots\dots\ \frac{1}{99.100}=\frac{1}{9900}=\frac{1}{99}-\frac{1}{100}$$

Then write the given series as follows:

$$(1-{}^1/_2)+({}^1/_2-{}^1/_3)+({}^1/_3-{}^1/_4)+\dots\dots$$

$$\dots\dots\ ({}^1/_{98}-{}^1/_{99})+({}^1/_{99}-{}^1/_{100})$$

Finally, note that every term except the first and last subtract out, giving the sum

$$1-{}^1/_{100}={}^{99}/_{100}$$

Conclusion

Discovery learning provides students with an opportunity to take active part in teaching learning processes. It also helps students to arrive at mathematical generalizations or rules through the process of induction and deduction. It increases students' retention and therefore makes learning lasting.

References

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