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The Role of Intuition in Math Problem Solving

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A problem is a request for a result subject to conditions that must be satisfied simultaneously. In mathematics, problem solving involves several steps including: interpreting the problem, devising a method to solve it, implementing procedures, and analyzing the result to determine if it is an appropriate soluuon.

Intuition involves quick and ready insight, which is difficult to define, but one knows it when one sees it. Intuition meshes with inductive reasoning (an aspect of applied reasoning), often referred to as discovery learning, in which one considers a number of related cases and then makes a generalization based on those cases. Inductive reasoning can help younger students solve problems whereas deductive reasoning (which requires knowledge of axioms, postulates, theorems, etc.) is beyond the understanding and background of most elementary school students.

Suppose a teacher asks elementary school students to determine the sum of the angles in any triangle. Younger students do not have the background regarding geometric axioms and postulates to provide or understand a formal proof. But they can use a compass to measure an angle or scissors to cut paper. They also can make an "intuitive leap" such as by drawing lots of triangles on paper, cutting out the angles of each, and aligning these at the vertices to discover that the three angles of a triangle form a straight line (meaning the angles sum to 180 degrees). In other words, the students make a generalization based on related cases.

Carl Friedrich Gauss, a famous mathematician, was in elementary school when asked to sum the integers from 1 to 100. This is a rather boring activity- a problem to do rather than a problem to solve. His peers did the obvious: add 1 to 2 to get 3, add 3 to 3 to get 6, add 6 to 4 and so on. But Gauss made an intuitive leap. He noticed that the sum of certain integer pairs is 101: (1 +100), (2+99), (3 + 98,) (3 + 97) etc. He also saw that there are 50 such pairs of integers, so that 50 x 101 = 5050. Gauss apparently gave the answer to the teacher in less than a minute.

Here's another inductive reasoning challenge: give students several subtraction problems involving odd numbers, like 7-3, 21-5, 11-9, 35-23, 57-33, etc. When investigating the results they will discover that an odd number minus an odd number always yields an even number. What about an odd number plus an odd number?

Problem doing is the implementation of an algorithm, a series of steps that provide a result or answer, which the student may or may not understand. Implementing an algorithm is easy (consider a computer program which is an algorithm), but understanding the meaning, implications, answer, or process used to acquire it may be a challenge.

Inductive mathematics instruction provides younger students opportunities to use intuition and to make intuitive leaps. Teaching mathematics as merely a series of algorithms that must be learned by rote and applied, sometimes haphazardly, may lead students to arrive at answers they do not understand. With the inductive process of discovery, students' intuitive appreciation of problems may be beyond their formal knowledge. Students may form misconceptions when using intuition and cling to them even when presented with new evidence that refutes them. Therefore, teachers need to help students keep their minds open so they can move from their informal insights into a more advanced stage of formal thought as required by such subjects as geometry, algebra, and calculus.

Learning more about applied reasoning.

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