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Distinguishing features of mechanical and human problem-solving.

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Over the years, research in mathematical problem-solving has examined expert/novice problem-solving performance on various types of problems and subjects. In particular, DeFranco examined two groups of Ph.D. mathematicians as they solved four mathematics problems and found that although all were content experts, only one group were problem-solving experts. Based on this study, this article posits the notion that one distinguishing feature between experts and novices is that experts tend to look for special features of a problem and use algorithms only as a 'fail-safe' system while novices act like 'machines' relying on algorithms to solve the problems. Why? The article explores the idea that novice problem solvers learned to solve problems the way they learned proof, that is, in a formal, abstract and mechanizable way. Beliefs about proof and the culture in which it is practiced help frame a mathematician's view of the discipline and ultimately impacts classroom practice. The authors believe that current classroom instruction tends to create a culture that fosters algorithmic proficiency and a 'machine-like' approach to the learning of mathematics and problem-solving. Further, they argue that mathematicians need to be aware of the distinction between knowing a proof is true and explaining why it is true. When these distinctions are appreciated and practiced during classroom instruction, then and only then will students begin to acquire the mathematical knowledge to become better problem solvers.

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