Biografi George Pólya 1887-1985
George Pólya was a Hungarian who immigrated to the United States in 1940. His major contribution is for his work in problem solving.
In 1945 he published the book ‘How to Solve It’ which quickly became his most prized publication. It sold over one million copies and has been translated into 17 languages.
George Pólya went on to publish a two-volume set, Mathematics and Plausible Reasoning (1954) and Mathematical Discovery (1962). These texts form the basis for the current thinking in mathematics education and are as timely and important today as when they were written. Pólya has become known as the father of problem solving.

Polya’s prescription for solving problems consists of four steps that use the 3 R’s of problems solving, Request-Response-Result, and a verification of the result.

1. Understanding the problem. (Recognizing what is asked for)
2. Devising a plan. (Responding to what is asked for)
3. Carrying out the plan. (Developing the result of the response)
4. Looking back. (Checking. What does the result tell me?)

Learn more at: www.hawaii.edu/suremath/howTo.html

Charles Simonyi (Microsoft Application Software Group): “Programmers get a couple of books on their first day here. One of them, called How to Solve It, is by George Pólya, the mathematician. [Simonyi takes the book from a bookcase next to his desk and opens it to a certain page.] These two pages are important. The rest of the book just elaborates on these two pages. This is like a checklist for problem solving. This is the preflight, the takeoff, and the landing checklist. It doesn’t mean this will tell you how to fly, but it does mean if you don’t do this, then you can crash even if you already know how to fly. We follow these four steps of problem solving: first, understanding the problem, then devising a plan, carrying out the plan, and, finally, looking back.”

Steve McConnell writes about “Design as a Heuristic(*) Process” and cites the schema from “How to Solve It” in “Code Complete” page 163-164

Growing up George Pólya was very frustrated with the practice of having to regularly memorize information. He was an excellent problem solver. Early on his uncle tried to convince him to go into the mathematics field but he wanted
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to study law like his late father had. After a time at law school he became bored with all the legal technicalities he had to memorize. He tired of that and switched to Biology and the again switched to Latin and Literature, finally graduating with a degree. Yet, he tired of that quickly and went back to school and took math and physics. He found he loved math.

His first job was to tutor Gregor the young son of a baron. Gregor struggled due to his lack of problem solving skills. Polya spent hours and developed a method of problem solving that would work for Gregor as well as others in the same situation. Polya maintained that the skill of problem was not an inborn quality but, something that could be taught.

In 1940 he and his wife Stella moved to the United States because of their concern for Nazism in Germany. He taught briefly at Brown University and then, for the remainder of his life, at Stanford University. He quickly became well known for his research and teachings on problem solving. He taught many classes to elementary and secondary classroom teachers on how to motivate and teach skills to their students in the area of problem solving.

Polya’s First Principle: Understand the Problem

This seems so obvious that it is often not even mentioned, yet students are often stymied in their efforts to solve problems simply because they don’t understand it fully, or even in part. Polya taught teachers to ask students questions such as:

- Do you understand all the words used in stating the problem?
- What are you asked to find or show?
- Can you restate the problem in your own words?
- Can you think of a picture or a diagram that might help you understand the problem?
- Is there enough information to enable you to find a solution?

Polya’s Second Principle: Devise a plan

Polya mentions that it are many reasonable ways to solve problems. The skill at choosing an appropriate strategy is best learned by solving many problems. You will find choosing a strategy increasingly easy. A partial list of strategies is included:

- Guess and check
- Make and orderly list
- Eliminate possibilities
- Use symmetry
- Look for a pattern
- Draw a picture
- Solve a simpler problem
- Use a model
Polya’s third Principle: Carry out the plan

This step is usually easier than devising the plan. In general, all you need is care and patience, given that you have the necessary skills. Persistent with the plan that you have chosen. If it continues not to work discard it and choose another. Don’t be misled, this is how mathematics is done, even by professionals.

Polya’s Fourth Principle: Look back

Polya mentions that much can be gained by taking the time to reflect and look back at what you have done, what worked and what didn’t. Doing this will enable you to predict what strategy to use to solve future problems.

Heuristic

<philosophy of science, logic> an informal method for solving problems in the absence of an algorithm for formal proof. Heuristics typically have only restricted applicability and limited likelihood of success but, as George Polya showed, contribute significantly to our understanding of mathematical truths. Recommended Reading: George Polya, How to Solve It (Princeton, 1971); Gerd Gigerenzer and Peter M. Todd, Simple Heuristics That Make Us Smart (Oxford, 1999); and George Polya, Mathematics and Plausible Reasoning (Princeton, 1990).

[A Dictionary of Philosophical Terms and Names]

1. <PI> A rule of thumb, simplification or educated guess that reduces or limits the search for solutions in domains that are difficult and poorly understood. Unlike algorithms, heuristics do not guarantee optimal, or even feasible, solutions and are often used with no theoretical guarantee.