

## WA Maths Book Club Review

March 2019

### How to Solve It, A New Aspect of Mathematical Method, G Polya, 2014

First published in 1945, George Polya, a Professor of Mathematics was the first to write down the process and methods used to solve mathematical problems. The basis of many other books about mathematics education it lays the foundation for the mathematical thinking processes, proficiency strands, working mathematically that many of us as maths educators are familiar with today. We all probably had this on our undergraduate reading lists in some form but reading it a second time is much more purposeful as it really relates to our current practice in schools, especially the current challenge of writing good mathematical investigations.

Polya describes four phases in solving a problem

1. First you must understand the problem, students should have a desire to solve the problem.
2. The second is to devise a plan to solve the problem. If the teacher is met with silence in this stage, the role of the teacher is to help students recognise related more familiar problems and transfer the strategies used to this problem.
3. Carry out your plan to solve the problem. The teacher should not interrupt but let the students make their own mistakes.
4. Last you must look back and examine the solution obtained. No problem is completely exhausted, there always remains something to do with sufficient study and penetration. The teacher should support the student to find connections, so the result or method could be used for some future problem.

Polya's phases of problem solving really support the idea of slow mathematics as good mathematics. A good problem takes time to solve and requires deep thinking, students need to apply productive struggle for learning to occur. He describes how problems should start with a guess or a prediction, this leads way to a conjecture to be given. Observing patterns and generalising these patterns requires the use of inductive thinking. Is it proved? Don't believe your own guess, doubt your guesses, test them and check them.

Describing how the subconscious is a powerful friend to the problem solver, Polya highlights the wisdom of a pillow to help the path to a solution to become clear. There was a great discussion by the book club members on how many of these great 'Eureka' moments in history occurred in the least expected moments once the subconscious had been allowed to do its work.

"Student learning is greatest in classrooms where the tasks consistently encourage high-level student thinking and reasoning and least in classrooms where the tasks are routinely

procedural in nature” (Boaler and Staples 2009; Hieber and Wearne 1993; Stein and Lane 1996) For teachers considering making the change to problem solving as suggested by Polya a good place to start may be ‘60 Mathematical Investigations’ available at the MAWA shop. The introduction and teacher notes provide practical ideas for moving forward with problem solving in the classroom. Using these as assessment tasks demonstrates to students that they are an important component of a mathematics course. With 60 problems to choose from there is sure to be one suitable for your class.

A video of Polya demonstrating the teacher’s role in problem solving can be found

<https://vimeo.com/48768091>