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# INTERVIEW WITH ALAN SCHOENFELD ON PROBLEM SOLVING

# ENTREVISTA COM ALAN SCHOENFELD SOBRE RESOLUÇÃO DE PROBLEMAS

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Alan Schoenfeld nasceu em 09 de julho de 1946, em Nova York. Iniciou sua carreira como matemático no *Queens College* em NY, onde realizou sua graduação e o mestrado no final da década de 1960. Em 1973 concluiu seu doutorado na Universidade de Stanford. Trabalhou em algumas instituições até se estabelecer na Universidade da Califórnia, em Berkeley, onde é professor desde 1985 e pesquisador no Grupo de Pós-Graduação em Educação em Ciências e Matemática.

É membro da Associação Americana para o Avanço da Ciência, membro da Associação Americana de Pesquisa Educacional (AERA) e conquistou, em 2011, a Medalha Klein da Comissão Internacional de Instrução Matemática (ICMI), a mais alta distinção internacional em Educação Matemática, dentre outros prêmios.

Foi escolhido para ser o entrevistado neste número temático, devido à relevância de seus estudos sobre resolução de problemas e ao reconhecimento internacional de suas pesquisas na área de Educação Matemática, que abarcam questões relacionadas ao pensamento, aprendizagem, ensino, avaliação e a natureza de "poderosos" ambientes de aprendizagem. Seu livro clássico *Mathematical Problem Solving* (1985) caracteriza o que significa pensar matematicamente e traz resultados de pesquisa em resolução de problemas matemáticos. No livro *How We Think* (2010), apresenta uma teoria da tomada de decisão humana, com foco no ensino. Até então, conforme dados institucionais, foram 24 livros que escreveu, editou ou coeditou, e mais de 300 artigos sobre a temática.

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1) **Professor Alan Schoenfeld, tell us about the origin of your involvement with problem solving**.

Not long after finishing my dissertation in mathematics I happened to read George Pólya's "How to Solve It." I thought the ideas were wonderful, but nobody seemed to be using them. I asked math-ed researchers and mathematicians who coached problem solving teams, and both groups said, "the ideas feel right but we can't get them to work." This was a very attractive challenge – if I could get the ideas to work, then many more students could learn to think mathematically. So I changed from doing mathematical research to doing research in mathematics education.

2) **Your book *Mathematical Problem Solving* had and has great impact and relevance for the research. How do you understand the ideas of this book for today?**

Let me talk about research, theory, and practice. First, research: I think that the book showed that it is possible to conduct different kinds of studies about mathematical thinking with analytic precision and rigor. I did laboratory studies to test preliminary ideas. I analyzed videotapes of students engaged in problem solving, and modeled what they did. (That was true for my work on metacognition and beliefs.) I conducted what we now call "design experiments," testing the ideas by teaching problem solving courses. Those efforts both demonstrated that the ideas could work, and suggested new ideas for more rigorous study. I am pleased to say that both the methods and the findings have been robust, and that they are still in use today.

Second, about theory. The book offered a *framework*. It said that if you want to understand someone's success or failure when they are trying to solve a problem, you need to examine their knowledge, their use of strategies, their "control" – now referred to as monitoring and self-regulation, an important aspect of metacognition – and their beliefs and practices. That is every much as true today as it was in 1985. What is new is a general emphasis on practices, and on other aspects of the results of instruction, for example, students' mathematical identities. Third, practice. In many ways the book was an existence proof: it *is* possible to teach students to become good problem solvers. That is something we should never forget. At least as important, the book is about thinking mathematically – the ways that people who understand mathematics work with mathematical ideas. We have a broader sense of what this means today (see below). One major challenge remains the same: to help these ideas take place "at scale" in classrooms.



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**3) How do you currently understand (or perceive) research and teaching in the classroom about problem solving?**

To my mind, a focus on teaching problem solving should be part of something much larger – a focus on "Teaching for Robust Understanding," also known as "equitable and ambitious instruction." We want *every* student to become a powerful mathematical thinker. Moreover, we want them to have positive mathematical identities. The big question is, how do we create classrooms in which all students are empowered in that way? That has been the focus of my work for the past 20 years. For information, see the Teaching for Robust Understanding (TRU) Framework web site, https://truframework.org/. This year Routledge will be publishing two new books, *Helping Students Become Powerful Mathematics Thinkers: Case Studies of Teaching for Robust Understanding* and *Mathematics Teaching On Target: A TRU guide for Enriching Mathematics Teaching at all Grade Levels.* The books provide a comprehensive view of the important aspects of mathematics instruction (which, of course, include problem solving).

**4) We have seen studies on problem solving and problem posing. How do you understand the focus of studies on problem solving and posing?**

I see problem solving and problem posing as closely related – as part of "thinking mathematically" – and I wish I had emphasized problem posing more in my earlier writing. It has always been part of my teaching. The problems I use in my problem solving courses are intended to be the beginnings of mathematical explorations. When we've solved them, the question is always, "Can we solve it a different way? Can we extend it? Can we generalize it? Can we find an interesting related problem to think about?" Asking such questions is an essential part of thinking mathematically.

**5) Finally, Professor Alan Schoenfeld, what directions do you see regarding problem solving in/for research and the classroom?**

Let me build on my answer to question 3. For me, the goal of mathematics instruction is for all students to engage with mathematics in ways that result in their being flexible and knowledgeable thinkers who enjoy mathematics and are willing to engage with mathematical problems and situations. The question is, what kinds of classrooms support this kind of learning? The answer is that five dimensions of mathematics classrooms are essential. They are summarized in the figure below:

**Figura 1**: As cinco dimensões de “poderosas” salas de aula de Matemática

| The Five Dimensions of Powerful Mathematics Classrooms | | | | |
|---|---|---|---|---|
| The Mathematics | Cognitive Demand | Equitable Access to Mathematics | Agency, Ownership, and Identity | Formative Assessment |
| *The extent to which classroom activity structures provide opportunities for students to become knowledgeable, flexible, and resourceful mathematical thinkers. Discussions are focused and coherent, providing opportunities to learn mathematical ideas, techniques, and perspectives, make connections, and develop productive mathematical habits of mind.* | *The extent to which students have opportunities to grapple with and make sense of important mathematical ideas and their use. Students learn best when they are challenged in ways that provide room and support for growth, with task difficulty ranging from moderate to demanding. The level of challenge should be conducive to what has been called "productive struggle."* | *The extent to which classroom activity structures invite and support the active engagement of all of the students in the classroom with the core mathematical content being addressed by the class. Classrooms in which a small number of students get most of the "air time" are not equitable, no matter how rich the content: all students need to be involved in meaningful ways.* | *The extent to which students are provided opportunities to "walk the walk and talk the talk" – to contribute to conversations about mathematical ideas, to build on others' ideas and have others build on theirs – in ways that contribute to their development of agency (the willingness to engage), their ownership over the content, and the development of positive identities as thinkers and learners.* | *The extent to which classroom activities elicit student thinking and subsequent interactions respond to those ideas, building on productive beginnings and addressing emerging misunderstandings. Powerful instruction "meets students where they are" and gives them opportunities to deepen their understandings.* |

Fonte: TRU (2023)

This is a framework. It will take a huge amount of research and development to make this a classroom reality. I would love to see the field work on these issues in coherent ways. Again, see the TRU web site, https://truframework.org/, and my two upcoming books, from Routledge, *Helping Students Become Powerful Mathematics Thinkers: Case Studies of Teaching for Robust Understanding* and *Mathematics Teaching On Target: A TRU guide for Enriching Mathematics Teaching at all Grade Levels,* for detail.

Thank you for the conversation!

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