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Toward a Cooperative Model of Mathematics Staff Development

NOW IS AN EXCITING TIME TO BE A MATHEmatics teacher. The field is constantly changing. Nothing is sacred—not materials, not methods, not forms of assessment. Such drastic change, however, necessitates serious and extensive time for teachers to reflect on their own teaching and to become comfortable with new ideas and approaches (Joyce and Showers 1981, 1982; Schon 1983; Stallings 1989).

However, such expanded emphasis on professional development for veteran teachers can be controversial. The message that one's teaching may not be adequate or may be outdated is a difficult one—not a message that many of us, in any field, would want to face. The challenge, then, is to expose teachers of mathematics to the changes in the field in a safe setting that encourages and supports risk taking.

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At the Education Development Center (EDC) in Newton, Massachusetts, a group of mathematics teachers from elementary, middle, and high schools in seven districts has been meeting biweekly to explore mathematics together in a project called Teachers, Time, and Transformations. The meetings take the form of workshops in which the teachers are addressed by various leaders in the mathematics-reform movement and work in groups on interesting, open-ended problems.

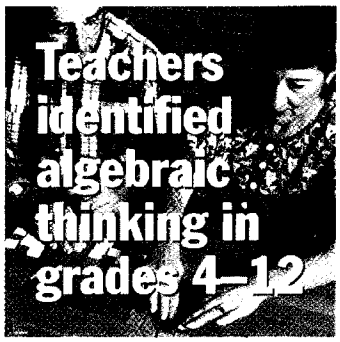
In this article, we describe the project and use the discussion of an open-ended problem to present a cooperative model of staff development. We attempt to portray the advantages of such an approach through our writings about our experiences. Finally, we challenge the reader to attempt a similar group-mathematics experience in his or her school, system, or learning community.

The Project

THE TEACHERS, TIME, AND TRANSFORMATIONS (T T T) project responds to several pressing issues in mathematics education, including *(a)* the need for teachers to expand their "comfort zones," *(b)* the need for teachers to develop expertise in critiquing and adapting curricula, *(c)* the need for increased communication among teachers in grades 4–12 concerning a coherent view of algebra, and *(d)* the need for teachers to become change agents of reform in their districts.

Teams of two elementary, two middle, and two high school teachers from each of seven school districts in the greater Boston area participate in the T T T project. Over the course of three years, these forty-two teachers attend a series of biweekly seminars held during the school day. Designed by project staff, the seminars enable teachers to *(a)* redefine and identify algebraic thinking in grades 4–12; *(b)* examine exemplary curricular materials; *(c)* begin the process of adapting their current curricula; and *(d)* develop a district-based course, Algebra for Everyone, as a vehicle for reform in their districts. In addition, project staff support the teachers throughout the project by classroom coaching and giving teachers opportunities to work with colleagues as they share ideas and support one another in a spirit of risk taking.

This professional development program leverages industry support of teachers as they participate in those seminars addressing key issues in mathematics education. To give teachers time away from their classes, volunteers from local corporations—Digital Equipment Corporation, GTE Laboratories, NYNEX, and Polaroid—substitute for teachers while they attend seminars. The project has written a "how to" handbook, available from EDC, for schools interested in adopting the industry-volunteer model. A dissemination conference will conclude the project, affording an opportunity for project staff to share this professional-development model with school districts and businesses throughout the nation. For a description of this model of industry-school cooperation in professional development, see Cutler and Roupp (1993).



At the seminars, teachers engage in various mathematical explorations. They investigate both classic mathematics problems and innovative materials in depth to clarify their understanding of algebraic thinking and to examine how this thinking is addressed across the grade levels.

This article was written by a group of teachers participating in the T T T project. It was designed with the professional development of the reader in mind: it is intended to help teachers employ strategies that encourage students to solve problems in different ways. Readers might want to explore the problem with peers in an in-service setting before trying it in the classroom. A partial list of solutions, developed by teachers in the project and their students, appears in the **appendix.** Try to resist the temptation to look at them until you have worked on the problem (see **fig. 1**) with a group!

The Staircase Problem

THE STATEMENT OF THE STAIRCASE PROBLEM IS shown in **figure 1.** Perhaps the most interesting conclusion that our group agreed on after working on this problem was that the actual answer—the general formula—is hardly interesting when compared with the many approaches and ideas that we used when solving the problem. In fact, we are so convinced of the truth of this statement that we are going to do away with any suspense and give the formula: $n(n + 1)/2$, where n is the number of blocks in the bottom row of the nth staircase. Now that we have that out of the way, we can get to the exciting part of the exploration.

Insights and Experiences

THE TEACHERS IN THE GROUP FOUND THE process of working together on this problem tremendously rewarding. Each of us wrote a brief