

Results

More than five years ago, the National Science Foundation (NSF) and the Stuart Foundation funded the *Understanding Science Project* at WestEd to develop a science intervention that would help elementary school teachers increase their science knowledge, improve their science pedagogy, and more successfully prepare students. After rigorous evaluation with two research cohorts of project students and comparison students, the results—for teachers and students—have led NSF and the Stuart Foundation to renew their commitment to the project and to make it more widely available to schools and districts.

Highlights from the independent project evaluation

An extensive, multi-year study showed that *Understanding Science* courses build teacher knowledge, strengthen classroom practice and positively impact student achievement.

- Students of all entering ability levels showed significant gains, with the most dramatic increase among low-performing students.
- Teachers learned science, developed more sophisticated pedagogical content knowledge, and maintained these gains over time.
- Teachers reported changes in their classroom practice in general, not only of the course topics. They also became clearer as to what students should know and more discriminating regarding what students were actually learning.

The professional development experience

The *Understanding Science* model provides teachers with opportunities for active learning of science content using the same curriculum materials they use to teach their students. Each of the eight three-hour sessions focuses on a teaching case based on actual classroom lessons and learning events that perplexed, surprised, or disappointed the teacher in whose classrooms they originally occurred. Participants explore student work, student-teacher dialogue, teacher behaviors, and the teacher's thoughts. They also engage in the hands-on activities described in a case. The goal is to stimulate facilitated discussion with a three-fold focus: (1) exploration of scientific meanings, (2) attention to student thinking, and (3) critical analysis of practice. This focus offers a rich learning experience with many “hooks” for teachers to situate their new knowledge. Such an intense and intentional design may account not only for teacher gains in knowledge but also for their maintenance or even increase of gains from one year to the next.

Excerpts from the independent evaluation of Understanding Science conducted by Heller Research Associates:

Table 23
Distribution of Responses and Mean Ratings of Project Impact on Teaching of Electricity and Magnetism for Cohort 1 (2000-2001) and Cohort 2 (2001-2002) Teachers

6. To what extent has your involvement in science case discussions influenced your science teaching in general?	Cohort 1 Teachers (n = 21)	Cohort 2 Teachers (n = 27)
<i>Distribution of responses</i>		
A lot	42.9%	70.4%
Somewhat	38.1%	22.2%
A little	14.3%	7.4%
Not at all	4.8%	0.0%
Mean ratings	3.19	3.63
(S.D.)	(0.87)	(0.63)

Note. Ratings are on a scale from 1 ("Not at all") to 4 ("A lot").

Table 30
Comparison of Pre and Post Ratings of Confidence in Teaching Ability for Cohort 1 Teachers (n = 21).

Please indicate how confident you are in your ability to do each of the following:	Pre	Post	t	p
b. Address my students' misconceptions about electricity and magnetism concepts.	2.33 (0.73)	3.0 (0.63)	3.16**	.005
d. Ask good questions when helping my students learn science.	2.95 (0.67)	3.24 (0.70)	2.34*	.030
h. Use informal questioning to assess student understanding.	2.90 (0.70)	3.29 (0.56)	2.36*	.029
k. Analyze student work to understand their science thinking.	2.86 (0.65)	3.19 (0.75)	2.09*	.049

Note. Ratings are on a scale from 1 ("Not at all confident") to 4 ("Very confident").

* $p < .05$, ** $p < .01$

Table 38
Comparisons of Pre and Post Percentage Correct Scores on Electricity and Magnetism Test for Cohort 1 Teachers' Students with High, Medium, and Low Pretest Scores

Score on pretest	Pre	Post	t	p
High - Score greater than 49.1% (n = 58)	57.12% (6.63%)	59.63% (8.74%)	2.38*	.021
Medium - Score between 38.6% and 49.1% (n = 49)	43.95% (2.65%)	51.25% (11.02%)	4.88**	.000
Low - Score below 38.6% (n = 59)	32.71% (6.71%)	47.26% (12.11%)	7.80**	.000

Note. * $p < .03$, ** $p < .001$

Figure 8
Graph of pre and post percentage correct scores on electricity and magnetism test for Cohort 1 teachers' students with pretest scores classified as high (n=58), medium (n=49), and low (n=59)

