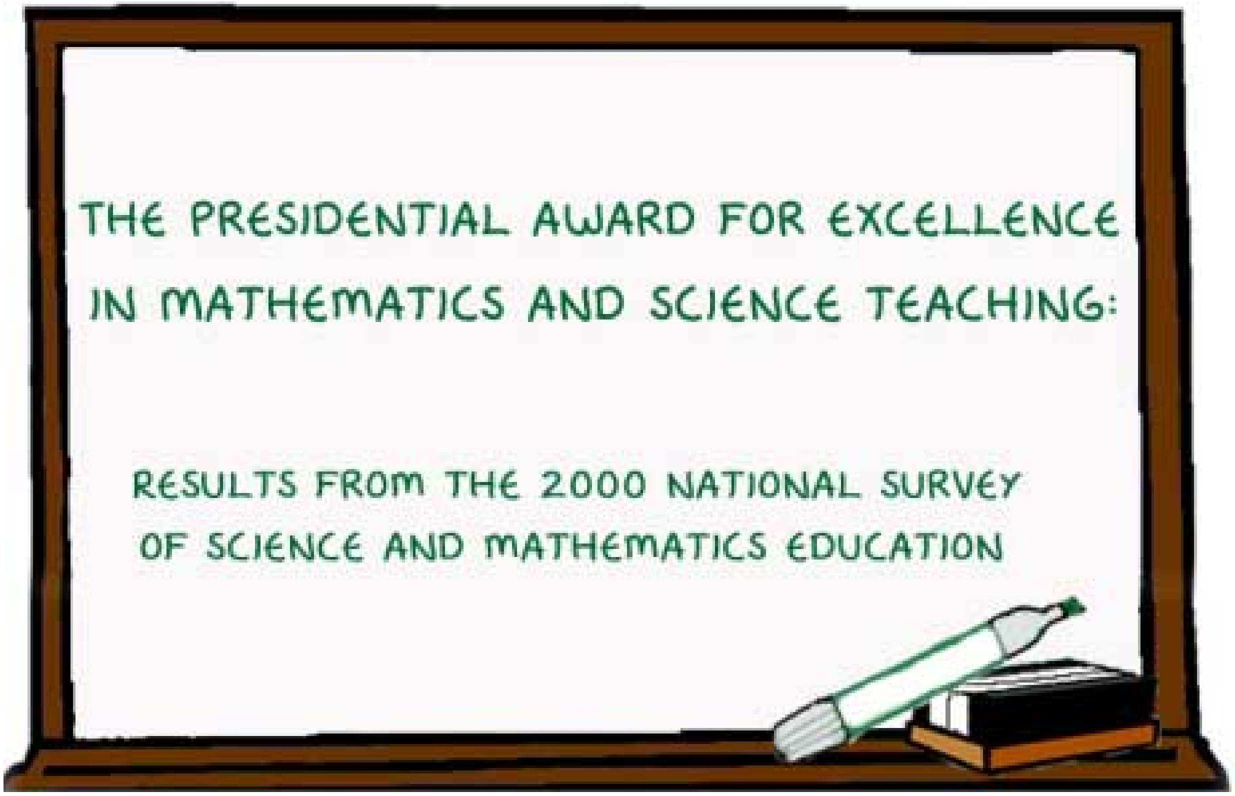

Part I: Impacts of the Award

Part II: Comparison of Presidential Awardees with Science and Mathematics Teachers Nationally

December 2001

Horizon Research, Inc.
326 Cloister Court
Chapel Hill, NC 27514

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THE PRESIDENTIAL AWARD FOR EXCELLENCE IN MATHEMATICS AND SCIENCE TEACHING:

RESULTS FROM THE 2000 NATIONAL SURVEY OF SCIENCE AND MATHEMATICS EDUCATION

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This report is available on the Web at:
2000survey.horizon-research.com

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Appendix B: Definitions of Teacher Composites

Introduction

The Presidential Award for Excellence in Mathematics and Science Teaching (PAEMST) program was established by the White House in 1983 to recognize outstanding mathematics and science teachers in the United States. Administered by the National Science Foundation (NSF) on behalf of the White House, the Presidential Awards are given to teachers who demonstrate:

- Subject-matter competence and sustained professional growth in science or mathematics and in the art of teaching;
- An understanding of how students learn science or mathematics;
- The ability to engage students in direct hands-on science inquiry or mathematics inquiry activities;
- The ability to foster curiosity and to generate excitement among students, colleagues, and parents about the uses of science and mathematics in everyday life;
- A conviction that all students can learn science and mathematics, and a sensitivity to the needs of all students' cultural, linguistic, learning, and social uniqueness;
- An understanding of the relationships of science and mathematics to each other and the interconnectedness of all subject matter;
- An experimental and innovative attitude in their approach to teaching; and
- Professional involvement and leadership.

Nominations are typically sent to the state department of education, which then sends an application packet to the nominees. A selection committee reviews the applications and picks the three state finalists for each award category, and then a national panel makes the final selection. Initially, Presidential Awards were restricted to secondary (grades 7–12) school teachers in the 50 states, District of Columbia, and Puerto Rico; with two science teachers and two mathematics teachers in each jurisdiction receiving awards each year. The program was expanded in 1986 to include U.S. territories and the Department of Defense Dependent Schools and in 1990 to include elementary (grades K–6) teachers.

Each awardee is given an expense-paid trip for two to Washington, DC to attend an awards ceremony, receive a presidential citation, meet with leaders in government and education, and attend a number of special receptions. In addition, each awardee's school receives a grant (originally $5,000, later increased to $7,500) to be used under the direction of the awardee to improve the local science or mathematics program. Activities supported by these grants have included field trips, curriculum development, purchase of laboratory and instructional materials, and professional development for teachers. Finally, awardees and their schools often receive gifts from private sector donors in honor of their achievement and contributions.

In 2000, Horizon Research, Inc. distributed surveys to a national probability sample of approximately 9,000 teachers in grades K–12 asking about teacher background and preparation, classroom practices, and professional activities. At the same time, questionnaires were sent to all teachers who had received the Presidential Award for Excellence in Mathematics and Science Teaching. The response rates were 74 percent for the national sample and 83 percent for the Presidential Awardees. An accompanying questionnaire was sent to each awardee asking about impacts of the award. A copy of each instrument is included in Appendix A.

Based on the selection criteria used in evaluating the nominees, and the resources and opportunities made available to the recipients, it was expected that the groups would differ in teaching experience, in subject matter background, in classroom practices, and in roles in the professional community. The purpose of this report is to provide information about the nature and extent of these differences and about impacts as reported by the awardees.[1] Part I provides demographic characteristics of the awardees and explores the impacts the award has had on them. Part II provides a number of comparisons between the awardees and the population of K–12 science and mathematics teachers in the United States. Throughout this report, any differences noted are statistically significant at the 0.05 probability level.

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[1] The results of the national survey are reported in the *Report of the 2000 National Survey of Science and Mathematics Education* (Weiss, et. al, 2001).

Part I
Impacts of the Award

Each year since 1983, Presidential Awards for Excellence in Mathematics and Science Teaching have been given to recognize outstanding teaching in mathematics and science. Initially restricted to the secondary level, since 1990 elementary teachers have been included in the PAEMST program.

Table 1 provides basic demographic information about the population of the Presidential Awardees. Roughly two-thirds of awardees are female, and more than 90 percent are White. At the time of the survey, most had more than 20 years teaching experience.

Table 1
Characteristics of Presidential Awardees

	Percent of Awardees				
		Science		Mathematics	
Category	**Total**	**Elem.**	**Sec.**	**Elem.**	**Sec.**
Sex					
Female	69	84	48	94	66
Male	31	16	52	6	34
Race					
White	92	93	91	93	93
Asian	3	3	2	2	4
Hispanic or Latino	2	2	2	2	2
Black or African-American	2	2	1	3	1
American Indian or Alaskan Native	1	<1	<1	<1	1
Native Hawaiian or Other Pacific Islander	<1	<1	1	1	<1
Age					
≤ 30 years	<1	<1	0	0	0
31–40	6	9	4	7	6
41–50	33	37	29	43	29
51+ years	61	54	67	50	65
Experience					
0–2 years	<1	0	<1	1	<1
3–5	<1	<1	0	0	0
6–10	4	6	3	6	3
11–20	27	32	24	34	22
≥ 21 years	69	62	73	60	75

Where Are the Awardees Now?

One of the most important issues for the PAEMST program is what awardees do professionally after receiving the award, and in particular, whether the award results in an exodus from the classroom. Data provided by recipients suggest that the award is not viewed as “a ticket out” of the classroom. Roughly two-thirds of all awardees in each subject/grade-range category are still employed as classroom teachers. As of 2000, 11 percent of the awardees were retired.[2] Most of the remainder of the awardees continue to be employed in K–12 education. (See Table 2.)

Table 2
Current Occupations of Presidential Awardees

	Percent of Awardees				
		Science		Mathematics	
Occupation	**Total**	**Elem.**	**Sec.**	**Elem.**	**Sec.**
Employed as a K–12 classroom teacher, full or part-time	65	68	65	66	63
Employed in any other position	23	25	22	28	22
Retired	11	7	13	5	15
Currently not employed	<1	<1	<1	1	<1

Those who were no longer teaching were asked to provide information about their current occupations, to describe the key factors that led to their decision to leave the classroom, and to indicate if the award had contributed in any way to this decision. Table 3 provides a breakdown of the current occupations of those who have left the classroom, excluding those who have retired. Note that most of the awardees who no longer have direct classroom teaching responsibilities are still actively involved in K–12 education, e.g., as district-level science/mathematics supervisors, teachers on “special assignment” with school- or district-wide responsibilities, or principals.

[2] Secondary awardees are much more likely than their elementary counterparts to have retired, owing to the fact that the secondary award began in 1983, while the elementary award was not initiated until 1990.

Table 3
Occupations of Awardees Who Are Employed Outside the Classroom

Occupation	Percent of Awardees*				
		Science		Mathematics	
	Total	Elem.	Sec.	Elem.	Sec.
Employed in K–12 education, but not as a classroom teacher	**65**	**74**	**54**	**82**	**57**
Employed as a district-level science supervisor	22	22	17	23	26
Employed as a teacher on special assignment	18	22	11	27	14
Employed as a school principal/assistant principal	13	17	11	16	9
Employed at the state/regional level	5	2	9	6	3
Employed as a gifted/talented resource teacher	2	4	2	2	<1
Employed as a guidance counselor	1	1	2	1	<1
Employed as a superintendent	1	<1	1	2	2
Employed in another K–12 education position	3	4	2	4	3
Employed in post-secondary education (e.g., college or university)	**19**	**8**	**25**	**9**	**26**
Employed outside of a formal education setting	**17**	**18**	**21**	**9**	**17**
Occupation directly affects K–12 education	15	16	19	7	15
Occupation does not directly affect K–12 education	2	2	2	2	2

* Only awardees who are currently employed, but no longer full- or part-time K–12 classroom teachers, were included in these analyses.

Awardees who were no longer teaching were also asked if the award contributed to their decision to leave the classroom and if they planned to return to teaching. Of those who have left the classroom, only about 1 in 5 indicated that the award contributed to their decision to leave. (See Table 4.) As noted above, the vast majority of those who have left (and have not retired) are still working in K–12 education. Interestingly, elementary science and mathematics awardees are more likely than their secondary counterparts to say the award played a role in their decision to leave the classroom.

Table 4
Award Contributed to Decision to Leave the Classroom

Did Award Contribute to Decision to Leave?	Percent of Awardees				
		Science		Mathematics	
	Total	Elem.	Sec.	Elem.	Sec.
Yes	17	19	15	24	14

Awardees who have left the classroom were asked if they plan on returning to classroom teaching in the future. The likelihood of returning appears largely dependent on the awardees' current position. For example, of those currently employed as a teacher on special assignment, 62 percent anticipate returning to the classroom, compared to 34 percent of district-level supervisors, 29 percent of principals, and 27 percent of those in post-secondary education.

It is interesting to note that some awardees stressed that the validation of the award encouraged them to remain in teaching:

> *It encouraged me to keep trying to do my best, to excel, to not get discouraged at the incredibly difficult task of teaching in the public school system.*
>
> *If I had not received this award, I would have left teaching for research in the industrial sector. The award gave me credibility that allowed me to implement a state-of-the-art, elementary science program in my district.*

Specific Impacts

When asked about the types of impacts the award had on them, many awardees cited the following:

- Renewed enthusiasm for teaching;
- Allowed more opportunities for professional development;
- Increased opportunities to network with other teachers;
- Increased resources available for teaching; and
- Increased respect received from the school and community.

As can be seen in Table 5, ratings of impacts were quite similar across subjects and grade levels. The only exception was that elementary awardees were more likely than their secondary-level counterparts to indicate that the award increased resources available for teaching, possibly due to the fact that budgets for equipment and supplies tend to be smaller at the elementary level.

Table 5
Impact of the Award

	Percent of Awardees*				
		Science		Mathematics	
Impact	**Total**	**Elem.**	**Sec.**	**Elem.**	**Sec.**
It renewed my enthusiasm for teaching	79	83	79	80	77
It allowed more opportunities for my professional development	78	80	74	82	78
It increased my opportunities to network with other teachers	77	76	72	79	81
It increased resources available for my teaching	74	80	71	78	70
It increased the respect I received from the school and community	69	67	72	73	65
It increased the time spent away from my daily teaching assignment	20	15	18	25	21
It reduced the time that I had available for my teaching responsibilities	10	9	9	15	10

* Awardees responding with 4 or 5 on a five-point scale, where 1 was "Not at all" and 5 was "To a great extent."

Another item on the questionnaire asked awardees to describe in their own words the impact the award had on them. While the item specified "the single" greatest impact, many of the awardees listed multiple impacts, typically talking about the opportunities the recognition had provided them and how much they have gained from those opportunities.

One of the most frequently cited impacts was increased "clout" following receipt of the award. The following responses were typical:

> *The recognition has given me more credibility with powerful political entities such as our school board. I now have more confidence that my judgment is likely to be good, and a more realistic view of who "award winning" teachers are and how they behave.*
>
> *Finally, I "think" my opinion counts—at least I am given the opportunity as a reliable voice to speak about science and children K–12.*
>
> *The PAEMST is like a "stamp of approval" within the professional community. It has given me a voice. Other science educators—and some politicians—are more eager to listen to my ideas and advice.*
>
> *It has given me clout within the district and in my school. When I weigh-in on a subject I at least get listened to.*

Many awardees pointed to increased appreciation of their beliefs, practice, and philosophy from colleagues, parents, students, and the local and professional community. For example:

> *The prestige associated with the award created a public confirmation (validation) that I was/am an excellent teacher, resulting in students and parents being more confident and responding in a positive fashion before and after entering my classroom. Students take responsibility for learning, parents are supportive, overall raised student expectations for themselves.*
>
> *I am recognized by all educators in my city as an outstanding science teacher. It earned me the respect that teachers (who dedicate their lives to improving the education of America's youth) so richly deserve.*
>
> *Perhaps the greatest impact is that I feel deeply respected by my administrators.*

Others talked about an increase in their own enthusiasm for their work.

> *[The award] re-ignited my love of teaching science, thereby making me better than ever.*
>
> *It revolutionized my own teaching and totally revitalized me.*
>
> *It has renewed my spirit in teaching and confirmed that my novel approaches to science education are acceptable.*

The recognition for their current teaching practices led some awardees to become more self-reflective, and to work even harder to improve their teaching and their students' learning. As several teachers described:

The award validated my philosophy for teaching math. It made me more aware of my teaching style and the learning styles of my students. The self-examination of my teaching methods was extremely valuable.

The Presidential Award was ultimate validation of what I continue to try to do for my students. It continues to encourage me to reach a little higher, to risk a little more, to give my students the best science education I am capable of giving them.

It reinforced my drive to develop new ways (radically new) to teach physics.

Because I have greater self-confidence after this outside affirmation, I have been far more willing to try new teaching approaches and professional development opportunities.

The recognition solidified the need to risk and renew my teaching philosophy. What are students learning—not what am I teaching.

In a few cases, awardees talked about the pressure they felt as a result of having received the PAEMST. Said one:

[I am] going crazy trying to be constantly innovative and creative. So much pressure to prove I deserve this award.

In many cases, the public credibility, the internal positive feelings, and the self-confidence generated by the PAEMST empowered awardees to pursue and accept responsibilities that enabled them to have a wide-ranging impact on mathematics and science education.

The greatest impact of the award has been the recognition of me by my colleagues, the school district, parents, and the community in general as a leader and expert in science education. This recognition has led to my being asked to take part in task forces for curriculum adoption, leadership conferences at the state level, and serving as a consultant for elementary teachers.

The Presidential Award led to other recognition by local, state, and national colleagues and agencies. It had a cascade effect. I was recognized by my district. As a result of local recognition, I've had the opportunity to work with state science educators, review chapters for a publisher, and teach a Science Methods class for a local university. At the most recent science fair I spoke with four science teachers that I've helped train—that's an amazing impact!

The award gave me the confidence to go forth with the beliefs I had at the time to bring about changes in mathematics at the elementary level for my district. I was inspired and excited so much so, that I then wanted to help teachers in my state, which I did and still continue to do so. Ten years have passed since receiving this award and I am just now starting to slow down (meaning that I turn down requests to do workshops or conference presentations). However, I'll never stop working in the field of education!

I have made hundreds of presentations, served as President of the state-level NCTM affiliate, chaired numerous committees, developed in-service training, developed and provided training and support for math teacher leaders, worked on many state level math standards projects, participated in several NSF grants, etc. The PAEMST gave me the confidence and credentials to be able to do this.

This award validated my devotion to teaching and what I have been doing daily in a classroom for 25 years. It has provided the motivation to work harder in reaching out to colleagues, parents, and students. Finally, it has encouraged me to play a significant part in encouraging all educators to provide for a standards based education in mathematics. My career has been greatly impacted by the number of opportunities the award has afforded me. I have served as a consultant at the state level in mathematics education, written test items for our state testing, been invited to participate in a number of activities, and served as a field reader for grants for the U.S. Department of Education. None of these things would have occurred had it not been for the PAESMT. I am truly appreciative of the program.

The data in Table 5 also suggest that the award is having very little of its potential negative impacts. Only 20 percent of awardees saw the award as increasing the time spent away from their daily teaching assignment to a large extent, and only about 10 percent perceived the award as reducing the time that was available for their teaching responsibilities.

Uses of the Monetary Award

Another item on the questionnaire asked awardees to indicate the ways in which they used the monetary component of the award. As shown in Table 6, the most frequent use of money is for awardees' own classrooms. However, the data also indicate that many awardees used the award funds for purchases to benefit both their own instruction and that of their school as a whole. Similarly, most awardees used some of the funds for the professional development of their colleagues, as well as some for their own professional development.

Table 6
How the Monetary Component of the Award Was Used

	Percent of Awardees				
		Science		Mathematics	
Use of Monetary Award	**Total**	**Elem.**	**Sec.**	**Elem.**	**Sec.**
Purchase materials for my classroom	82	86	83	86	77
Purchase technology for the school	79	73	82	67	85
Participate in professional development	74	76	68	82	76
Purchase materials for other classrooms	69	76	58	82	69
Plan and present professional development for colleagues	60	61	53	68	63
Provide additional activities for students (e.g., field trips, camps, special classroom projects)	44	63	48	35	34
Sponsor a colleague to participate in professional development	43	40	36	53	48
Extend the award's impact by combining it with other sources of funds	37	40	43	26	34
Provide materials for parents and the community (e.g., information packets, workshops, special presentations)	18	24	12	36	11
Offer scholarships or grants to students	9	9	11	3	9
Contribute to school maintenance/renovation efforts	4	9	3	4	3

The data in Table 6 suggest some differences between science and mathematics awardees in how they use the monetary award. First, science awardees are more likely to use the award to provide additional activities for students, perhaps because more of these opportunities exist in science (e.g., field trips, science camps) than in mathematics. Second, science awardees are more likely to extend the award's impact by combining it with other sources of funds, again perhaps because more opportunities exist than in mathematics. Finally, mathematics awardees are more likely than their science counterparts to sponsor a colleague to participate in professional development.

In the open-ended item discussed earlier, when asked to describe the overall impact of the award, roughly one-third of the awardees talked about the ways they were able to use the money. Some described how they had used the award to purchase materials for their own classrooms, as the following examples illustrate:

> *The monies awarded have allowed me to infuse technology into my everyday classroom setting via TI Graphing calculators and Mac software. The recognition and trip were great, but the money provided was the best part of the experience. I am a better teacher because of it, and I believe my students are way better off because of it.*

[The] greatest impact was being able to use grant money to enhance science teaching for students. There were wonderful projects [and a] vast array of students benefited. We were able to study "fast plants," build a classroom pond, and study animal habitats to a greater extent. It allowed for hands-on materials for the students.

I would say the greatest impact has been providing equipment for my students to use. We have stereoscopes and a computer to use for various projects such as forestry and fossil studies. The computer is used every day. I love watching their faces light up when they see something magnified.

The greatest impact was on the students. I was able to plan and create activities that would enhance student learning. These increased resources and supplies and materials gave the students a richer learning experience.

Others described how they were able to use the funds to enhance the instructional resources available for their schools:

The receivers of the benefits of the award were entirely the students and teachers at [our school] by purchasing their needs—calculators, software, materials, and supplies.

I believe the greatest impact has been what I have been able to provide for my students. I purchased tables for my classroom and a science classroom. I purchased technology (computer, calculators, probes, software, etc.) for my courses. The acquisition of an Ellison die cutter and a good selection of dies have impacted our entire school.

The greatest impact of receiving this award has been the ability to upgrade technology in my classroom and school, and the ability to purchase new science kits (FOSS) for my school.

The development of the outdoor classroom—Arboretum—gardens made a significant impact on the students involved in their creation. These areas have become a welcomed addition to the school. I am proud to have been able to use the money as seed-money to create this lasting memorial.

It is interesting to note that for some of the awardees, it was the flexibility in purchasing rather than the money itself that was of greatest import. For example:

The greatest impact of the Presidential Award is being able to purchase supplies and technology for my classroom without having to get approval from 4–5 individuals first.

The ability to purchase classroom materials immediately without consulting others.

A number of awardees talked about using the award money to support their own professional development and/or that of other teachers in their schools.

> *Financial resources enabled me to send teachers to workshops, and to provide materials needed to follow through in the classroom with the changes learned at workshops.*
>
> *The financial incentive ($7,500) allowed me to build and foster graphing calculator technology into the high school curriculum via teacher-supplied technology, in-service training.*
>
> *The greatest impact of this award was being able to provide intensive training for teachers through providing a one-week class (funding from my grant combined with other resources) and my having additional opportunities to present in 15-hour professional development courses.*

Recognition of the Award

Awardees were asked to indicate which of a variety of media were used to publicize their award. As can be seen in Table 7, awardees were most likely to be recognized in their local newspaper, followed by school or district publications. These two vehicles were by far the most common for publicizing the award, although just over one-third also received television coverage. There were no differences by level or subject of award in how awardees were recognized. Among those listed in the "other" category, recognition at a school board meeting was by far the most common.

Table 7
How the Award Was Publicized

	Percent of Awardees				
		Science		Mathematics	
Publicity of Award	**Total**	**Elem.**	**Sec.**	**Elem.**	**Sec.**
In a local newspaper article	92	93	91	92	91
In a school/district newsletter	69	74	68	73	66
On a television news program	36	34	38	38	36
In a radio news story	25	24	23	26	28
I received no local media recognition for winning the award	4	4	5	3	4
Other	12	11	10	14	13

Given the award's stature, it is reasonable to expect that one outcome might be increased respect for the recipient, and as noted earlier, many awardees mentioned increased respect when asked about the impact of the award. The questionnaire also asked awardees to rate this impact with regard to four groups. Award recipients generally perceived the greatest impacts on respect to occur among the parents of their students; followed closely by their teaching colleagues, the local community, and their students. (See Table 8.)

Table 8
How the Award Impacted Respect from Various Groups

Award Led to Increased Respect From:	Percent of Awardees*				
		Science		Mathematics	
	Total	Elem.	Sec.	Elem.	Sec.
The parents of your students	61	66	63	68	54
Your teaching colleagues	56	55	55	58	56
The local community generally	52	55	56	50	49
Your students	50	52	57	44	46

* Awardees responding with 4 or 5 on a five-point scale, where 1 was "Not at all" and 5 was "To a great extent."

It is interesting to note that a number of awardees mentioned respect from their family as a particularly salient impact. For example:

> *The greatest impact of receiving the Presidential Award for me personally is the change in my father's attitude toward my teaching. Now he does not see teaching as a waste of my talents and education.*

> *Respect from those outside education—especially family members (it wasn't until we were entering the White House that my husband realized the significance of the award—and how important my job was).*

Whenever an individual is singled out for an honor, the potential exists for resentment on the part of the individual's peers. The data in Table 9 suggest that such reactions are rare in the case of the Presidential Award, and that to the contrary, awardees' colleagues view the award as intended—a well-deserved recognition for excellent teaching. Half the awardees indicated their colleagues saw the award as reflecting the excellence of the school as a whole, and one-third suggested that others were inspired to apply for similar awards by the experience of the awardee.

Table 9
How the Award Was Viewed by Colleagues

Award Viewed As:	Percent of Awardees*				
		Science		Mathematics	
	Total	Elem.	Sec.	Elem.	Sec.
A well-deserved recognition of your excellence in teaching	75	73	74	76	77
A reflection of the excellence of the school as a whole	48	50	50	47	46
Inspiration to apply for the Presidential Award or similar awards themselves	35	35	39	31	32
A reward for simply being visible in the profession rather than excellent in teaching	11	9	11	12	11
Money that could have been better spent on other things	2	2	2	2	1

* Awardees responding with 4 or 5 on a five-point scale, where 1 was "Not at all" and 5 was "To a great extent."

At the same time, there was some evidence of jealousy and resentment in responses to the open-ended question on the impact of the award. Some described jealous reactions on the part of other teachers, others poor treatment by school or district administrators. For example:

> *I feel it has earned me respect at the university level. In my school district, it only aroused jealousy.*
>
> *[I have been] ostracized by the Science Department of my district.*
>
> *I have been unfairly treated by central office administration, due to jealousy.*
>
> *Among my colleagues I have received praise and encouragement. However, with the district for a host of reasons, the award has been greatly minimized. The current school administration views this award as a connection to the previous administration. For this reason, they seek to downplay it. What a shame they acted in such a petty manner.*
>
> *Because I was not politically or professionally well connected, receiving the Presidential Award, I felt, was validation of my work and impact as a classroom teacher. I was very surprised at the negative reaction of members of my department. This reaction of my colleagues resulted in my focusing even more on my teaching and curtailing my involvement on committees and activities in the school and community.*

Professional Involvement of the Awardees

To help identify the impacts of the award, respondents were given a list of activities in different areas and asked to indicate those in which they were involved five years preceding and five years following the award. To ensure a valid comparison, only those who held the award for at least five years prior to completing the questionnaire were included in the analysis.

One series of items asked about awardees' involvement in their school and district as a professional development provider and as a resource generally (e.g., serving on a textbook selection committee). Given that award criteria include these types of activities, it is not surprising that the majority of awardees were involved in them prior to receiving the award. These data are shown in Tables 10 and 11. The largest overall increases occurred in the activity where the smallest percentages of awardees were involved prior to the award—mentoring or coaching a new teacher.

Table 10
Science Awardee Involvement in
Professional Activities Before and After the Award

	Percent of Awardees			
	Elementary		Secondary	
Activity	**5 Years Before**	**5 Years After**	**5 Years Before**	**5 Years After**
Serving as an informal resource in science to other teachers in your school or district	84	97	85	92
Providing workshops on science teaching to other teachers in your school or district	78	91	79	89
Serving on a school or district science curriculum committee	74	89	78	82
Supervising a student teacher	71	66	67	68
Serving as a grade-level/team leader*	64	68	42	47
Serving on a school or district science textbook selection committee	56	63	75	72
Serving as the science lead teacher or science department chair	51	63	57	64
A formal mentoring or coaching arrangement with a new teacher	37	50	36	52

* This item was written specifically for K–8 teachers. Data for secondary awardees should be interpreted with caution, as they include responses from teachers for whom this item may not have been appropriate.

Table 11
Mathematics Awardee Involvement in
Professional Activities Before and After the Award

	Percent of Awardees			
	Elementary		Secondary	
Activity	**5 Years Before**	**5 Years After**	**5 Years Before**	**5 Years After**
Serving as an informal resource in mathematics to other teachers in your school or district	80	97	87	96
Providing workshops on mathematics teaching to other teachers in your school or district	79	91	79	89
Serving on a school or district mathematics curriculum committee	75	89	84	89
Supervising a student teacher	66	63	70	65
Serving on a school or district mathematics textbook selection committee	61	76	87	84
Serving as a grade-level/team leader*	56	66	53	56
A formal mentoring or coaching arrangement with a new teacher	37	52	39	52
Serving as the mathematics lead teacher or mathematics department chair	31	46	68	73

* This item was written specifically for K–8 teachers. Data for secondary awardees should be interpreted with caution, as they include responses from teachers for whom this item may not have been appropriate.

Another series of items asked about the awardees' involvement in professional organizations. As can be seen in Tables 12 and 13, five years after their award, virtually all awardees were involved in their primary organization (NSTA or NCTM) at the most basic level; i.e., they held membership. The award itself seemed to make a substantial difference among elementary recipients, who were less likely than their secondary counterparts to be members prior to the award. A similar pattern was evident for membership in state-level chapters of these organizations.

Table 12
Science Awardee Membership in
Professional Organizations Before and After the Award

Professional Organization	Percent of Awardees			
	Elementary		Secondary	
	5 Years Before	5 Years After	5 Years Before	5 Years After
NSTA	71	98	88	94
State-level chapter of NSTA	68	85	81	81

Table 13
Mathematics Awardee Membership in
Professional Organizations Before and After the Award

Professional Organization	Percent of Awardees			
	Elementary		Secondary	
	5 Years Before	5 Years After	5 Years Before	5 Years After
NCTM	79	98	96	98
State-level chapter of NCTM	72	90	93	96

As can be seen in Tables 14 and 15, most respondents reported attending conferences for their respective professional organizations both before and after receiving the award, and the majority in each category gave presentations as well. Nine in 10 awardees reported giving presentations at conferences after the award, a pre-post difference most noticeable among elementary awardees in both subjects. The most obvious change is in the level of involvement in organizing conferences, and again elementary awardees seem most affected in this regard. That two-thirds or more of respondents reported serving on an organizing committee after their award is evidence of their commitment to the profession.

Table 14
Science Awardee Involvement in
Professional Organizations Before and After the Award

Type of Involvement	Percent of Awardees			
	Elementary		Secondary	
	5 Years Before	5 Years After	5 Years Before	5 Years After
Attended conferences	90	98	97	98
Presented at conferences	75	89	83	92
Served on organization committees	50	74	63	74

Table 15
Mathematics Awardee Involvement in Professional Organizations Before and After the Award

	Percent of Awardees			
	Elementary		Secondary	
Type of Involvement	5 Years Before	5 Years After	5 Years Before	5 Years After
Attended conferences	89	98	98	99
Presented at conferences	71	91	81	92
Served on organization committees	51	71	67	80

A final series of items asked about awardees' involvement in activities related to science and mathematics education outside their school and district. Responses to these items indicate that the PAEMST program has mobilized a small army of science and mathematics education consultants, which is perhaps the most major program impact of all. As can be seen in Tables 16 and 17, the largest change in involvement relates to awardees reviewing applications for the PAEMST program. Other areas of involvement also showed gains, and are likely to have had a substantial impact on the field. For example, in the five years following receipt of their award, roughly two-thirds of the awardees were involved in state efforts to develop standards and competencies for students and teachers, compared to one-third prior to the award. Similarly, two-thirds reported working outside their own district on science and mathematics curriculum development and consulting with districts other than their own on issues related to science and mathematics education. Eight in 10 awardees taught in-service workshops and courses outside their district in the five years following their award, compared to only 1 in 2 prior to the award. Forty percent of all awardees (more secondary than elementary) reported lobbying their state legislators on issues related to science and mathematics education, compared to only 15 percent before their award.

Table 16
Science Awardee Involvement in Professional Activities Outside the School District Before and After the Award

	Percent of Awardees			
	Elementary		Secondary	
Type of Involvement	5 Years Before	5 Years After	5 Years Before	5 Years After
Taught in-service workshops or courses in science/science teaching outside of your district	54	81	61	84
Consulted on science education for other districts	33	63	36	64
Worked on science curriculum development outside of your district	32	65	36	65
Worked on state science competencies/standards for K–12 students and/or teachers	25	63	27	62
Spoke to state legislators about science education	12	38	19	46
Served on a state-level higher education review panel (e.g., reviewed Eisenhower proposals) or advisory boards	8	25	12	35
Reviewed PAEMST applications	5	67	7	68
Reviewed proposals for a federal agency (e.g., National Science Foundation, Department of Education, NASA)	5	21	10	37
Served on a national-level science education advisory board	4	18	6	22
Other	3	16	3	12

Table 17
Mathematics Awardee Involvement in Professional Activities Outside the School District Before and After the Award

	Percent of Awardees			
	Elementary		Secondary	
Type of Involvement	5 Years Before	5 Years After	5 Years Before	5 Years After
Taught in-service workshops or courses in mathematics/mathematics teaching outside of your district	55	85	55	82
Consulted on mathematics education for other districts	31	66	35	65
Worked on mathematics curriculum development outside of your district	21	53	33	65
Worked on state mathematics competencies/standards for K–12 students and/or teachers	20	60	37	65
Spoke to state legislators about mathematics education	7	27	15	41
Reviewed PAEMST applications	3	68	8	70
Served on a state-level higher education review panel (e.g., reviewed Eisenhower proposals) or advisory boards	3	19	8	30
Served on a national-level mathematics education advisory board	2	11	6	17
Reviewed proposals for a federal agency (e.g., National Science Foundation, Department of Education, NASA)	1	14	4	23
Other	4	13	5	14

In their open-ended responses describing the single greatest impact of the award, respondents consistently pointed out how the award opened doors to just the kinds of involvement described above.

> *The recognition as an involved and dedicated math teacher throughout the state has probably had the greatest impact. Being a Presidential Award winner gives one an immediate credibility as an outstanding educator which opens doors on a state level that would be hard to open otherwise.*
>
> *There is a great deal of respect from the community and I have had several opportunities to serve on state-wide committees. Overall, this award has opened up many doors in the teaching career and has given me a reason to work even harder.*
>
> *Provided opportunity to reach out beyond my classroom, something I was ready to do, by giving me credibility/confidence. It was something that helped to "open doors."*
>
> *The recognition and opportunities afforded me as a result of this award had the greatest impact….This award opened doors to many opportunities.*

If the higher levels of involvement reflected in the quantitative data are attributable to the award, the PAEMST program is responsible for a vast amount of advocacy and involvement on behalf of science and mathematics education that likely would not have occurred otherwise.

Part II
Comparison of Presidential Awardees with Science and Mathematics Teachers Nationally

One of the purposes of surveying the awardees was to be able to compare their backgrounds, attitudes, and teaching practices to those of teachers in the nation as a whole.

Table 18 shows the extent of teaching experience of Presidential Awardees and science and mathematics teachers nationally. It is clear that Presidential Awardees are a much more experienced group than the national teaching force. For example, in 2000, 70 percent of the elementary science Presidential Awardees had taught for at least 20 years, while only 30 percent of elementary science teachers nationally had that much experience. (The fact that none of the awardees was in the 0–4 years experience category reflects the requirement of five years K–12 teaching experience in science/mathematics for eligibility for these awards.)

Table 18
Teaching Experience of Presidential Awardees and the National Science and Mathematics Teaching Force

	Percent of Teachers							
	Science				Mathematics			
	Grades K–6		Grades 7–12		Grades K–6		Grades 7–12	
Number of Years	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**
0–4 years	0	24	0	27	0	27	0	25
5–9 years	2	17	3	21	2	15	2	16
10–14 years	14	16	7	13	13	15	9	13
15–19 years	14	12	10	8	24	11	12	11
20+ years	70	30	81	31	62	31	77	36

To enable valid comparisons, the remaining tables in this monograph focus on teachers in each group with 10 or more years teaching experience. These analyses are based on 1,137 Presidential Awardees and 3,089 teachers nationally.[3] (See Table 19.)

[3] Only awardees still employed as full- or part-time teachers were included in these analyses.

Table 19
Number of Presidential Awardees and Teachers Nationally Included in These Analyses

Grade and Subject	Number of Teachers P.A.	Number of Teachers Nat.
Grades K–6		
Science	229	467
Mathematics	209	549
Grades 7–12		
Science	340	943
Mathematics	359	1,130
TOTAL	1,137	3,089

Teacher Demographics

Nationally, roughly 9 out of 10 elementary teachers are female. While that holds true for Presidential Awardees in elementary mathematics, only about 8 out of 10 elementary science awardees are female. (See Table 20.) In terms of race/ethnicity, both the national teaching force and the Presidential Awardees are a predominately white group, including 90 percent or more in each subject/grade combination. African-American teachers are even less well-represented among Presidential Awardees than in the national teaching force. For example, while about 12 percent of the United States population is African-American, only 5 percent of the secondary mathematics teachers nationally and only 1 percent of the secondary mathematics awardees are African-American. Awardees are more likely than their national counterparts to have earned degrees beyond the bachelor's. Finally, elementary awardees are quite a bit less likely than their national counterparts to teach in self-contained settings.

Table 20
Characteristics of Experienced Science and Mathematics Teaching Force

	Percent of Teachers							
	Science				Mathematics			
	Grades K–6		Grades 7–12		Grades K–6		Grades 7–12	
Characteristic	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**
Sex								
Female	82	90	44	51	94	91	66	59
Male	18	10	55	49	6	9	34	41
Race								
White	93	90	93	92	95	90	95	91
Asian	3	1	3	1	2	0	3	2
Hispanic or Latino	2	2	2	2	2	3	3	2
Black or African-American	1	5	0	4	1	5	1	5
American Indian or Alaskan Native	0	1	1	2	0	1	1	0
Native Hawaiian or Other Pacific Islander	0	0	1	0	0	0	0	0
Degree Beyond Bachelor's	84	53	90	67	78	50	89	60
Teach in Self-Contained Setting	66	92	—	—	73	89	—	—

Teacher Preparation

Not surprisingly, Presidential Awardees are more likely than others to have extensive coursework in science and mathematics. For example, secondary science and mathematics awardees are more likely to have undergraduate majors in their field—80 percent in science compared to 65 percent nationally, and 65 percent in mathematics compared to 51 percent nationally.

Table 21
Undergraduate Majors of
Experienced Science and Mathematics Teachers

	Percent of Teachers*							
	Science				Mathematics			
	Grades K–6		Grades 7–12		Grades K–6		Grades 7–12	
Major	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**
Science/Mathematics	10	1	80	65	3	1	65	51
Science/Mathematics Education	4	2	7	7	3	1	20	19
Other Education	76	88	8	20	86	92	11	22
Other Fields	10	9	6	8	8	7	4	9

* Excludes the roughly 10 percent of respondents who indicated they had undergraduate majors in three or more fields.

In science, there are large differences in the percentage of secondary awardees and secondary teachers in the nation as a whole who have completed each of a number of different college courses; the differences are most substantial in the physical sciences, especially in coursework in analytical chemistry, modern or quantum physics, and electricity and magnetism. Similarly, 91 percent of the awardees compared to 79 percent of teachers nationally completed courses on methods of teaching science. The percentage taking computer programming was also significantly higher for Presidential Awardees. (See Table 22.)

In mathematics, the differences are most notable in some of the more advanced courses, such as abstract algebra, advanced calculus, and discrete mathematics. Likewise, 59 percent of awardees compared to only 40 percent nationally completed courses on instructional uses of computers/other technologies. (See Table 23.)

Table 22
Grade 7–12 Experienced Science Teachers Completing Various College Courses

College Course	Percent of Teachers	
	P.A.	Nat.
General methods of teaching	90	96
Methods of teaching science	91	79
Supervised student teaching in science	72	63
General/introductory chemistry	96	88
Analytical chemistry	50	34
Organic chemistry	67	60
Physical chemistry	33	23
Quantum chemistry	11	5
Biochemistry	36	28
Other chemistry	36	19
Introductory earth science	36	41
Astronomy	44	36
Geology	52	46
Meteorology	29	22
Oceanography	22	17
Physical geography	24	20
Environmental science	48	42
Agricultural science	5	7
Introductory biology/life science	86	86
Botany, plant physiology	66	62
Cell biology	42	44
Ecology	53	49
Entomology	22	23
Genetics, evolution	57	49
Microbiology	47	45
Anatomy/Physiology	49	55
Zoology, animal behavior	59	54
Other life science	51	47
Physical science	47	48
General/introductory physics	82	74
Electricity and magnetism	35	18
Heat and thermodynamics	30	17
Mechanics	33	17
Modern or quantum physics	28	10
Nuclear physics	21	8
Optics	23	9
Solid state physics	9	5
Other physics	25	12
History of science	31	18
Philosophy of science	23	11
Science and society	16	15
Electronics	14	4
Engineering (any)	12	4
Integrated science	9	8
Computer programming	41	21
Instructional uses of computers/other technologies	53	44
Other computer science	30	18

Table 23
Grade 7–12 Experienced Mathematics Teachers Completing Various College Courses

College Course	Percent of Teachers P.A.	Percent of Teachers Nat.
General methods of teaching	88	92
Methods of teaching mathematics	89	81
Supervised student teaching in mathematics	78	68
Mathematics for middle school teachers	36	39
Geometry for elementary/middle school teachers	26	27
College algebra/trigonometry/elementary functions	81	82
Calculus	96	85
Advanced calculus	79	56
Real analysis	53	32
Differential equations	67	56
Geometry	86	76
Probability and statistics	86	80
Abstract algebra	79	55
Number theory	72	55
Linear algebra	84	69
Applications of mathematics/problem solving	50	36
History of mathematics	50	35
Discrete mathematics	47	29
Other upper division mathematics	70	50
Biological sciences	51	54
Chemistry	49	46
Physics	58	46
Physical science	24	28
Earth/space science	18	22
Engineering (any)	9	9
Computer programming	67	54
Instructional uses of computers/other technologies	59	40
Any computer programming/computer science	72	59
Other computer science	33	25

Similarly, as can be seen in Table 24, elementary mathematics Presidential Awardees are more likely than their peers nationally to have taken such college courses as probability and statistics (43 percent versus 31 percent), geometry for teachers (42 percent versus 20 percent), and calculus (23 percent versus 10 percent).

Table 24
Grade K–6 Experienced Mathematics
Teachers Completing Various College Courses

College Course	Percent of Teachers P.A.	Percent of Teachers Nat.
Mathematics for elementary school teachers	95	97
Mathematics Education*	93	95
College algebra/trigonometry/elementary functions	46	38
Probability and statistics	43	31
Geometry for elementary/middle school teachers	42	20
Applications of mathematics/problem solving	30	21
Calculus	23	10

* Includes General methods of teaching, Methods of teaching mathematics, Instructional use of computers/other technologies, and Supervised student teaching in mathematics courses.

The National Science Teachers Association (NSTA) has recommended that for the preparation of elementary and middle school science teachers, in addition to course work in science education, "conceptual content should be balanced among life, earth/space, physical, and environmental science, including natural resources" (National Science Teachers Association, 1998). Using completion of a college course in life, earth, and physical science as a proxy for competency, Table 25 shows that 75 percent of the elementary science awardees, compared to only 55 percent nationally, meet those standards.

Table 25
Grade K–6 Experienced Science Teachers
Meeting NSTA Course-Background Standards

Course Background	Percent of Teachers P.A.	Percent of Teachers Nat.
Coursework in each science discipline plus science education	75	55
Lack science education only	4	11
Lack one science discipline	15	21
Lack two science disciplines	5	8
Lack three science disciplines	0	5

Perhaps as a result of their more extensive coursework, Presidential Awardees tend to feel more prepared pedagogically than do their national counterparts. (See Table 26.) For example, 96 percent of elementary mathematics Presidential Awardees, compared to 66 percent of teachers nationally consider themselves well prepared to lead a class of students using investigative strategies. Even more striking is that 9 out of 10 elementary science awardees feel well prepared to involve parents in the science education of their children, compared to 5 out of 10 nationally. Whether it is providing deeper coverage of fewer science/mathematics concepts; making connections between science/mathematics and other disciplines; using calculators to demonstrate science/mathematics principles; or using the Internet in their science/mathematics teaching, Presidential Awardees are much more likely than the general teaching population to consider themselves at least fairly well prepared.

Table 26
Experienced Science and Mathematics Teachers Considering Themselves Well Prepared For Each of a Number of Tasks

	Percent of Teachers*							
	Science				Mathematics			
	Grades K–6		Grades 7–12		Grades K–6		Grades 7–12	
Task	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**
Encourage participation of females in science/mathematics	100	94	99	96	99	98	98	94
Encourage students' interest in science/mathematics	100	91	99	95	99	95	97	93
Manage a class of student engaged in hands-on/ project-based work	100	80	97	93	97	84	91	71
Lead a class of students using investigative strategies	100	64	95	86	96	66	90	67
Make connections between science/mathematics and other disciplines	100	76	94	87	97	84	86	72
Listen/ask questions as students work in order to gauge their understanding	99	90	98	95	99	93	96	94
Develop students' conceptual understanding of science/mathematics	98	76	99	93	99	92	98	92
Have students work in cooperative learning groups	98	84	90	86	96	85	91	76
Teach groups that are heterogeneous in ability	98	88	87	81	97	88	80	75
Use the textbook as a resource rather than the primary instructional tool	97	79	98	88	99	81	93	74
Provide deeper coverage of fewer science/mathematics concepts	95	65	97	89	97	78	93	81
Take students' prior understanding into account when planning curriculum and instruction	95	72	89	83	100	86	93	87
Encourage participation of minorities in science/mathematics	94	87	90	91	88	89	84	88
Involve parents in the science/mathematics education of their children	91	48	62	48	89	68	58	42
Recognize and respond to student cultural diversity	81	63	68	58	66	66	61	57
Use the Internet in your science/mathematics teaching for general reference	78	37	84	61	51	22	53	29
Use calculators/computers for drill and practice	76	50	74	67	82	70	84	86
Use calculators/computers for science/mathematics learning games	70	39	55	51	80	70	69	58
Use the Internet in your science/mathematics teaching for data acquisition	67	27	72	53	46	17	47	28
Use calculators/computers to collect and/or analyze data	66	32	82	61	72	45	90	67
Use the Internet in your science/mathematics teaching for collaborative projects with classes/individuals in other schools	51	16	45	27	32	12	27	16
Use calculators/computers to demonstrate science/mathematics principles	43	21	73	48	60	45	93	74
Use calculators/computers for laboratory simulations and applications	39	14	67	40	53	41	87	57
Teach students who have limited English proficiency	31	28	17	17	27	29	19	21

* Includes teachers responding "very well prepared" and "fairly well prepared."

Based on the results of a factor analysis, the items in Table 26 were combined into four pedagogical preparedness composite variables. (Definitions of all composite variables, descriptions of how they were created, and reliability information are included in Appendix B.) Each composite has a minimum possible score of 0 and a maximum possible score of 100. Table 27 presents the composite scores related to teachers' pedagogical preparedness by subject and grade range.

Table 27
Composite Scores of Experienced Science and Mathematics Teachers' Pedagogical Preparedness

	Mean Score							
	Preparedness to Use Standards-Based Teaching Practices		Preparedness to Teach Students from Diverse Backgrounds		Preparedness to Use Calculators/ Computers		Preparedness to Use the Internet	
Subject and Grade	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**
Science								
Grades K–6	92	68	88	74	57	34	62	30
Grades 7–12	86	78	83	76	66	51	64	46
Mathematics								
Grades K–6	91	74	84	78	65	51	44	22
Grades 7–12	83	70	78	74	80	64	45	29

Professional Development

A series of items asked respondents to think back to three years ago, and describe their needs for professional development at that time. Given the differences in preparedness reported above, it is not surprising that Presidential Awardees as a whole were less likely than teachers nationally to perceive a moderate or substantial need for professional development in several areas. (See Table 28.) Large differences exist between national secondary science and mathematics teachers and awardees in the perceived needs to learn how to use technology in science and mathematics instruction and how to use inquiry/investigation-oriented teaching strategies.

The differences are even more evident at the elementary level. For example, 57 percent of national elementary mathematics teachers perceived a moderate or substantial need to learn how to use inquiry/investigation-oriented teaching strategies, compared to 37 percent of the Presidential Awardees. Similarly, 69 percent of elementary science teachers nationally, compared to only 53 percent of awardees, reported a moderate or substantial need to deepen their own science content knowledge. In addition, the need to understand student thinking in science was higher for teachers nationally (58 percent versus 37 percent). In contrast, awardees in 3 of the 4 subject/grade groups were at least as likely as their national counterparts to perceive a need for professional development in how to assess student learning.

Table 28
Experienced Science and Mathematics Teachers Reporting That They Perceived a Moderate or Substantial Need for Professional Development Three Years Ago

	Percent of Teachers							
	Science				Mathematics			
	Grades K–6		Grades 7–12		Grades K–6		Grades 7–12	
Statement	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**
Learning how to use technology in science/mathematics instruction	76	85	63	74	77	79	53	71
Deepening my own science/mathematics content knowledge	53	69	33	37	45	41	29	26
Learning how to assess student learning in science/mathematics	47	57	39	34	42	40	38	27
Learning how to teach science/mathematics in a class that includes students with special needs	41	53	55	56	44	51	58	50
Understanding student thinking in science/mathematics	37	58	36	37	40	41	34	31
Learning how to use inquiry/investigation-oriented teaching strategies	36	62	30	44	37	57	39	51

Although Presidential Awardees generally reported less of a need for professional development, they are, in fact, more likely to spend substantial amounts of time on in-service education in their field. For example, as can be seen in Table 29, roughly 8 out of 10 secondary Presidential Awardees reported spending more than 35 hours on in-service education in their field in the past three years, compared to only about 4 in 10 nationally.

Table 29
Time Spent by Experienced Teachers on In-Service Education in Science and Mathematics in Last Three Years

	Percent of Teachers							
	Science				Mathematics			
	Grades K–6		Grades 7–12		Grades K–6		Grades 7–12	
Number of Hours	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**
None	1	21	1	6	3	12	0	7
Less than 6 hours	4	25	3	5	3	22	2	6
6–15 hours	12	26	4	22	10	33	6	20
16–35 hours	20	17	12	23	15	17	11	23
More than 35 hours	64	10	80	45	69	16	81	43

Similarly, Presidential Awardees were much more likely to participate in each of a number of types of specific science- and mathematics-related professional development activities. (See Table 30.) More than 70 percent of the awardees in each group reported teaching an in-service workshop in their field, compared to less than 20 percent nationally. In addition, roughly 7 out of 10 Presidential Awardees in each group reported serving on a school or district curriculum committee for their field, compared to only 2 in 10 in grades K–6, and 5 in 10 in grades 7–12 for the national population.

Table 30
Experienced Teachers Participating in Various Professional Activities in Last Twelve Months

	Percent of Teachers							
	Science				Mathematics			
	Grades K–6		Grades 7–12		Grades K–6		Grades 7–12	
Professional Activity	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**
Taught any in-service workshops in science/mathematics or science/mathematics teaching	73	4	78	19	71	6	74	17
Served on a school or district science/mathematics curriculum committee	69	18	67	50	68	20	73	47
Received any local, state, or national grants or awards for science/mathematics teaching	50	3	54	15	32	2	38	7
Mentored another teacher as part of a formal arrangement that is recognized or supported by the school or district, not including supervision of student teachers	48	19	48	29	45	20	44	22
Served on a school or district science/mathematics textbook selection committee	38	17	46	41	46	20	57	47

Not surprisingly given their active involvement in professional development, Presidential Awardees are much more likely to be familiar with the National Research Council (NRC) *Standards* and the National Council of Teachers of Mathematics (NCTM) *Standards.* (See Tables 31 and 32.) In science at the elementary level, 48 percent of the awardees reported being "very familiar" with the NRC *Standards* compared to only 3 percent nationally.

Where nationally, only 12 percent of elementary mathematics teachers and 23 percent of secondary mathematics teachers reported being "very familiar" with the NCTM *Standards*, 81 percent of elementary awardees and 75 percent of secondary awardees indicated that level of awareness. Presidential Awardees across the board in science and mathematics were also much more likely to report strong agreement with their respective *Standards* and a great extent of implementation of the recommendations made by the *Standards* documents.

Table 31
Experienced Science Teachers' Familiarity with the NRC *Standards*

	Percent of Teachers			
	Grades K–6		Grades 7–12	
	P.A.	Nat.	P.A.	Nat.
Familiarity with NRC *Standards*				
Not at all familiar	2	66	5	32
Somewhat familiar	11	21	16	36
Fairly familiar	39	10	33	21
Very familiar	48	3	45	10
Extent of agreement with NRC *Standards**				
Strongly Disagree	1	0	2	0
Disagree	0	7	4	6
No Opinion	1	24	8	22
Agree	55	60	59	65
Strongly Agree	43	9	28	7
Extent to which recommendations have been implemented*				
Not at all	0	5	2	3
To a minimal extent	2	20	12	22
To a moderate extent	46	60	51	62
To a great extent	51	15	35	13

* These analyses included only those teachers indicating they were at least somewhat familiar with the *Standards.*

Table 32
Experienced Mathematics Teachers' Familiarity with the NCTM *Standards*

	Percent of Teachers			
	Grades K–6		Grades 7–12	
	P.A.	Nat.	P.A.	Nat.
Familiarity with NCTM *Standards*				
Not at all familiar	0	37	0	10
Somewhat familiar	2	30	3	28
Fairly familiar	17	21	22	39
Very familiar	81	12	75	23
Extent of agreement with NCTM *Standards**				
Strongly Disagree	2	0	1	0
Disagree	0	1	1	7
No Opinion	0	17	1	14
Agree	30	69	52	68
Strongly Agree	68	13	45	10
Extent to which recommendations have been implemented*				
Not at all	0	0	0	2
To a minimal extent	0	18	2	20
To a moderate extent	16	56	41	57
To a great extent	84	26	56	22

* These analyses included only those teachers indicating they were at least somewhat familiar with the *Standards.*

Table 33 shows the percentages of elementary science and mathematics teachers nationally reporting that they are very well-qualified to teach each of a number of subjects. Presidential Awardees were much more likely than teachers in the nation as a whole to indicate they felt very well-qualified to teach their discipline. For example, 70 percent of elementary science awardees compared to 30 percent nationally indicated they felt very well-qualified to teach life science, and 67 percent compared to 24 percent nationally felt very well-qualified to teach earth science. Likewise, 96 percent of mathematics awardees compared to 57 percent nationally felt very well-qualified to teach mathematics.

Table 33
Experienced Grade K–6 Science and Mathematics Teachers Reporting That They Are Very Well-Qualified to Teach Each of a Number of Subjects

	Percent of Teachers			
	Science		Mathematics	
Subject	**P.A.**	**Nat.**	**P.A.**	**Nat.**
Life Science	70	30	34	37
Earth Science	67	24	30	30
Physical Science	53	14	23	25
Mathematics	74	70	96	57
Reading/Language Arts	70	79	76	81
Social Studies	64	56	43	57

Differences were much smaller in secondary science (Table 34), with the largest disparity in perceived qualifications occurring in physics and science process/inquiry skills. For instance, 83 percent of awardees reported they are very well-qualified to teach experimental design as part of the science process, compared to only 57 percent of teachers nationally.

Table 34
Experienced Grade 7–12 Science Teachers Reporting That They Are Very Well-Qualified to Teach Each of a Number of Science Topics

Topic	Percent of Teachers P.A.	Percent of Teachers Nat.
Earth science		
Earth's features and physical processes	30	33
The solar system and the universe	37	34
Climate and weather	26	29
Biology		
Structure and function of human systems	51	59
Plant biology	47	48
Animal behavior	42	46
Interactions of living things/ecology	53	58
Genetics and evolution	46	49
Chemistry		
Structure of matter and chemical bonding	57	52
Properties and states of matter	62	60
Chemical reactions	50	47
Energy and chemical change	53	48
Physics		
Forces and motion	48	34
Energy	50	33
Light and sound	42	29
Electricity and magnetism	37	24
Modern physics (e.g., special relativity)	26	11
Environmental and resource issues		
Pollution, acid rain, global warming	53	48
Population, food supply and production	46	44
Science process/inquiry skills		
Formulating hypotheses, drawing conclusions, making generalizations	89	69
Experimental design	83	57
Describing, graphing, and interpreting data	90	67

The items in Table 34 were combined into seven content preparedness composite variables. Table 35 displays the mean content composite scores for all secondary awardees and national science teachers for those responsible for teaching that subject, and for those not teaching that subject. The fact that Presidential Awardees feel much more prepared in science content areas than their national peers is most apparent in the area of physical science and physics. Awardees who teach physical science are more likely to feel qualified to teach physical science topics than their national counterparts (with mean composite scores of 81 and 68, respectively). Likewise, awardees who teach physics are more likely to feel qualified to teach physics topics than teachers nationally (a mean score of 94 versus 78).

Table 35
Content Preparedness Composite Scores
of Experienced Grade 9–12 Science Teachers

	Mean Score					
	All Teachers		Teach Subject		Do Not Teach Subject	
Subject	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**
Chemistry	82	76	96	89	75	68
Earth Science	71	64	85	83	69	61
Biology/Life Science	70	71	90	84	57	59
Environmental Science	70	67	85	75	69	67
Physics	69	59	94	78	56	53
Physical Science	66	60	81	68	65	59
Integrated/General Science	64	62	67	64	63	61

Similarly, as can be seen in Table 36, a larger proportion of secondary mathematics Presidential Awardees perceive themselves as very well-qualified to teach a number of mathematics concepts. Differences are most marked in the use of technology in support of mathematics (60 percent versus 24 percent) and in the more advanced mathematics topics such as calculus (43 percent versus 18 percent), functions and pre-calculus (80 percent versus 51 percent), and topics from discrete mathematics (35 percent versus 13 percent).

Table 36
Experienced Grade 7–12 Mathematics Teachers Reporting That They
Are Very Well-Qualified to Teach Each of a Number of Mathematics Topics

	Percent of Teachers	
Topic	**P.A.**	**Nat.**
Numeration and number theory	74	76
Computation	89	92
Estimation	88	88
Measurement	88	87
Pre-Algebra	95	94
Algebra	95	87
Patterns and relationships	92	77
Geometry and spatial sense	86	70
Functions and pre-calculus concepts	80	51
Data collection and analysis	69	48
Probability	56	47
Statistics	44	24
Topics from discrete mathematics	35	13
Mathematical structures	19	10
Calculus	43	18
Technology in support of mathematics	60	24

As was done with science, composite variables were created to measure mathematics teachers' feelings of preparedness to teach both general and advanced mathematics topics. Table 37 shows Presidential Awardees' and national teachers' scores on the mathematics content composites. While both awardees and their national peers feel well qualified to teach general mathematics topics (e.g., computation, numeration and number theory), awardees are much more likely to feel prepared to teach advanced mathematics topics (e.g., discrete mathematics, calculus). For example, awardees who do not teach any advanced courses are more likely to feel qualified in these topics than are comparable teachers in the nation (with mean scores of 70 and 51, respectively).

Table 37
Content Preparedness Composite Scores
of Experienced Grade 9–12 Mathematics Teachers

	Mean Score					
	All Teachers		Teaching No Advanced Courses		Teaching One or More Advanced Courses	
Mathematics	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**
General Mathematics	93	91	97	90	93	91
Advanced Mathematics	74	59	70	51	75	63

Teacher Decisionmaking

As can be seen in Table 38, K–12 Presidential Awardees perceive themselves as having more control over curriculum and instructional decisions than do their peers nationally. Whether the decision at hand was determining course goals and objectives; selecting the content, topics, and skills to be taught; selecting textbooks/instructional programs; or even setting the pace for covering topics, Presidential Awardees were considerably more likely than other teachers to indicate that they had strong control over the decision.

Table 38
Classes Where Experienced Teachers Report Having Strong Control Over Various Curriculum and Instructional Decisions

	Percent of Classes*							
	Science				Mathematics			
	Grades K–6		Grades 7–12		Grades K–6		Grades 7–12	
Decision	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**
Selecting teaching techniques	88	58	92	79	88	66	92	74
Determining the amount of homework to be assigned	79	69	90	79	74	68	92	79
Choosing tests for classroom assessment	78	55	87	78	71	42	90	77
Selecting the sequence in which topics are covered	71	48	80	62	72	40	75	54
Setting the pace for covering topics	70	47	79	61	73	48	75	50
Choosing criteria for grading students	69	51	81	69	62	46	83	67
Selecting other instructional materials (besides textbooks/instructional programs)	69	27	74	53	71	35	78	48
Determining course goals and objectives	43	10	58	42	35	12	53	28
Selecting content, topics, and skills to be taught	40	12	58	38	34	13	53	29
Selecting textbooks/instructional programs	34	9	57	41	31	9	54	28

* Teachers were given a five-point scale for each decision, with 1 labeled “no control” and 5 labeled “strong control.”

Based on the results of a factor analysis, the items in Table 38 were combined into two composite variables—Curriculum Control and Pedagogy Control. Each composite has a minimum possible score of 0 and a maximum possible score of 100. Table 39 displays the composite scores for science and mathematics classes by grade range, illustrating that Presidential Awardees across the board perceive much more control over decisions related to curriculum and pedagogy than do their national peers, especially in curriculum control at the K–6 level.

Table 39
Curriculum Control and Pedagogy Control Composite Scores for Science and Mathematics Classes Taught by Experienced Teachers

	Mean Score			
	Curriculum Control		Pedagogy Control	
Subject and Grade	**P.A.**	**Nat.**	**P.A.**	**Nat.**
Science Classes				
Grades K–6	73	52	91	84
Grades 7–12	85	74	96	92
Mathematics Classes				
Grades K–6	74	52	89	80
Grades 7–12	84	69	97	92

Science and Mathematics Teaching

Overall, the student composition of Presidential Awardees' classes is quite similar to that of science and mathematics classes nationally. As can be seen in Table 40, class sizes average roughly 22 students in each group.

Table 40
Composition of Science and
Mathematics Classes of Experienced Teachers

	Science				Mathematics			
	Grades K–6		Grades 7–12		Grades K–6		Grades 7–12	
Class Composition	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**
Average Class Size (number of students)	23	22	23	22	21	23	21	22
Race/Ethnic Composition (percent of students)								
White	69	69	76	73	71	69	80	70
Black or African-American	16	14	7	12	14	16	7	13
Hispanic or Latino	6	12	7	10	8	10	6	10
Asian	5	3	7	3	3	3	5	4
American Indian or Alaskan Native	3	1	1	1	1	1	1	1
Native Hawaiian or Other Pacific Islander	1	1	1	1	3	0	2	1

While the demographics of their classes are fairly similar, Presidential Awardees have very different ideas than teachers in the nation as a whole about the objectives appropriate for science and mathematics instruction, and they use very different strategies to achieve their objectives. Science awardees are more likely than their national peers to emphasize increasing interest in science, developing science process/inquiry skills, learning to explain science ideas, and learning to evaluate arguments based on scientific evidence. In contrast, the general population of science teachers is more likely than the awardees to emphasize learning science terms and facts and preparing students for standardized tests. (See Table 41.)

Table 41
Science Classes of Experienced Teachers with Heavy Emphasis on Various Instructional Objectives

	Percent of Classes*			
	Grades K–6		Grades 7–12	
Objective	**P.A.**	**Nat.**	**P.A.**	**Nat.**
Learn science process/inquiry skills	89	41	82	69
Increase students' interest in science	78	61	63	50
Learn basic science concepts	80	66	83	81
Learn how to communicate ideas in science effectively	57	24	55	40
Prepare for further study in science	45	27	48	50
Learn to evaluate arguments based on scientific evidence	37	10	43	28
Learn important terms and facts of science	31	41	34	49
Learn about the relationship between science, technology, and society	31	11	35	29
Learn about the applications of science in business and industry	16	4	20	17
Learn about the history and nature of science	16	8	16	12
Prepare for standardized tests	9	21	12	21

* Teachers were given a four-point scale for each objective, with 0 labeled "None"; 1, "Minimal Emphasis"; 2, "Moderate Emphasis"; and 3, "Heavy Emphasis."

Table 42 presents means for composite variables related to objectives for science classes. Of the two sets of objectives, Science Content (e.g., learning basic science concepts, learning science process/inquiry skills) is emphasized more by awardees and national teachers across the board. Although receiving less of an emphasis, Nature of Science (e.g., learning to evaluate arguments based on scientific evidence, learning how to communicate ideas in science effectively) is more likely to be stressed at the secondary level, and more likely to be emphasized by elementary science awardees than by elementary science teachers nationally.

Table 42
Mean Composite Scores Related to Objectives in Science Classes Taught by Experienced Teachers

	Mean Score			
	Grades K–6		Grades 7–12	
Class Objective	**P.A.**	**Nat.**	**P.A.**	**Nat.**
Science Content	84	77	85	85
Nature of Science	67	50	71	67

Table 43 shows the percentage of mathematics Presidential Awardees and mathematics teachers nationally who reported giving heavy emphasis to each of a number of instructional objectives. Awardees are more likely than their national peers to emphasize learning how mathematical ideas connect with one another, learning to explain ideas in mathematics effectively, and increasing interest in mathematics; while mathematics teachers nationally are more likely than awardees to emphasize learning mathematical algorithms/procedures, learning to perform computations with speed and accuracy, and preparing for standardized tests.

Table 43
Mathematics Classes of Experienced Teachers with Heavy Emphasis on Various Instructional Objectives

	Percent of Classes*			
	Grades K–6		Grades 7–12	
Objective	**P.A.**	**Nat.**	**P.A.**	**Nat.**
Learn how to solve problems	97	84	85	77
Learn mathematical concepts	93	89	93	88
Learn to reason mathematically	95	73	89	76
Learn how mathematics ideas connect with one another	80	57	78	59
Learn to explain ideas in mathematics effectively	74	39	60	38
Increase students' interest in mathematics	71	55	50	32
Prepare for further study in mathematics	50	43	73	62
Understand the logical structure of mathematics	46	32	46	41
Develop students' computational skills	25	67	20	37
Learn mathematical algorithms/procedures	28	47	45	61
Prepare for standardized tests	16	39	14	29
Learn to perform computations with speed and accuracy	15	44	10	22
Learn how to apply mathematics in business and industry	11	11	18	17
Learn about the history and nature of mathematics	9	2	9	3

* Teachers were given a four-point scale for each objective, with 0 labeled "None"; 1, "Minimal Emphasis"; 2, "Moderate Emphasis"; and 3, "Heavy Emphasis."

Differences between types of objectives among grade ranges are captured in the mean scores on three composite variables—Mathematics Reasoning, Basic Mathematics Skills, and Nature of Mathematics—as shown in Table 44. For both Presidential Awardees and national teachers, the greatest reported emphasis is on objectives related to mathematical reasoning—e.g., learning mathematical concepts. K–12 national teachers however, tend to have a greater emphasis on basic mathematics skills (e.g., developing computational skills) than do awardees.

Table 44
Mean Composite Scores Related to Objectives in Mathematics Classes Taught by Experienced Teachers

	Mean Score			
	Grades K–6		Grades 7–12	
Class Objective	**P.A**	**Nat.**	**P.A.**	**Nat.**
Mathematics Reasoning	97	91	95	91
Basic Mathematics Skills	59	77	51	65
Nature of Mathematics	63	55	69	62

Differences between awardees and the national population can also be seen in science and mathematics class activities. Students in Presidential Awardees' science classes are more likely than others to do hands-on science activities, work on extended science investigations or projects; design their own investigations; and record, represent, and/or analyze data. They are less likely to read a science textbook in class or answer textbook/worksheet questions. (See Table 45).

Table 45
Science Classes of Experienced Teachers Where Teachers Report that Students Take Part in Various Instructional Activities at Least Once a Week

	Percent of Classes			
	Grades K–6		Grades 7–12	
Activity	**P.A.**	**Nat.**	**P.A.**	**Nat.**
Work in groups	95	63	89	81
Do hands-on/laboratory science activities or investigations	97	53	89	73
Record, represent, and/or analyze data	78	32	81	62
Follow specific instructions in an activity or investigation	73	49	71	77
Write reflections	59	23	26	20
Use mathematics as a tool in problem-solving	51	28	64	49
Design or implement their *own* investigation	40	7	25	13
Read other (non-textbook) science-related material in class	34	42	19	23
Watch a science demonstration	37	32	49	45
Work on extended science investigations or projects	27	7	16	9
Participate in field work	25	6	9	4
Listen and take notes during presentation by teacher	25	21	68	77
Make formal presentations to the rest of the class	17	3	10	6
Use computers as a tool	15	6	28	15
Read from a science textbook in class	13	33	13	32
Prepare written science reports	16	6	40	26
Watch audiovisual presentations	13	20	22	25
Answer textbook or worksheet questions	14	32	50	66
Take field trips	10	5	1	3

Table 46 shows the percentage of teachers *never* using computers in their science instruction. Fifty-nine percent of secondary science teachers nationally reported students never collecting data using sensors or probes, compared to 30 percent of the awardees. In addition, 45 percent nationally compared to 28 percent of awardees reported never using the computer to demonstrate scientific principles. At the elementary level, both awardees and national elementary teachers tend to use computers for playing science learning games. However, it is more common for awardees than for other teachers to use the computer to do laboratory simulations and retrieve or exchange data.

Table 46
Science Classes of Experienced Teachers Where Teachers Report that Students Never Use Computers to do Particular Activities

	Percent of Classes			
	Grades K–6		Grades 7–12	
Activity	**P.A.**	**Nat.**	**P.A.**	**Nat.**
Take a test or quiz	68	70	72	66
Collect data using sensors or probes	66	80	30	59
Do drill and practice	52	52	54	58
Solve problems using simulations	47	68	36	52
Do laboratory simulations	45	73	31	47
Demonstrate scientific principles	39	62	28	45
Retrieve or exchange data	36	64	26	44
Play science learning games	29	43	56	55

A summary of the data on teaching practice is provided by the composite variables listed in Table 47. A score of 100 is attained if an individual indicated s/he used each strategy in the composite every science lesson. Similarly a score of 0 indicates that none of the strategies in the composite were ever used. While the mean scores for the secondary awardees and their national peers are fairly comparable, there are substantial differences at the elementary level. The data indicate that the use of projects/extended investigations; laboratory activities; and computers are far more common teaching practices of Presidential Awardees than of the general population of elementary science teachers.

Table 47
Mean Scores for Teaching Practice Composite Variables
in Science Classes Taught by Experienced Teachers

	Mean Score			
	Grades K–6		Grades 7–12	
Teaching Practice	**P.A.**	**Nat.**	**P.A.**	**Nat.**
Use of Strategies to Develop Students' Abilities to Communicate Ideas	82	70	74	70
Use of Laboratory Activities	81	61	75	71
Use of Traditional Teaching Practices	59	52	67	70
Use of Projects/Extended Investigations	47	28	42	36
Use of Computers	24	14	27	20

Table 48 shows that students in Presidential Awardees' mathematics classes are more likely than others to work in groups; write reflections; engage in mathematical activities using concrete materials; record, represent, and/or analyze data; and design their own activity or investigation. They are less likely than classes nationally to practice routine computations/algorithms or, at the elementary level, answer textbook or worksheet questions.

Table 48
Mathematics Classes of Experienced Teachers Where Teachers Report that Students Take Part in Various Instructional Activities at Least Once a Week

	Percent of Classes			
	Grades K–6		Grades 7–12	
Activity	P.A.	Nat.	P.A.	Nat.
Engage in mathematical activities using concrete materials	96	77	49	28
Work in groups	91	70	87	56
Use mathematical concepts to interpret and solve applied problems	83	68	83	71
Follow specific instructions in an activity or investigation	72	74	74	74
Record, represent, and/or analyze data	66	47	54	37
Practice routine computations/algorithms	51	77	47	72
Review homework/worksheet assignments	55	77	84	93
Use calculators or computers for learning or practicing skills	48	36	83	79
Use calculators or computers to develop conceptual understanding	45	29	79	61
Write reflections	38	21	17	8
Answer textbook or worksheet questions	44	83	86	92
Read other (non-textbook) mathematics-related materials in class	32	23	13	9
Design their *own* activity or investigation	25	13	15	6
Use calculators or computers as a tool	31	15	65	35
Make formal presentations to the rest of the class	25	11	18	7
Listen and take notes during presentation by teacher	24	30	81	86
Work on extended mathematics investigations or projects	18	6	12	5
Read from a mathematics textbook in class	18	45	32	37

Likewise, secondary mathematics Presidential Awardees as a whole are more inclined than their peers to use calculators/computers to demonstrate mathematics principles, retrieve and exchange data, and solve problems using simulations. National teachers, on the other hand, are more likely to use those resources to do drill and practice, and at the elementary level, play mathematics learning games. (See Table 49.)

Table 49
Mathematics Classes Where Teachers Report that Students Use Calculators/Computers for Various Activities at Least Once a Week

	Percent of Classes			
	Grades K–6		Grades 7–12	
Activity	P.A.	Nat.	P.A.	Nat.
Play mathematics learning games	32	45	8	7
Demonstrate mathematics principles	31	24	71	52
Do drill and practice	20	38	35	53
Solve problems using simulations	13	12	24	14
Do simulations	13	11	25	10
Retrieve or exchange data	10	6	19	9
Take a test or quiz	8	16	65	60
Collect data using sensors or probes	8	3	11	4

Table 50 displays the means for composite variables related to mathematics teaching practice. As previously noted, the data suggest that national teachers are more inclined to use traditional teaching practices—lecture, doing worksheet/textbook problems, and practicing routine computations—than are Presidential Awardees. This is most apparent at the elementary level where the national mean score is 70 compared to the awardee mean score of 54. In contrast, secondary awardees are more likely to use calculators/computers for investigations than teachers in the national population (a mean score of 46 versus 32).

Table 50
Mean Scores for Teaching Practice Composite Variables in Mathematics Classes Taught by Experienced Teachers

	Mean Score			
	Grades K–6		Grades 7–12	
Teaching Practice	**P.A.**	**Nat.**	**P.A.**	**Nat.**
Use of Strategies to Develop Students' Abilities to Communicate Mathematics Ideas	86	73	80	69
Use of Traditional Teaching Practices	54	70	76	81
Use of Calculators/Computers for Developing Concepts and Skills	43	39	72	65
Use of Calculators/Computers for Investigations	37	27	46	32

Data about their "most recent lesson" support the general findings that Presidential Awardees in both science and mathematics are more likely to implement lessons that involve students in reform-oriented activities, such as doing hands-on/manipulative activities, working in small groups, and using computers and calculators. For example, as seen in Table 51, roughly 7 out of 10 lessons taught by awardees included students working in small groups in their most recent lesson, compared to roughly 5 out of 10 nationally. Similarly, 80 percent of lessons taught by elementary mathematics awardees involved students doing hands-on/manipulative activities, compared to 67 percent of lessons taught by teachers nationally. In contrast, national science and mathematics teachers are more likely to implement lessons that involve students completing textbook/worksheet problems.

Table 51
Science and Mathematics Classes of Experienced Teachers Participating in Various Activities in the Most Recent Lesson

	Percent of Classes							
	Science				Mathematics			
	Grades K–6		Grades 7–12		Grades K–6		Grades 7–12	
Activity	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**
Discussion	85	90	75	77	95	89	93	92
Students doing hands-on/manipulative activities	79	60	66	49	80	67	38	23
Students working in small groups	78	53	66	51	77	51	72	52
Lecture	27	60	45	65	40	66	69	85
Students reading about science/mathematics	21	40	13	27	21	19	18	18
Students completing textbook/worksheet problems	16	45	30	51	45	77	58	78
Students using other technologies (besides calculators or computers)	15	6	16	10	9	3	3	2
Students using calculators	10	1	35	24	37	14	80	73
Students using computers	8	6	19	9	15	8	9	3
Test or quiz	5	9	8	10	10	12	16	16

It is not at all surprising therefore, that classes taught by Presidential Awardees spend a greater percentage of science and mathematics instructional time working with hands-on manipulatives or laboratory materials. (See Table 52.) For example, lessons taught by national elementary science teachers spend an average of only 28 percent of the time using hands-on activities, while awardees' lessons spend roughly half of their time on such activities.

Table 52
Average Percentage of Experienced Teachers' Science and Mathematics Class Time Spent on Different Types of Activities

	Percent of Class Time							
	Science				Mathematics			
	Grades K–6		Grades 7–12		Grades K–6		Grades 7–12	
Activity	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**
Working with hands-on, laboratory or manipulative materials	47	28	38	26	33	25	14	7
Whole class lecture/discussion	23	33	28	33	26	29	36	41
Non-laboratory/non-manipulative small group work	11	9	11	10	14	8	20	14
Daily routines, interruptions, and other non-instructional activities	8	8	10	11	8	9	10	12
Individual students reading textbooks, completing worksheets, etc.	7	18	6	15	13	26	12	20
Other activities	4	4	7	5	6	3	8	6

Assessment practices of Presidential Awardees also differ greatly from those of their peers. (See Table 53.) In elementary science classes, awardees are more likely than other science teachers to use review of student portfolios, notebooks/journals, observation of class presentations, open-ended laboratory task, and long term-science projects. Science teachers nationally are more likely than awardees to assess students based on short-answer tests.

In mathematics, Presidential Awardees are more likely than other teachers to base assessment of student progress on open-ended tasks using defined criteria; tests requiring open-ended responses; student presentations of their work to the class; and long-term mathematics projects. In contrast, national teachers are more likely than awardees to use predominately short-answer tests, such as multiple choice or fill in the blanks.

Table 53
Science and Mathematics Classes of Experienced Teachers Where Teachers Report Assessing Students' Progress Using Various Methods at Least Monthly

	Percent of Classes							
	Science				Mathematics			
	Grades K–6		Grades 7–12		Grades K–6		Grades 7–12	
	P.A.	Nat.	P.A.	Nat.	P.A.	Nat.	P.A.	Nat.
Ask students questions during large group discussions	98	98	97	98	99	100	99	97
Observe students and ask questions as they work in small groups	98	91	97	96	100	96	96	87
Use assessments embedded in class activities to see if students are "getting it"	96	90	94	93	100	98	99	93
Observe students and ask questions as they work individually	93	90	96	93	98	99	95	96
Review student notebooks/journals	83	60	57	56	78	55	55	45
Grade student work on open-ended and/or laboratory tasks using defined criteria (e.g., a scoring rubric)	83	47	85	78	72	39	77	46
Have students present their work to the class	74	51	55	44	82	53	68	55
Give tests requiring open-ended responses (e.g., descriptions, explanations)	79	56	87	85	82	57	90	74
Conduct a pre-assessment to determine what students already know	74	50	47	48	74	68	40	45
Review student homework	74	64	91	96	79	88	96	98
Review student portfolios	55	42	31	28	61	41	28	20
Have students assess each other (peer evaluation)	55	22	38	30	46	34	36	25
Have students do long-term science/mathematics projects	45	19	34	25	45	17	37	19
Give predominantly short-answer tests (e.g., multiple choice, true/false, fill-in-the-blank)	35	57	59	79	33	59	29	48

These findings are summarized in the composite variables related to assessment practices; mean scores are presented in Table 54. Presidential Awardees, as a whole, use informal assessment strategies (e.g., using assessments embedded in class activities) and journals/portfolios more frequently than teachers in the nation as a whole, but the differences are most pronounced in science at the elementary level. Elementary awardees in both subjects use journals/portfolios quite a bit more than their national counterparts.

Table 54
Mean Scores for Assessment Practice Composite Variables in Science and Mathematics Classes Taught by Experienced Teachers

	Mean Score			
	Grades K–6		Grades 7–12	
	P.A.	Nat.	P.A.	Nat.
Science Classes				
Use of Informal Assessment	81	71	76	72
Use of Journals/Portfolios	58	41	38	34
Mathematics Classes				
Use of Informal Assessment	87	83	83	77
Use of Journals/Portfolios	53	37	35	24

The vast majority of secondary science and mathematics classes, both Presidential Awardees' classes and those nationally, use commercially published textbooks/programs. (See Table 55.) Awardees are not very different from the national population in terms of the percentage of the textbook they attempt to cover. The most apparent difference can be seen in elementary mathematics where 79 percent of the national teachers, compared to 58 percent of the awardees, cover more than three-fourths of the textbook during the year.

Table 55
Science and Mathematics Classes of Experienced Teachers Using Commercially-Published Textbooks/Programs and Percentage Covered During the Year

	Percent of Classes*							
	Science				Mathematics			
	Grades K–6		Grades 7–12		Grades K–6		Grades 7–12	
Textbook/Program Use and Coverage	P.A.	Nat.	P.A.	Nat.	P.A.	Nat.	P.A.	Nat.
Use Commercially Published Textbooks/Programs	65	69	87	94	77	89	95	94
Percentage Covered During the Year*								
Less than 25 percent	24	6	5	5	2	1	1	0
25–49 percent	12	16	21	19	11	3	7	7
50–74 percent	31	33	39	34	28	17	20	30
75–90 percent	21	20	27	35	37	40	49	45
More than 90 percent	13	25	7	7	21	39	23	18

* Only classes using commercially published textbooks/programs were included in these analyses.

Tables 56, 57, and 58 provide data on equipment usage in Presidential Awardees' and national elementary and secondary science and mathematics classes. In elementary science, awardees are more likely than teachers nationally to report using laboratory facilities and such technologies as CD-ROM players, videodisc players, and four-function calculators.

Similarly, at the secondary level, science awardees are more likely than their national counterparts to report use of graphing and scientific calculators, and calculator/computer lab interfacing devices. Teachers nationally are much more likely to say they do not need these kinds of equipment. (See Table 58.)

The differences in equipment usage between mathematics Presidential Awardees and teachers nationally are similar to those in science. At both the elementary and secondary level, mathematics awardees are more likely than their national peers to use videotape players and CD-ROM players. Fifty-three percent of the elementary mathematics awardees reported using fraction calculators in their classes, compared to 16 percent nationally. In addition, nearly 7 out of 10 elementary mathematics awardees compared to 5 out of 10 national teachers use computers with Internet connection during instruction. At the secondary level, mathematics awardees are much more likely than others to use graphing calculators (91 percent versus 67 percent), and calculator/computer lab interfacing devices (53 percent versus 30 percent); while awardees are less likely than secondary mathematics teachers nationally to use four-function and fraction calculators.

Table 56
Science and Mathematics Classes of Experienced Teachers
Where Various Equipment Is Used During Instruction

	Percent of Classes							
	Science				Mathematics			
	Grades K–6		Grades 7–12		Grades K–6		Grades 7–12	
Equipment	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**
Videotape player	98	91	98	93	68	48	66	48
Overhead projector	91	89	94	89	98	90	96	89
Computers with Internet connection	91	71	85	77	66	51	65	43
Computers	87	76	93	86	87	89	84	62
Videodisc player	54	27	68	56	12	14	9	4
CD-ROM player	77	52	67	59	57	47	34	22
Four-function calculators	53	39	67	63	85	73	43	69
Calculator/computer lab interfacing devices	20	11	63	34	26	23	53	30
Fraction calculators	10	5	25	25	53	16	38	65
Graphing calculators	5	1	57	27	18	4	91	67
Scientific calculators	7	4	62	50	14	10	65	76
Electric outlets in labs/classrooms	98	89	99	97	—	—	—	—
Running water in labs/classrooms	96	83	96	97	—	—	—	—
Gas for burners in labs/classrooms	15	9	67	67	—	—	—	—
Hoods or air hoses in labs/classrooms	7	4	48	46	—	—	—	—

Table 57
Science and Mathematics Classes of Experienced Teachers Where Various Equipment Is Needed for Instruction, But Not Available

	Percent of Classes							
	Science				Mathematics			
	Grades K–6		Grades 7–12		Grades K–6		Grades 7–12	
Equipment	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**
Calculator/computer lab interfacing devices	15	7	14	23	11	11	6	11
Graphing calculators	6	5	5	7	4	5	1	4
Videodisc player	3	8	6	7	8	4	3	4
Computers with Internet connection	3	7	5	10	9	6	3	6
Fraction calculators	5	4	3	5	2	5	1	3
CD-ROM player	3	6	7	8	7	4	3	4
Scientific calculators	6	3	5	5	2	4	0	1
Four-function calculators	4	3	3	5	5	2	0	1
Computers	2	3	2	6	3	3	1	5
Overhead projector	2	1	1	0	0	1	0	0
Videotape player	0	2	0	0	1	1	1	0
Gas for burners in labs/classrooms	11	8	4	7	—	—	—	—
Hoods or air hoses in labs/classrooms	11	7	12	13	—	—	—	—
Running water in labs/classrooms	4	6	1	1	—	—	—	—
Electric outlets in labs/classrooms	1	1	0	1	—	—	—	—

Table 58
Science and Mathematics Classes of Experienced Teachers Where Various Equipment Is Not Needed for Instruction

	Percent of Classes							
	Science				Mathematics			
	Grades K–6		Grades 7–12		Grades K–6		Grades 7–12	
Equipment	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**	**P.A.**	**Nat.**
Scientific calculators	87	93	33	46	84	86	35	23
Graphing calculators	89	94	38	66	78	91	8	29
Fraction calculators	85	92	72	70	45	78	61	32
Calculator/computer lab interfacing devices	65	83	24	43	63	66	41	60
Videodisc player	43	65	26	37	80	82	88	92
Four-function calculators	43	58	29	33	11	25	57	30
CD-ROM player	20	42	26	33	37	48	63	74
Computers	11	21	5	8	10	8	15	33
Computers with Internet connection	6	22	10	13	25	42	32	51
Overhead projector	8	11	5	11	2	9	4	11
Videotape player	2	7	1	7	31	51	34	52
Hoods or air hoses in labs/classrooms	83	89	41	41	—	—	—	—
Gas for burners in labs/classrooms	74	84	29	25	—	—	—	—
Electric outlets in labs/classrooms	2	9	0	3	—	—	—	—
Running water in labs/classrooms	1	11	3	2	—	—	—	—

Conclusion

The 2000 National Survey of Science and Mathematics Education included a component for recipients of the Presidential Award for Excellence in Mathematics and Science Teaching in order to gauge the impacts of the award. An important finding is that most awardees are still in the classroom, and the vast majority of those who are employed outside the classroom are still involved in K–12 education at the school or district level.

Recipients reported that the award renewed their enthusiasm for teaching; led to increased respect from their school and community; provided additional resources for their own teaching, as well as for science and mathematics teaching in their schools, more generally; and increased their opportunities for professional development and networking with other teachers. In response to an open-ended question concerning the single greatest impact of the award, recipients spoke eloquently about how the award had "opened doors" for them. A small number of awardees described negative impacts, either jealousy and resentment on the part of their peers or, in a few cases, the pressure they felt to prove they deserved the award.

A series of items about their professional involvement in the five years prior to receipt of the award and the five years after receipt of the award provided additional insight into the impacts of the Presidential Award program. While most recipients were active in the profession before the award, the extent of involvement after the award was greater still, with awardees more likely to present at conferences, teach in-service workshops, consult for other districts, and serve on state and national committees/advisory boards.

Awardees who are still in the classroom were asked to complete the same surveys administered to random samples of science and mathematics teachers nationally. Given the eligibility criteria and the process of selecting Presidential Awardees, some of the differences between awardees and the national population of science and mathematics teachers described in this report are to be expected. Presidential Awardees tend to be more highly educated; and as a consequence of the award, have more resources to devote to their teaching, and more opportunities to serve in leadership roles than their national peers.

At the same time, the differences in level of involvement in professional activities are extraordinary. Presidential Awardees were much more likely to be active professionally—whether serving on a school or district curriculum or textbook committee, receiving grants or awards for teaching, or providing professional development for others. For instance, 74 percent of the awardees, but only 29 percent of national teachers reported spending more than 35 hours on in-service science/mathematics education in the last three years. Presidential Awardees are also far more likely to be familiar with, and in strong agreement with, both the NRC and NCTM *Standards* documents.

These differences in professional activities and beliefs are reflected in differences in instructional objectives. In science, Presidential Awardees are more inclined to place a greater emphasis on objectives related to the nature of science (e.g., learning to evaluate arguments based on scientific evidence, and communicating ideas in science effectively) than their national peers.

Likewise in mathematics, awardees are much more likely than other teachers to emphasize objectives related to mathematics reasoning and the nature of mathematics. Teachers nationally tend to emphasize objectives related to basic mathematics skills such as learning computational skills, algorithms/procedures, and preparing for standardized tests.

The classroom pedagogical and assessment practices by which these instructional objectives are addressed result in further differences between Presidential Awardees and the national population. Presidential Awardees tend to use more investigative teaching strategies. Their classes are much more likely to work in small groups, use manipulative materials, and use technology. Likewise Presidential Awardees are more likely than others to use open-ended performance tasks, portfolios, or long-term projects in determining student progress and much less likely to use multiple choice and other objective tests. In contrast, national teachers are more apt to use traditional teaching practices where their students read a textbook in class or do drill and practice with worksheet problems.

In summary, the process of selecting Presidential Awardees seems to be effective in recognizing teachers whose backgrounds, professional involvement, and teaching objectives and styles are consistent with the recommendations of professional associations and state and national standards.

References

National Council of Teachers of Mathematics. *Curriculum and Evaluation Standards for School Mathematics*. Reston, VA: National Council of Teachers of Mathematics, 1989.

National Council of Teacher of Mathematics. *Principles and Standards for School Mathematics*. Reston, VA: National Council of Teachers of Mathematics, 2000.

National Council of Teachers of Mathematics. *Professional Standards for Teaching Mathematics*. Reston, VA: National Council of Teachers of Mathematics, 1991.

National Research Council. *National Science Education Standards*. Washington, DC: National Research Council, 1996.

NCATE Mathematics Program Standards. Reston, VA: National Council of Teachers of Mathematics, October 1998. Available: nctm.org/corners/ncate (11/13/01)

Standards for Science Teacher Preparation. National Science Teachers Association in collaboration with the Association for the Education of Teachers in Science, November 1998.

Weiss, I.R., Banilower, E.R., McMahon, K.C., and Smith, P.S. *Report of the 2000 National Survey of Science and Mathematics Education.* Chapel Hill, NC: Horizon Research, Inc., 2001.