Standing Out in Their Field: A Comparison of the Knowles Science Teaching Foundation Fellows to Teachers Nationally

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KSTF Knowles Science Teaching Foundation

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FOREWORD

The KSTF Teaching Fellows Program was officially launched in 2002, when four high-school physics teachers were awarded a Fellowship. Since then, the Teaching Fellows Program has grown in leaps and bounds, and now awards approximately 34 five-year Fellowships each year to beginning high school teachers in all science disciplines as well as mathematics. In 2011, we added a Senior Fellows Program in order to support and continue to engage those who complete all five years of the Teaching Fellows Program.

Thanks to a generous endowment from Harry and Janet Knowles, KSTF has been able to use the first decade of the Teaching Fellows Program to clarify our purpose, and refine and test the design of our Programs. Although we regularly collect and analyze a variety of data for formative purposes and to assess whether or not we are meeting our Program goals, the time has come for us to start measuring the impact of what we do.

Measuring the impact of one program on something as complex as teaching practice is never easy, but KSTF faces a couple of additional challenges in this endeavor. First, the selection process for the Teaching Fellowship is extremely rigorous; on average, only approximately 15% of applicants are awarded a Fellowship and we have some evidence that there is a self-selection bias among applicants, leading to a highly competitive pool. While we have some systematic data and a great many anecdotes that suggest Fellows are, in fact, highly competent and effective teachers, we don't have a clear sense of how much of that is due to the strengths they came with and how much is due to Program contributions. The second challenge KSTF faces is trying to disentangle Program effects from other contextual effects, such as resources, on-site support and mentoring, and school culture, which can have a significant impact on teaching practice and student learning. This challenge is exacerbated by the fact that we are studying only 188 teachers in 183 different schools.

In order to begin to make progress, despite these challenges, we engaged Horizon Research, Inc. (HRI) to conduct two studies for us in late 2013 and early 2014. The first study used data from the National Study of Science and Mathematics Education (NSSME), also designed and implemented by HRI, to give us a broad view of how KSTF Fellows compared to their peers, and what, if anything, they attributed to their participation in KSTF's Programs. The results of that study are described in this report. The second study asked a similar set of questions of Fellows' principals or other school leaders in order to balance Fellows' self-assessment with the assessment of a school leader familiar with their teaching practice. The results of the second study are reported in KSTF Report ER072014-01 titled *How do they measure up? School leaders' opinions of Knowles Science Teaching Foundation fellows.*

Like most good research, this study confirmed some things we knew, opened our eyes to things we did not expect, answered some of our questions, and raised many new ones. Some of the key differences between Fellows and their peers are clearly attributable to experiences they had prior to receiving the Fellowship. One of our selection criteria is the potential to develop content knowledge needed for teaching, so it's not surprising that Fellows are more likely than their peers to have had in-depth content preparation. Fellows are also more likely than their peers to have pedagogical beliefs that are aligned with research on effective math and science teaching. Since Fellows are required to obtain certification, and almost all do so in combination with a master's degree in education, it seems likely to us that these beliefs might have roots in both their teacher preparation programs as well as their KSTF experiences.

Other differences between Fellows and their peers reflect intentional Program design decisions on our part. Fellows are more likely than their peers to have participated in substantial, discipline-focused professional development and they largely credit KSTF for these experiences (that include things like studying classroom artifacts and trying things out in their classroom with the opportunity to discuss results afterwards). These high quality professional development experiences are exactly what the Fellowship program has been designed to provide. We developed the Program based on research recommendations for high quality professional development and evidence that many teachers do not have access to robust professional learning. This study suggests that decisions we have made about Program design are providing the high quality professional development we believe all teachers deserve, but that Fellows might not have the opportunity to experience otherwise. Furthermore, Fellows are more likely than their peers to use reform-oriented strategies such as group-work, requiring students to justify their claims with evidence and explain their solutions. While we can point to elements of the Program that support these practices, we need to dive deeper in order to determine the extent to which the KSTF experience engenders these differences and supports Fellows' ability to deploy these strategies effectively.

The Program also includes many opportunities for Fellows to study their practice together, and to design and conduct workshops for each other at our annual summer meeting. While we intend for these to be professional development experiences in and of themselves, we also intend for them to serve as practice and inspiration for Fellows to recreate these experiences in their own teaching contexts. The fact that Fellows are more likely than their peers to have engaged in these kinds of leadership roles may be a reference to what they've done in KSTF, or it may be a reference to things they've done in their own schools. Developing teachers as leaders who have a positive impact in and beyond their own classrooms is our overarching goal, so this finding affirms some Program components and simultaneously suggests the need for further study.

One of the most intriguing findings in this report is that, despite being more likely to have in-depth content preparation, KSTF Fellows feel *less* prepared than their peers in some topic areas. And despite reporting that KSTF contributed to their preparedness to teach diverse learners, Fellows feel less prepared to do so than their peers. As the authors of this report suggest, some of these differences may be due to the fact that Fellows have had opportunities through KSTF to develop a greater appreciation for the complexities of teaching, but this is clearly something that we need to explore in more depth.

This report will, we hope, provide the broader education field with a snapshot of who KSTF Fellows are and what their potential is, and has already provided KSTF with data that will allow us to continue to improve our Programs and heighten their impact.

Nicole M. Gillespie, PhD
Executive Director
Knowles Science Teaching Foundation

EXECUTIVE SUMMARY

This report summarizes the findings of a study of the Knowles Science Teaching Foundation's (KSTF's) Teaching Fellowship program conducted by Horizon Research, Inc. (HRI) from April 2013 through March 2014. The study compares KSTF Fellows—those with an active fellowship and Senior Fellows (Fellows who have completed their fellowship)—currently teaching high school science and/or mathematics to high school science and mathematics teachers nationally, as well as to teachers with similar years of experience and preparation for teaching as the Fellows.

The KSTF Teaching Fellowship is a competitive program that selects promising individuals with strong content backgrounds and seeks to prepare them to become outstanding teachers and teacher leaders. The goal of this study was to provide some evidence about the effects of the Fellowship program, in particular on Fellows' perceptions of preparedness to teach science/mathematics, beliefs about effective instruction, and classroom practices. Data on all high school science and mathematics teachers, and those similarly prepared to the Fellows, come from the 2012 National Survey of Science and Mathematics Education (NSSME). The 2012 NSSME teacher questionnaires were adapted for the Fellows, focusing on their preparation for teaching, professional development (PD) opportunities, and instructional practice. Questions pertaining specifically to the Fellows' KSTF experience were added as well.

Surveys were administered online over the seven-week period from December 3, 2013 to January 20, 2014. In addition to the initial survey invitation, several reminder emails were sent. All KSTF Fellows currently teaching at least one mathematics or science course at the high school level (grades 9–12) were invited to complete the survey. To encourage participation, Fellows were offered a $25 honorarium. Of the 120 eligible Fellows teaching high school science, 103 completed the survey (a response rate of 86 percent); 51 of the 68 Fellows teaching high school mathematics completed the survey (a response rate of 75 percent).

After data collection ended, propensity-score matching was used to select a subset of teachers from the 2012 NSSME data who had preparation for teaching similar to the Fellows, referred to as "Matched Teachers." Years teaching at the K–12 level, subject of college degree, and pathway to teaching certification were the key factors used in the matching process.

MAJOR FINDINGS

Because the KSTF program targets individuals who have recently obtained a teaching license, Fellows tend to be younger and less experienced than teachers nationally. In contrast, Fellows are more likely to have earned their teaching credential through a master's program and to have a degree in a science- or mathematics-specific discipline. Further, their beliefs about teaching tend to be more closely aligned with what is known from research about effective instruction.

Somewhat surprisingly, Fellows are less likely than other teachers to rate themselves as very well prepared in a number of aspects of teaching. For example, Fellows teaching biology/life science were less likely to rate themselves as very well prepared in a number of topics compared to the matched teachers. For most topics in mathematics, including measurement and geometry, a smaller percentage of Fellows considered themselves very well prepared when compared to matched teachers. These differences between groups in feelings of preparedness extended to pedagogy as well, with Fellows being less likely than matched teachers and teachers nationally to consider themselves well prepared to monitor and assess student understanding. One possible explanation may be that the experiences provided by the KSTF program have raised Fellows' awareness of the complexities in teaching and presented a more realistic picture of high-quality instruction.

Survey data also suggest that Fellows' PD experiences are more likely than those of teachers nationally to exhibit characteristics of high-quality PD, including examining classroom artifacts and having opportunities to try out what they learned in the classroom. Fellows are very likely to attribute these qualities to KSTF. In terms of emphasis, Fellows' PD is more likely than that of teachers nationally to focus on difficulties students may have learning the content and on monitoring student understanding. Particularly in mathematics, Fellows' PD has had a greater emphasis on student-centered instruction in general than is evident in PD opportunities for teachers nationally.

Follow-up questions were asked of Fellows to understand the extent to which they attributed their feelings of preparedness to the KSTF program, and the influence of KSTF is evident. For example, the majority of both science and mathematics Fellows attributed their preparedness to monitor student understanding to the KSTF program to a substantial extent. The data on Fellows' PD also provide several lines of evidence suggesting that their involvement with KSTF has a positive impact. Fellows are more likely than teachers nationally to have participated in discipline-focused PD in the last three years. They are much more likely to have participated in a substantial amount of PD; i.e., more than 35 hours. Fellows attribute most of their PD to KSTF. These findings are consistent with KSTF's focus.

Fellows are more likely than other teachers to have served in certain leadership roles, including leading a teacher workshop and teaching a workshop. This finding is particularly striking given the relative inexperience of Fellows. Such leadership opportunities are typically afforded to more experienced teachers. Further, most Fellows attribute increases in their leadership abilities to their involvement with KSTF.

In terms of instruction, data from the surveys indicate that science and mathematics Fellows, similar to teachers nationally, perceive more control over decisions related to pedagogy than curriculum. Science classes taught by Fellows are less likely than classes taught by other teachers to have a heavy emphasis on increasing students' interest in science and learning about real-life applications of science. However, Fellows' classes are also less likely to emphasize learning test taking skills/strategies and memorizing science vocabulary and/or facts. Mathematics classes taught by Fellows are less likely to emphasize learning test taking skills/strategies. In mathematics, Fellows' classes focus heavily on understanding mathematical ideas, compared to classes of matched teachers and teachers nationally.

In science and mathematics, Fellows tend to be less likely than other teachers to employ instructional strategies that might be thought of as traditional and more likely to use reform-oriented strategies. For example, classes taught by Fellows are more likely to include group work and less likely to engage in whole class discussions than similarly prepared teachers and teachers in general. Classes taught by Fellows are also more likely to require students to justify claims with evidence and explain solutions. In both science and mathematics, informal means of assessment—e.g., questioning students during activities, reviewing student work—are commonly used to monitor student progress. The only substantive difference between groups in this regard occurred in science. Classes taught by science Fellows are more likely to have students use rubrics to examine their own or their classmates' work as compared to classes taught by matched teachers or teachers nationally.

Data related to the textbooks and equipment teachers use with their classes offer a glimpse into the learning environment experienced by students of Fellows and other high school students. One key finding is that Fellows are considerably less likely than other high school classes to use published textbooks/programs. For classes taught by Fellows, non-commercially published materials are used a substantial amount of the time. Taken together, these data suggest that Fellows are much more likely than other teachers to create their own instructional materials. In terms of facilities and equipment, classes of Fellows and classes nationally seem to be about equally resourced.

Overall, this study provides encouraging data about the efficacy of the KSTF Fellowship program in general, and KSTF-provided professional development in particular. The findings also indicate that additional studies of the Fellowship program and the long-term impacts of the Fellows on the education system are worth pursuing.

CHAPTER ONE: INTRODUCTION

This report summarizes the findings of a study of the Knowles Science Teaching Foundation's (KSTF's) Teaching Fellowship program conducted by Horizon Research, Inc. (HRI) from April 2013 through March 2014. The study compares KSTF Fellows—those with an active fellowship and Senior Fellows (Fellows who have completed their fellowship)—currently teaching high school science and/or mathematics to high school science and mathematics teachers nationally, as well as to teachers with similar years of experience and preparation for teaching as the Fellows.

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The 2012 NSSME teacher questionnaires were adapted for the Fellows, focusing on their preparation for teaching, professional development opportunities, and instructional practice. Questions pertaining specifically to the Fellows' KSTF experience were added as well. The versions of the questionnaires administered to Fellows are included in Appendix A.

Surveys were administered online over the seven-week period from December 3, 2013 to January 20, 2014. In addition to the initial survey invitation, several reminder emails were sent. All KSTF Fellows currently teaching at least one mathematics or science course at the high school level (grades 9–12) were invited to complete the survey. To encourage participation, Fellows were offered a $25 honorarium for completing the questionnaire. Of the 120 eligible Fellows teaching high school science, 103 completed the survey (a response rate of 86 percent); 51 of the 68 Fellows teaching high school mathematics completed the survey (a response rate of 75 percent).

After data collection ended, propensity-score matching was used to select a subset of teachers from the 2012 NSSME data who had preparation for teaching similar to the Fellows, referred to as "Matched Teachers." Years teaching at the K–12 level, subject of college degree, and pathway to teaching certification were the key factors used in this process. The matching procedure is described more fully in Appendix B. To the extent possible, comparisons are made between KSTF Fellows and the matched teachers, with the national data serving as a point of reference. In a few cases, data are not available for the matched sample teachers due to the matrix sampling strategy employed in the 2012 NSSME. In these instances, comparisons are made between Fellows and high school teachers nationally.

Results in this report are presented for groups of high school teachers—KSTF Fellows, matched teachers, and teachers nationally. Unless otherwise noted, results for the Fellows represent all of the Fellows responding to the survey. When results are for only a subset of Fellows (e.g., due to skip patterns in the survey), the number of respondents is provided within the table. Tables in this report typically display results to individual survey items. Additional tables display scores on composite variables related to key constructs measured on the questionnaires. Composite variables, which are more reliable than individual survey items, were created for the 2012 NSSME using factor analysis. These variables have a minimum possible value of 0 and a maximum possible value of 100. The

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[1]Banilower, E. R., Smith, P. S., Weiss, I. R., Malzahn, K. A., Campbell, K. M., and Weis, A. M. (2013). Report of the 2012 National Survey of Science and Mathematics Education. Chapel Hill, NC: Horizon Research, Inc.

definitions of the composites used in this report are included in Appendix C.

The narrative sections of the report point out only those differences among groups that are substantial as well as statistically significant at the 0.05 level.[2] All tables in this report include standard errors in parentheses to allow readers to make additional comparisons. The standard error provides a measure of the range within which a sample estimate can be expected to fall a certain proportion of the time. For example, it may be estimated that 7 percent of all high school mathematics lessons involve the use of computers. If it is determined that the standard error for this estimate is 1 percent, then, according to the Central Limit Theorem, 95 percent of all possible samples of that same size selected in the same way would yield computer usage estimates between 5 percent and 9 percent (that is, 7 percent ± 2 standard error units).

This report is organized into major topical areas. Chapter Two focuses on science and mathematics teacher backgrounds and beliefs. Basic demographic data are presented along with information about course background, perceptions of preparedness, and pedagogical beliefs. Chapter Three examines data on the professional status of teachers, including their opportunities for continued professional development. Chapter Four examines the instructional objectives of science and mathematics classes, and the activities used to achieve these objectives, followed by a discussion of the availability and use of various types of instructional resources in Chapter Five. Results from survey items specific to the KSTF Fellow experience are interspersed throughout the report, their location corresponding to appropriate topic areas within a chapter. Complete descriptive results for KSTF-specific items can be found in Appendix D.

CHAPTER TWO: TEACHER BACKGROUND AND BELIEFS

OVERVIEW

This chapter provides data on the backgrounds of KSTF Fellows and the nation's high school science and mathematics teachers. It includes data on their age, race/ethnicity, teaching experience, college course taking, and beliefs about effective teaching.

TEACHER CHARACTERISTICS

The KSTF Teaching Fellows program targets individuals early in their teaching career. As described in the eligibility criteria, the program solicits applicants who: have outstanding current content knowledge; have a recent college degree (typically within the last 5–10 years); have not previously established a career; and have recently earned, or are about to earn, a secondary teaching credential in the U.S.

Given these criteria, it is not surprising that the Fellows, as a group, are quite a bit younger in age and less experienced than high school teachers nationally. As can be seen in Table 2.1, roughly 70 percent of science Fellows are under the age of 30; none are above the age of 50. Nationally, only 16 percent of high school science teachers are under age 30 and approximately 30 percent are over 50. In terms of experience, about half of Fellows have fewer than three years of teaching experience, and another third have between three and five years of experience. In contrast, only about a quarter of high school science teachers nationally have five or fewer years of experience. These patterns are even more pronounced in mathematics (see Table 2.2). Because teaching experience was used as part of the matching process, it is also not surprising that the Fellows are more similar to the matched teachers than teachers nationally.

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[2]The False Discovery Rate was used to control the Type I error rate when comparing multiple groups on the same outcome. Benjamini, Y. and Hochberg, Y. (1995). Controlling the false discovery rate: A practical and powerful approach to multiple testing. Journal of the Royal Statistical Society, B, 57, 289–300.

Table 2.1
Characteristics of the High School Science Teaching Force, by Group

	Percent of Teachers		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Race			
White	89 (3.2)	94 (1.5)	92 (0.8)
Black or African American	1 (1.0)	2 (1.4)	3 (0.5)
Hispanic or Latino	4 (2.0)	3 (1.0)	4 (0.6)
Asian	5 (2.2)	2 (1.1)	2 (0.5)
American Indian/Alaskan Native	0 (__)†	1 (0.7)	0 (0.2)
Native Hawaiian/Other Pacific Islander	0 (__)†	0 (__)†	0 (0.2)
Two or more races	5 (2.2)	0 (__)†	2 (0.4)
Age			
≤ 30	68 (4.7)	42 (4.3)	16 (1.4)
31–40	31 (4.8)	32 (4.1)	30 (1.3)
41–50	1 (1.0)	13 (3.0)	24 (1.3)
51–60	0 (__)†	9 (3.4)	22 (1.3)
61+	0 (__)†	4 (1.7)	7 (1.0)
Experience Teaching any Subject at the K–12 Level‡			
0–2 years	49 (5.1)	42 (4.8)	14 (1.3)
3–5 years	32 (4.8)	27 (4.2)	13 (0.9)
6–10 years	18 (3.9)	24 (4.2)	23 (1.4)
11–20 years	1 (1.0)	1 (0.3)	30 (1.6)
≥ 21 years	0 (__)†	7 (2.4)	19 (1.3)
Experience Teaching Science at the K–12 Level			
0–2 years	51 (5.1)	37 (4.5)	13 (1.1)
3–5 years	32 (4.7)	30 (4.3)	15 (1.2)
6–10 years	16 (3.8)	23 (4.2)	23 (1.5)
11–20 years	1 (1.0)	1 (1.0)	31 (1.4)
≥ 21 years	0 (__)†	9 (3.3)	18 (1.1)
Experience Teaching at this School, any Subject			
0–2 years	67 (4.8)	50 (4.5)	23 (1.3)
3–5 years	20 (4.1)	34 (4.7)	21 (1.2)
6–10 years	13 (3.4)	11 (2.6)	23 (1.4)
11–20 years	1 (1.0)	1 (0.4)	24 (1.3)
≥ 21 years	0 (__)†	4 (1.9)	9 (1.0)

†No teachers in the sample selected this response option. Thus, it is not possible to calculate the standard error of this estimate.
‡This characteristic was used in the matching procedure.

Table 2.2 Characteristics of the High School Mathematics Teaching Force, by Group			
	Percent of Teachers		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Race			
White	76 (6.1)	93 (2.9)	92 (1.0)
Black or African American	2 (2.0)	3 (1.9)	3 (0.6)
Hispanic or Latino	6 (3.3)	4 (2.0)	5 (0.6)
Asian	14 (5.0)	4 (2.3)	3 (0.6)
American Indian/Alaskan Native	2 (2.0)	0 (__)†	1 (0.4)
Native Hawaiian/Other Pacific Islander	0 (__)†	0 (__)†	0 (0.1)
Two or more races	6 (3.4)	0 (__)†	1 (0.2)
Age			
≤ 30	86 (4.9)	40 (6.2)	17 (1.2)
31–40	14 (4.9)	34 (6.5)	25 (1.3)
41–50	0 (__)†	14 (4.0)	27 (1.2)
51–60	0 (__)†	7 (2.9)	20 (1.1)
61+	0 (__)†	4 (2.9)	10 (1.1)
Experience Teaching any Subject at the K–12 Level‡			
0–2 years	51 (7.2)	44 (6.1)	10 (1.0)
3–5 years	35 (6.9)	26 (6.0)	13 (1.1)
6–10 years	14 (5.1)	29 (5.6)	21 (1.2)
11–20 years	0 (__)†	2 (1.3)	33 (1.5)
≥ 21 years	0 (__)†	0 (__)†	23 (1.2)
Experience Teaching Mathematics at the K–12 Level			
0–2 years	49 (7.1)	33 (5.0)	10 (0.8)
3–5 years	37 (6.8)	27 (6.3)	14 (1.1)
6–10 years	14 (4.9)	34 (5.8)	22 (1.3)
11–20 years	0 (__)†	5 (2.2)	33 (1.4)
≥ 21 years	0 (__)†	0 (__)†	21 (1.1)
Experience Teaching at this School, any Subject			
0–2 years	74 (6.3)	39 (5.5)	21 (1.3)
3–5 years	22 (5.9)	35 (6.7)	23 (1.2)
6–10 years	4 (2.8)	23 (4.6)	25 (1.3)
11–20 years	0 (__)†	3 (1.7)	23 (1.3)
≥ 21 years	0 (__)†	0 (__)†	8 (0.7)

†No teachers in the sample selected this response option. Thus, it is not possible to calculate the standard error of this estimate.
‡This characteristic was used in the matching procedure.

TEACHER PREPARATION

The selection criteria for a KSTF Fellowship require individuals to demonstrate a strong foundation of current content knowledge in the subjects they intend to teach, minimally a bachelor's degree or equivalent in a related discipline. As a result, almost all of the science Fellows, and more than 4 in 5 mathematics Fellows have a degree in their discipline, as shown in Table 2.3. The Fellows are more similar to the matched teachers in this regard than to teachers nationally because the matching process took into account teacher degrees. The proportion of KSTF Fellows with a degree in their discipline far exceeds that of teachers nationally.

Table 2.3 High School Teacher Degrees,† by Group			
	Percent of Teachers		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Science Teachers			
Science/Engineering	99 (1.0)	80 (3.9)	61 (1.6)
Science Education	70 (4.5)	53 (4.9)	48 (1.4)
Science/Engineering or Science Education	99 (1.0)	92 (3.1)	82 (1.3)
Mathematics Teachers			
Mathematics	82 (5.4)	73 (5.5)	52 (1.5)
Mathematics Education	74 (6.3)	64 (6.5)	54 (1.7)
Mathematics or Mathematics Education	96 (2.7)	85 (5.1)	73 (1.7)
†This characteristic was used in the matching procedure.			

Table 2.4 shows the percentage of science teachers in each group with at least one college course in each of a number of science disciplines. KSTF Fellows appear quite similar to the matched teachers and teachers nationally in this regard.

Table 2.4 High School Science Teachers with College Coursework in Various Science Disciplines, by Group			
	Percent of Teachers		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Chemistry	96 (1.9)	96 (1.6)	93 (1.1)
Physics	95 (2.1)	92 (2.6)	86 (1.1)
Life Sciences	83 (3.7)	86 (3.2)	91 (0.9)
Earth/Space Science	54 (4.9)	59 (5.2)	61 (1.7)
Environmental Science	40 (4.8)	52 (5.1)	56 (1.1)
Engineering	22 (4.1)	18 (3.1)	14 (1.0)

However, science Fellows tend to have more in-depth preparation in their discipline than matched teachers (see Table 2.5). For example, 89 percent of Fellows teaching biology have a degree in biology compared to 66 percent of matched teachers and 53 percent of biology teachers nationally. Fellows teaching chemistry and those teaching physics are more likely to have a degree in field than teachers nationally. These differences are likely attributable to the KSTF's purposeful selection of program applicants with a strong content background. Note, the apparent differences between Fellows and matched teachers in these fields are not statistically significant, likely due to the relatively small sample sizes and, consequently, large standard errors.

Table 2.5 High School Science Teachers with Varying Levels of Background in Subject,† by Group			
	Percent of Teachers		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Life science/biology			
Degree in Field	89 (5.0)	66 (6.4)	53 (2.4)
No Degree in Field, but 1 or More Courses beyond Introductory	8 (4.4)	32 (6.3)	41 (2.3)
No Degree in Field or Courses beyond Introductory	3 (2.6)	2 (1.6)	6 (1.2)
Chemistry			
Degree in Field	50 (8.7)	28 (6.4)	25 (1.8)
No Degree in Field, but 1 or More Courses beyond Introductory	38 (8.5)	60 (7.4)	64 (2.1)
No Degree in Field or Courses beyond Introductory	12 (5.6)	11 (5.3)	11 (2.4)
Physics			
Degree in Field	50 (8.5)	29 (7.1)	20 (2.4)
No Degree in Field, but 1 or More Courses beyond Introductory	28 (7.6)	46 (7.8)	51 (3.6)
No Degree in Field or Courses beyond Introductory	22 (7.0)	24 (7.4)	29 (3.7)
†Teachers assigned to teach classes in more than one subject area are included in each category.			

In mathematics, Fellows are more likely than matched teachers to have had college courses in advanced calculus, real analysis, and linear algebra (see Table 2.6). They are also more likely to have taken an upper division mathematics course not included in the list presented to them. There are no areas in which Fellows are less likely to have completed a college course.

Table 2.6 High School Mathematics Teachers Completing Various College Courses, by Group			
	Percent of Teachers		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Calculus	100 (__)†	97 (2.1)	93 (0.9)
Advanced Calculus	100 (__)†	82 (5.1)	79 (1.6)
Differential equations	82 (5.4)	75 (5.3)	62 (1.7)
Real analysis	75 (6.2)	40 (6.7)	44 (1.7)
Linear algebra	94 (3.3)	81 (5.3)	80 (1.7)
Mathematics content for high school teachers	92 (3.8)	77 (5.7)	71 (1.8)
Abstract algebra	86 (4.9)	73 (6.2)	67 (1.7)
Axiomatic geometry (Euclidean or non-Euclidean)	67 (6.7)	57 (6.7)	55 (1.7)
Analytic/Coordinate geometry	45 (7.0)	48 (5.8)	53 (1.7)
Integrated mathematics	33 (6.7)	40 (5.7)	34 (1.7)
Statistics	92 (3.8)	93 (3.4)	83 (1.5)
Probability	75 (6.2)	71 (5.7)	56 (1.7)
Discrete mathematics	75 (6.2)	54 (6.7)	52 (1.8)

Table 2.6 (Cont.) High School Mathematics Teachers Completing Various College Courses, by Group			
	Percent of Teachers		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Number theory	65 (6.8)	57 (5.6)	54 (1.9)
Other upper division mathematics	86 (4.9)	44 (6.1)	43 (1.5)
Computer science	73 (6.3)	83 (4.4)	77 (1.7)
Engineering	27 (6.3)	16 (4.4)	19 (1.4)

†All teachers in the sample selected this response option. Thus, it is not possible to calculate the standard error of this estimate.

The National Council of Teachers of Mathematics (NCTM) has recommended that high school mathematics teachers take college coursework in seven areas: algebra, calculus, discrete mathematics, geometry, number theory, probability, and statistics. As can be seen in Table 2.7, Fellows are more likely than the matched teachers to have taken coursework in at least five of the areas (90 and 75 percent, respectively).

Table 2.7 High School Mathematics Teachers' Coursework Related to NCTM Course-Background Standards, by Group			
	Percent of Teachers		
	KSTF Fellows	Matched Teachers	Teachers Nationally
All 7 courses	37 (6.8)	27 (4.9)	26 (1.5)
5–6 courses	53 (7.1)	48 (6.0)	40 (1.6)
3–4 courses	10 (4.2)	23 (5.4)	22 (1.6)
1–2 courses	0 (__)†	2 (2.0)	10 (1.4)
No courses	0 (__)†	0 (__)†	2 (0.7)

†No teachers in the sample selected this response option. Thus, it is not possible to calculate the standard error of this estimate.

As can be seen in Table 2.8, Fellows in both science and mathematics are less likely than teachers nationally to have taken coursework in their field at a two-year institution. Further, Fellows tend to take fewer science/mathematics coursework at these institutions than teachers nationally (see Table 2.9).

Table 2.8 High School Teachers Completing at Least One Course in their Field at Two-Year Institutions, by Group		
	Percent of Teachers	
	KSTF Fellows	Teachers Nationally
Science	12 (3.2)	31 (2.2)
Mathematics	12 (4.6)	31 (2.0)

Table 2.9 Average Percentage† of Courses High School Teachers Completed in their Field at Two-Year Institutions, by Group		
	Average Percent of Courses in Field	
	KSTF Fellows	Teachers Nationally
Science	18 (4.1)	26 (2.3)
Mathematics	15 (3.4)	30 (1.7)
†Includes only teachers who completed part of the coursework in their field at a two-year institution.		

Teachers were also asked about their path to certification. As can be seen in Table 2.10, Fellows in both subjects are much more likely than teachers nationally to have had a master's program that also awarded a teaching credential. Fellows are more similar to the matched teachers because teacher certification pathway was a factor used in the matching procedure.

Table 2.10 High School Teachers' Paths to Certification,† by Group			
	Percent of Teachers		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Science			
An undergraduate program leading to a bachelor's degree and a teaching credential	12 (3.2)	18 (3.3)	34 (2.0)
A post-baccalaureate credentialing program (no master's degree awarded)	11 (3.1)	20 (3.7)	30 (1.9)
A master's program that also awarded a teaching credential	78 (4.1)	56 (4.5)	28 (1.8)
No formal teacher preparation	0 (__)‡	5 (1.9)	8 (1.3)
Mathematics			
An undergraduate program leading to a bachelor's degree and a teaching credential	12 (4.6)	24 (5.3)	48 (2.3)
A post-baccalaureate credentialing program (no master's degree awarded)	0 (__)‡	10 (3.6)	20 (1.8)
A master's program that also awarded a teaching credential	88 (4.6)	65 (6.2)	22 (1.6)
No formal teacher preparation	0 (__)‡	1 (1.3)	10 (1.9)
†This characteristic was used in the matching procedure. ‡No teachers in the sample selected this response option. Thus, it is not possible to calculate the standard error of this estimate.			

TEACHER PEDAGOGICAL BELIEFS

Teachers were asked about their beliefs regarding effective teaching and learning in science/mathematics. Science Fellows' views tend to be more aligned with what is known about effective science teaching than those of the matched teachers (see Table 2.11). For example, 92 percent of Fellows agree that it is better to focus on ideas in depth, even if it means covering fewer topics, compared to 74 percent of similarly prepared teachers. In addition, Fellows are less likely than matched teachers to agree that: (1) at the beginning of instruction on a science idea, students should be provided with definitions for new scientific vocabulary that will be used; (2) hands-on/laboratory activities should be used primarily to reinforce a science idea that the students have already learned; and (3) teachers should explain an idea to students before having them consider evidence that relates to the idea. Fellows are also less likely to agree that class periods should conclude with a summary of key ideas addressed and that students should be assigned homework most days.

Table 2.11
High School Science Teachers Agreeing† with Various Statements about Teaching and Learning, by Group

	Percent of Teachers		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Most class periods should provide opportunities for students to share their thinking and reasoning	100 (__)‡	95 (1.5)	92 (0.9)
It is better for science instruction to focus on ideas in depth, even if that means covering fewer topics	92 (2.7)	74 (3.4)	73 (1.3)
Inadequacies in students' science background can be overcome by effective teaching	90 (2.9)	86 (2.7)	84 (1.1)
Students should be provided with the purpose for a lesson as it begins	89 (3.1)	90 (2.5)	88 (1.0)
Most class periods should conclude with a summary of the key ideas addressed	78 (4.1)	91 (2.1)	88 (1.0)
Most class periods should include some review of previously covered ideas and skills	64 (4.8)	88 (3.0)	86 (1.2)
Students should be assigned homework most days	29 (4.5)	42 (4.1)	48 (1.4)
Students learn science best in classes with students of similar abilities	22 (4.1)	65 (4.2)	65 (1.7)
At the beginning of instruction on a science idea, students should be provided with definitions for new scientific vocabulary that will be used	17 (3.8)	69 (3.8)	70 (1.7)
Hands-on/laboratory activities should be used primarily to reinforce a science idea that the students have already learned	9 (2.8)	54 (4.5)	56 (1.9)
Teachers should explain an idea to students before having them consider evidence that relates to the idea	2 (1.4)	34 (4.2)	39 (1.7)

†Includes teachers indicating "strongly agree" or "agree" on a 5-point scale ranging from 1 "strongly disagree" to 5 "strongly agree."
‡All teachers in the sample selected this response option. Thus, it is not possible to calculate the standard error of this estimate.

As can be seen in Table 2.12, data for mathematics teachers follow a similar pattern as in science, with Fellows tending to have beliefs more closely aligned with the research on effective teaching than other teachers. For example, nearly all Fellows agree that it is better to focus on ideas in depth, compared to only about three-quarters of the matched teachers. They are also less likely to agree that hands-on activities/manipulatives should be used primarily to reinforce previously addressed ideas (20 vs. 54 percent), or that teachers should explain an idea to students before having them investigate it (0 vs. 39 percent).

Table 2.12 High School Mathematics Teachers Agreeing[†] with Various Statements about Teaching and Learning, by Group			
	Percent of Teachers		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Most class periods should provide opportunities for students to share their thinking and reasoning	98 (2.0)	97 (1.6)	93 (0.8)
It is better for mathematics instruction to focus on ideas in depth, even if that means covering fewer topics	96 (2.7)	76 (5.8)	78 (1.2)
Most class periods should conclude with a summary of the key ideas addressed	80 (5.6)	92 (2.8)	90 (0.9)
Inadequacies in students' mathematics background can be overcome by effective teaching	80 (5.6)	69 (5.6)	77 (1.3)
Students should be provided with the purpose for a lesson as it begins	62 (6.9)	82 (3.9)	85 (0.9)
Students should be assigned homework most days	61 (6.9)	84 (4.2)	82 (1.3)
Most class periods should include some review of previously covered ideas and skills	59 (7.0)	85 (5.0)	87 (1.0)
Students learn mathematics best in classes with students of similar abilities	43 (7.0)	77 (5.4)	77 (1.1)
At the beginning of instruction on a mathematical idea, students should be provided with definitions for new vocabulary that will be used	27 (6.3)	85 (4.3)	81 (1.0)
Hands-on activities/manipulatives should be used primarily to reinforce a mathematical idea that the students have already learned	20 (5.6)	54 (6.1)	39 (1.7)
Teachers should explain an idea to students before having them investigate the idea	0 (__)[‡]	39 (6.6)	38 (1.6)

[†]Includes teachers indicating "strongly agree" or "agree" on a 5-point scale ranging from 1 "strongly disagree" to 5 "strongly agree."
[‡]No teachers in the sample selected this response option. Thus, it is not possible to calculate the standard error of this estimate.

TEACHERS' PERCEPTIONS OF PREPAREDNESS

The questionnaires included a series of items about a single, randomly selected class. Science Fellows were shown a list of topics based on the subject of that class, and asked how well prepared they feel to teach each of those topics. Data from these items are shown in Table 2.13. (Note, because the number of respondents for each topic is less than the total number of Fellows in the study, the standard errors are larger.) Overall, results for the Fellows are similar to those of the matched teachers, though there are a few areas in which the Fellows do not feel as well prepared. Fellows teaching biology are less likely to feel very well prepared to teach cell biology, and structures and functions of organisms. Fellows teaching physics are less likely than matched teachers to feel very well prepared to teach electricity and magnetism.

Table 2.13 High School Science Teachers Considering Themselves Very Well Prepared to Teach Each of a Number of Topics,[†] by Group			
	Percent of Teachers		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Biology/Life Science			
Genetics	69 (8.0)	74 (5.8)	63 (2.5)
Evolution	60 (8.4)	68 (5.6)	52 (2.5)
Cell Biology	57 (8.5)	81 (4.7)	68 (2.2)
Ecology/Ecosystems	37 (8.3)	56 (6.8)	56 (2.4)
Structures and Functions of Organisms	32 (8.1)	63 (6.9)	64 (2.5)
Chemistry			
Elements, compounds, and mixtures	79 (7.0)	85 (8.4)	83 (2.2)
States, classes, and properties of matter	71 (7.9)	80 (8.5)	80 (2.4)
Chemical bonding, equations, nomenclature, and reactions	68 (8.1)	83 (8.4)	77 (2.5)
The periodic table	65 (8.3)	85 (8.4)	82 (2.2)
Atomic structure	65 (8.3)	84 (8.3)	80 (2.3)
Properties of solutions	56 (8.6)	66 (8.4)	66 (2.5)
Physics			
Forces and motion	76 (7.4)	85 (4.3)	71 (3.0)
Energy transfers, transformations, and conservation	61 (8.6)	74 (8.9)	62 (3.3)
Properties and behaviors of waves	50 (8.7)	69 (7.3)	51 (3.1)
Electricity and magnetism	29 (7.9)	57 (9.1)	43 (2.8)
Modern physics (e.g., special relativity)	21 (7.0)	21 (6.0)	19 (2.1)
Other			
Engineering (e.g., nature of engineering and technology, design processes, analyzing and improving technological systems, interactions between technology and society)	8 (2.7)	15 (3.2)	7 (0.8)

[†]Each science teacher was asked about one set of science topics based on the discipline of his/her randomly selected class, and all science teachers were asked about engineering.

Fellows were asked to indicate the extent to which their preparedness to teach could be attributed to their involvement with the KSTF. As can be seen in Table 2.14, a majority of Fellows teaching biology/life science, chemistry, and physics indicated that their involvement with the KSTF program contributed substantially to their preparedness to teach the subject.

Table 2.14 Science Fellows Indicating their Preparedness to Teach Various Topics† Is Due Substantially‡ to their Involvement with KSTF	
	Percent of KSTF Fellows
Biology/Life Science	60 (8.4)
Chemistry	56 (8.6)
Physics	56 (8.6)
Engineering (e.g., nature of engineering and technology, design processes, analyzing and improving technological systems, interactions between technology and society)	24 (4.3)

†Each science teacher was asked about one set of science topics based on the discipline of his/her randomly selected class, and all science teachers were asked about engineering.
‡Includes teachers indicating 4 or 5 on a 5-point scale ranging from 1 "Not at all" to 5 "To a great extent."

In mathematics, Fellows tend to feel less well prepared than matched teachers in a number of areas, including the number system and operations, measurement, geometry, modeling, and discrete mathematics (see Table 2.15). These data are surprising given the relative strength of their content preparation, and may reflect the Fellows having a greater sense of the complexity of teaching these topics. Alternatively, because the Fellows have more extensive coursework in mathematics, they may not have had as much training in how to teach mathematics.

Table 2.15
High School Mathematics Teachers Considering Themselves Very Well Prepared to Teach Each of a Number of Topics, by Group

	Percent of Teachers		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Algebraic thinking	75 (6.2)	87 (4.4)	91 (0.9)
Functions	71 (6.4)	79 (5.9)	84 (1.5)
The number system and operations	65 (6.8)	86 (4.8)	90 (1.1)
Geometry	45 (7.0)	64 (6.4)	70 (1.4)
Modeling	35 (6.8)	57 (6.6)	58 (2.0)
Measurement	31 (6.6)	76 (5.6)	79 (1.2)
Statistics and probability	22 (5.8)	27 (5.2)	30 (1.2)
Discrete mathematics	10 (4.2)	25 (5.4)	25 (1.2)

When asked to what extent their preparedness could be attributed to KSTF, mathematics Fellows tended to give more credit to KSTF in the areas they felt very well prepared to teach. As can be seen in Table 2.16, about two-thirds of Fellows indicated that their preparedness to teach algebraic thinking and functions was due to a substantial extent to KSTF; just under half credit KSTF with their preparedness to teach modeling, geometry, and the number system and operations.

Table 2.16 Mathematics Fellows Indicating their Preparedness to Teach Various Topics Is Due Substantially† to their Involvement with KSTF	
	Percent of KSTF Fellows
Algebraic thinking	63 (6.8)
Functions	59 (7.0)
The number system and operations	49 (7.1)
Geometry	45 (7.0)
Modeling	43 (7.0)
Measurement	22 (5.8)
Statistics and probability	22 (5.8)
Discrete mathematics	18 (5.4)

†Includes teachers indicating 4 or 5 on a 5-point scale ranging from 1 "Not at all" to 5 "To a great extent."

In addition to asking about the Fellows' preparedness to teach their content areas, two series of items focused on pedagogical preparedness. First, they were asked how well prepared they feel to address diverse learners in their science/mathematics instruction, including encouraging participation of each of a number of underrepresented groups. Second, they were asked about how well prepared they feel to monitor and address student understanding, focusing on a specific unit in the randomly selected class.

As can be seen in Table 2.17, less than 40 percent of science Fellows consider themselves very well prepared to teach and encourage diverse learners. Furthermore, with the exceptions of teaching students with learning disabilities and teaching English-language learners, Fellows feel less well prepared in these areas than do the matched teachers. The results for mathematics are similar, with fewer Fellows feeling very well prepared in any of these areas than teachers nationally (see Table 2.18).

Table 2.17 High School Science Teachers Considering Themselves Very Well Prepared for Each of a Number of Tasks, by Group			
	Percent of Teachers		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Encourage students' interest in science and/or engineering	39 (4.8)	60 (4.1)	53 (2.2)
Manage classroom discipline	34 (4.7)	49 (4.9)	59 (2.3)
Encourage participation of females in science and/or engineering	32 (4.6)	58 (4.5)	55 (2.2)
Encourage participation of students from low socioeconomic backgrounds in science and/or engineering	29 (4.5)	47 (4.9)	44 (2.1)
Plan instruction so students at different levels of achievement can increase their understanding of the ideas targeted in each activity	24 (4.2)	39 (5.1)	38 (1.9)
Encourage participation of racial or ethnic minorities in science and/or engineering	23 (4.2)	48 (4.7)	44 (2.0)
Teach science to students who have physical disabilities	10 (3.0)	19 (3.4)	21 (1.8)
Provide enrichment experiences for gifted students	9 (2.8)	33 (4.3)	33 (2.0)
Teach science to students who have learning disabilities	8 (2.7)	16 (3.8)	21 (1.8)
Teach science to English-language learners	7 (2.5)	12 (3.1)	14 (1.3)

Table 2.18 High School Mathematics Teachers Considering Themselves Very Well Prepared for Each of a Number of Tasks, by Group[†]		
	Percent of Teachers	
	KSTF Fellows	Teachers Nationally
Encourage participation of females in mathematics	29 (6.4)	51 (2.2)
Encourage students' interest in mathematics	29 (6.4)	39 (2.2)
Manage classroom discipline	18 (5.4)	58 (2.3)
Encourage participation of students from low socioeconomic backgrounds in mathematics	18 (5.4)	40 (2.2)
Encourage participation of racial or ethnic minorities in mathematics	16 (5.1)	39 (2.0)
Plan instruction so students at different levels of achievement can increase their understanding of the ideas targeted in each activity	10 (4.2)	31 (1.9)
Provide enrichment opportunities for gifted students	8 (3.8)	23 (1.8)
Teach mathematics to English-language learners	8 (3.8)	13 (1.2)
Teach mathematics to students who have learning disabilities	0 (__)[‡]	19 (1.6)
Teach mathematics to students who have physical disabilities	0 (__)[‡]	17 (1.4)

[†]This series of items was not on the questionnaire version presented to the Matched Teachers.
[‡]No teachers in the sample selected this response option. Thus, it is not possible to calculate the standard error of this estimate.

Despite their relatively low preparedness ratings, other data suggest that the ratings would have been even lower without the influence of KSTF. Fellows were asked the extent to which KSTF contributed to their preparedness in these areas. Encouraging students' interest in science and/or engineering, encouraging participation of females and racial/ethnic minorities in science and/or engineering, and planning differentiated instruction were each highlighted by a majority of science Fellows. About half of mathematics Fellows indicated their preparedness to plan differentiated instruction, encourage students' interest in mathematics, and encourage the participation of females in mathematics was due in large part to KSTF (see Table 2.19).

Table 2.19 Fellows Indicating their Preparedness for Each of a Number of Tasks Is Due Substantially† to their Involvement with KSTF		
	Percent of KSTF Fellows	
	Science	Mathematics
Encourage students' interest in science and/or engineering/ mathematics	64 (4.8)	54 (7.1)
Encourage participation of females in science and/or engineering/ mathematics	61 (4.8)	46 (7.1)
Plan instruction so students at different levels of achievement can increase their understanding of the ideas targeted in each activity	61 (4.8)	62 (6.9)
Encourage participation of racial or ethnic minorities in science and/ or engineering/mathematics	51 (4.9)	36 (6.9)
Encourage participation of students from low socioeconomic backgrounds in science and/or engineering/mathematics	45 (4.9)	34 (6.8)
Provide enrichment experiences for gifted students	29 (4.5)	31 (6.7)
Manage classroom discipline	15 (3.5)	18 (5.5)
Teach science/mathematics to students who have learning disabilities	12 (3.2)	8 (3.9)
Teach science/mathematics to English-language learners	8 (2.7)	10 (4.3)
Teach science/mathematics to students who have physical disabilities	7 (2.5)	4 (2.8)

†Includes teachers indicating 4 or 5 on a 5-point scale ranging from 1 "Not at all" to 5 "To a great extent."

Tables 2.20 and 2.21 show the percentage of teachers who feel very well prepared for each of a number of tasks related to instruction, such as monitoring student understanding at different stages of instruction, anticipating difficulties students may have with the content, and implementing their textbook/program. These data indicate that Fellows in both subjects do not feel as well prepared as matched teachers in these areas.

Table 2.20 High School Science Teachers Who Feel Very Well Prepared for Each of a Number of Tasks, by Group			
	Percent of Teachers		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Assess student understanding at the conclusion of this unit	31 (4.6)	65 (4.0)	63 (1.6)
Monitor student understanding during this unit	26 (4.4)	54 (4.2)	56 (1.5)
Anticipate difficulties that students may have with particular science ideas and procedures in this unit	26 (4.4)	46 (4.9)	48 (1.5)
Implement the science textbook/module to be used during this unit†	25 (8.3)	44 (6.3)	51 (2.1)
Find out what students thought or already knew about the key science ideas	24 (4.2)	41 (4.0)	42 (1.4)

†This item was presented only to teachers who indicated using commercially published textbooks/ modules in the most recent unit.

Table 2.21 High School Mathematics Teachers Who Feel Very Well Prepared for Each of a Number of Tasks, by Group			
	Percent of Teachers		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Assess student understanding at the conclusion of this unit	37 (6.8)	68 (5.9)	72 (1.4)
Monitor student understanding during this unit	35 (6.8)	58 (6.4)	65 (1.7)
Anticipate difficulties that students will have with particular mathematical ideas and procedures in this unit	27 (6.3)	51 (6.0)	59 (1.4)
Implement the mathematics textbook/program to be used during this unit†	22 (8.8)	61 (6.3)	63 (1.8)
Find out what students thought or already knew about the key mathematical ideas	18 (5.4)	39 (6.8)	49 (1.6)

†This item was presented only to teachers who indicated using commercially published textbooks/programs in the most recent unit.

Similar to the data on teaching and encouraging diverse learners, Fellows are fairly likely to attribute their preparedness in these areas to the KSTF program (see Table 2.22). Because the likelihood of Fellows using similar textbooks is low, it is not surprising few indicated KSTF prepared them in this area.

Table 2.22 Fellows Indicating their Preparedness for Each of a Number of Tasks in the Most Recent Unit Is Due Substantially† to their Involvement with KSTF		
	Percent of KSTF Fellows	
	Science	Mathematics
Monitor student understanding during this unit	60 (4.9)	55 (7.0)
Anticipate difficulties that students may have with particular science/mathematical ideas and procedures in this unit	60 (4.9)	47 (7.1)
Find out what students thought or already knew about the key science/mathematical ideas	59 (4.9)	39 (6.9)
Assess student understanding at the conclusion of this unit	47 (5.0)	43 (7.0)
Implement the science/mathematics textbook/program to be used during this unit‡	21 (7.9)	22 (8.8)

†Includes teachers indicating 4 or 5 on a 5-point scale ranging from 1 "Not at all" to 5 "To a great extent."
‡This item was presented only to teachers who indicated using commercially published textbooks/modules in the most recent unit.

Responses to the perceptions of preparedness items were combined into four composite variables: teach science/mathematics content, implement instruction in a particular unit, encourage students' interest in science, and teach students from diverse backgrounds. Given the differences on the individual items, it is not surprising that the mean score for each composite is lower for Fellows than for matched teachers and/or high school science teachers in general (see Table 2.23).

Table 2.23 Mean Scores for Teacher Perceptions of Preparedness Composites, by Group			
	Mean Score		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Science			
Teach Science Content†	78 (1.9)	88 (1.4)	85 (0.8)
Implement Instruction in Particular Unit	69 (1.9)	80 (1.7)	81 (0.6)
Encourage Students' Interest in Science	66 (2.3)	79 (2.4)	77 (1.2)
Teach Students from Diverse Backgrounds	48 (1.8)	57 (2.1)	59 (1.1)
Mathematics			
Teach Mathematics Content	72 (2.5)	81 (2.3)	83 (0.5)
Implement Instruction in Particular Unit	69 (2.7)	82 (2.1)	85 (0.5)
Encourage Students' Interest in Mathematics	62 (3.1)	__ (__)‡	75 (1.0)
Teach Students from Diverse Backgrounds	43 (2.3)	__ (__)‡	56 (1.0)

†Perceptions of Preparedness to Teach Science Content score is based on the content of the randomly selected class.
‡The items in this composite were not on the questionnaire version presented to the Matched Teachers.

SUMMARY

Data in this chapter provide insight on KSTF Fellows' background, preparation, and beliefs compared to other high school science and mathematics teachers. Because the KSTF program targets individuals who have recently obtained a teaching license, Fellows tend to be younger and less experienced than teachers nationally. In contrast, Fellows are more likely to have earned their teaching credential through a master's program and to have a degree in a science- or mathematics-specific discipline. Further, their beliefs about teaching tend to be more closely aligned with what is known from research about effective instruction.

Somewhat surprisingly, Fellows are less likely than other teachers to rate themselves as very well prepared in a number of aspects of teaching. For example, Fellows teaching biology/life science were less likely to rate themselves as very well prepared in a number of topics compared to the matched teachers. For most topics in mathematics, including measurement and geometry, a smaller percentage of Fellows considered themselves very well prepared when compared to matched teachers. These differences between groups in feelings of preparedness extended to pedagogy as well, with Fellows being less likely than matched teachers and teachers nationally to consider themselves well prepared to monitor and assess student understanding. One possible explanation may be that the experiences provided by the KSTF program have raised Fellows' awareness of the complexities in teaching and presented a more realistic picture of high-quality instruction.

Follow-up questions were asked of Fellows to understand the extent to which they attributed their feelings of preparedness to the KSTF program, and the influence of KSTF is evident. For example, the majority of both science and mathematics Fellows attributed their preparedness to monitor student understanding to the KSTF program to a substantial extent.

CHAPTER THREE: SCIENCE AND MATHEMATICS PROFESSIONAL DEVELOPMENT

OVERVIEW

In addition to examining Fellows' initial preparation for teaching, the study investigated their opportunities for professional growth, both in terms of disciplinary content and how to help their students learn important science/mathematics content. Thus, the survey collected data on Fellows' participation in in-service education and other professional activities (e.g., leadership roles), as well as the extent to which KSTF contributed to these opportunities.

TEACHER PROFESSIONAL DEVELOPMENT

Given KSTF's emphasis on continual professional growth and the opportunities it provides to Fellows, it is not surprising that all Fellows have participated in discipline-focused professional development (i.e., focused on science/mathematics content or the teaching of science/mathematics) within the last three years. Participation rates for the matched teachers and teachers nationally are also quite high (see Table 3.1)

Table 3.1
High School Teachers Participating in Discipline-Focused Professional Development in the Last Three Years, by Group

	Percent of Teachers		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Science	100 (__)†	92 (2.0)	85 (1.3)
Mathematics	100 (__)†	97 (2.2)	88 (1.0)

†All teachers in the sample selected this response option. Thus, it is not possible to calculate the standard error of this estimate.

However, data on the amount of professional development teachers have participated in over the last three years highlight a major difference between Fellows and other teachers. Eighty-six percent of science and mathematics Fellows have participated in more than 35 hours of professional development in this time period (see Table 3.2). In contrast, only about a third of matched teachers, and a similar proportion of all science and mathematics teachers, have participated in that much discipline-focused professional development in the last three years.

Table 3.2 High School Teachers' Time Spent on Professional Development in the Last Three Years, by Group			
	Percent of Teachers		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Science			
Less than 6 hours	1 (1.0)	13 (2.9)	23 (1.6)
6–15 hours	7 (2.5)	30 (4.4)	20 (1.1)
16–35 hours	6 (2.3)	19 (2.9)	21 (1.4)
More than 35 hours	86 (3.4)	38 (3.9)	36 (1.1)
Mathematics			
Less than 6 hours	0 (__)†	18 (4.7)	23 (1.5)
6–15 hours	2 (2.0)	32 (5.8)	24 (1.4)
16–35 hours	12 (4.6)	23 (5.4)	22 (1.1)
More than 35 hours	86 (4.9)	27 (4.9)	32 (1.5)

†No teachers in the sample selected this response option. Thus, it is not possible to calculate the standard error of this estimate.

The Fellows were also asked the extent to which their discipline-focused professional development was sponsored or supported by KSTF. As can be seen in Table 3.3, a majority of Fellows indicated that KSTF was responsible for 75 percent or more of these opportunities.

Table 3.3 Extent to which Discipline-Focused Professional Development Was Sponsored or Supported by KSTF		
	Percent of KSTF Fellows	
	Science	Mathematics
Less than 25 percent	17 (3.7)	14 (4.9)
25–49 percent	3 (1.7)	14 (4.9)
50–74 percent	26 (4.4)	22 (5.8)
75 percent or more	54 (4.9)	51 (7.1)

One survey question asked about the nature of professional development activities. Data for science teachers are shown in Table 3.4, and for mathematics teachers in Table 3.5. In both subjects and all groups, attending a workshop is the most common professional development activity. Still, with the exception of receiving feedback from a mentor or coach, Fellows are more likely to have participated in each of these activities than similarly prepared teachers and science/mathematics teachers in general. These differences are likely attributable to the KSTF program's support for the Fellows' professional growth.

Table 3.4 High School Science Teachers Participating in Various Professional Development Activities in the Last Three Years, by Group			
	Percent of Teachers		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Attended a workshop on science or science teaching	98 (1.4)	87 (3.1)	90 (1.2)
Participated in a professional learning community/lesson study/teacher study group focused on science or science teaching	91 (2.8)	69 (5.1)	73 (1.6)
Received feedback about your science teaching from a mentor/coach formally assigned by the school/district/diocese†	74 (4.4)	__ (__)	54 (2.4)
Attended a national, state, or regional science teacher association meeting	73 (4.4)	45 (4.1)	44 (1.7)

†This item was asked of teachers whether or not they had participated in professional development in the last three years. However, it was not on the questionnaire version presented to the Matched Teachers.

Table 3.5 High School Mathematics Teachers Participating in Various Professional Development Activities in the Last Three Years, by Group			
	Percent of Teachers		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Attended a workshop on mathematics or mathematics teaching	98 (2.0)	82 (5.8)	89 (1.0)
Participated in a professional learning community/lesson study/teacher study group focused on mathematics or mathematics teaching	94 (3.3)	79 (5.3)	73 (2.1)
Attended a national, state, or regional mathematics teacher association meeting	76 (6.0)	31 (5.3)	38 (1.5)
Received feedback about your mathematics teaching from a mentor/coach formally assigned by the school/district/diocese†	75 (6.2)	74 (4.5)	54 (2.2)

†This item was asked of teachers whether or not they had participated in professional development in the last three years.

The emerging consensus about effective professional development suggests that teachers need opportunities to work with colleagues who face similar challenges, including other teachers from their school and those who have similar teaching assignments. Other recommendations include engaging teachers in investigations, both to learn disciplinary content and to experience inquiry-oriented learning; examining student work and other classroom artifacts for evidence of what students do and do not understand; and applying what they have learned in their classrooms and subsequently discussing how it went.[3] Accordingly, teachers who had participated in professional development in the last three years were asked a series of additional questions about the nature of those experiences.

As can be seen in Table 3.6, science Fellows' professional development opportunities were more likely to have these features than those of other high school science teachers. For example, they are much more likely than other teachers to have had opportunities to examine classroom artifacts in their professional development (72 and 33 percent, respectively). They are also more likely to have worked closely with others teaching the same grade and/or subject (70 vs. 58 percent), and to have had opportunities to try out what they were learning in the classroom and then discuss it as part of the professional development (61 vs. 47 percent). However, they are less likely to have had opportunities to work closely with other science teachers in their school (38 vs. 62 percent).

Table 3.6
High School Science Teachers Whose Professional Development in the Last Three Years Had Each of a Number of Characteristics to a Substantial Extent,† by Group‡

	Percent of Teachers	
	KSTF Fellows	Teachers Nationally
Had opportunities to examine classroom artifacts (e.g., student work samples)	72 (4.5)	33 (2.4)
Worked closely with other science teachers who taught the same grade and/or subject whether or not they were from your school	70 (4.5)	58 (2.6)
Had opportunities to try out what you learned in your classroom and then talk about it as part of the professional development	61 (4.8)	47 (2.4)
Had opportunities to engage in science investigations	50 (5.0)	45 (2.8)
Worked closely with other science teachers from your school	38 (4.8)	62 (2.6)
The professional development was a waste of time	2 (1.4)	8 (1.1)

†Includes teachers indicating 4 or 5 on a 5-point scale ranging from 1 "Not at all" to 5 "To a great extent."
‡This series of items was not on the questionnaire version presented to the Matched Teachers.

In contrast, there are fewer discernable differences in mathematics, in part due to the smaller sample sizes and larger standard errors. Fellows are more likely to have engaged in mathematics investigations than other high school mathematics teachers, and are less likely to have worked closely with other mathematics teachers at their school (see Table 3.7).

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[3]Elmore, R. F. (2002). Bridging the gap between standards and achievement: The imperative for professional development in education. Washington, DC: Albert Shanker Institute.

Garet, M. S., Porter, A. C., Desimone, L., Birman, B. F., and Yoon, K. S. (2001). What makes professional development effective? Results from a national sample of teachers. American Educational Research Journal 38(4), 915–945.

Table 3.7 High School Mathematics Teachers Whose Professional Development in the Last Three Years Had Each of a Number of Characteristics to a Substantial Extent,[†] by Group			
	Percent of Teachers		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Had opportunities to engage in mathematics investigations	69 (6.6)	39 (6.3)	41 (2.0)
Worked closely with other mathematics teachers who taught the same grade and/or subject whether or not they were from your school	63 (6.8)	63 (5.6)	56 (2.4)
Had opportunities to examine classroom artifacts (e.g., student work samples)	61 (6.9)	46 (6.3)	36 (2.4)
Had opportunities to try out what you learned in your classroom and then talk about it as part of the professional development	55 (7.0)	45 (6.4)	47 (2.4)
Worked closely with other mathematics teachers from your school	37 (6.8)	74 (5.7)	67 (2.3)
The professional development was a waste of time	6 (3.3)	9 (3.3)	7 (0.9)

[†]Includes teachers indicating 4 or 5 on a 5-point scale ranging from 1 "Not at all" to 5 "To a great extent."

Responses to these six items describing the characteristics of professional development experiences were combined into a single composite variable called "quality of professional development." As can be seen in Table 3.8, the mean score on this composite is higher for science Fellows than teachers nationally.

Table 3.8 High School Teacher Mean Scores for the Quality of Professional Development Composite, by Group			
	Percent of Teachers		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Science[†]	71 (1.5)	__ (__)	62 (1.2)
Mathematics	68 (2.0)	64 (2.0)	63 (1.2)

[†]The items in this composite were not on the questionnaire version presented to the Matched Teachers.

When Fellows indicated having professional development with one of these characteristics of quality, they were asked a follow-up question about the extent to which the opportunity was sponsored or supported by KSTF. For both science and mathematics, a large majority of Fellows indicated that their professional development experiences with these characteristics were attributable to KSTF (see Table 3.9). For example, about three quarters of Fellows who had professional development that included examining classroom artifacts indicated that these opportunities were largely due to KSTF.

Table 3.9 Fellows Whose Professional Development in the Last Three Years with a Number of Characteristics Was Sponsored or Supported by KSTF to a Substantial Extent†		
	Percent of KSTF Fellows	
	Science	Mathematics
Had opportunities to try out what you learned in your classroom and then talk about it as part of the professional development	75 (4.3)	71 (6.4)
Had opportunities to examine classroom artifacts (e.g., student work samples)	75 (4.3)	76 (6.1)
Worked closely with other science/mathematics teachers who taught the same grade and/or subject whether or not they were from your school	65 (4.8)	63 (6.8)
Had opportunities to engage in science/mathematics investigations	62 (4.9)	71 (6.5)
Worked closely with other science/mathematics teachers from your school	10 (3.1)	6 (3.6)
The professional development was a waste of time	2 (1.6)	0 (__)‡

†Includes teachers indicating 4 or 5 on a 5-point scale ranging from 1 "Not at all" to 5 "To a great extent."
‡No teachers in the sample selected this response option. Thus, it is not possible to calculate the standard error of this estimate.

Another series of items asked about the focus of the opportunities Fellows have had to learn about content and the teaching of that content in the last three years, whether through professional development or college coursework. In general, science Fellows' professional growth opportunities have had similar foci as those of other high school science teachers (see Table 3.10). For example, a majority of Fellows and matched teachers have had professional development and/or college coursework with a heavy emphasis on learning about student difficulties with the content, monitoring student understanding, and eliciting students' initial ideas prior to instruction. In addition, although the Fellows' professional growth opportunities are just as likely as those of the matched teachers to have had a heavy emphasis on planning instruction so students at different levels of achievement could increase their understanding, their growth opportunities have been somewhat less likely to emphasize teaching students with special needs, English-language learners, or gifted students. Fellows' professional development/coursework has also been less likely to focus on implementing their textbook/module.

Table 3.10 **High School Science Teachers Reporting that their Professional Development/ Coursework in the Last Three Years Gave Heavy Emphasis† to Various Areas, by Group**			
	Percent of Teachers		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Learning about difficulties that students may have with particular science ideas and procedures	67 (4.7)	55 (4.9)	49 (2.5)
Monitoring student understanding during science instruction	64 (4.8)	66 (3.9)	55 (2.2)
Finding out what students think or already know about the key science ideas prior to instruction on those ideas	61 (4.8)	52 (4.9)	44 (2.3)
Planning instruction so students at different levels of achievement can increase their understanding of the ideas targeted in each activity	56 (4.9)	65 (4.1)	56 (2.1)
Assessing student understanding at the conclusion of instruction on a topic	55 (4.9)	59 (4.5)	58 (2.1)
Deepening their science content knowledge	47 (4.9)	50 (4.6)	48 (2.1)
Providing alternative science learning experiences for students with special needs	22 (4.1)	36 (5.0)	28 (2.1)
Teaching science to English-language learners	20 (4.0)	23 (4.1)	18 (1.8)
Providing enrichment experiences for gifted students	17 (3.8)	35 (5.1)	33 (2.2)
Implementing the science textbook/module to be used in their classroom	12 (3.2)	30 (3.9)	29 (1.7)

†Includes teachers responding 4 or 5 on a 5-point scale ranging from 1 “Not at all” to 5 “To a great extent.”

As can be seen in Table 3.11, compared to high school mathematics teachers nationally, Fellows’ professional growth opportunities have been fairly similar with two exceptions. Mathematics Fellows are more likely to have had experiences that gave heavy emphasis to monitoring student understanding during instruction and learning about student difficulties with the content. A majority of Fellows’ professional development/coursework also gave heavy emphasis to planning instruction for students at different levels of achievement, assessing student understanding at the end of instruction on a topic, and learning how to use hands-on activities/manipulatives.

Table 3.11 High School Mathematics Teachers Reporting that their Professional Development/ Coursework in the Last Three Years Gave Heavy Emphasis† to Various Areas, by Group‡		
	Percent of Teachers	
	KSTF Fellows	Teachers Nationally
Monitoring student understanding during mathematics instruction	63 (6.8)	49 (2.1)
Learning about difficulties that students may have with particular mathematical ideas and procedures	63 (6.8)	46 (2.3)
Planning instruction so students at different levels of achievement can increase their understanding of the ideas targeted in each activity	59 (7.0)	53 (2.3)
Assessing student understanding at the conclusion of instruction on a topic	53 (7.1)	49 (2.3)
Learning how to use hands-on activities/manipulatives for mathematics instruction	51 (7.1)	55 (2.3)
Finding out what students think or already know about the key mathematical ideas prior to instruction on those ideas	42 (7.1)	32 (1.9)
Deepening their mathematics content knowledge	35 (6.8)	35 (1.9)
Implementing the mathematics textbook/program to be used in their classroom	25 (6.2)	32 (1.9)
Providing alternative mathematics learning experiences for students with special needs	20 (5.6)	30 (1.9)
Providing enrichment experiences for gifted students	14 (4.9)	21 (1.9)
Teaching mathematics to English-language learners	14 (4.9)	18 (1.6)

†Includes teachers responding 4 or 5 on a 5-point scale ranging from 1 "Not at all" to 5 "To a great extent."
‡This series of items was not on the questionnaire version presented to the Matched Teachers.

Several items related to a focus on student-centered instruction in recent teacher professional development/coursework were combined into a composite variable. The items are: finding out what students think or already know prior to instruction, planning instruction so students at different levels of achievement can increase their understandings, monitoring student understanding during instruction, and assessing student understanding at the conclusion of instruction on a topic. There are no significant differences on this composite among the groups in science. In mathematics, Fellows' scores on this composite are substantially higher than those of high school mathematics teachers nationally. (See Table 3.12.)

Table 3.12 High School Teacher Mean Score on the Extent to which Professional Development/Coursework Focused on Student-Centered Instruction Composite, by Group			
	Percent of Teachers		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Science	66 (1.8)	68 (2.2)	62 (1.2)
Mathematics†	64 (2.4)	__ (__)	50 (0.8)

†The items in this composite were not on the questionnaire version presented to the Matched Teachers.

The Fellows were also asked to what extent their growth opportunities with these emphases were supported or sponsored by KSTF. As can be seen in Table 3.13, for both science and mathematics, KSTF has substantially supported or sponsored a majority of Fellows' opportunities to deepen their own understanding of science/mathematics content, learn about difficulties students may have with science/mathematical ideas and procedures, and monitor student thinking at the beginning, during, and conclusion of instruction on a topic. Mathematics Fellows also credit KSTF with substantially supporting/sponsoring their opportunities to learn about how to use hands-on activities/manipulatives and to differentiate instruction. The Fellows report relatively little emphasis on teaching science/mathematics to special populations.

Table 3.13
Fellows Reporting that their Professional Development/Coursework in the Last Three Years in Various Areas Was Supported or Sponsored by KSTF to a Substantial Extent†

	Percent of KSTF Fellows	
	Science	Mathematics
Learning about difficulties that students may have with particular science/mathematical ideas and procedures	71 (4.6)	73 (6.3)
Deepening their science/mathematics content knowledge	69 (4.7)	69 (6.6)
Finding out what students think or already know about the key science/mathematical ideas prior to instruction on those ideas	68 (4.7)	65 (6.8)
Monitoring student understanding during science/mathematics instruction	62 (4.9)	73 (6.3)
Assessing student understanding at the conclusion of instruction on a topic	56 (5.1)	59 (7.0)
Learning how to use hands-on activities/manipulatives for mathematics instruction‡	— (—)	60 (7.0)
Planning instruction so students at different levels of achievement can increase their understanding of the ideas targeted in each activity	49 (5.1)	70 (6.5)
Providing enrichment experiences for gifted students	23 (4.6)	19 (5.7)
Implementing the science/mathematics textbook/program to be used in their classroom	20 (4.4)	22 (6.3)
Providing alternative science/mathematics learning experiences for students with special needs	16 (3.8)	10 (4.5)
Teaching science/mathematics to English-language learners	14 (3.8)	9 (4.3)

†Includes teachers responding 4 or 5 on a 5-point scale ranging from 1 "Not at all" to 5 "To a great extent."
‡This item was asked only of mathematics teachers.

In addition to asking Fellows about their involvement as participants in professional development, the survey asked whether they had served in various leadership roles in the profession in the last three years. As can be seen in Table 3.14, science Fellows are more likely than teachers nationally to have led a teacher study group or an in-service workshop on science or science teaching. This finding may be due to the support and growth opportunities provided by KSTF, the process used to select Fellows, or an interaction of these two factors. Fellows are less likely to have served as a mentor/coach or supervised a student teacher than teachers nationally, perhaps because those roles typically go to teachers with greater years of experience.

Table 3.14 High School Science Teachers Serving in Various Leadership Roles in the Last Three Years, by Group		
	Percent of Teachers	
	KSTF Fellows	Teachers Nationally
Led a teacher study group focused on science teaching	41 (4.9)	26 (2.1)
Taught in-service workshops on science or science teaching	31 (4.6)	17 (1.9)
Served as a formally assigned mentor/coach for science teaching	14 (3.4)	24 (2.2)
Supervised a student teacher	11 (3.1)	23 (1.7)

Mathematics Fellows are more likely than both matched teachers and teachers nationally to have taught an in-service workshop (see Table 3.15). As in science, they are less likely than teachers nationally to have served as a mentor/coach or supervised a student teacher, though they are no less likely than the matched teachers to have had these experiences.

Table 3.15 High School Mathematics Teachers Serving in Various Leadership Roles in the Last Three Years, by Group			
	Percent of Teachers		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Led a teacher study group focused on mathematics teaching	35 (6.8)	23 (5.5)	25 (1.9)
Taught in-service workshops on mathematics or mathematics teaching	29 (6.4)	10 (3.2)	15 (1.4)
Served as a formally assigned mentor/coach for mathematics teaching	8 (3.8)	19 (4.1)	22 (1.8)
Supervised a student teacher	8 (3.8)	18 (5.1)	23 (2.0)

The Fellows were asked to rate the extent to which their involvement in KSTF improved their ability to be effective in each of these leadership roles. As can be seen in Table 3.16, a majority of science and mathematics Fellows indicated that KSTF has had a positive impact on their ability to lead a content-focused teacher study group. About half also credit KSTF with improving their ability to lead an in-service workshop. Interestingly, in both subjects and for each role, more Fellows indicated a positive impact due to KSTF than have had the opportunity in the last three years to serve in that role.

Table 3.16 Fellows Attributing Substantially† Improved Abilities to be Effective in Various Leadership Roles to KSTF		
	Percent of KSTF Fellows	
	Science	Mathematics
Led a teacher study group focused on science/mathematics teaching	60 (5.0)	55 (7.3)
Taught in-service workshops on science/mathematics or science/mathematics teaching	58 (5.0)	48 (7.4)
Served as a formally assigned mentor/coach for science/mathematics teaching	38 (5.0)	36 (7.2)
Supervised a student teacher	24 (4.4)	22 (6.3)
†Includes teachers indicating 4 or 5 on a 5-point scale ranging from 1 "Not at all" to 5 "To a great extent."		

SUMMARY

The data on Fellows' professional development provide several lines of evidence suggesting that their involvement with KSTF has a positive impact. Fellows are more likely than teachers nationally to have participated in discipline-focused PD in the last three years. They are much more likely to have participated in a substantial amount of PD; i.e., more than 35 hours. Fellows attribute most of their PD to KSTF. These findings are consistent with KSTF's focus.

Survey data also suggest that Fellows' PD experiences are more likely than those of teachers nationally to exhibit characteristics of high-quality PD, including examining classroom artifacts and having opportunities to try out what they learned in the classroom. Fellows are very likely to attribute these qualities to KSTF. In terms of emphasis, Fellows' PD is more likely than that of teachers nationally to focus on difficulties students may have learning the content and on monitoring student understanding. Particularly in mathematics, Fellows' PD has had a greater emphasis on student-centered instruction in general than is evident in PD opportunities for teachers nationally.

Finally, Fellows are more likely than other teachers to have served in certain leadership roles, including leading a teacher workshop and teaching a workshop. This finding is particularly striking given the relative inexperience of Fellows. Such leadership opportunities are typically afforded to more experienced teachers. Further, most Fellows attribute increases in their leadership abilities to their involvement with KSTF.

CHAPTER FOUR: INSTRUCTIONAL DECISION MAKING, OBJECTIVES, AND ACTIVITIES

OVERVIEW

The surveys collected data about teachers' perceptions of their autonomy in making curriculum and instruction decisions. Questions also focused on teachers' instructional objectives, class activities they use in accomplishing these objectives, and how student performance is assessed in a particular, randomly selected science or mathematics class. These data are discussed in the following sections. The unit of analysis for these data is the individual class rather than Fellows/teachers. Therefore, results are reported in terms of the percentage of classes.

TEACHERS' PERCEPTIONS OF THEIR DECISION-MAKING AUTONOMY

Underlying many school reform efforts is the notion that classroom teachers are in the best position to know their students' needs and interests, and therefore should be the ones to make decisions about tailoring instruction to a particular group of students. Teachers were asked the extent to which they had control over a number of curriculum and instruction decisions for their classes. Results for science and mathematics classes are presented in Tables 4.1 and 4.2, respectively. There are no substantive differences between Fellows and other teachers on these items. In science and mathematics classes across all groups, teachers are more likely to perceive themselves as having strong control over pedagogical decisions such as determining the amount of homework to be assigned (71–78 percent), selecting teaching techniques (65–75 percent), and choosing criteria for grading student performance (49–61 percent). In fewer science and mathematics classes, teachers perceive themselves as having strong control in determining course goals and objectives (20–38 percent); selecting content, topics, and skills to be taught (19–40 percent); and selecting textbooks/modules/programs (10–36 percent).

Table 4.1
High School Science Classes in which Teachers Report Having Strong Control Over Various Curriculum and Instruction Decisions, by Group†

	Percent of Classes	
	KSTF Fellows	Teachers Nationally
Determining the amount of homework to be assigned	78 (4.1)	76 (1.9)
Selecting teaching techniques	74 (4.4)	73 (2.0)
Choosing criteria for grading student performance	57 (4.9)	61 (2.3)
Selecting content, topics, and skills to be taught	40 (4.9)	35 (2.7)
Determining course goals and objectives	38 (4.8)	36 (2.3)
Selecting textbooks/modules	36 (4.8)	33 (2.6)

†This series of items was not on the questionnaire version presented to the Matched Teachers.

Table 4.2 High School Mathematics Classes in which Teachers Report Having Strong Control Over Various Curriculum and Instruction Decisions, by Group			
	Percent of Classes		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Selecting teaching techniques	75 (6.2)	65 (5.4)	72 (1.8)
Determining the amount of homework to be assigned	71 (6.4)	71 (4.9)	75 (2.0)
Choosing criteria for grading student performance	53 (7.1)	49 (6.0)	55 (2.1)
Determining course goals and objectives	25 (6.2)	20 (5.1)	28 (2.1)
Selecting content, topics, and skills to be taught	24 (6.0)	19 (5.0)	24 (1.9)
Selecting textbooks/programs	18 (5.4)	10 (4.0)	20 (2.1)

The items shown in Tables 4.1 and 4.2 were combined into two composite variables—Curriculum Control and Pedagogical Control. Curriculum Control comprises the following items:

- Determining course goals and objectives;
- Selecting content, topics, and skills to be taught; and
- Selecting textbooks/modules/programs.

For Pedagogical Control, the items are:

- Choosing criteria for grading student performance;
- Determining the amount of homework to be assigned; and
- Selecting teaching techniques.

Scores on these composites are similar across all groups (see Table 4.3). In general, teachers perceive much more control over decisions related to pedagogy than curriculum.

Table 4.3 High School Class Mean Scores for Curriculum Control and Pedagogical Control Composites, by Group			
	Mean Score		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Science			
Curriculum Control†	59 (3.1)	— (—)	59 (1.6)
Pedagogical Control†	87 (1.7)	— (—)	89 (0.7)
Mathematics			
Curriculum Control	50 (4.4)	47 (3.5)	52 (1.4)
Pedagogical Control	87 (2.0)	83 (1.9)	88 (0.7)
†The items in this composite were not on the version of the questionnaire presented to the Matched Teachers.			

OBJECTIVES OF SCIENCE AND MATHEMATICS INSTRUCTION

The surveys provided a list of possible objectives of science and mathematics instruction and asked teachers how much emphasis each would receive over the duration of the randomly selected class. Table 4.4 shows the percentage of science classes whose teachers indicated heavy emphasis for each objective. Understanding science concepts is emphasized in three-fourths of Fellows' classes, similar to the classes of the matched teachers and teachers nationally. Less than half of Fellows' classes have a heavy emphasis on learning science process skills and preparing students for further study in science. Fellows' classes are less likely than classes of the matched teachers to emphasize increasing student interest in science and learning about real-life applications of science. They are also less likely to focus on learning test taking skills/strategies and memorizing science vocabulary and/or facts.

Table 4.4
High School Science Classes with Heavy Emphasis on Various Instructional Objectives, by Group

	Percent of Classes		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Understanding science concepts	75 (4.3)	84 (3.5)	80 (1.2)
Learning science process skills (e.g., observing, measuring)	46 (4.9)	45 (3.9)	49 (1.6)
Increasing students' interest in science	40 (4.8)	55 (4.9)	50 (1.4)
Preparing for further study in science	39 (4.9)	43 (4.7)	46 (1.3)
Learning about real-life applications of science	26 (4.4)	49 (5.1)	45 (1.5)
Learning test taking skills/strategies	9 (2.8)	23 (4.4)	22 (1.2)
Memorizing science vocabulary and/or facts	4 (1.9)	23 (4.6)	13 (1.3)

Compared to classes of the matched teachers, mathematics Fellows' classes are more likely to emphasize understanding mathematics ideas and less likely to emphasize learning test taking skills/strategies (see Table 4.5). Fellows' classes are less likely to focus on learning mathematical procedures and/or algorithms, and performing computations with speed and accuracy than high school mathematics classes in general, though they are not different than classes of the matched teachers in these areas.

Table 4.5
High School Mathematics Classes with Heavy Emphasis on Various Instructional Objectives, by Group

	Percent of Classes		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Understanding mathematical ideas	78 (5.8)	56 (7.1)	69 (1.4)
Learning mathematical practices (e.g., considering how to approach a problem, justifying solutions)	65 (6.8)	50 (6.4)	55 (1.3)
Preparing for further study in mathematics	45 (7.0)	57 (6.3)	55 (1.6)
Increasing students' interest in mathematics	33 (6.7)	31 (5.9)	27 (1.4)
Learning about real-life applications of mathematics	29 (6.4)	30 (4.7)	29 (1.3)
Learning mathematical procedures and/or algorithms	25 (6.2)	40 (6.3)	48 (1.5)
Learning to perform computations with speed and accuracy	6 (3.3)	12 (4.0)	18 (1.2)
Learning test taking skills/strategies	4 (2.7)	27 (6.0)	28 1.3)

Objectives related to reform-oriented instruction were combined into a composite variable. The composite includes: understanding science concepts/mathematical ideas, learning science process skills/mathematical practices, learning about real-life applications of science/mathematics, increasing student interest in science/mathematics, and preparing students for further study. As can be seen in Table 4.6, scores on this composite were slightly lower for science Fellows' classes than classes of the matched teachers and teachers nationally (scores of 77 and 83, respectively). In mathematics, there are no significant differences between the classes of Fellows, matched teachers, and teachers nationally.

Table 4.6
High School Class Mean Scores on the Reform-Oriented Instructional Objectives Composite, by Group

	KSTF Fellows	Matched Teachers	Teachers Nationally
Science	77 (1.4)	83 (1.2)	82 (0.4)
Mathematics	79 (2.0)	77 (2.3)	78 (0.4)

CLASS ACTIVITIES

Teachers were given a list of activities and asked how often they did each in the randomly selected class; response options were: never, rarely (e.g., a few times a year), sometimes (e.g., once or twice a month), often (e.g., once or twice a week), and all or almost all lessons. In science, Fellows' classes are more likely than those of the matched teachers to engage in small group work at least once a week and more likely than classes nationally to require students to supply evidence to support claims (see Table 4.7). Fellows' classes are less likely to include what are typically considered "traditional teaching practices" such as the teacher explaining science ideas to the whole class, engaging in whole class discussions, reading from a science text, taking short-answer quizzes/tests, and practicing for standardized tests on a weekly basis.

Table 4.7 High School Science Classes in which Teachers Report Using Various Activities at Least Once a Week, by Group			
	Percent of Classes		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Have students work in small groups	96 (1.9)	86 (3.5)	83 (1.2)
Explain science ideas to the whole class	83 (3.8)	97 (2.0)	95 (0.8)
Do hands-on/laboratory activities	76 (4.2)	72 (4.2)	70 (1.5)
Require students to supply evidence in support of their claims	76 (4.2)	64 (4.5)	61 (1.6)
Engage the whole class in discussions	63 (4.8)	81 (3.3)	83 (1.0)
Have students represent and/or analyze data using tables, charts, or graphs	52 (4.9)	59 (4.7)	58 (1.6)
Focus on literacy skills (e.g., informational reading or writing strategies)	30 (4.6)	27 (4.4)	25 (1.5)
Have students write their reflections (e.g., in their journals) in class or for homework	28 (4.5)	26 (4.3)	21 (1.3)
Give tests and/or quizzes that include constructed-response/ open-ended items	26 (4.4)	33 (4.3)	40 (1.4)
Have students read from a science textbook, module, or other science-related material in class, either aloud or to themselves	22 (4.1)	37 (5.5)	37 (1.6)
Give tests and/or quizzes that are predominantly short-answer (e.g., multiple choice, true /false, fill in the blank)	21 (4.0)	37 (4.8)	44 (1.6)
Engage the class in project-based learning (PBL) activities	15 (3.5)	24 (4.3)	18 (1.2)
Have students make formal presentations to the rest of the class (e.g., on individual or group projects)	6 (2.3)	10 (2.7)	9 (1.0)
Have students practice for standardized tests	5 (2.1)	19 (3.5)	20 (1.2)
Have students attend presentations by guest speakers focused on science and/or engineering in the workplace	0 (__)†	2 (1.2)	2 (0.5)

†No teachers in the sample were in this category. Thus, it is not possible to calculate the standard error of this estimate.

There are fewer differences in mathematics instruction between classes of Fellows and matched teachers, likely due in part to the smaller sample size and larger standard errors. Fellows' classes are more likely to have students explain and justify their method for solving a problem and less likely to have students practice for standardized tests than similarly prepared teachers at least once a week (see Table 4.8). Compared to high school mathematics classes nationally, Fellows' classes are more likely to have students work in small groups, consider multiple representations in solving a problem, and present their solution strategies to the rest of the class.

Table 4.8 High School Mathematics Classes in which Teachers Report Using Various Activities at Least Once a Week, by Group			
	Percent of Classes		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Have students explain and justify their method for solving a problem	100 (__)†	80 (5.2)	79 (1.3)
Explain mathematical ideas to the whole class	92 (3.8)	97 (1.9)	95 (0.7)
Have students work in small groups	88 (4.6)	75 (5.1)	63 (1.7)
Engage the whole class in discussions	84 (5.1)	88 (4.0)	84 (1.1)
Have students consider multiple representations in solving a problem (e.g., numbers, tables, graphs, pictures)	78 (5.8)	64 (5.8)	65 (1.4)
Have students present their solution strategies to the rest of the class	63 (6.8)	55 (5.6)	46 (1.4)
Have students compare and contrast different methods for solving a problem	59 (7.0)	54 (5.9)	56 (1.6)
Give tests and/or quizzes that include constructed-response/ open-ended items	51 (7.1)	46 (5.8)	56 (1.6)
Give tests and/or quizzes that are predominantly short-answer (e.g., multiple choice, true/false, fill in the blank)	25 (6.2)	37 (5.8)	36 (1.2)
Provide manipulatives for students to use in problem-solving/ investigations	25 (6.2)	24 (5.4)	18 (1.0)
Have students write their reflections (e.g., in their journals) in class or for homework	22 (5.9)	13 (4.1)	11 (1.0)
Focus on literacy skills (e.g., informational reading or writing strategies)	16 (5.1)	25 (5.1)	14 (1.0)
Have students read from a mathematics textbook/program or other mathematics-related material in class, either aloud or to themselves	12 (4.6)	25 (5.4)	25 (1.4)
Have students practice for standardized tests	8 (3.8)	35 (5.1)	32 (1.5)
Have students attend presentations by guest speakers focused on mathematics in the workplace	0 (__)†	2 (1.8)	1 (0.3)
†All/No teachers in the sample were in this category. Thus, it is not possible to calculate the standard error of this estimate.			

Teachers were also asked about the frequency with which they use various instructional technologies in their classes. As can be seen in Table 4.9, technology use is generally low in high school science classes across groups. Fellows' classes are somewhat more likely than classes of the matched teachers to use computers (personal or hand-held) and the Internet on a weekly basis.

Table 4.9 High School Science Classes in which Teachers Report that Students Use Various Instructional Technologies at Least Once a Week, by Group			
	Percent of Classes		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Internet	45 (5.0)	32 (4.2)	35 (2.2)
Personal computers, including laptops	41 (4.9)	26 (3.9)	31 (2.3)
Graphing calculators	22 (4.1)	22 (4.0)	19 (1.7)
Hand-held computers	17 (3.8)	8 (2.3)	9 (1.3)
Probes for collecting data	9 (2.8)	6 (2.0)	8 (1.1)
Classroom response system or "Clickers"	4 (1.9)	4 (1.8)	6 (1.0)

In mathematics, the frequency of use of graphing calculators is similar across groups, though Fellows' classes are less likely to use scientific calculators on a weekly basis (see Table 4.10). Similar to science, a higher percentage of classes taught by Fellows use hand-held computers weekly than classes taught by the matched teachers.

Table 4.10 High School Mathematics Classes in which Teachers Report that Students Use Various Instructional Technologies at Least Once a Week, by Group			
	Percent of Classes		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Graphing calculators	61 (6.9)	73 (4.6)	64 (2.0)
Scientific calculators	37 (6.8)	60 (5.6)	53 (2.1)
Four-function calculators	22 (5.8)	32 (5.0)	33 (2.2)
Internet	18 (5.4)	16 (4.0)	11 (1.2)
Personal computers, including laptops	18 (5.4)	11 (3.9)	10 (1.2)
Hand-held computers	14 (4.9)	0 (__)†	4 (0.8)
Classroom response system or "Clickers"	6 (3.3)	8 (3.5)	4 (0.7)
Probes for collecting data	2 (2.0)	4 (3.1)	1 (0.4)
†No teachers in the sample were in this category. Thus, it is not possible to calculate the standard error of this estimate.			

Two composite variables were created from subsets of the instructional practices items. The first, use of reform-oriented teaching practices, includes items such as having students work in small groups, requiring students to supply evidence to support their claims, and having students write reflections for science. For mathematics, it includes having students explain and justify their solution methods, compare and contrast different solution methods, and present their solutions strategies to the class. The second composite, use of instructional technology, includes having students use computers and the Internet.

As can be seen in Table 4.11, science classes taught by Fellows are not more likely to experience reform-oriented teaching practices than classes taught by the matched teachers. However, they are more likely to use instructional technology. In contrast, scores on both composites are higher for mathematics classes taught by Fellows than for those taught by similarly prepared teachers and teachers nationally.

Table 4.11
Class Mean Scores on High School Teaching Practice Composites, by Group

	Mean Score		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Science			
Use of Reform-Oriented Teaching Practices	63 (1.0)	62 (1.4)	59 (0.5)
Use of Instructional Technology	40 (1.8)	32 (1.8)	34 (0.9)
Mathematics			
Use of Reform-Oriented Teaching Practices	75 (1.9)	68 (2.0)	67 (0.6)
Use of Instructional Technology	30 (3.3)	18 (2.3)	21 (1.0)

In addition to asking about class activities in the course as a whole, the surveys asked teachers about activities that took place during their most recent lesson in the randomly selected class. As can be seen in Table 4.12, Fellows' science classes are substantially less likely than classes of the matched teachers to include activities typically considered traditional teaching practices, such as the teacher explaining a science idea to the whole class, students completing textbook/worksheet problems, students reading about science, and practicing for standardized tests. In mathematics, Fellows' classes are less likely than those of the matched teachers to include the teacher explaining a mathematical idea to the whole class, conducting a demonstration while students watched, and having students practice for standardized tests (see Table 4.13).

Table 4.12
High School Science Classes Participating in Various Activities in the Most Recent Lesson, by Group

	Percent of Classes		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Teacher explaining a science idea to the whole class	76 (4.3)	90 (2.3)	90 (0.9)
Whole class discussion	55 (5.0)	64 (4.4)	67 (1.4)
Students doing hands-on/laboratory activities	41 (4.9)	35 (4.8)	39 (1.5)
Students completing textbook/worksheet problems	39 (4.9)	59 (5.2)	59 (1.6)
Teacher conducting a demonstration while students watched	30 (4.6)	36 (4.1)	32 (1.4)
Students reading about science	26 (4.4)	43 (5.0)	35 (1.5)
Test or quiz	18 (3.8)	16 (3.1)	20 (1.4)
Students using instructional technology	17 (3.7)	22 (3.8)	27 (1.4)
Practicing for standardized tests	4 (2.0)	11 (2.7)	10 (0.8)

Table 4.13 High School Mathematics Classes Participating in Various Activities in the Most Recent Lesson, by Group	Percent of Classes		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Teacher explaining a mathematical idea to the whole class	71 (6.4)	87 (4.4)	95 (0.7)
Whole class discussion	71 (6.4)	67 (5.5)	75 (1.3)
Students completing textbook/worksheet problems	59 (7.0)	75 (5.8)	83 (1.0)
Students using instructional technology	31 (6.6)	31 (5.2)	43 (1.3)
Students doing hands-on/manipulative activities	27 (6.3)	20 (5.2)	21 (1.3)
Teacher conducting a demonstration while students watched	22 (5.8)	61 (5.8)	65 (1.2)
Test or quiz	18 (5.4)	25 (5.4)	20 (1.3)
Students reading about mathematics	12 (4.6)	20 (5.4)	17 (1.2)
Practicing for standardized tests	4 (2.7)	24 (5.6)	16 (1.1)

The surveys also asked teachers to estimate the time spent on each of a number of types of activities in this most recent lesson. In both subjects, classes taught by Fellows spent less time on whole class activities than classes taught by similarly prepared teachers and teachers nationally (see Tables 4.14 and 4.15). Fellows tend to devote more time in their classes to small group work than the matched teachers, though the apparent difference in science is not statistically significant.

Table 4.14 Average Percentage of Time Spent on Different Activities in the Most Recent High School Science Lesson, by Group	Average Percent of Class Time		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Small group work	39 (2.7)	31 (2.7)	30 (0.7)
Whole class activities (e.g., lectures, explanations, discussions)	33 (2.1)	41 (2.0)	43 (0.6)
Students working individually (e.g., reading textbooks, completing worksheets, taking a test or quiz)	20 (2.4)	19 (1.8)	18 (0.6)
Non-instructional activities (e.g., attendance taking, interruptions)	9 (0.7)	9 (0.6)	9 (0.3)

Table 4.15 Average Percentage of Time Spent on Different Activities in the Most Recent High School Mathematics Lesson, by Group	Average Percent of Class Time		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Small group work	42 (3.1)	23 (2.6)	22 (0.8)
Whole class activities (e.g., lectures, explanations, discussions)	33 (2.6)	46 (2.9)	48 (0.7)
Students working individually (e.g., reading textbooks, completing worksheets, taking a test or quiz)	17 (2.8)	22 (2.5)	22 (0.6)
Non-instructional activities (e.g., attendance taking, interruptions)	8 (0.8)	9 (0.6)	9 (0.2)

ASSESSMENT PRACTICES

Teachers were also given a list of ways that they might assess student progress and asked to indicate which practices they used in the most recently completed unit in the randomly selected class. These data are shown in Tables 4.16 and 4.17. In both science and mathematics, the vast majority of classes across all groups included informal assessment practices during the unit to see if students were "getting it." The only substantive difference in these data is that science classes taught by Fellows were more likely than those taught by similarly prepared teachers to have students use rubrics to examine their own or their classmates' work (35 vs. 12 percent).

Table 4.16
High School Science Classes in which Teachers Report Assessing Students Using Various Methods in the Most Recent Unit, by Group

	Percent of Classes		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Questioned individual students during class activities to see if they were "getting it"	97 (1.7)	95 (2.4)	97 (0.5)
Reviewed student work (e.g., homework, notebooks, journals, portfolios, projects) to see if they were "getting it"	95 (2.1)	96 (1.7)	94 (0.7)
Administered one or more quizzes and/or tests to assign grades	94 (2.3)	92 (2.1)	91 (0.7)
Assigned grades to student work (e.g., homework, notebooks, journals, portfolios, projects)	88 (3.2)	92 (2.7)	92 (0.7)
Used information from informal assessments of the entire class (e.g., asking for a show of hands, thumbs up/thumbs down, clickers, exit tickets) to see if students were "getting it"	84 (3.6)	87 (2.9)	80 (1.3)
Administered one or more quizzes and/or tests to see if students were "getting it"	80 (4.0)	83 (3.6)	81 (1.3)
Went over the correct answers to assignments, quizzes, and/or tests with the class as a whole	74 (4.4)	84 (3.2)	88 (1.0)
Administered an assessment, task, or probe at the beginning of the unit to find out what students thought or already knew about the key science ideas	60 (4.8)	51 (5.0)	53 (1.4)
Had students use rubrics to examine their own or their classmates' work	35 (4.7)	12 (2.4)	18 (1.2)

Table 4.17 High School Mathematics Classes in which Teachers Report Assessing Students Using Various Methods in the Most Recent Unit, by Group			
	Percent of Classes		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Questioned individual students during class activities to see if they were "getting it"	100 (__)†	98 (1.3)	97 (0.5)
Reviewed student work (e.g., homework, notebooks, journals, portfolios, projects) to see if they were "getting it"	96 (2.7)	97 (1.7)	96 (0.7)
Administered one or more quizzes and/or tests to assign grades	88 (4.6)	92 (3.3)	94 (0.6)
Administered one or more quizzes and/or tests to see if students were "getting it"	88 (4.6)	83 (4.5)	86 (1.4)
Used information from informal assessments of the entire class (e.g., asking for a show of hands, thumbs up/thumbs down, clickers, exit tickets) to see if students were "getting it"	88 (4.6)	81 (4.4)	83 (1.1)
Assigned grades to student work (e.g., homework, notebooks, journals, portfolios, projects)	86 (4.9)	88 (3.9)	85 (0.9)
Went over the correct answers to assignments, quizzes, and/or tests with the class as a whole	76 (6.0)	86 (3.7)	92 (0.7)
Administered an assessment, task, or probe at the beginning of the unit to find out what students thought or already knew about the key science ideas	47 (7.1)	47 (6.2)	42 (1.8)
Had students use rubrics to examine their own or their classmates' work	22 (5.8)	13 (4.3)	8 (0.7)

†All teachers in the sample selected this response option. Thus, it is not possible to calculate the standard error of this estimate.

SUMMARY

Data from the surveys indicate that science and mathematics Fellows, similar to teachers nationally, perceive more control over decisions related to pedagogy than curriculum. In terms of instructional objectives, science classes taught by Fellows are less likely than classes taught by other teachers to have a heavy emphasis on increasing students' interest in science, learning about real-life applications of science, learning test taking skills/strategies, and memorizing science vocabulary and/or facts. Mathematics classes taught by Fellows are less likely to emphasize learning test taking skills/strategies. In mathematics, Fellows' classes focus heavily on understanding mathematical ideas, compared to classes of matched teachers and teachers nationally.

In science and mathematics, Fellows tend to be less likely than other teachers to employ instructional strategies that might be thought of as traditional and more likely to use reform-oriented strategies. For example, classes taught by Fellows are more likely to include group work and less likely to engage in whole class discussions than similarly prepared teachers and teachers in general. Classes taught by Fellows are also more likely to require students to justify claims with evidence and explain solutions. In both science and mathematics, informal means of assessment—e.g., questioning students during activities, reviewing student work—are commonly used to monitor student progress. The only substantive difference between groups in this regard occurred in science. Classes taught by science Fellows are more likely to have students use rubrics to examine their own or their classmates' work as compared to classes taught by matched teachers or teachers nationally.

CHAPTER FIVE: INSTRUCTIONAL RESOURCES

OVERVIEW

The quality and availability of instructional resources is a major factor in science and mathematics teaching. The surveys included a series of items on how teachers used their textbooks/programs. Teachers were also asked about the availability and use of a number of other instructional resources, including instructional technology, supplies, and equipment for science/mathematics instruction. These results are presented in the following sections.

TEXTBOOK USAGE

The surveys collected data on the use of commercially published textbooks or programs in science and mathematics classes. As can be seen in Table 5.1, classes taught by Fellows are considerably less likely than other high school classes to use published textbooks/programs.

Table 5.1
High School Classes Using Commercially Published Textbooks/Programs, by Group

	Percent of Classes		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Science	41 (6.0)	74 (4.1)	77 (1.2)
Mathematics	53 (7.1)	83 (4.4)	81 (1.0)

The surveys also asked if one textbook/program is used all or most of the time, or if multiple materials are used. As can be seen in Table 5.2, science classes taught by Fellows are much less likely than the matched teachers' classes to rely on one commercially published textbook (25 vs. 54 percent) and much more likely to use non-commercially published materials (59 vs. 26 percent).

Table 5.2
Instructional Materials Used in High School Science Classes, by Group

	Percent of Classes		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Mainly commercially published textbook(s)			
One textbook	25 (5.2)	54 (4.6)	52 (1.7)
Multiple textbooks	6 (2.8)	5 (1.6)	7 (0.7)
Mainly commercially published modules			
Modules from a single publisher	1 (1.4)	2 (1.2)	2 (0.4)
Modules from multiple publishers	4 (2.5)	1 (0.4)	2 (0.4)
Other			
A roughly equal mix of commercially published text books and commercially published modules most of the time	4 (2.5)	12 (3.0)	15 (1.2)
Non-commercially published materials most of the time	59 (6.0)	26 (4.1)	23 (1.2)

A similar pattern exists in mathematics (see Table 5.3). Fellows' mathematics classes less likely than classes taught by similarly prepared teachers to use a single textbook/program most of the time (43 vs. 65 percent) and much more likely to use non-commercially published materials (47 vs. 17 percent).[4]

Table 5.3 Instructional Materials Used in High School Mathematics Classes, by Group			
	Percent of Classes		
	KSTF Fellows	Matched Teachers	Teachers Nationally
One commercially published textbook or program most of the time	43 (7.0)	65 (5.6)	65 (1.4)
Multiple commercially published textbooks/programs most of the time	10 (4.2)	18 (4.2)	16 (0.9)
Non-commercially published instructional materials most of the time	47 (7.1)	17 (4.4)	19 (1.0)

FACILITIES AND EQUIPMENT

Teachers were also asked about the adequacy of resources available for science/mathematics instruction. As can be seen in Table 5.4, Fellows are much more likely than similarly prepared teachers to rate their equipment, consumable supplies, and instructional technology for science instruction as mostly adequate (4 or 5 on a 5-point scale from 1 "not adequate" to 5 "adequate"). Both of these groups were less likely than high school science teachers nationally to rate their facilities highly. In mathematics, the only difference was in the adequacy of manipulatives for instruction; about half of Fellows rated their access to manipulatives as mostly adequate, compared to less than a third of classes taught by matched teachers (see Table 5.5).

Table 5.4 High School Science Classes with Adequate† Resources for Instruction, by Group			
	Percent of Classes		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Equipment (e.g., microscopes, beakers, photogate timers, Bunsen burners)	67 (4.7)	48 (6.0)	60 (1.8)
Consumable supplies (e.g., chemicals, living organisms, batteries)	65 (4.8)	50 (5.9)	59 (1.9)
Facilities (e.g., lab tables, electric outlets, faucets and sinks)	55 (5.0)	53 (5.6)	71 (1.7)
Instructional technology (e.g., calculators, computers, probes/sensors)	54 (4.9)	39 (5.6)	48 (2.2)
†Includes those responding 4 or 5 on a 5-point scale ranging from 1 "not adequate" to 5 "adequate."			

[4]Fellows were also asked about how they used their textbooks/programs in their most recently completed unit. Because few Fellows reported using commercially published textbooks/programs in that unit, these data are not included in this report.

Table 5.5 High School Mathematics Classes with Adequate† Resources for Instruction, by Group			
	Percent of Classes		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Instructional technology (e.g., calculators, computers, probes/sensors)	65 (6.8)	57 (6.2)	69 (1.7)
Measurement tools (e.g., protractors, rulers)	64 (6.9)	64 (6.9)	70 (1.4)
Consumable supplies (e.g., graphing paper, batteries)	59 (7.0)	57 (6.7)	66 (1.7)
Manipulatives (e.g., pattern blocks, algebra tiles)	49 (7.1)	29 (6.0)	43 (1.7)

†Includes those responding 4 or 5 on a 5-point scale ranging from 1 "not adequate" to 5 "adequate."

A composite variable named "Adequacy of Resources for Instruction" was created from these items. Although there are differences on some of the individual items comprising this composite, as a whole, scores are not different between classes taught by Fellows and those taught by matched teachers (see Table 5.6).

Table 5.6 High School Class Mean Scores on the Adequacy of Resources for Instruction Composite, by Group			
	Mean Score		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Science	69 (2.7)	61 (2.7)	68 (0.9)
Mathematics	67 (3.8)	62 (3.2)	70 (0.8)

SUMMARY

Data related to the textbooks and equipment teachers use with their classes offer a glimpse into the learning environment experienced by students of Fellows and other high school students. One key finding is that Fellows' classes are considerably less likely than other high school classes to use published textbooks/programs. For classes taught by Fellows, non-commercially published materials are used a substantial amount of the time. Taken together, these data suggest that Fellows are much more likely than other teachers to create their own instructional materials. In terms of facilities and equipment, classes of Fellows and classes nationally seem to be about equally resourced.

APPENDIX A: 2013 SURVEY OF KNOWLES SCIENCE TEACHING FOUNDATION QUESTIONNAIRES: SCIENCE TEACHER QUESTIONNAIRE

Section A. Science Teacher Background and Opinions

1. How many years have you taught prior to this school year:

	0	1	2	3	4	5	6	7	8	9	10	More than 10
a. Any subject at the K-12 level?												
b. Science at the K-12 level?												
c. At this school, any subject?												

2. At what grade levels do you currently teach science? [Select all that apply.]
   - ☐ 6-8
   - ☐ 9-12
   - ☐ You do not currently teach science

3. Does your school use block scheduling (class periods scheduled to create extended blocks of instructional time) to organize most classes? [Select one.]
   - ☐ Yes
   - ☐ No

4. ***In a typical week***, how many different classes of each of the following do you teach?
   - If you meet with the *same class of students* multiple times per week, count that class only once.
   - If you teach the *same science or engineering course* to multiple classes of students, count each class separately.
   - Select one on each row.

	0	1	2	3	4	5	6	7	8	9	10
Middle School Class (Grades 6-8)											
a. Science (may include some engineering content)											
b. Engineering (may include some science content)											
High School Class (Grades 9-12)											
c. Science (may include some engineering content)											
d. Engineering (may include some science content)											

5. For each high school science class you teach, select the course type and level. Enter the classes in the order that you teach them. For teachers on an alternating day block schedule, please order your classes starting with the first class you teach this week. [Select one course type and level on each row.]

   Use the descriptions below to help identify the course level.

Course Level	Description
Non-college Prep	A course that does not count towards the entrance requirements of a 4-year college. For example: Life Science.
1st Year College Prep, Including Honors	The first course in a discipline that counts towards the entrance requirements of a 4-year college. For example: Biology, Chemistry I.
2nd Year Advanced	A course typically taken after a 1st year college prep course. For example: Anatomy and Physiology, Advanced Chemistry, Physics II. Include Advanced Placement, International Baccalaureate, and concurrent college and high school credit/dual enrollment.

Class	Course Type	Course Level
Your 1st high school science class:		
Your 2nd high school science class:		
Your 3rd high school science class:		
Your 4th high school science class:		
Your 5th high school science class:		
Your 6th high school science class:		
Your 7th high school science class:		
Your 8th high school science class:		
Your 9th high school science class:		
Your 10th high school science class:		

Course Type List	
1	Coordinated or Integrated Science including General Science and Physical Science (Grades 9 - 12)
2	Earth/Space Science (Grades 9 - 12)
3	Life Science/Biology (Grades 9 - 12)
4	Environmental Science/Ecology (Grades 9 - 12)
5	Chemistry (Grades 9 - 12)
6	Physics (Grades 9 - 12)

6. Later in this questionnaire, we will ask you questions about a randomly selected high school science class that you teach. Use the table in the survey invitation email to determine which class to answer about. For your randomly selected high school science class, what is your school's title for this course? ______________________________

7. What type of degree do you have? (With regard to bachelor's degrees, count only areas in which you majored.) [Select all that apply.]

Education

☐ Elementary Education ☐ Mathematics Education

☐ Science Education

☐ Other education, please specify. ____________________

Natural Science/Engineering

☐ Biology/Life Science ☐ Chemistry

☐ Earth/Space Science ☐ Engineering

☐ Environmental Science/Ecology ☐ Physics

☐ Other natural science, please specify. ________________

☐ Other, please specify. ________________________________

8. Did you complete any of the following types of courses at the undergraduate or graduate level (include courses you took in high school for which you received college credit)? [Select one on each row.]

	Yes	No
a. Biology/Life science		
General/introductory biology/life science courses (for example: Biology I, Introduction to Biology)		
Biology/life science courses beyond the general/introductory level		
Biology/life science education courses		
b. Chemistry		
General/introductory chemistry courses (for example: Chemistry I, Introduction to Chemistry)		
Chemistry courses beyond the general/introductory level		
Chemistry education courses		
c. Physics		
General/introductory physics courses (for example: Physics I, Introduction to Physics)		
Physics courses beyond the general/introductory level		
Physics education courses		
d. Earth/Space science		
General/introductory Earth/space science courses (for example: Earth Science I, Introduction to Earth Science)		
Earth/space science courses beyond the general/introductory level		
Earth/space science education courses		
e. Environmental science		
General/introductory environmental science courses (for example: Environmental Science I, Introduction to Environmental Science)		
Environmental science courses beyond the general/introductory level		
Environmental science education courses		
f. Other		
Engineering		
Mathematics		

9. Considering all of your undergraduate and graduate level science courses, approximately what percentage were completed at two-year/community colleges and/or technical schools versus four-year colleges and/or universities? (Please do not include science education courses.) [Enter each response as a whole number (for example: 20) and estimate to the nearest 10 percent.]
   a. Two-year college, community college, and/or technical school _______________
   b. Four-year college and/or university____

10. Which of the following best describes your teacher certification program?
    - ☐ An undergraduate program leading to a bachelor's degree and a teaching credential
    - ☐ A post-baccalaureate credentialing program (no master's degree awarded)
    - ☐ A master's program that also awarded a teaching credential
    - ☐ You did not have any formal teacher preparation

11. When did you **last participate** in professional development (sometimes called in-service education) focused on science or science teaching? (Include attendance at professional meetings, workshops, and conferences, as well as professional learning communities/lesson studies/teacher study groups. **Do not** include formal courses for which you received college credit or time you spent **providing** professional development for other teachers.)
    - ☐ In the last 3 years
    - ☐ 4–6 years ago
    - ☐ 7–10 years ago
    - ☐ More than 10 years ago
    - ☐ Never

Presented only to teachers that answered "In the last 3 years" to Q11

12. In the last 3 years have you... [Select one on each row.]

	Yes	No
a. attended a workshop on science or science teaching?		
b. attended a national, state, or regional science teacher association meeting?		
c. participated in a professional learning community/lesson study/teacher study group focused on science or science teaching?		

13. What is the total amount of time you have spent on professional development in science or science teaching in the last 3 years? (Include attendance at professional meetings, workshops, and conferences, as well as professional learning communities/lesson studies/teacher study groups. Do not include formal courses for which you received college credit or time you spent providing professional development for other teachers.)
    - ☐ Less than 6 hours
    - ☐ 6-15 hours
    - ☐ 16-35 hours
    - ☐ More than 35 hours

Presented only to teachers that answered "In the last 3 years" to Q11

14. About what percentage of your professional development in science or science teaching **in the last 3 years** was sponsored or supported by KSTF?
    - ☐ Less than 25 percent
    - ☐ 25-49 percent
    - ☐ 50-74 percent
    - ☐ 75 percent or more

Presented only to teachers that answered "In the last 3 years" to Q11

15. Thinking about your science-related professional development **in the last 3 years,** to what extent did you have opportunities to engage in science investigations?
    - ☐ Not at all
    - ☐ 2
    - ☐ Somewhat
    - ☐ 4
    - ☐ To a great extent

Presented only to teachers that answered 2-5 in Q15

16. To what extent were these opportunities to engage in science investigations sponsored or supported by KSTF?
    - ☐ Not at all
    - ☐ 2
    - ☐ Somewhat
    - ☐ 4
    - ☐ To a great extent

Presented only to teachers that answered "In the last 3 years" to Q11

17. Thinking about your science-related professional development **in the last 3 years**, to what extent did you have opportunities to examine classroom artifacts (for example: student work samples)?
    - ☐ Not at all
    - ☐ 2
    - ☐ Somewhat
    - ☐ 4
    - ☐ To a great extent

Presented only to teachers that answered 2-5 in Q17

18. To what extent were these opportunities to examine classroom artifacts (for example: student work samples) sponsored or supported by KSTF?
    - ☐ Not at all
    - ☐ 2
    - ☐ Somewhat
    - ☐ 4
    - ☐ To a great extent

Presented only to teachers that answered "In the last 3 years" to Q11

19. Thinking about your science-related professional development **in the last 3 years,** to what extent did you have opportunities to try out what you learned in your classroom ***and*** then talk about it as part of the professional development?

- ☐ Not at all
- ☐ 2
- ☐ Somewhat
- ☐ 4
- ☐ To a great extent

Presented only to teachers that answered 2-5 in Q19

20. To what extent were these opportunities to try out what you learned in your classroom ***and*** then talk about it as part of the professional development sponsored or supported by KSTF?

- ☐ Not at all
- ☐ 2
- ☐ Somewhat
- ☐ 4
- ☐ To a great extent

Presented only to teachers that answered "In the last 3 years" to Q11

21. Thinking about your science-related professional development **in the last 3 years**, to what extent did you work closely with other science teachers from your school?

- ☐ Not at all
- ☐ 2
- ☐ Somewhat
- ☐ 4
- ☐ To a great extent

Presented only to teachers that answered 2-5 in Q21

22. To what extent were these opportunities to work closely with other science teachers from your school sponsored or supported by KSTF?

- ☐ Not at all
- ☐ 2
- ☐ Somewhat
- ☐ 4
- ☐ To a great extent

Presented only to teachers that answered "In the last 3 years" to Q11

23. Thinking about your science-related professional development **in the last 3 years**, to what extent did you work closely with other science teachers who taught the same grade and/or subject whether or not they were from your school?

- ☐ Not at all
- ☐ 2
- ☐ Somewhat
- ☐ 4
- ☐ To a great extent

Presented only to teachers that answered 2-5 in Q23

24. To what extent were these opportunities to work closely with other science teachers who taught the same grade and/or subject whether or not they were from your school sponsored or supported by KSTF?
    - ☐ Not at all
    - ☐ 2
    - ☐ Somewhat
    - ☐ 4
    - ☐ To a great extent

Presented only to teachers that answered "In the last 3 years" to Q11

25. Thinking about your science-related professional development **in the last 3 years,** to what extent did you think the professional development was a waste of your time?
    - ☐ Not at all
    - ☐ 2
    - ☐ Somewhat
    - ☐ 4
    - ☐ To a great extent

Presented only to teachers that answered 2-5 in Q25

26. To what extent were the professional development opportunities that you thought were a waste of your time sponsored or supported by KSTF?
    - ☐ Not at all
    - ☐ 2
    - ☐ Somewhat
    - ☐ 4
    - ☐ To a great extent

27. Did you take a formal course on science or how to teach science for **college credit** in the last three years? (Do not count courses for which you received only Continuing Education Units.)
    - ☐ Yes
    - ☐ No

Presented only to teachers who chose "In the last 3 years" to Q11 or teachers who selected "Yes" to Q27

28. Considering all the opportunities to learn about science or the teaching of science (professional development and coursework) **in the last 3 years**, how much was each of the following emphasized? [Select one on each row.]

	Not at all	2	Somewhat	4	To a great extent
a. Deepening your own science content knowledge					
b. Learning about difficulties that students may have with particular science ideas and procedures					
c. Finding out what students think or already know about the key science ideas prior to instruction on those ideas					
d. Implementing the science textbook/module to be used in your classroom					
e. Planning instruction so students at different levels of achievement can increase their under standing of the ideas targeted in each activity					
f. Monitoring student understanding during science instruction					
g. Providing enrichment experiences for gifted students					
h. Providing alternative science learning experiences for students with special needs					
i. Teaching science to English-language learners					
j. Assessing student understanding at the conclusion of instruction on a topic					

Presented only to teachers who chose "In the last 3 years" to Q11 or teachers who selected "Yes" to Q27

29. Considering all the opportunities to learn about science or the teaching of science (professional development and coursework) **in the last 3 years**, to what extent were the opportunities for each of the following supported by or sponsored by KSTF? [Select one on each row. If you did not have this experience, select NA.]

	Not at all	2	Somewhat	4	To a great extent	NA
a. Deepening your own science content knowledge						
b. Learning about difficulties that students may have with particular science ideas and procedures						
c. Finding out what students think or already know about the key science ideas prior to instruction on those ideas						
d. Implementing the science textbook/module to be used in your classroom						
e. Planning instruction so students at different levels of achievement can increase their under standing of the ideas targeted in each activity						
f. Monitoring student understanding during science instruction						
g. Providing enrichment experiences for gifted students						
h. Providing alternative science learning experiences for students with special needs						
i. Teaching science to English-language learners						
j. Assessing student understanding at the conclusion of instruction on a topic						

Presented only to teachers who chose "In the last 3 years" to Q11 or teachers who selected "Yes" to Q27

30. In **the last 3 years** have you... [Select one on each row.]

	Yes	No
a. received feedback about your science teaching from a mentor/coach **formally assigned** by the school or district/diocese?		
b. served as a **formally-assigned** mentor/coach for science teaching? (Please do not include supervision of student teachers.)		
c. supervised a student teacher in your classroom?		
d. taught in-service workshops on science or science teaching?		
e. led a professional learning community/lesson study/teacher study group focused on science or science teaching?		

31. To what extent did your involvement in KSTF improve your ability to be effective in each of the following roles? [Select one on each row.]

	Not at all	2	Somewhat	4	To a great extent
a. serving as a **formally-assigned** mentor/coach for science teaching? (Please do not include supervision of student teachers.)					
b. supervising a student teacher in your classroom?					
c. teaching in-service workshops on science or science teaching?					
d. leading a professional learning community/ lesson study/teacher study group focused on science or science teaching?					

32. How well prepared do you feel to do each of the following in your science instruction? [Select one on each row.]

	Not adequately prepared	Somewhat prepared	Fairly well prepared	Very well prepared
a. Plan instruction so students at different levels of achievement can increase their under standing of the ideas targeted in each activity				
b. Teach science to students who have learning disabilities				
c. Teach science to students who have physical disabilities				
d. Teach science to English-language learners				
e. Provide enrichment experiences for gifted students				
f. Encourage students' interest in science and/or engineering				
g. Encourage participation of females in science and/or engineering				
h. Encourage participation of racial or ethnic minorities in science and/or engineering				
i. Encourage participation of students from low socioeconomic backgrounds in science and/ or engineering				
j. Manage classroom discipline				

33. To what extent did your involvement with KSTF increase your preparedness to do each of the following in your science instruction? [Select one on each row.]

	Not at all	2	Somewhat	4	To a great extent
a. Plan instruction so students at different levels of achievement can increase their understanding of the ideas targeted in each activity					
b. Teach science to students who have learning disabilities					
c. Teach science to students who have physical disabilities					
d. Teach science to English-language learners					
e. Provide enrichment experiences for gifted students					
f. Encourage students' interest in science and/or engineering					
g. Encourage participation of females in science and/or engineering					
h. Encourage participation of racial or ethnic minorities in science and/or engineering					
i. Encourage participation of students from low socioeconomic backgrounds in science and/or engineering					
j. Manage classroom discipline					

34. Please provide your opinion about each of the following statements. [Select one on each row.]

	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
a. Students learn science best in classes with students of similar abilities.					
b. Inadequacies in students' science background can be overcome by effective teaching.					
c. It is better for science instruction to focus on ideas in depth, even if that means covering fewer topics.					
d. Students should be provided with the purpose for a lesson as it begins.					
e. At the beginning of instruction on a science idea, students should be provided with definitions for new scientific vocabulary that will be used.					
f. Teachers should explain an idea to students before having them consider evidence that relates to the idea.					
g. Most class periods should include some review of previously covered ideas and skills.					
h. Most class periods should provide opportunities for students to share their thinking and reasoning.					
i. Hands-on/laboratory activities should be used primarily to reinforce a science idea that the students have already learned.					
j. Students should be assigned homework most days.					
k. Most class periods should conclude with a summary of the key ideas addressed.					

Section B. Your Science Instruction in Your Randomly Selected Class

The rest of this questionnaire is about your science instruction in your randomly selected high school class. Do not be concerned if this class is not typical of your science instruction.

35. For your randomly selected high school science class, please select the course type.

Class	Course Type
Your randomly selected science class:	

Course Type List	
5	Coordinated or Integrated Science including General Science and Physical Science (Grades 9 - 12)
6	Earth/Space Science (Grades 9 - 12)
7	Life Science/Biology (Grades 9 - 12)
8	Environmental Science/Ecology (Grades 9 - 12)
9	Chemistry (Grades 9 - 12)
10	Physics (Grades 9 - 12)

Teachers saw only the sub-items corresponding to the course type selected in Q35.
All teachers saw 5a, Engineering.

36. Within science many teachers feel better prepared to teach some topics than others. How well prepared do you feel to teach each of the following topics **at the grade level(s) you teach**, whether or not they are currently included in your teaching responsibilities? [Select one on each row.]

	Not adequately prepared	Somewhat prepared	Fairly well prepared	Very well prepared
1. Earth/Space Science				
a. Earth's features and physical processes				
b. The solar system and the universe				
c. Climate and weather				
2. Biology/Life Science				
a. Cell biology				
b. Structures and functions of organisms				
c. Ecology/ecosystems				
d. Genetics				
e. Evolution				
3. Chemistry				
a. Atomic structure				
b. Chemical bonding, equations, nomenclature, and reactions				

	Not adequately prepared	Somewhat prepared	Fairly well prepared	Very well prepared
c. Elements, compounds, and mixtures				
d. The Periodic Table				
e. Properties of solutions				
f. States, classes, and properties of matter				
4. Physics				
a. Forces and motion				
b. Energy transfers, transformations, and conservation				
c. Properties and behaviors of waves				
d. Electricity and magnetism				
e. Modern physics (for example: special relativity)				
5. Other				
a. Engineering (for example: nature of engineering and technology, design processes, analyzing and improving technological systems, interactions between technology and society)				
b. Environmental and resource issues (for example: land and water use, energy resources and consumption, sources and impacts of pollution)				

Teachers saw only the sub-item corresponding to the course type selected in Q35. All teachers saw e, Engineering.

37. To what extent did your involvement with KSTF increase your preparedness to teach each of the following topics **at the grade level(s) you teach**, whether or not they are currently included in your teaching responsibilities? [Select one on each row.]

	Not at all	2	Somewhat	4	To a great extent
a. Earth/Space Science					
b. Biology/Life Science					
c. Chemistry					
d. Physics					
e. Engineering					
f. Environmental and resource issues					

38. On average, how many minutes per week does this class meet? [Enter your response as a whole number (for example: 300).] __________

39. Enter the number of students for each grade represented in this class. [Enter each response as a whole number (for example: 15).]

6th grade	
7th grade	
8th grade	
9th grade	
10th grade	
11th grade	
12th grade	

40. For the students in this class, indicate the number of males and females in this class in each of the following categories of race/ethnicity. [Enter each response as a whole number (for example: 15).]

	Males
a. American Indian or Alaska Native	
b. Asian	
c. Black or African American	
d. Hispanic/Latino	
e. Native Hawaiian or Other Pacific Islander	
f. White	
g. Two or more races	

	Females
a. American Indian or Alaska Native	
b. Asian	
c. Black or African American	
d. Hispanic/Latino	
e. Native Hawaiian or Other Pacific Islander	
f. White	
g. Two or more races	

41. Which of the following best describes the prior science achievement levels of the students in this class relative to other students in this school?
- ☐ Mostly low achievers
- ☐ Mostly average achievers
- ☐ Mostly high achievers
- ☐ A mixture of levels

42. How much control do you have over each of the following aspects of science instruction in this class? [Select one on each row.]

	No Control		Moderate Control		Strong Control
Determining course goals and objectives					
Selecting textbooks/modules					
Selecting content, topics, and skills to be taught					
Selecting teaching techniques					
Determining the amount of homework to be assigned					
Choosing criteria for grading student performance					

43. Think about your plans for this class for the entire course/year. By the end of the course/year, how much emphasis will each of the following student objectives receive? [Select one on each row.]

	None	Minimal emphasis	Moderate emphasis	Heavy emphasis
a. Memorizing science vocabulary and/or facts				
b. Understanding science concepts				
c. Learning science process skills (for example: observing, measuring)				
d. Learning about real-life applications of science				
e. Increasing students' interest in science				
f. Preparing for further study in science				
g. Learning test taking skills/strategies				

44. How often do you do each of the following in your science instruction in this class? [Select one on each row.]

	Never	Rarely (for example: A few times a year)	Some-times (for example: Once or twice a month)	Often (for example: Once or twice a week)	All or almost all science lessons
a. Explain science ideas to the whole class					
b. Engage the whole class in discussions					
c. Have students work in small groups					
d. Do hands-on/laboratory activities					
e. Engage the class in project-based learning (PBL) activities					
f. Have students read from a science textbook, module, or other science-related material in class, either aloud or to themselves					
g. Have students represent and/or analyze data using tables, charts, or graphs					
h. Require students to supply evidence in support of their claims					
i. Have students make formal presentations to the rest of the class (for example: on individual or group projects)					
j. Have students write their reflections (for example: in their journals) in class or for homework					
k. Give tests and/or quizzes that are predominantly short-answer (for example: multiple choice, true /false, fill in the blank)					

	Never	Rarely (for example: A few times a year)	Some-times (for example: Once or twice a month)	Often (for example: Once or twice a week)	All or almost all science lessons
l. Give tests and/or quizzes that include constructed-response/open-ended items					
m. Focus on literacy skills (for example: informational reading or writing strategies)					
n. Have students practice for standardized tests					
o. Have students attend presentations by guest speakers focused on science and/or engineering in the workplace					

45. How often do students use each of the following instructional technologies in this science class? [Select one on each row.]

	Never	Rarely (for example: A few times a year)	Some-times (for example: Once or twice a month)	Often (for example: Once or twice a week)	All or almost all science lessons
a. Personal computers, including laptops					
b. Hand-held computers					
c. Internet					
d. Graphing calculators					
e. Probes for collecting data					
f. Classroom response system or "Clickers"					

46. Which best describes the instructional materials students **most frequently** use in this class?

Mainly commercially published textbook(s)

- ☐ One textbook
- ☐ Multiple textbooks

Mainly commercially published textbook(s)

- ☐ Modules from a single publisher
- ☐ Modules from multiple publishers

Other

- ☐ A roughly equal mix of commercially published textbooks and commercially published modules most of the time
- ☐ Non-commercially published materials most of the time

47. Science courses may benefit from the availability of particular kinds of ***equipment*** (for example: microscopes, beakers, photogate timers, Bunsen burners). How adequate is the ***equipment*** you have available for teaching this science class?

- ☐ Not adequate
- ☐ 2
- ☐ Somewhat adequate
- ☐ 4
- ☐ Adequate

48. Science courses may benefit from the availability of particular kinds of ***instructional technology*** (for example: calculators, computers, probes/sensors). How adequate is the ***instructional technology*** you have available for teaching this science class?

- ☐ Not adequate
- ☐ 2
- ☐ Somewhat adequate
- ☐ 4
- ☐ Adequate

49. Science courses may benefit from the availability of particular kinds of ***consumable supplies*** (for example: chemicals, living organisms, batteries). How adequate are the ***consumable supplies*** you have available for teaching this science class?

- ☐ Not adequate
- ☐ 2
- ☐ Somewhat adequate
- ☐ 4
- ☐ Adequate

50. Science courses may benefit from the availability of particular kinds of ***facilities*** (for example: lab tables, electric outlets, faucets and sinks). How adequate are the ***facilities*** you have available for teaching this science class?

- ☐ Not adequate
- ☐ 2
- ☐ Somewhat adequate
- ☐ 4
- ☐ Adequate

Section C. Your Most Recently Completed Science Unit in Your Randomly Selected Class

The questions in this section are about the most recently completed science unit in your randomly selected class.

- Depending on the structure of your class and the instructional materials you use, a unit may range from a few to many class periods.
- Do not be concerned if this unit was not typical of your instruction.

51. How many class periods were devoted to instruction on the **most recently completed science unit?** [Enter your response as a whole number (for example: 15).] ____________________

52. Which of the following best describes the content of this unit?
- ☐ Earth/Space Science
- ☐ Life Science/Biology
- ☐ Environmental Science/Ecology
- ☐ Chemistry
- ☐ Physics
- ☐ Engineering

53. What science ideas and/or skills were addressed in this unit? ______________________________

54. Was this unit based on a commercially published textbook/module?
- ☐ Yes
- ☐ No

Presented only to people who answered "Yes" to Q54

55. Please indicate the extent to which you used the textbook/module to guide the overall structure and content emphasis of the unit.
- ☐ Not at all
- ☐ 2
- ☐ Somewhat
- ☐ 4
- ☐ To a great extent

Presented only to people who answered "Yes" to Q54

56. Please indicate the extent to which you followed the textbook/module to guide the detailed structure and content emphasis of the unit.
- ☐ Not at all
- ☐ 2
- ☐ Somewhat
- ☐ 4
- ☐ To a great extent

Presented only to people who answered "Yes" to Q54

57. Please indicate the extent to which you picked what is important from the textbook/module and skipped the rest.
- ☐ Not at all
- ☐ 2
- ☐ Somewhat
- ☐ 4
- ☐ To a great extent

Presented only to people who answered "2–5" in Q57

58. During this unit, when you skipped activities (for example: problems, investigations, readings) in your textbook/module, how much was each of the following a factor in your decisions? [Select one on each row.]

	Not a factor	A minor factor	A major factor
a. The science ideas addressed in the activities you skipped are not included in your pacing guide and/or current state standards.			
b. You did not have the materials needed to implement the activities you skipped.			
c. The activities you skipped were too difficult for your students.			
d. Your students already knew the science ideas or were able to learn them without the activities you skipped.			
e. You have different activities for those science ideas that work better than the ones you skipped.			

Presented only to people who answered "Yes" to Q54

59. Please indicate the extent to which you incorporated activities (for example: problems, investigations, readings) from other sources to supplement what the textbook/module was lacking.
   - ☐ Not at all
   - ☐ 2
   - ☐ Somewhat
   - ☐ 4
   - ☐ To a great extent

Presented only to people who answered "2–5" in Q59

60. During this unit, when you supplemented the textbook/module with additional activities, how much was each of the following a factor in your decisions? [Select one on each row.]

	Not a factor	A minor factor	A major factor
a. Your pacing guide indicated that you should use supplemental activities.			
b. Supplemental activities were needed to prepare students for standardized tests.			
c. Supplemental activities were needed to provide students with additional practice.			
d. Supplemental activities were needed so students at different levels of achievement could increase their understanding of the ideas targeted in each activity.			

Present sub-item c to those who answered "Yes" to Q54

61. How well prepared did you feel to do each of the following as part of your instruction on this particular unit? [Select one on each row.]

	Not adequately prepared	Somewhat prepared	Fairly well prepared	Very well prepared
a. Anticipate difficulties that students may have with particular science ideas and procedures in this unit				
b. Find out what students thought or already knew about the key science ideas				
c. Implement the science textbook/module to be used during this unit				
d. Monitor student understanding during this unit				
e. Assess student understanding at the conclusion of this unit				

Present sub-item c to those who answered "Yes" to Q54

62. To what extent did your involvement with KSTF increase your preparedness to do each of the following as part of your instruction on this particular unit? [Select one on each row.]

	Not at all	2	Somewhat	4	To a great extent
a. Anticipate difficulties that students may have with particular science ideas and procedures in this unit					
b. Find out what students thought or already knew about the key science ideas					
c. Implement the science textbook/module to be used during this unit					
d. Monitor student understanding during this unit					
e. Assess student understanding at the conclusion of this unit					

63. Which of the following did you do during this unit? [Select all that apply.]
    - ☐ Administered an assessment, task, or probe at the beginning of the unit to find out what students thought or already knew about the key science ideas
    - ☐ Questioned individual students during class activities to see if they were "getting it"
    - ☐ Used information from informal assessments of the entire class (for example: asking for a show of hands, thumbs up/thumbs down, clickers, exit tickets) to see if students were "getting it"
    - ☐ Reviewed student work (for example: homework, notebooks, journals, portfolios, projects) to see if they were "getting it"
    - ☐ Administered one or more quizzes and/or tests to see if students were "getting it"
    - ☐ Had students use rubrics to examine their own or their classmates' work
    - ☐ Assigned grades to student work (for example: homework, notebooks, journals, portfolios, projects)
    - ☐ Administered one or more quizzes and/or tests to assign grades
    - ☐ Went over the correct answers to assignments, quizzes, and/or tests with the class as a whole

64.

Section D. Your Most Recent Science Lesson in Your Randomly Selected Class

The next three questions refer to the most recent science lesson in your randomly selected class, whether or not that instruction was part of the unit you've just been describing. Do not be concerned if this lesson included activities and/or interruptions that are not typical (for example: a test, students working on projects, a fire drill).

65. How many minutes was that lesson? [Answer for the entire length of the class period, even if there were interruptions.] Enter your response as a non-zero whole number (for example: 50).
____

66. Of these minutes, how many were spent on the following: [Enter each response as a whole number (for example: 15).]
   a. Non-instructional activities (for example: attendance taking, interruptions) _____
   b. Whole class activities (for example: lectures, explanations, discussions)_____
   c. Small group work ____
   d. Students working individually (for example: reading textbooks, completing worksheets, taking a test or quiz) ____

67. Which of the following activities took place during that science lesson? [Select all that apply.]
   - ☐ Teacher explaining a science idea to the whole class
   - ☐ Whole class discussion
   - ☐ Students completing textbook/worksheet problems
   - ☐ Teacher conducting a demonstration while students watched
   - ☐ Students doing hands-on/laboratory activities
   - ☐ Students reading about science
   - ☐ Students using instructional technology
   - ☐ Practicing for standardized tests
   - ☐ Test or quiz
   - ☐ None of the above

Section E. Demographic Information

68. Are you of Hispanic or Latino origin?
   - ☐ Yes
   - ☐ No

69. What is your race? [Select all that apply.]
   - ☐ American Indian or Alaska Native
   - ☐ Asian
   - ☐ Black or African American
   - ☐ Native Hawaiian or Other Pacific Islander
   - ☐ White

70. In what year were you born? [Enter your response as a whole number (for example: 1969). Do not use commas.] ___________

THANK YOU!

2013 SURVEY OF KNOWLES SCIENCE TEACHING FOUNDATION QUESTIONNAIRES: MATHEMATICS TEACHER QUESTIONNAIRE

1. How many years have you taught prior to this school year:

	0	1	2	3	4	5	6	7	8	9	10	More than 10
a. Any subject at the K-12 level?												
b. Mathematics at the K-12 level?												
c. At this school, any subject?												

2. At what grade levels do you currently teach mathematics? [Select all that apply.]
   - ☐ 6-8
   - ☐ 9-12
   - ☐ You do not currently teach mathematics

3. Does your school use block scheduling (class periods scheduled to create extended blocks of instructional time) to organize most classes? [Select one.]
   - ☐ Yes
   - ☐ No

4. In ***a typical week***, how many different mathematics classes do you teach?
   - If you meet with the *same class of students* multiple times per week, count that class only once.
   - If you teach the *same mathematics course* to multiple classes of students, count each class separately.

   Select one on each row.

	0	1	2	3	4	5	6	7	8	9	10
a. Middle School Class (Grades 6-8)											
b. High School Class (Grades 9-12)											

5. For each high school mathematics class you teach, select the course type. Enter the classes in the order that you teach them. For teachers on an alternating day block schedule, please order your classes starting with the first class you teach this week. Use the table below to help identify the course type. [Select one course type on each row.]

Course Level	Description
Non-college prep mathematics courses	Developmental Math; High School Arithmetic; Remedial Math; General Math; Vocational Math; Consumer Math; Basic Math; Business Math; Career Math; Practical Math; Essential Math; Pre-Algebra; Introductory Algebra; Algebra 1 Part 1; Algebra 1A; Math A; Basic Geometry; Informal Geometry; Practical Geometry
Formal/College-prep Mathematics Level 1 courses	Algebra 1; Integrated Math 1; Unified Math I; Algebra 1 Part 2; Algebra 1B; Math B
Formal/College-prep Mathematics Level 2 courses	Geometry; Plane Geometry; Solid Geometry; Integrated Math 2; Unified Math II; Math C
Formal/College-prep Mathematics Level 3 courses	Algebra 2; Intermediate Algebra; Algebra and Trigonometry; Advanced Algebra; Integrated Math 3; Unified Math III
Formal/College-prep Mathematics Level 4 courses	Algebra 3; Trigonometry; Pre-Calculus; Analytic/Advanced Geometry; Elementary Functions; Integrated Math 4; Unified Math IV; Calculus (not including college level/AP); any other College Prep Senior Math with Algebra 2 as a prerequisite
Mathematics courses that might qualify for college credit	Advanced Placement Calculus (AB, BC); Advanced Placement Statistics; IB Mathematics standard level; IB Mathematics higher level; concurrent college and high school credit/dual enrollment

Class	Course Type
Your 1st high school mathematics class:	
Your 2nd high school mathematics class:	
Your 3rd high school mathematics class:	
Your 4th high school mathematics class:	
Your 5th high school mathematics class:	
Your 6th high school mathematics class:	
Your 7th high school mathematics class:	
Your 8th high school mathematics class:	
Your 9th high school mathematics class:	
Your 10th high school science class:	

Course Type List	
1	Non-college prep mathematics course (Grades 9 - 12)
2	Formal/College-prep Mathematics Level 1 course (Grades 9 - 12)
3	Formal/College-prep Mathematics Level 2 course (Grades 9 - 12)
4	Formal/College-prep Mathematics Level 3 course (Grades 9 - 12)
5	Formal/College-prep Mathematics Level 4 course (Grades 9 - 12)
6	Mathematics course that might qualify for college credit (Grades 9 - 12)

6. Later in this questionnaire, we will ask you questions about a randomly selected high school mathematics class that you teach. Use the table in the survey invitation email to determine which class to answer about. For your randomly selected mathematics class, what is your school's title for this course? ______________________________

7. Have you been awarded one or more bachelor's and/or graduate degrees in the following fields? (With regard to bachelor's degrees, count only areas in which you majored.) [Select one on each row.]

	Yes	No
a. Education, including mathematics education		
b. Mathematics		
c. Computer Science		
d. Engineering		
e. Other, please specify.______________		

Presented only to teachers that answered "Yes" to Q7a

8. What type of education degree do you have? (With regard to bachelor's degrees, count only areas in which you majored.) [Select all that apply.]
   - ☐ Elementary Education
   - ☐ Mathematics Education
   - ☐ Science Education
   - ☐ Other Education, please specify. ______________

9. For each of the following areas, have you taken any courses at the undergraduate or graduate level (include courses you took in high school for which you received college credit)?

	Yes	No
a. Mathematics content for elementary school teachers		
b. Mathematics content for middle school teachers		
c. Mathematics content for high school teachers		
d. Integrated mathematics (a single course that addresses content across ***multiple*** mathematics subjects, such as algebra and geometry)		
e. College algebra/trigonometry/functions		
f. Abstract algebra (for example: groups, rings, ideals, fields)		
g. Linear algebra (for example: vectors, matrices, eigenvalues)		
h. Calculus		
i. Advanced calculus		
j. Real analysis		
k. Differential equations		
l. Analytic/Coordinate Geometry (for example: transformations or isometries, conic sections)		
m. Axiomatic Geometry (Euclidean or non-Euclidean)		
n. Probability		
o. Statistics		

	Yes	No
p. Number theory (for example: divisibility theorems, properties of prime numbers)		
q. Discrete mathematics (for example: combinatorics, graph theory, game theory)		
r. Other upper division mathematics		

10. For each of the following areas, have you taken any courses at the undergraduate or graduate level (include courses you took in high school for which you received college credit)?

	Yes	No
a. Computer science		
b. Engineering		
c. Science		

11. Considering all of your undergraduate and graduate level mathematics courses, approximately what percentage were completed at two-year/community colleges and/or technical schools versus four-year colleges and/or universities? (Please do not include mathematics education courses.) [Enter each response as a whole number (for example: 20) and estimate to the nearest 10 percent.]
 a. Two-year college, community college, and/or technical school ________
 b. Four-year college and/or university ________

12. Which of the following best describes your teacher certification program?
 - ☐ An undergraduate program leading to a bachelor's degree and a teaching credential
 - ☐ A post-baccalaureate credentialing program (no master's degree awarded)
 - ☐ A master's program that also awarded a teaching credential
 - ☐ You do not have any formal teacher preparation

13. When did you **last participate** in professional development (sometimes called in-service education) focused on mathematics or mathematics teaching? (Include attendance at professional meetings, workshops, and conferences, as well as professional learning communities/lesson studies/teacher study groups. **Do not** include formal courses for which you received college credit or time spent **providing** professional development for other teachers.)
 - ☐ In the last 3 years
 - ☐ 4–6 years ago
 - ☐ 7–10 years ago
 - ☐ More than 10 years ago
 - ☐ Never

Presented only to teachers that answered "In the last 3 years" to Q11

14. In **the last 3 years** have you... [Select one on each row.]

	Yes	No
a. attended a workshop on mathematics or mathematics teaching?		
b. attended a national, state, or regional mathematics teacher association meeting?		
c. participated in a professional learning community/lesson study/ teacher study group focused on mathematics or mathematics teaching?		

Presented only to teachers that answered "In the last 3 years" to Q13

15. What is the **total** amount of time you have spent on professional development in mathematics or mathematics teaching **in the last 3 years?** (Include attendance at professional meetings, workshops, and conferences, as well as professional learning communities/lesson studies/ teacher study groups. **Do not** include formal courses for which you received college credit or time spent **providing** professional development for other teachers.)
    - ☐ Less than 6 hours
    - ☐ 6-15 hours
    - ☐ 16-35 hours
    - ☐ More than 35 hours

Presented only to teachers that answered "In the last 3 years" to Q13

16. About what percentage of your professional development in mathematics or mathematics teaching **in the last 3 years** were sponsored or supported by KSTF?
    - ☐ Less than 25 percent
    - ☐ 25-49 percent
    - ☐ 50-74 percent
    - ☐ 75 percent or more

Presented only to teachers that answered "In the last 3 years" to Q13

17. Thinking about your mathematics-related professional development **in the last 3 years**, to what extent did you have opportunities to engage in mathematics investigations?
    - ☐ Not at all
    - ☐ 2
    - ☐ Somewhat
    - ☐ 4
    - ☐ To a great extent

Presented only to teachers that answered 2-5 in Q17

18. To what extent were these opportunities to engage in mathematics investigations sponsored or supported by KSTF?
    - ☐ Not at all
    - ☐ 2
    - ☐ Somewhat
    - ☐ 4
    - ☐ To a great extent

Presented only to teachers that answered "In the last 3 years" to Q13

19. Thinking about your mathematics-related professional development **in the last 3 years**, to what extent did you have opportunities to examine classroom artifacts (for example: student work samples)?
    - ☐ Not at all
    - ☐ 2
    - ☐ Somewhat
    - ☐ 4
    - ☐ To a great extent

Presented only to teachers that answered 2-5 in Q19

20. To what extent were these opportunities to examine classroom artifacts (for example: student work samples) sponsored or supported by KSTF?
    - ☐ Not at all
    - ☐ 2
    - ☐ Somewhat
    - ☐ 4
    - ☐ To a great extent

Presented only to teachers that answered "In the last 3 years" to Q13

21. Thinking about your mathematics-related professional development **in the last 3 years**, to what extent did you have opportunities to try out what you learned in your classroom ***and*** then talk about it as part of the professional development?
    - ☐ Not at all
    - ☐ 2
    - ☐ Somewhat
    - ☐ 4
    - ☐ To a great extent

Presented only to teachers that answered 2-5 in Q21

22. To what extent were these opportunities to try out what you learned in your classroom ***and*** then talk about it as part of the professional development sponsored or supported by KSTF?
    - ☐ Not at all
    - ☐ 2
    - ☐ Somewhat
    - ☐ 4
    - ☐ To a great extent

Presented only to teachers that answered "In the last 3 years" to Q13

23. Thinking about your mathematics-related professional development **in the last 3 years**, to what extent did you work closely with other mathematics teachers from your school?
    - ☐ Not at all
    - ☐ 2
    - ☐ Somewhat
    - ☐ 4
    - ☐ To a great exten

Presented only to teachers that answered 2-5 in Q23

24. To what extent were these opportunities to work closely with other mathematics teachers from your school sponsored or supported by KSTF?
    - ☐ Not at all
    - ☐ 2
    - ☐ Somewhat
    - ☐ 4
    - ☐ To a great extent

Presented only to teachers that answered "In the last 3 years" to Q13

25. Thinking about your mathematics-related professional development **in the last 3 years**, to what extent did you work closely with other mathematics teachers who taught the same grade and/or subject whether or not they were from your school?
    - ☐ Not at all
    - ☐ 2
    - ☐ Somewhat
    - ☐ 4
    - ☐ To a great extent

Presented only to teachers that answered 2-5 in Q25

26. To what extent were these opportunities to work closely with other mathematics teachers who taught the same grade and/or subject whether or not they were from your school sponsored or supported by KSTF?
    - ☐ Not at all
    - ☐ 2
    - ☐ Somewhat
    - ☐ 4
    - ☐ To a great extent

Presented only to teachers that answered "In the last 3 years" to Q13

27. Thinking about your mathematics-related professional development **in the last 3 years**, to what extent did you think the professional development was a waste of your time?
    - ☐ Not at all
    - ☐ 2
    - ☐ Somewhat
    - ☐ 4
    - ☐ To a great extent

Presented only to teachers that answered 2-5 in Q27

28. To what extent were the professional development opportunities that you thought were a waste of your time sponsored or supported by KSTF?
    - ☐ Not at all
    - ☐ 2
    - ☐ Somewhat
    - ☐ 4
    - ☐ To a great extent

29. Did you take a formal course on mathematics or how to teach mathematics for **college credit** in the last three years? (Do not count courses for which you received only Continuing Education Units.)

- ☐ Yes
- ☐ No

Presented only to teachers who chose "In the last 3 years" to Q13 or teachers who selected "Yes" to Q29

30. Considering all the opportunities to learn about mathematics or the teaching of mathematics (professional development and coursework) **in the last 3 years**, how much was each of the following emphasized? [Select one on each row.]

	Not at all	2	Somewhat	4	To a great extent
a. Deepening your own mathematics content knowledge					
b. Learning how to use hands-on activities/ manipulatives for mathematics instruction					
c. Learning about difficulties that students may have with particular mathematical ideas and procedures					
d. Finding out what students think or already know about the key mathematical ideas prior to instruction on those ideas					
e. Implementing the mathematics textbook/ program to be used in your classroom					
f. Planning instruction so students at different levels of achievement can increase their understanding of the ideas targeted in each activity					
g. Monitoring student understanding during mathematics instruction					
h. Providing enrichment experiences for gifted students					
i. Providing alternative mathematics learning experiences for students with special needs					
j. Teaching mathematics to English-language learners					
k. Assessing student understanding at the conclusion of instruction on a topic					

Presented only to teachers who chose "In the last 3 years" to Q13 or teachers who selected "Yes" to Q29

31. Considering all the opportunities to learn about mathematics or the teaching of mathematics (professional development and coursework) **in the last 3 years**, to what extent were the opportunities for each of the following supported by or sponsored by KSTF? [Select one on each row. If you did not have this experience, select NA.]

	Not at all	2	Somewhat	4	To a great extent	N/A
a. Deepening your own mathematics content knowledge						
b. Learning how to use hands-on activities/ manipulatives for mathematics instruction						
c. Learning about difficulties that students may have with particular mathematical ideas and procedures						
d. Finding out what students think or already know about the key mathematical ideas prior to instruction on those ideas						
e. Implementing the mathematics textbook/ program to be used in your classroom						
f. Planning instruction so students at different levels of achievement can increase their understanding of the ideas targeted in each activity						
g. Monitoring student understanding during mathematics instruction						
h. Providing enrichment experiences for gifted students						
i. Providing alternative mathematics learning experiences for students with special needs						
j. Teaching mathematics to English-language learners						
k. Assessing student understanding at the conclusion of instruction on a topic						

Presented only to teachers who chose "In the last 3 years" to Q13 or teachers who selected "Yes" to Q29

32. In **the last 3 years** have you... [Select one on each row.]

	Yes	No
a. received feedback about your mathematics teaching from a mentor/coach **formally assigned** by the school or district/ diocese?		
b. served as a **formally assigned** mentor/coach for mathematics teaching? (Please do not include supervision of student teachers.)		
c. supervised a student teacher in your classroom?		
d. taught in-service workshops on mathematics or mathematics teaching ?		
e. led a professional learning community/lesson study/teacher study group focused on mathematics or mathematics teaching?		

33. To what extent did your involvement in KSTF improve your ability to be effective in each of the following roles? [Select one on each row.]

	Not at all	2	Somewhat	4	To a great extent
a. serving as a **formally assigned** mentor/coach for mathematics teaching? (Please do not include supervision of student teachers.)					
b. supervising a student teacher in your classroom?					
c. teaching in-service workshops on mathematics or mathematics teaching ?					
d. leading a professional learning community/ lesson study/teacher study group focused on mathematics or mathematics teaching?					

34. Within mathematics many teachers feel better prepared to teach some topics than others. How prepared do you feel to teach each of the following topics **at the grade level(s) you teach**, whether or not they are currently included in your curriculum? [Select one on each row.]

	Not at all	2	Somewhat	4	To a great extent
a. The number system and operations					
b. Algebraic thinking					
c. Functions					
d. Modeling					
e. Measurement					
f. Geometry					
g. Statistics and probability					
h. Discrete mathematics					

35. To what extent did your involvement with KSTF increase your preparedness to teach each of the following topics **at the grade level(s) you teach**, whether or not they are currently included in your teaching responsibilities? [Select one on each row.]

	Not adequately prepared	Somewhat prepared	Fairly well prepared	Very well prepared
a. The number system and operations				
b. Algebraic thinking				
c. Functions				
d. Modeling				
e. Measurement				
f. Geometry				
g. Statistics and probability				
h. Discrete mathematics				

36. How well prepared do you feel to do each of the following in your mathematics instruction? [Select one on each row.]

	Not adequately prepared	Somewhat prepared	Fairly well prepared	Very well prepared
a. Plan instruction so students at different levels of achievement can increase their understanding of the ideas targeted in each activity				
b. Teach mathematics to students who have learning disabilities				
c. Teach mathematics to students who have physical disabilities				
d. Teach mathematics to English-language learners				
e. Provide enrichment opportunities for gifted students				
f. Encourage students' interest in mathematics				
g. Encourage participation of females in mathematics				
h. Encourage participation of racial or ethnic minorities in mathematics				
i. Encourage participation of students from low socioeconomic backgrounds in mathematics				
j. Manage classroom discipline				

37. To what extent did your involvement with KSTF increase your preparedness to do each of the following in your mathematics instruction? [Select one on each row.]

	Not at all	2	Somewhat	4	To a great extent
a. Plan instruction so students at different levels of achievement can increase their understanding of the ideas targeted in each activity					
b. Teach mathematics to students who have learning disabilities					
c. Teach mathematics to students who have physical disabilities					
d. Teach mathematics to English-language learners					
e. Provide enrichment opportunities for gifted students					
f. Encourage students' interest in mathematics					
g. Encourage participation of females in mathematics					
h. Encourage participation of racial or ethnic minorities in mathematics					
i. Encourage participation of students from low socioeconomic backgrounds in mathematics					
j. Manage classroom discipline					

38. Please provide your opinion about each of the following statements. [Select one on each row.]

	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
a. Students learn mathematics best in classes with students of similar abilities.					
b. Inadequacies in students' mathematics background can be overcome by effective teaching.					
c. It is better for mathematics instruction to focus on ideas in depth, even if that means covering fewer topics.					
d. Students should be provided with the purpose for a lesson as it begins.					
e. At the beginning of instruction on a mathematical idea, students should be provided with definitions for new vocabulary that will be used.					
f. Teachers should explain an idea to students before having them investigate the idea.					
g. Most class periods should include some review of previously covered ideas and skills.					
h. Most class periods should provide opportunities for students to share their thinking and reasoning.					
i. Hands-on activities/manipulatives should be used primarily to reinforce a mathematical idea that the students have already learned.					
j. Students should be assigned homework most days.					
k. Most class periods should conclude with a summary of the key ideas addressed.					

<u>Section B. Your Mathematics Instruction in Your Randomly Selected Class</u>

The rest of this questionnaire is about your mathematics instruction in your randomly selected high school class. Do not be concerned if this class is not typical of your mathematics instruction.

39. On average, how many minutes per week does this class meet? [Enter your response as a whole number (for example: 300).] __________

40. Enter the number of students for each grade represented in this class. [Enter each response as a whole number (for example: 15).]

6th grade		10th grade	
7th grade		11th grade	
8th grade		12th grade	
9th grade			

41. For the students in this class, indicate the number of males and females in each of the following categories of race/ethnicity. [Enter each response as a whole number (for example: 15).]

	Females
a. American Indian or Alaska Native	
b. Asian	
c. Black or African American	
d. Hispanic/Latino	
e. Native Hawaiian or Other Pacific Islander	
f. White	
g. Two or more races	

	Males
a. American Indian or Alaska Native	
b. Asian	
c. Black or African American	
d. Hispanic/Latino	
e. Native Hawaiian or Other Pacific Islander	
f. White	
g. Two or more races	

42. Which of the following best describes the prior mathematics achievement levels of the students in this class relative to other students in this school?

- ☐ Mostly low achievers
- ☐ Mostly average achievers
- ☐ Mostly high achievers
- ☐ A mixture of levels

43. How much control do you have over each of the following aspects of mathematics instruction in this class? [Select one on each row.]

	No Control	2	Moderate Control	4	Strong Control
a. Determining course goals and objectives					
b. Selecting textbooks/programs					
c. Selecting content, topics, and skills to be taught					
d. Selecting teaching techniques					
e. Determining the amount of homework to be assigned					
f. Choosing criteria for grading student performance					

44. Think about your plans for this class for the entire course/year. By the end of the course/year, how much emphasis will each of the following student objectives receive? [Select one on each row.]

	None	Minimal emphasis	Moderate emphasis	Heavy emphasis
a. Learning mathematical procedures and/or algorithms				
b. Learning to perform computations with speed and accuracy				
c. Understanding mathematical ideas				
d. Learning mathematical practices (for example: considering how to approach a problem, justifying solutions)				

	None	Minimal emphasis	Moderate emphasis	Heavy emphasis
e. Learning about real-life applications of mathematics				
f. Increasing students' interest in mathematics				
g. Preparing for further study in mathematics				
h. Learning test taking skills/strategies				

45. How often do you do each of the following in your mathematics instruction in this class? [Select one on each row.]

	Never	Rarely (for example: A few times a year)	Sometimes (for example: Once or twice a month)	Often (for example: Once or twice a week)	All or almost all mathematics lessons
a. Explain mathematical ideas to the whole class					
b. Engage the whole class in discussions					
c. Have students work in small groups					
d. Provide manipulatives for students to use in problem-solving/investigations					
e. Have students read from a mathematics textbook/program or other mathematics-related material in class, either aloud or to themselves					
f. Have students consider multiple representations in solving a problem (for example: numbers, tables, graphs, pictures)					
g. Have students explain and justify their method for solving a problem					
h. Have students compare and contrast different methods for solving a problem					
i. Have students develop mathematical proofs					
j. Have students present their solution strategies to the rest of the class					
k. Have students write their reflections (for example: in their journals) in class or for homework					
l. Give tests and/or quizzes that are predominantly short-answer (for example: multiple choice, true/false, fill in the blank)					
m. Give tests and/or quizzes that include constructed-response/open-ended items					
n. Focus on literacy skills (for example: informational reading or writing strategies)					
o. Have students practice for standardized tests					
p. Have students attend presentations by guest speakers focused on mathematics in the workplace					

46. How often do students use each of the following instructional technologies in this mathematics class? [Select one on each row.]

	Never	Rarely (for example: A few times a year)	Some-times (for example: Once or twice a month)	Often (for example: Once or twice a week)	All or almost all math-ematics lessons
a. Personal computers, including laptops					
b. Hand-held computers					
c. Internet					
d. Four-function calculators					
e. Scientific calculators					
f. Graphing calculators					
g. Probes for collecting data					
h. Classroom response system or "Clickers"					

47. Which best describes the instructional materials students **most frequently** use in this class?

- ☐ One commercially published textbook or program most of the time
- ☐ Multiple commercially published textbooks/programs most of the time
- ☐ Non-commercially published instructional materials most of the time

48. Mathematics courses may benefit from the availability of particular resources. Considering what you have available, how adequate is each of the following for teaching this mathematics class? [Select one on each row.]

	Not Adequate	2	Somewhat Adequate	4	Adequate
a. Instructional technology (for example: calculators, computers, probes/sensors)					
b. Measurement tools (for example: protractors, rulers)					
c. Manipulatives (for example: pattern blocks, algebra tiles)					
d. Consumable supplies (for example: graphing paper, batteries)					

Section C. Your Most Recently Completed Mathematics Unit in Your Randomly Selected Class

The questions in this section are about the most recently completed mathematics unit your randomly selected class.

- Depending on the structure of your class and the instructional materials you use, a unit may range from a few to many class periods.
- Do not be concerned if this unit was not typical of your instruction.

49. How many class periods were devoted to instruction on the **most recently completed mathematics unit?** [Enter your response as a whole number (for example: 15).] ____________

50. Which of the following best describes the content focus of this unit?

- ☐ Number and Operations
- ☐ Measurement and Data Representation
- ☐ Algebra
- ☐ Geometry
- ☐ Probability
- ☐ Statistics
- ☐ Trigonometry
- ☐ Calculus

51. What mathematical ideas and/or skills were addressed in this unit?______________________

52. Was this unit based on a commercially published textbook/program?

- ☐ Yes
- ☐ No

Presented only to people who answered "Yes" to Q52

53. Please indicate the extent to which you used the textbook/program to guide the overall structure and content emphasis of the unit.

- ☐ Not at all
- ☐ 2
- ☐ Somewhat
- ☐ 4
- ☐ To a great extent

Presented only to people who answered "Yes" to Q52

54. Please indicate the extent to which you followed the textbook/program to guide the detailed structure and content emphasis of the unit.

- ☐ Not at all
- ☐ 2
- ☐ Somewhat
- ☐ 4
- ☐ To a great extent

Presented only to people who answered "Yes" to Q52

55. Please indicate the extent to which you picked what is important from the textbook/program and skipped the rest.

- ☐ Not at all
- ☐ 2
- ☐ Somewhat
- ☐ 4
- ☐ To a great extent

Presented only to people who answered "2–5" in Q55

56. During this unit, when you skipped activities (for example: problems, investigations, readings) in your textbook/program, how much was each of the following a factor in your decisions? [Select one on each row.]

	Not a factor	A minor factor	A major factor
a. The mathematical ideas addressed in the activities you skipped are not included in your pacing guide and/or current state standards.			
b. You did not have the materials needed to implement the activities you skipped.			
c. The activities you skipped were too difficult for your students.			
d. Your students already knew the mathematical ideas or were able to learn them without the activities you skipped.			
e. You have different activities for those mathematical ideas that work better than the ones you skipped.			

Presented only to people who answered "Yes" to Q52

57. Please indicate the extent to which you incorporated activities (for example: problems, investigations, readings) from other sources to supplement what the textbook/program was lacking.

- ☐ Not at all
- ☐ 2
- ☐ Somewhat
- ☐ 4
- ☐ To a great extent

Presented only to people who answered "2–5" in Q57

58. During this unit, when you supplemented the textbook/program with additional activities, how much was each of the following a factor in your decisions? [Select one on each row.]

	Not a factor	A minor factor	A major factor
a. Your pacing guide indicated that you should use supplemental activities.			
b. Supplemental activities were needed to prepare students for standardized tests.			
c. Supplemental activities were needed to provide students with additional practice.			
d. Supplemental activities were needed so students at different levels of achievement could increase their understanding of the ideas targeted in each activity.			

Present sub-item c to those who answered "Yes" to Q52.

59. How well prepared did you feel to do each of the following as part of your instruction on this particular unit? [Select one on each row.]

	Not adequately prepared	Somewhat prepared	Fairly well prepared	Very well prepared
a. Anticipate difficulties that students will have with particular mathematical ideas and procedures in this unit				
b. Find out what students thought or already knew about the key mathematical ideas				
c. Implement the mathematics textbook/ program to be used during this unit				
d. Monitor student understanding during this unit				
e. Assess student understanding at the conclusion of this unit				

Present sub-item c to those who answered "Yes" to Q52

60. To what extent did your involvement with KSTF increase your preparedness to do each of the following as part of your instruction on this particular unit? [Select one on each row.]

	Not at all	2	Somewhat	4	To a great extent
a. Anticipate difficulties that students will have with particular mathematical ideas and procedures in this unit					
b. Find out what students thought or already knew about the key mathematical ideas					
c. Implement the mathematics textbook/ program to be used during this unit					
d. Monitor student understanding during this unit					
e. Assess student understanding at conclusion of this unit					

61. Which of the following did you do during this unit? [Select all that apply.]

- ☐ Administered an assessment, task, or probe at the beginning of the unit to find out what students thought or already knew about the key mathematical ideas
- ☐ Questioned individual students during class activities to see if they were "getting it"
- ☐ Used information from informal assessments of the entire class (for example: asking for a show of hands, thumbs up/thumbs down, clickers, exit tickets) to see if students were "getting it"
- ☐ Reviewed student work (for example: homework, notebooks, journals, portfolios, projects) to see if they were "getting it"
- ☐ Administered one or more quizzes and/or tests to see if students were "getting it"
- ☐ Had students use rubrics to examine their own or their classmates' work
- ☐ Assigned grades to student work (for example: homework, notebooks, journals, portfolios, projects)
- ☐ Administered one or more quizzes and/or tests to assign grades
- ☐ Went over the correct answers to assignments, quizzes, and/or tests with the class as a whole

Section D. Your Most Recent Mathematics Lesson in Your Randomly Selected Class

The next three questions refer to the most recent mathematics lesson your randomly selected class, whether or not that instruction was part of the unit you've just been describing. Do not be concerned if this lesson included activities and/or interruptions that are not typical (for example: a test, students working on projects, a fire drill).

62. How many minutes was that lesson? [Answer for the entire length of the class period, even if there were interruptions.] Enter your response as a non-zero whole number (for example: 50).
____

63. Of these minutes, how many were spent on the following: [Enter each response as a whole number (for example: 15).]
    a. Non-instructional activities (for example: attendance taking, interruptions) _____
    b. Whole class activities (for example: lectures, explanations, discussions) _____
    c. Small group work ____
    d. Students working individually (for example: reading textbooks, completing worksheets, taking a test or quiz) ____

64. Which of the following activities took place during that mathematics lesson? [Select all that apply.]
    - ☐ Teacher explaining a mathematical idea to the whole class
    - ☐ Whole class discussion
    - ☐ Students completing textbook/worksheet problems
    - ☐ Teacher conducting a demonstration while students watched
    - ☐ Students doing hands-on/manipulative activities
    - ☐ Students reading about mathematics
    - ☐ Students using instructional technology
    - ☐ Practicing for standardized tests
    - ☐ Test or quiz
    - ☐ None of the above

Section E. Demographic Information

65. Are you of Hispanic or Latino origin?
    - ☐ Yes
    - ☐ No

66. What is your race? [Select all that apply.]
    - ☐ American Indian or Alaska Native
    - ☐ Asian
    - ☐ Black or African American
    - ☐ Native Hawaiian or Other Pacific Islander
    - ☐ White

67. In what year were you born? [Enter your response as a whole number (for example: 1969). Do not use commas.] ___________

THANK YOU!

APPENDIX B
DESCRIPTION OF SELECTION STRATEGY FOR MATCHED TEACHERS COMPARISON GROUP

In order to compare the KSTF Fellows to teachers similar in terms of teaching experience, college degrees, and certification, propensity score matching was used to identify a comparison group. Propensity score matching[5] is a two-stage statistical technique. First, the probability of being a KSTF Fellow was estimated based on a set of observed characteristics (Table B-1 shows the list of variables used for this study), resulting in propensity score for each individual. Second, using the generated scores, a teacher from the national pool was selected based upon how closely his/her score matches the score of a KSTF Fellow. This study used a 2:1 without replacement matching process, meaning that two teachers from the national pool were selected for each KSTF Fellow such that the total number of teachers in the resulting comparison group is twice the number of KSTF Fellows. Although increasing the number of cases selected for the comparison group may result in a lower quality match, it increases the statistical power of comparisons—the ability to detect differences between KSTF Fellows and other teachers, should actual differences exist.

Table B-1
Matching Characteristics

Science	Mathematics
Teaching Experience Years of K–12 teaching experience	**Teaching Experience** Years of K–12 teaching experience
Path to Teaching Certification An undergraduate program leading to a bachelor's degree and a teaching credential A post-baccalaureate credentialing program (no master's degree awarded) A master's program that also awarded a teaching credential You did not have any formal teacher preparation	**Path to Teaching Certification** An undergraduate program leading to a bachelor's degree and a teaching credential A post-baccalaureate credentialing program (no master's degree awarded) A master's program that also awarded a teaching credential You did not have any formal teacher preparation
College Degree Biology/Life Science Chemistry Earth/Space Science Environmental Science/Ecology Physics Science Education Elementary, Mathematics, or Other Education Other natural science	**College Degree** Mathematics Computer Science Engineering Mathematics Education Elementary, Science, or Other Education Other

Tables B-2, B-3, and B-4 show descriptive statistics on the factors used in the matching process for the KSTF Fellows, matched teachers, and teachers nationally. Overall, the matched teachers are more similar to KSTF Fellows on these factors than teachers nationally. In science, the matched teachers more closely resemble KSTF Fellows than teachers nationally on 11 of the 14 factors; differences on the other 3 factors are relatively small. In mathematics, matched teachers are more similar to the KSTF Fellows than teachers nationally on all 11 of the characteristics.

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[5]Rosenbaum, P. R. and Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. Biometrica, 70(1), 41–55.

Table B-2
Matching Characteristics: Years of K–12 Teaching Experience, by Group

	KSTF Fellows		Matched Teachers		Teachers Nationally	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Science	3.01	2.73	5.72	9.04	12.68	9.50
Mathematics	2.88	2.18	3.80	3.45	14.27	10.27

Table B-3
Matching Characteristics: Paths to Certification, by Group

	Percent of Teachers		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Science			
An undergraduate program leading to a bachelor's degree and a teaching credential	12	18	34
A post-baccalaureate credentialing program (no master's degree awarded)	11	20	30
A master's program that also awarded a teaching credential	78	56	28
No formal teacher preparation	0	5	8
Mathematics			
An undergraduate program leading to a bachelor's degree and a teaching credential	12	24	48
A post-baccalaureate credentialing program (no master's degree awarded)	0	10	20
A master's program that also awarded a teaching credential	88	65	22
No formal teacher preparation	0	1	10

Table B-4
Matching Characteristics: College Degrees, by Group

	Percent of Teachers		
	KSTF Fellows	Matched Teachers	Teachers Nationally
Science			
Biology/Life Science	39	41	34
Chemistry	24	19	17
Earth/Space Science	7	6	4
Engineering	9	11	6
Environmental Science/Ecology	4	5	3
Physics	25	13	7
Science Education	70	53	48
Elementary, Mathematics, or Other Education	19	23	23
Other natural science	9	12	9
Mathematics			
Mathematics	82	73	52
Computer Science	2	3	5
Engineering	8	7	4
Mathematics Education	74	64	54
Elementary, Science, or Other Education	15	21	23
Other	29	31	36

APPENDIX C
DESCRIPTION OF COMPOSITES

Overview of Composites

Each composite is calculated by summing the responses to the items associated with that composite and then dividing by the total points possible. In order for the composites to be on a 100-point scale, the lowest response option on each scale was set to 0 and the others were adjusted accordingly; for example, an item with a scale ranging from 1 to 4 was re-coded to have a scale of 0 to 3. By doing this, someone who marks the lowest point on every item in a composite receives a composite score of 0 rather than a positive number. It also assures that 50 is the true mid-point. The denominator for each composite is determined by computing the maximum possible sum of responses for a series of items and dividing by 100; e.g., a 9-item composite where each item is on a scale of 0–3 would have a denominator of 0.27. Composite values were not computed for participants who responded to less than two-thirds of the items that form the composite. Support for the validity and reliability of the composites can be found in Appendix E of the 2012 NSSME report.

Definitions of Composites

Composite definitions for the science and mathematics teacher questionnaire are presented below along with the item numbers from the respective questionnaires and Cronbach's Coefficient Alpha (a measure of reliability) for the responding KSTF Fellows. Composites that are identical for the two subjects are presented in the same table; composites unique to a subject are presented in separate tables.

Teacher Background and Opinions

These composites estimate the extent to which teachers feel prepared in both science and mathematics content and pedagogy.

Table C-1
Quality of Professional Development†

	Science	Mathematics
You had opportunities to engage in science investigations‡	Q15	
You had opportunities to engage in mathematics investigations‡		Q17
You had opportunities to examine classroom artifacts (e.g., student work samples)	Q17	Q19
You had opportunities to try out what you learned in your classroom and then talk about it as part of the professional development	Q19	Q21
You worked closely with other science teachers from your school‡	Q21	
You worked closely with other mathematics teachers from your school‡		Q23
You worked closely with other science teachers who taught the same grade and/or subject whether or not they were from your school‡	Q23	
You worked closely with other mathematics teachers who taught the same grade and/or subject whether or not they were from your school‡		Q25
The professional development was a waste of your time§	Q25	Q27
Number of Items in Composite	6	6
Reliability – Cronbach's Coefficient Alpha	0.60	0.51

†These items were presented only to teachers who participated in science-/mathematics-related professional development in the last three years.
‡The science and mathematics versions of this item are considered equivalent, worded appropriately for that discipline.
§Responses were flipped when computing the composite to account for the negative polarity of the item.

Table C-2
Extent to Which Professional Development/Coursework Focused on Student-Centered Instruction†

	Science	Mathematics
Finding out what students think or already know about the key science ideas prior to instruction on those ideas‡	Q28c	
Finding out what students think or already know about the key mathematical ideas prior to instruction on those ideas‡		Q30d
Planning instruction so students at different levels of achievement can increase their understanding of the ideas targeted in each activity	Q28e	Q30f
Monitoring student understanding during science instruction‡	Q28f	
Monitoring student understanding during mathematics instruction‡		Q30g
Assessing student understanding at the conclusion of instruction on a topic	Q28j	Q30k
Number of Items in Composite	4	4
Reliability – Cronbach's Coefficient Alpha	0.76	0.74

†These items were presented only to teachers who participated in science-/mathematics-related professional development or coursework within the last three years.
‡The science and mathematics versions of this item are considered equivalent, worded appropriately for that discipline.

Table C-3
Perceptions of Content Preparedness: Science

	Biology/Life Science	Chemistry	Earth Science	Integrated/ General Science	Physical Science	Physics
Earth's features and physical processes			Q36ai	Q36ai		
The solar system and the universe			Q36aii	Q36aii		
Climate and weather			Q36aiii	Q36aiii		
Cell biology	Q36bi			Q36bi		
Structures and functions of organisms	Q36bii			Q36bii		
Ecology/ecosystems	Q36biii			Q36biii		
Genetics	Q36biv			Q36biv		
Evolution	Q36bv			Q36bv		
Atomic structure		Q36ci		Q36ci	Q36ci	
Chemical bonding, equations, nomenclature, and reactions		Q36cii		Q36cii	Q36cii	
Elements, compounds, and mixtures		Q36ciii		Q36ciii	Q36ciii	
The Periodic Table		Q36civ		Q36civ	Q36civ	
Properties of solutions		Q36cv		Q36cv	Q36cv	
States, classes, and properties of matter		Q36cvi		Q36cvi	Q36cvi	

Table C-3 (Cont.) Perceptions of Content Preparedness: Science						
	Biology/Life Science	Chemistry	Earth Science	Integrated/ General Science	Physical Science	Physics
Forces and motion				Q36di	Q36di	Q36di
Energy transfers, transformations, and conservation				Q36dii	Q36dii	Q36dii
Properties and behaviors of waves				Q36diii	Q36diii	Q36diii
Electricity and magnetism				Q36div	Q36div	Q36div
Modern physics (e.g., special relativity)				Q36dv	Q36dv	Q36dv
Environmental and resource issues (e.g., land and water use, energy resources and consumption, sources and impacts of pollution)				Q36eii		
Number of Items in Composite	5	6	3	20	11	5
Reliability – Cronbach's Coefficient Alpha	0.93	0.91	0.67	0.78	0.88	0.86

Table C-4 Perceptions of Content Preparedness: Mathematics	
	Mathematics
The number system and operations	Q34a
Algebraic thinking	Q34b
Functions	Q34c
Modeling	Q34d
Measurement	Q34e
Geometry	Q34f
Statistics and probability	Q34g
Discrete mathematics	Q34h
Number of Items in Composite	8
Reliability – Cronbach's Coefficient Alpha	0.82

Table C-5 Perceptions of Preparedness to Teach Diverse Learners		
	Science	Mathematics
Plan instruction so students at different levels of achievement can increase their understanding of the ideas targeted in each activity	Q32a	Q36a
Teach science to students who have learning disabilities†	Q32b	
Teach mathematics to students who have learning disabilities†		Q36b
Teach science to students who have physical disabilities†	Q32c	
Teach mathematics to students who have physical disabilities†		Q36c
Teach science to English-language learners†	Q32d	
Teach mathematics to English-language learners†		Q36d
Provide enrichment experiences for gifted students	Q32e	Q36e
Number of Items in Composite	5	5
Reliability – Cronbach's Coefficient Alpha	0.66	0.66
†The science and mathematics versions of this item are considered equivalent, worded appropriately for that discipline.		

Table C-6 Perceptions of Preparedness to Encourage Students		
	Science	Mathematics
Encourage students' interest in science and/or engineering†	Q32f	
Encourage students' interest in mathematics†		Q36f
Encourage participation of females in science and/or engineering†	Q32g	
Encourage participation of females in mathematics†		Q36g
Encourage participation of racial or ethnic minorities in science and/or engineering†	Q32h	
Encourage participation of racial or ethnic minorities in mathematics†		Q36h
Encourage participation of students from low socioeconomic backgrounds in science and/or engineering†	Q32i	
Encourage participation of students from low socioeconomic backgrounds in mathematics†		Q36i
Number of Items in Composite	4	4
Reliability – Cronbach's Coefficient Alpha	0.89	0.83
†The science and mathematics versions of these items are considered equivalent, worded appropriately for that discipline.		

Table C-7 Perceptions of Preparedness to Implement Instruction in Particular Unit		
	Science	Mathematics
Anticipate difficulties that students will have with particular science ideas and procedures in this unit†	Q61a	
Anticipate difficulties that students will have with particular mathematical ideas and procedures in this unit†		Q59a
Find out what students thought or already knew about the key science ideas†	Q61b	
Find out what students thought or already knew about the key mathematical ideas†		Q59b
Implement the science textbook/ module to be used during this unit†	Q61c	
Implement the mathematics textbook/ program to be used during this unit†		Q59c
Monitor student understanding during this unit	Q61d	Q59d
Assess student understanding at the conclusion of this unit	Q61e	Q59e
Number of Items in Composite	5	5
Reliability – Cronbach's Coefficient Alpha	0.77	0.80
†The science and mathematics versions of this item are considered equivalent, worded appropriately for that discipline.		

Decision-Making Autonomy
These composites estimate the level of control teachers perceive having over curriculum and pedagogy decisions for their classrooms.

Table C-8 Curriculum Control		
	Science	Mathematics
Determining course goals and objectives	Q42a	Q43a
Selecting textbooks/modules	Q42b	Q43b
Selecting content, topics, and skills to be taught	Q42c	Q43c
Number of Items in Composite	3	3
Reliability – Cronbach's Coefficient Alpha	0.80	0.85

Table C-9 Pedagogical Control		
	Science	Mathematics
Selecting teaching techniques	Q42d	Q43d
Determining the amount of homework to be assigned	Q42e	Q43e
Choosing criteria for grading student performance	Q42f	Q43f
Number of Items in Composite	3	3
Reliability – Cronbach's Coefficient Alpha	0.73	0.40

Instructional Objectives

These composites estimate the amount of emphasis teachers place on reform-oriented instructional objectives.

Table C-10
Reform-Oriented Instructional Objectives

	Science	Mathematics
Understanding science concepts‡	Q43b	
Understanding mathematical ideas‡		Q44c
Learning science process skills (e.g., observing, measuring)‡	Q43c	
Learning mathematical practices (e.g., considering how to approach a problem, justifying solutions)‡		Q44d
Learning about real-life applications of science‡	Q43d	
Learning about real-life applications of mathematics‡		Q44e
Increasing students' interest in science‡	Q43e	
Increasing students' interest in mathematics‡		Q44f
Preparing for further study in science‡	Q43f	
Preparing for further study in mathematics‡		Q44g
Number of Items in Composite	5	5
Reliability – Cronbach's Coefficient Alpha	0.67	0.67

‡The science and mathematics versions of this item are considered equivalent, worded appropriately for that discipline.

Teaching Practices

These composites estimate the extent to which teachers use reform-oriented teaching practices and instructional technology.

Table C-11
Use of Reform-Oriented Teaching Practices: Science

	Science
Have students work in small groups	Q44c
Do hands-on/laboratory activities	Q44d
Engage the class in project-based learning (PBL) activities	Q44e
Have students represent and/or analyze data using tables, charts, or graphs	Q44g
Require students to supply evidence in support of their claims	Q44h
Have students write their reflections (e.g., in their journals) in class or for homework	Q44j
Number of Items in Composite	6
Reliability – Cronbach's Coefficient Alpha	0.33

Table C-12 Use of Reform-Oriented Teaching Practices: Mathematics	
	Science
Have students consider multiple representations in solving a problem (e.g., numbers, tables, graphs, pictures)	Q45f
Have students explain and justify their method for solving a problem	Q45g
Have students compare and contrast different methods for solving a problem	Q45h
Have students present their solution strategies to the rest of the class	Q45j
Number of Items in Composite	4
Reliability – Cronbach's Coefficient Alpha	0.58

Table C-13 Use of Instructional Technology		
	Science	Mathematics
Personal computers, including laptops	Q45a	Q46a
Hand-held computers	Q45b	Q46b
Internet	Q45c	Q46c
Graphing Calculators	Q45d	
Probes for collecting data	Q45e	
Number of Items in Composite	5	3
Reliability – Cronbach's Coefficient Alpha	0.58	0.73

Influences on Instruction
These composites estimate the extent to which teachers perceive various factors as promoting/inhibiting effective instruction.

Table C-14 Adequacy of Resources for Instruction: Science	
	Science
Science courses may benefit from the availability of particular kinds of equipment (e.g., microscopes, beakers, photogate timers, Bunsen burners). How adequate is the equipment you have available for teaching this science class?	Q47
Science courses may benefit from the availability of particular kinds of instructional technology (e.g., calculators, computers, probes/sensors). How adequate is the instructional technology you have available for teaching this science class?	Q48
Science courses may benefit from the availability of particular kinds of consumable supplies (e.g., chemicals, living organisms, batteries). How adequate are the consumable supplies you have available for teaching this science class?	Q49
Science courses may benefit from the availability of particular kinds of facilities (e.g., lab tables, electric outlets, faucets and sinks). How adequate are the facilities you have available for teaching this science class?	Q50
Number of Items in Composite	4
Reliability – Cronbach's Coefficient Alpha	0.86

Table C-15 Adequacy of Resources for Instruction: Mathematics	
	Mathematics
Instructional technology (e.g., calculators, computers, probes/sensors)	Q48a
Measurement tools (e.g., protractors, rulers)	Q48b
Manipulatives (e.g., pattern blocks, algebra tiles)	Q48c
Consumable supplies (e.g., graphing paper, batteries)	Q48d
Number of Items in Composite	4
Reliability – Cronbach's Coefficient Alpha	0.82

APPENDIX D
COMPLETE DESCRIPTIVE STATISTICS FOR KSTF-SPECIFIC ITEMS

Note: In the following tables, "STQ" refers to the KSTF Science Teacher Questionnaire and "MTQ" refers to the KSTF Mathematics Teacher Questionnaire.

Table D-1
Science-/Mathematics-Focused Professional Development in the Last Three Years Sponsored or Supported by KSTF (STQ14/MTQ16)†

	Percent of Fellows	
	Science (N = 103)	Mathematics (N = 51)
Less than 25 percent	17 (3.7)	14 (4.9)
25–49 percent	3 (1.7)	14 (4.9)
50–74 percent	26 (4.4)	22 (5.8)
75 percent or more	54 (4.9)	51 (7.1)

†Presented only to teachers who indicated participating in science-/mathematics-focused professional development in the last three years.

Table D-2
Extent to which Professional Development that Provided Opportunities to Engage in Science/ Mathematics Investigations Was Sponsored or Supported by KSTF (STQ16/MTQ18)†

	Percent of Fellows	
	Science (N = 99)	Mathematics (N = 49)
Not at all	14 (3.5)	6 (3.5)
2 of 5	8 (2.8)	2 (2.0)
Somewhat	16 (3.7)	20 (5.8)
4 of 5	18 (3.9)	31 (6.7)
To a great extent	43 (5.0)	41 (7.1)

†Presented only to teachers who indicated participating in science-/mathematics-focused professional development in the last three years.

Table D-3
Extent to which Professional Development that Provided Opportunities to Examine Classroom Artifacts Was Sponsored or Supported by KSTF (STQ18/MTQ20)†

	Percent of Fellows	
	Science (N = 102)	Mathematics (N = 50)
Not at all	7 (2.5)	8 (3.9)
2 of 5	4 (1.9)	4 (2.8)
Somewhat	14 (3.4)	12 (4.6)
4 of 5	19 (3.9)	38 (6.9)
To a great extent	57 (4.9)	38 (6.9)

†Presented only to teachers who indicated participating in science-/mathematics-focused professional development in the last three years.

Table D-4
Extent to which Professional Development that Provided Opportunities to Try Out What You Learned in Your Classroom and Talk About it as Part of Professional Development Was Sponsored or Supported by KSTF (STQ20/MTQ22)†

	Percent of Fellows	
	Science (N = 101)	Mathematics (N = 51)
Not at all	6 (2.4)	8 (3.8)
2 of 5	4 (2.0)	6 (3.3)
Somewhat	15 (3.6)	16 (5.1)
4 of 5	22 (4.1)	35 (6.8)
To a great extent	53 (5.0)	35 (6.8)

†Presented only to teachers who indicated participating in science-/mathematics-focused professional development in the last three years.

Table D-5
Extent to which Professional Development that Provided Opportunities to Work Closely with Other Science/Mathematics Teachers From Your School Was Sponsored or Supported by KSTF (STQ22/MTQ24)†

	Percent of Fellows	
	Science (N = 93)	Mathematics (N = 47)
Not at all	51 (5.2)	43 (7.3)
2 of 5	26 (4.6)	28 (6.6)
Somewhat	14 (3.6)	23 (6.2)
4 of 5	9 (2.9)	6 (3.6)
To a great extent	1 (1.1)	0 (__)‡

†Presented only to teachers who indicated participating in science-/mathematics-focused professional development in the last three years.
‡No teachers in the sample selected this response option. Thus, it is not possible to calculate the standard error of this estimate.

Table D-6 Extent to which Professional Development that Provided Opportunities to Work Closely with Other Science/Mathematics Teachers in the Same Grade and/or Subject Whether or Not They Were at Your School Was Sponsored or Supported by KSTF (STQ24/MTQ26)†		
	Percent of Fellows	
	Science (N = 100)	Mathematics (N = 51)
Not at all	17 (3.8)	18 (5.4)
2 of 5	5 (2.2)	6 (3.3)
Somewhat	13 (3.4)	14 (4.9)
4 of 5	23 (4.1)	24 (6.0)
To a great extent	42 (5.0)	39 (6.9)

†Presented only to teachers who indicated participating in science-/mathematics-focused professional development in the last three years.

Table D-7 Extent to which Professional Development that Was a Waste of Time Was Sponsored or Supported by KSTF (STQ26/MTQ28)†		
	Percent of Fellows	
	Science (N = 63)	Mathematics (N = 34)
Not at all	56 (6.3)	41 (8.6)
2 of 5	37 (6.1)	50 (8.7)
Somewhat	6 (3.1)	9 (4.9)
4 of 5	0 (__)‡	0 (__)‡
To a great extent	2 (1.6)	0 (__)‡

†Presented only to teachers who indicated participating in science-/mathematics-focused professional development in the last three years.
‡No teachers in the sample selected this response option. Thus, it is not possible to calculate the standard error of this estimate.

Table D-8
Extent to which Science Professional Development with Various Characteristics Was Sponsored or Supported by KSTF (STQ29)†

	Percent of Fellows (N = 102)					
	Not at all		Somewhat		To a great extent	N/A‡
	1	2	3	4	5	6
Deepening your own science content knowledge	9 (2.8)	3 (1.7)	17 (3.7)	19 (3.9)	47 (5.0)	6 (2.4)
Learning about difficulties that students may have with particular science ideas and procedures	8 (2.7)	4 (1.9)	17 (3.7)	24 (4.2)	46 (5.0)	2 (1.4)
Finding out what students think or already know about the key science ideas prior to instruction on those ideas	7 (2.5)	14 (3.4)	11 (3.1)	22 (4.1)	45 (5.0)	2 (1.4)
Implementing the science textbook/module to be used in your classroom	30 (4.6)	19 (3.9)	18 (3.8)	6 (2.3)	11 (3.1)	17 (3.7)
Planning instruction so students at different levels of achievement can increase their understanding of the ideas targeted in each activity	11 (3.1)	14 (3.5)	25 (4.3)	16 (3.7)	33 (4.7)	2 (1.4)
Monitoring student understanding during science instruction	9 (2.8)	8 (2.7)	21 (4.)	19 (3.9)	41 (4.9)	3 (1.7)
Providing enrichment experiences for gifted students	19 (3.9)	26 (4.4)	21 (4.1)	9 (2.8)	11 (3.1)	15 (3.6)
Providing alternative science learning experiences for students with special needs	29 (4.5)	24 (4.2)	22 (4.1)	4 (1.9)	10 (3.0)	12 (3.2)
Teaching science to English-language learners	28 (4.5)	25 (4.3)	19 (3.9)	4 (1.9)	8 (2.7)	17 (3.7)
Assessing student understanding at the conclusion of instruction on a topic	10 (3.0)	7 (2.5)	26 (4.4)	31 (4.6)	23 (4.2)	4 (2.0)

†Presented only to teachers who indicated participating in science-/mathematics-focused professional development in the last three years.
‡Responses of "Not Applicable" were treated as missing in the analyses presented in the body of this report.

Table D-9 Extent to which Mathematics Professional Development with Various Characteristics Was Sponsored or Supported by KSTF (MTQ31)†						
	Percent of Fellows (N = 51)					
	Not at all		Somewhat		To a great extent	N/A‡
	1	2	3	4	5	6
Deepening your own mathematics content knowledge	6 (3.3)	6 (3.3)	20 (5.6)	29 (6.4)	39 (6.9)	0 (__)§
Learning how to use hands-on activities/manipulatives for mathematics instruction	8 (3.8)	14 (4.9)	18 (5.4)	20 (5.6)	39 (6.9)	2 (2.0)
Learning about difficulties that students may have with particular mathematical ideas and procedures	6 (3.3)	10 (4.2)	12 (4.6)	33 (6.7)	39 (6.9)	0 (__)§
Finding out what students think or already know about the key mathematical ideas prior to instruction on those ideas	6 (3.3)	14 (4.9)	16 (5.1)	35 (6.8)	29 (6.4)	0 (__)§
Implementing the mathematics textbook/program to be used in your classroom	25 (6.2)	24 (6.0)	20 (5.6)	8 (3.8)	12 (4.6)	12 (4.6)
Planning instruction so students at different levels of achievement can increase their understanding of the ideas targeted in each activity	6 (3.3)	14 (4.9)	10 (4.2)	37 (6.8)	31 (6.6)	2 (2.0)
Monitoring student understanding during mathematics instruction	6 (3.3)	16 (5.1)	6 (3.3)	33 (6.7)	39 (6.9)	0 (__)§
Providing enrichment experiences for gifted students	18 (5.4)	29 (6.4)	29 (6.4)	10 (4.2)	8 (3.8)	6 (3.3)
Providing alternative mathematics learning experiences for students with special needs	25 (6.2)	33 (6.7)	25 (6.2)	4 (2.7)	6 (3.3)	6 (3.3)
Teaching mathematics to English-language learners	29 (6.4)	35 (6.8)	16 (5.1)	4 (2.7)	4 (2.7)	12 (4.6)
Assessing student understanding at the conclusion of instruction on a topic	6 (3.3)	18 (5.4)	18 (5.4)	41 (7.0)	18 (5.4)	0 (__)§

†Presented only to teachers who indicated participating in science-/mathematics-focused professional development in the last three years.
‡Responses of "Not Applicable" were treated as missing in the analyses presented in the body of this report.
§No teachers in the sample selected this response option. Thus, it is not possible to calculate the standard error of this estimate.

Table D-10
Extent to which Involvement in KSTF Improved Science Fellows' Abilities to be Effective in Various Leadership Roles (STQ31)

	Percent of Fellows (N = 98)				
	Not at all		Somewhat		To a great extent
	1	2	3	4	5
Served as a formally assigned mentor/coach for science teaching	39 (5.0)	6 (2.5)	17 (3.9)	18 (4.0)	20 (4.1)
Supervised a student teacher	45 (5.1)	9 (3.0)	22 (4.2)	14 (3.5)	10 (3.1)
Taught in-service workshops on science or science teaching	24 (4.3)	4 (2.0)	14 (3.6)	18 (3.9)	40 (5.0)
Led a teacher study group focused on science teaching	20 (4.1)	3 (1.7)	16 (3.8)	16 (3.8)	44 (5.0)

Table D-11
Extent to which Involvement in KSTF Improved Mathematics Fellows' Abilities to be Effective in Various Leadership Roles (MTQ33)

	Percent of Fellows (N = 47)				
	Not at all		Somewhat		To a great extent
	1	2	3	4	5
Served as a formally assigned mentor/coach for mathematics teaching	40 (7.4)	9 (4.3)	16 (5.5)	27 (6.7)	9 (4.3)
Supervised a student teacher	53 (7.5)	4 (3.1)	20 (6.0)	20 (6.0)	2 (2.2)
Taught in-service workshops on mathematics or mathematics teaching	35 (7.1)	0 (__)†	17 (5.7)	24 (6.4)	24 (6.4)
Led a teacher study group focused on mathematics teaching	30 (6.7)	0 (__)†	15 (5.2)	34 (7.0)	21 (6.0)

†No teachers in the sample selected this response option. Thus, it is not possible to calculate the standard error of this estimate.

Table D-12
Extent to which Involvement with KSTF Increased Science Fellows' Preparedness for Each of a Number of Tasks (STQ33)

	Percent of Fellows (N = 103)				
	Not at all		Somewhat		To a great extent
	1	2	3	4	5
Plan instruction so students at different levels of achievement can increase their understanding of the ideas targeted in each activity	4 (1.9)	8 (2.7)	27 (4.4)	30 (4.5)	31 (4.6)
Teach science to students who have learning disabilities	37 (4.8)	24 (4.2)	27 (4.4)	10 (2.9)	2 (1.4)
Teach science to students who have physical disabilities	50 (5.0)	26 (4.4)	17 (3.8)	6 (2.3)	1 (1.0)
Teach science to English-language learners	37 (4.8)	29 (4.5)	25 (4.3)	6 (2.3)	2 (1.4)
Provide enrichment experiences for gifted students	16 (3.6)	22 (4.1)	33 (4.7)	19 (3.9)	10 (2.9)
Encourage students' interest in science and/or engineering	1 (1.0)	8 (2.7)	27 (4.4)	40 (4.8)	24 (4.2)
Encourage participation of females in science and/or engineering	2 (1.4)	10 (2.9)	27 (4.4)	32 (4.6)	29 (4.5)
Encourage participation of racial or ethnic minorities in science and/or engineering	5 (2.1)	17 (3.8)	26 (4.4)	30 (4.5)	21 (4.1)
Encourage participation of students from low socioeconomic backgrounds in science and/or engineering	10 (2.9)	20 (4.0)	25 (4.3)	25 (4.3)	19 (3.9)
Manage classroom discipline	13 (3.3)	35 (4.7)	38 (4.8)	6 (2.3)	9 (2.8)

Table D-13 Extent to which Involvement with KSTF Increased Mathematics Fellows' Preparedness for Each of a Number of Tasks (MTQ37)					
	Percent of Fellows (N = 50)				
	Not at all		Somewhat		To a great extent
	1	2	3	4	5
Plan instruction so students at different levels of achievement can increase their understanding of the ideas targeted in each activity	2 (2.0)	2 (2.0)	34 (6.8)	24 (6.1)	38 (6.9)
Teach mathematics to students who have learning disabilities	26 (6.3)	36 (6.9)	30 (6.5)	4 (2.8)	4 (2.8)
Teach mathematics to students who have physical disabilities	56 (7.1)	26 (6.3)	14 (5.0)	4 (2.8)	0 (__)†
Teach mathematics to English-language learners	28 (6.4)	36 (6.9)	26 (6.3)	10 (4.3)	0 (__)†
Provide enrichment opportunities for gifted students	14 (5.1)	29 (6.5)	27 (6.4)	22 (6.0)	8 (4.0)
Encourage students' interest in mathematics	2 (2.0)	8 (3.9)	36 (6.9)	28 (6.4)	26 (6.3)
Encourage participation of females in mathematics	8 (3.9)	10 (4.3)	36 (6.9)	24 (6.1)	22 (5.9)
Encourage participation of racial or ethnic minorities in mathematics	10 (4.3)	14 (5.0)	40 (7.0)	24 (6.1)	12 (4.6)
Encourage participation of students from low socioeconomic backgrounds in mathematics	10 (4.3)	16 (5.2)	40 (7.0)	20 (5.7)	14 (5.0)
Manage classroom discipline	14 (5.0)	30 (6.5)	38 (6.9)	12 (4.6)	6 (3.4)

†No teachers in the sample selected this response option. Thus, it is not possible to calculate the standard error of this estimate.

Table D-14 Extent to which Science Fellows' Involvement with KSTF Increased Their Preparedness to Teach Each of a Number of Topics (STQ37)†						
		Percent of Fellows				
		Not at all		Somewhat		To a great extent
	N	1	2	3	4	5
Earth/Space Science	14	21 (11.4)	14 (9.7)	29 (12.5)	36 (13.3)	0 (__)‡
Biology/Life Science	35	9 (4.8)	6 (4.0)	26 (7.5)	14 (6.0)	46 (8.5)
Chemistry	34	0 (__)‡	15 (6.2)	29 (7.9)	32 (8.1)	24 (7.4)
Physics	34	0 (__)‡	18 (6.6)	26 (7.7)	29 (7.9)	26 (7.7)
Engineering	101	18 (3.8)	30 (4.6)	29 (4.5)	11 (3.1)	13 (3.3)
Environmental and resource issues	12	8 (8.3)	42 (14.9)	25 (13.1)	8 (8.3)	17 (11.2)

†Fellows were asked only about the topic of their randomly selected class, with the exception of engineering which was asked of all Fellows.
‡No teachers in the sample selected this response option. Thus, it is not possible to calculate the standard error of this estimate.

Table D-15 Extent to which Mathematics Fellows' Involvement with KSTF Increased Their Preparedness to Teach Each of a Number of Topics (MTQ35)					
	Percent of Fellows (N = 51)				
	Not at all		Somewhat		To a great extent
	1	2	3	4	5
The number system and operations	10 (4.2)	16 (5.1)	31 (6.6)	27 (6.3)	16 (5.1)
Algebraic thinking	6 (3.3)	4 (2.7)	27 (6.3)	24 (6.0)	39 (6.9)
Functions	4 (2.7)	10 (4.2)	27 (6.3)	29 (6.4)	29 (6.4)
Modeling	4 (2.7)	12 (4.6)	35 (6.8)	25 (6.2)	24 (6.0)
Measurement	22 (5.8)	22 (5.8)	35 (6.8)	14 (4.9)	8 (3.8)
Geometry	12 (4.6)	18 (5.4)	25 (6.2)	24 (6.0)	22 (5.8)
Statistics and probability	27 (6.3)	18 (5.4)	33 (6.7)	12 (4.6)	10 (4.2)
Discrete mathematics	29 (6.4)	24 (6.0)	29 (6.4)	16 (5.1)	2 (2.0)

Table D-16
Extent to which Science Fellows' Involvement with KSTF Increased their Preparedness for Each of a Number of Tasks in the Most Recent Unit (STQ62)

	N	Percent of Fellows				
		Not at all		Somewhat		To a great extent
		1	2	3	4	5
Anticipate difficulties that students may have with particular science ideas and procedures in this unit	102	11 (3.1)	9 (2.8)	21 (4.0)	32 (4.7)	27 (4.4)
Find out what students thought or already knew about the key science ideas	102	9 (2.8)	13 (3.3)	20 (4.0)	28 (4.5)	30 (4.6)
Implement the science textbook/ module to be used during this unit	28	29 (8.7)	21 (7.9)	29 (8.7)	11 (6.0)	11 (6.0)
Monitor student understanding during this unit	102	8 (2.7)	8 (2.7)	25 (4.3)	33 (4.7)	26 (4.4)
Assess student understanding at the conclusion of this unit	102	7 (2.5)	15 (3.5)	31 (4.6)	25 (4.3)	23 (4.2)

Table D-17
Extent to which Mathematics Fellows' Involvement with KSTF Increased their Preparedness for Each of a Number of Tasks in the Most Recent Unit (MTQ60)

	N	Percent of Fellows				
		Not at all		Somewhat		To a great extent
		1	2	3	4	5
Anticipate difficulties that students will have with particular mathematical ideas and procedures in this unit	51	12 (4.6)	8 (3.8)	33 (6.7)	24 (6.0)	24 (6.0)
Find out what students thought or already knew about the key mathematical ideas	51	12 (4.6)	10 (4.2)	39 (6.9)	27 (6.3)	12 (4.6)
Implement the mathematics textbook/ program to be used during this unit	23	35 (10.2)	22 (8.8)	22 (8.8)	17 (8.1)	4 (4.3)
Monitor student understanding during this unit	51	10 (4.2)	8 (3.8)	27 (6.3)	35 (6.8)	20 (5.6)
Assess student understanding at the conclusion of this unit	51	10 (4.2)	16 (5.1)	31 (6.6)	29 (6.4)	14 (4.9)

ABOUT KSTF

The Knowles Science Teaching Foundation (KSTF) was established by Janet H. and C. Harry Knowles in 1999 to increase the number of high quality high school science and mathematics teachers and ultimately, improve math and science education in the United States. KSTF operates three programs that build national capacity for improving STEM teaching, leading, and learning: Teaching Fellows, Senior Fellows, and Research & Evaluation. To date, KSTF has supported more than 250 Fellows in 42 states.

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ABOUT HORIZON

Horizon Research, Inc. (HRI) is a private research firm located in Chapel Hill, North Carolina specializing in work related to science, technology, engineering, and mathematics (STEM) education. Incorporated in 1987, HRI's expertise encompasses research, evaluation, and technical assistance and information synthesis/dissemination. HRI has provided services for a variety of clients in both the public and private sector, including the National Science Foundation, the U.S. Department of Education, the Carnegie Corporation of New York, numerous colleges and universities, and professional organizations such as the National Science Teachers Association and the National Council of Teachers of Mathematics.

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