IOWA MATHEMATICS EDUCATION NEEDS ASSESSMENT REPORT
ANALYSIS OF K-12 TEACHER SURVEY
2018

Prepared for

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Executive Summary

The Jacobson Institute for Innovation in Education at Grand View University designed an Iowa mathematics education needs assessment in 2018. The purpose of the assessment was to gather data to help inform decisions about how to improve the teaching and learning of mathematics in Iowa's schools. The assessment was carried out through a survey of K-12 teachers. The resulting data and analysis are summarized in this report and provide information about the following questions:

- What are teachers' beliefs about teaching and learning mathematics?
- What are their teaching practices?
- What are their perceived strengths and weaknesses in mathematics and teaching?
- How confident are they in teaching Iowa Core Mathematics?
- What are their preferences for professional development?
- How and how much do they collaborate with their peers?
- And how do the answers to these questions differ for teachers with more or less experience, with different levels of education, with or without a mathematics endorsement, at different school levels, in districts of different sizes, in buildings where they do or do not have mathematics colleagues, and for different genders?

It has been many years since the last Iowa needs assessment. More recent data are needed to assess the current situation. The Jacobson Institute for Innovation in Education at Grand View University, in conjunction with the Research Institute for Studies in Education at Iowa State University, has endeavored to meet this need by conducting the present needs assessment, carried out with teachers in four Iowa AEAs spread across the state including urban, suburban, and rural schools.

The needs assessment survey first gathered demographic data on teachers, including years' teaching experience, grade level, whether or not they have a math endorsement and/or advanced degree, how many mathematics teaching colleagues they have in their building, and their participation in professional development activities.

Then data were gathered through a series of Likert-scale items related to six themes:

(1) mathematics teaching practices,
(2) teacher beliefs about teaching and learning mathematics,
(3) perceived abilities and knowledge related to teaching mathematics,
(4) preferences regarding professional development in mathematics,
(5) amount and type of peer collaboration, and
(6) confidence in teaching Iowa Core Mathematics.

These themes were further analyzed across four teacher profiles, defined by four key teacher characteristics:

(1) years' experience teaching mathematics,
(2) number of same-building peer teachers,
(3) school level taught, and
(4) having a mathematics endorsement.

Data were also analyzed with respect to other teacher characteristics: gender, district size, education level, and overall years' K-12 teaching experience (which includes teaching mathematics but may also include teaching other subjects).

Frequency analysis was used to provide descriptive statistics for the quantitative questions. Linear regression was used to examine relationships between the teacher characteristics and themes described above. Due to statistical limitations related to the large number of questions analyzed (60), these analyses are meant to uncover potential relationships between variables rather than make predictions or establish causality. Finally, the results from a few open-ended questions were summarized by grade level.

Many interesting results emerged from this needs assessment. These are presented in the full report. A few notable results are highlighted here, along with brief comments regarding possible implications for Iowa mathematics education.

1. *Strong positive results for teachers with a mathematics endorsement:*
   There are statistically and educationally significant positive results related to having a mathematics endorsement.
   ⇒ Recommendation: Identify concrete steps that will help recruit, train, and utilize more teachers with a mathematics endorsement.

2. *Positive results for teachers with more experience teaching mathematics:*
   Furthermore, results indicate demonstrably greater impact from years teaching mathematics than from general teaching experience.
   ⇒ Recommendation: Utilize, support, and promote teachers with more experience teaching mathematics, and find effective ways to connect them with their less experienced colleagues. Provide leadership opportunities and ongoing professional development in mathematics. Develop mentors and coaches with more years' experience teaching mathematics, not just general teaching experience.

3. *Some positive results regarding teaching practices:*
   Teachers report frequently using student collaboration when teaching mathematics; about 40% state they often or very often use rich tasks in their teaching; and a majority of teachers say they help their students achieve the Standards for Mathematical Practice daily or a few times weekly.

⇒ Recommendation: Build on and extend these positive results through ongoing professional development. But also carry out deeper analyses that find out how authentic and pervasive these practices are. For example, when teachers report teaching with "rich tasks," what does that really mean in terms of the actual tasks and how they are used, and when teachers report that they help students achieve the Standards for Mathematical Practice, how are they doing so and how are they determining that their students are achieving the standards.

4. *Some concerning results regarding teaching practices:*
   Data indicate that the higher the school level the less often students work on rich tasks, talk to each other about mathematics, and explain solutions and reasoning to each other, and the less often teachers believe their lessons help their students achieve the standards of mathematical practice. A majority of less experienced teachers report poor or fair ability to provide both access and challenge in their lessons, and this result is only somewhat better for teachers with more experience.
   ⇒ Recommendation: Find out more about these school level discrepancies and find strategies for reducing them. Design more effective professional development for promoting inquiry through "low floor, high ceiling" tasks.

5. *Indications of some disconnect between different descriptions of teaching practices and between practices and beliefs:*
   While the data suggest that teachers are unlikely to give lectures when teaching mathematics often or very often, a large majority explain solutions to problems step by step and do worked out examples on the board often or very often. Similarly, while over 80% of teachers state that they "do more asking than telling" in their teaching, 80% also say that "an effective way to teach is to carefully explain mathematical ideas and methods to students," and they often do worked out examples on the board.
   ⇒ Recommendation: Professional development programs should include analysis of teaching practices in classrooms, along with activities that move teachers from learning about evidence-based methods for improving mathematics education to learning how to implement those methods to owning those methods as habits of mind and habits of practice.

6. *Less than full confidence in many content areas of Iowa Core Mathematics:*
   Large percentages of teachers, at all grade levels except Kindergarten, rate themselves as at most "moderately confident" to teach many mathematics topics in the Iowa Core Mathematics standards. And teacher confidence in teaching mathematics declines with grade level taught.
   ⇒ Recommendation: Provide more mathematically rich, as well as pedagogically relevant, pre-service and in-service programs for teachers at all grade levels.

7. *Strong preference for face-to-face professional development:*
   This preference is strongest for face-to-face in combination with other modalities. Very few reported that professional development delivered solely online resulted in the most valuable experience.
   ⇒ Recommendation: Continue to design and deliver face-to-face professional development programs, augmented with other modalities.

8. *Positive results for teachers working in buildings with greater numbers of same-building peer teachers:*
   With few exceptions, teachers working in buildings with greater numbers of same-building peer teachers implement more effective teaching practices, benefit from increased levels of collaboration, and have stronger perceived abilities and knowledge related to teaching mathematics.
   ⇒ Recommendation: Increase support for teachers who have few, if any, colleagues teaching mathematics in the same building. Implement mechanisms to facilitate collaboration, especially at grade level and among a diverse population of teachers. Ensure that sufficient time is consistently afforded to allow for collaborative planning of mathematics instruction and review of student assessment data. The next point amplifies the need for this recommendation.

9. *Scarce peer collaboration among teachers:*
   Over half of teachers reported that they were never or rarely given regularly scheduled time during the school day to work collaboratively. One-third of teachers do not collaborate with teachers at their grade level and fewer than half collaborate more than a few times monthly with teachers at their grade level. About 60% do not collaborate with teachers at different grade levels and only 1 in 10 teachers collaborate more than a few times monthly with teachers at different grade levels.
   ⇒ Recommendation: Peer collaboration and collegial support are important factors in teacher effectiveness and teacher retention. More mechanisms should be designed and put in place to provide this.

It is hoped that the information provided by this needs assessment will be helpful to mathematics education leaders in Iowa in their ongoing work to improve mathematics teaching and learning for all students.

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Study Overview

Introduction

The Jacobson Institute for Innovation in Education, based at Grand View University, conducted an assessment of the status of K-12 mathematics education in the state of Iowa. Teachers were asked to share their beliefs about teaching and learning mathematics, their opinions about how they teach mathematics, their confidence in mathematics content, and their needs and preferences for professional development in mathematics. With this information, the Jacobson Institute plans to inform and guide professional development offerings, provide direction to state mathematics education leaders regarding potential regional and state mathematics initiatives, and form a baseline to enable future longitudinal studies.

Methodology

Survey Development. The 2018 Mathematics Needs Assessment was developed in conjunction with the Jacobson Institute's Steering Committee:

Robert Keller, PhD, Interim Director of the Jacobson Institute
Eric Hart, PhD, Jacobson Scholar
Judith Spitzli, MS, Jacobson Institute Steering Committee Co-Chair.

A review of a number of existing surveys helped determine key topic areas related to mathematics instruction. Questions focused on six themes: (1) practices employed in teaching mathematics, (2) beliefs about teaching and learning mathematics, (3) perceived abilities and knowledge related to teaching mathematics, (4) preferences regarding professional development in mathematics, (5) amount and type of peer collaboration, and (6) confidence in teaching Iowa Core Mathematics.

Data Collection. The 2018 Iowa Mathematics Needs Assessment was conducted between January and March of 2018. Because a list of mathematics teachers in Iowa was not practically available, mathematics teachers at both the elementary and secondary levels were reached through a series of communications. The Jacobson Institute's Steering Committee first contacted the Mathematics Consultants at four Iowa Area Education Agencies (AEA) to ask for assistance in reaching school-level personnel. The consultants notified mathematics curriculum directors at the schools in their area and asked them to pass along an anonymous survey link to mathematics teachers in the district.

The participating AEAs were Central Rivers AEA, Heartland AEA, Great Prairie AEA, and Keystone AEA. The intention in choosing these AEAs was to represent both rural and urban schools across the state. Responses were received from all four AEAs, with 40% from Great Prairie AEA, 23% from Heartland AEA, 20% from Keystone, and 18% from Central Rivers AEA (Table 1). Valid responses were received from 274 teachers. A return rate could not be calculated.

Table 1. Which Iowa Area Education Association do you teach in?

	n	Percent
Heartland	61	22.6%
Central Rivers	48	17.8%
Great Prairie	108	40.0%
Keystone	53	19.6%
Total	270	

Representativeness of the Sample. To determine if the final sample of respondents was representative of the state population of teachers, the count of responding mathematics teachers was compared to the count of all teachers in Iowa by district size. [The number of mathematics teachers in Iowa was not available.] When comparing this study's sample of teachers to all teachers by district size, this sample over-represents the smaller districts and under-represents the large districts (Table 2).

Table 2. Representativeness of the Sample District Size

	Sample		Iowa		% Difference
	n	Percent	n	Percent	
<=999	147	56.3%	9,794	26.6%	-30
1000-2499	58	22.2%	8,784	23.9%	2
>=2500	56	21.5%	18,208	49.5%	28
Total	261		36,786		

Analysis. Frequency analysis was used to provide descriptive statistics for the quantitative questions. In the break down analysis by school level taught, elementary was defined as K-5, middle was 6-8, and high was 9-12. In the demographic section, teachers were asked to provide all grade levels they teach, and many indicated multiple grade levels. In the confidence section, they selected one primary grade (or defined as the grade they taught the most). For the break down analyses, primary school level taught was first determined by the question that asked them to pick the primary grade they teach (in the confidence section), and if no grade level was selected there, their response to the question in the

demographic section was used. Four teachers were excluded because they did not answer primary school level and indicated that they teach grades that span multiple levels (e.g., K-12).

This report also includes linear regression analyses to examine whether/how teachers' demographic characteristics are related to their responses on attitudinal items or questions related to teaching behavior. Because of the large number of questions analyzed (over 60), it was infeasible to ensure each question meets the various assumptions of linear regression. Therefore, these analyses are meant not for making predictions or establishing causality but rather to illustrate potential relationships between the variables and responses.

Open-ended questions were coded into thematic categories based on emergent patterns. First, data were reviewed to become familiar with responses, followed by generating initial common themes found in the responses. The data were then reviewed for statements to support or dispute the themes.

Organization of the Report

This report contains three main parts. The first contains a description of the respondents and the districts and schools in which they teach. The second part of this report features the results of the survey broken out in various ways. Finally, appendices at the end of the report have full regression results and coding for these models.

Description of Respondents

The following section includes descriptions of the respondents, as well as the districts and schools in which they teach.

Regarding district and school characteristics, the results indicate that a majority of teachers (56%) worked in small districts with fewer than 1,000 students (Table 3). Teachers were asked which grades they teach, and 13-17% indicated they taught elementary grades, 11-13% taught middle school grades, and 20-23% taught high school grades (Table 4). Approximately 11% of respondents were the sole mathematics teachers in their building; the highest proportion of teachers (34%) reported working at schools with one or two other mathematics teachers in their building (Table 5). Forty-two percent of teachers reported that mathematics had not been a primary focus of their school's improvement plan in the last three years (Table 6).

Focusing on the respondents, 31% of teachers had an endorsement in mathematics (Table 7). Approximately 40% of teachers listed coursework beyond a bachelor's degree as their highest level of educational attainment, and another 40% of teachers had acquired a master's degree (Table 8). The remaining teachers reported having a bachelor's degree; no teachers had obtained a doctorate.

More than two-thirds of teachers (68%) had taught at a K-12 school more than 10 years, (Table 9) and slightly fewer (61%) had taught mathematics for more than 10 years (Table 10).

Most of the respondents were female (80%) (Table 11), and approximately two-thirds of female respondents (66%) taught at the elementary level (Table 12). Male teachers were more evenly distributed across the school levels: 38% at the elementary level (grades K-5), 27% at the middle school level (6-8), and 35% at the high school level (9-12). At most ten percent of the responding teachers were members of mathematics professional organizations or attend their conferences (Table 13).

A particular focus of the assessment and subsequent analysis concerns the professional development of teachers. Teachers reported having been offered mathematics-specific development from their AEA more frequently than they were offered such opportunities from their district and school within the past five years (Table 14). Table 15 presents these same results broken out by years teaching experience and school level (elementary, middle, and high school). Responses as to when and how teachers participate in professional development are presented both in aggregate and broken out by years teaching experience and school level (Tables 16 and 19). They reported participating in professional development most frequently at the beginning of the school year and throughout the school year; they were least likely to participate at night and on the weekends. When asked how

they typically participate in professional development, teachers reported participating in professional development via Professional Learning Communities much more frequently than the other options listed. They reported participating in professional development least frequently via webinars.

As a way to approximate the percentage of teachers that are participating in professional development given the constraints of the survey, additional analysis examined the series of questions that asked teachers to indicate when and how often they participate in mathematics professional development (Tables 16 and 19). The six questions asked, 'how often do you participate in mathematics professional development: 1) at the beginning of the school year; 2) throughout the school year; 3) in the summer only; 4) year-round in summer and during the school year; 5) at night; 6) on weekends.' The response options were Never, Rarely, Occasionally, and Frequently. With this method of examination, 73.9% of responding teachers had occasionally or frequently participated in mathematics professional development (Table 17), and 94.7% had rarely, occasionally, or frequently participated in mathematics professional development (Table 18).

When considering the respondents' experiences with professional development broken out by years teaching and experience and school level (Table 19), a number of differences emerged between the subgroups. Teachers with ten or fewer years of experience participate on nights and weekends at roughly twice the rate as do more seasoned teachers. Newer teachers have also made use of professional development through social media, webinars and vlogs/blogs at significantly higher rates than do longer-tenured teachers. Moreover, the data suggests that they participate in these ways *in addition* to other forms of professional development.

Table 3. What is the size of the district that you primarily teach in?

	n	Percent
<=999	147	56.3%
1,000-2,499	58	22.2%
>=2,500	56	21.5%
Total	261	

Table 4. Please indicate the grade levels you are currently teaching (Check all that apply.)

	n	Count	Percent
Kindergarten	269	37	13.8%
1st Grade	269	35	13.0%
2nd Grade	269	46	17.1%
3rd Grade	269	37	13.8%
4th Grade	269	38	14.1%
5th Grade	269	45	16.7%
6th Grade	269	35	13.0%
7th Grade	269	30	11.2%
8th Grade	269	34	12.6%
9th Grade	269	56	20.8%
10th Grade	269	65	24.2%
11th Grade	269	62	23.0%
12th Grade	269	61	22.7%

Note: 269 teachers answered this question. The count represents the number of teachers who indicated each grade level.

Table 5. How many other teachers teach mathematics at your level in your building?

	n	Percent
Just me	27	10.7%
1-2	86	34.0%
3-5	45	17.8%
6-10	42	16.6%
10+	53	20.9%
Total	253	

Table 6. How often in the last three years has mathematics been a primary focus of your school's improvement plan?

	n	Percent
Not in the last three years	107	42.3%
1 year	48	19.0%
2 years	44	17.4%
3 years	54	21.3%
Total	253	

Table 7. Do you have an endorsement in mathematics?

	n	Percent
Yes	86	31.4%
No	188	68.6%
Total	274	

Table 8. Identify the highest degree you have earned.

	n	Percent
Bachelor's	46	16.8%
Coursework beyond bachelor's	113	41.2%
Master's	115	42.0%
Doctorate	0	0.0%
Total	274	

Table 9. How many years have you taught at a K-12 school?

	n	Percent
2 or fewer years	15	5.5%
3-6 years	46	16.8%
7-10 years	26	9.5%
10+ years	187	68.2%
Total	274	

Table 10. How many years have you taught mathematics at a K-12 school?

	n	Percent
2 or fewer years	29	10.9%
3-6 years	51	19.1%
7-10 years	25	9.4%
10+ years	162	60.7%
Total	267	

Table 11. Which gender do you most identify with?

	n	Percent
Male	38	15.2%
Female	201	80.4%
Do not wish to provide	11	4.4%
Total	250	

Table 12. Gender by Primary School Level

	n	Elementary	Middle	High
Male	37	37.8%	27.0%	35.1%
Female	200	66.0%	15.0%	19.0%
Total	237	61.6%	16.9%	21.5%

Table 13. Professional Organization Membership and Participation

	Iowa Council of Teachers of Mathematics	National Council of Teachers of Mathematics	National Council of Supervisors of Mathematics
Please indicate whether you are a member of any of the following organizations.	15	25	0
Please indicate any of the professional organizations for which you have attended their conference(s) in the past 5 years.	27	16	1

Table 14. Tell us how often you have been offered mathematics-specific professional development within the past 5 years.

	n	Never	Rarely	Occasionally	Frequently
From your AEA	227	9.7%	20.3%	43.2%	26.9%
From your district	222	20.3%	36.0%	29.3%	14.4%
From your school	221	24.0%	33.5%	28.1%	14.5%

Table 15. Tell us how often you have been offered mathematics-specific professional development within the past 5 years.

			3-10 years' experience			10+ years' experience	
		Total n	n	Never + Rarely	Occasionally + Frequently	n	Never + Rarely	Occasionally + Frequently
From your AEA	**Total**	**218**	**56**	**35.7%**	**64.3%**	**162**	**26.5%**	**73.5%**
	Elementary	131	29	37.9%	62.1%	102	30.4%	69.6%
	Middle	38	11	0.0%	100.0%	27	22.2%	77.8%
	High	49	16	56.3%	43.8%	33	18.2%	81.8%
From your district	**Total**	**213**	**57**	**59.6%**	**40.4%**	**156**	**55.1%**	**44.9%**
	Elementary	125	29	41.4%	58.6%	96	50.0%	50.0%
	Middle	38	11	54.5%	45.5%	27	51.9%	48.1%
	High	50	17	94.1%	5.9%	33	72.7%	27.3%
From your school	**Total**	**211**	**57**	**63.2%**	**36.8%**	**154**	**56.5%**	**43.5%**
	Elementary	124	29	51.7%	48.3%	95	51.6%	48.4%
	Middle	38	11	63.6%	36.4%	27	55.6%	44.4%
	High	49	17	82.4%	17.6%	32	71.9%	28.1%

Table 16. Please indicate your participation in previous professional development in mathematics within the past 5 years. I have participated in mathematics professional development…

	n	Never	Rarely	Occasionally	Frequently
At the beginning of the school year	225	24.9%	27.6%	32.4%	15.1%
Throughout the school year	227	9.3%	30.4%	42.7%	17.6%
In the summer only	220	27.3%	34.5%	36.4%	1.8%
Year round in summer and during the school year	218	44.5%	31.2%	20.6%	3.7%
At night	215	63.3%	21.9%	12.6%	2.3%
On weekends	216	74.5%	18.5%	6.0%	0.9%
Through Professional Learning Communities	225	26.7%	24.9%	32.9%	15.6%
Through coaching in mathematics at my school	218	47.7%	23.9%	22.0%	6.4%
Using vlogs or blogs	220	62.3%	15.0%	15.0%	7.7%
Using webinars	220	53.2%	28.6%	17.3%	0.9%
Using social media (Twitter, etc.)	222	59.9%	18.9%	14.9%	6.3%

Table 17. Participation in professional development: Teachers who responded Never to each form of participation identified by questions 1-6 in Table 16.

Number of respondents	Count	Percent
207	11	5.3%

Table 18. Participation in professional development: Teachers who responded Never or Rarely to each form of participation identified by questions 1-6 in Table 16.

Number of respondents	Count	Percent
207	54	26.1%

Table 19. Please indicate your participation in previous professional development in mathematics within the past 5 years. I have participated in mathematics professional development…

			3-10 years' experience			10+ years' experience	
	Total n	n	Never + Rarely	Occasionally + Frequently	n	Never + Rarely	Occasionally + Frequently
Total	**215**	**57**	**50.9%**	**49.1%**	**158**	**53.2%**	**46.8%**
At the beginning of the school year — Elementary	128	29	48.3%	51.7%	99	48.5%	51.5%
At the beginning of the school year — Middle	37	11	45.5%	54.5%	26	53.8%	46.2%
At the beginning of the school year — High	50	17	58.8%	41.2%	33	66.7%	33.3%
Total	**217**	**57**	**29.8%**	**70.2%**	**160**	**42.5%**	**57.5%**
Throughout the school year — Elementary	130	29	31.0%	69.0%	101	43.6%	56.4%
Throughout the school year — Middle	37	11	9.1%	90.9%	26	42.3%	57.7%
Throughout the school year — High	50	17	41.2%	58.8%	33	39.4%	60.6%
Total	**210**	**56**	**58.9%**	**41.1%**	**154**	**61.0%**	**39.0%**
In the summer only — Elementary	124	28	71.4%	28.6%	96	64.6%	35.4%
In the summer only — Middle	37	11	45.5%	54.5%	26	65.4%	34.6%
In the summer only — High	49	17	47.1%	52.9%	32	46.9%	53.1%
Total	**208**	**56**	**76.8%**	**23.2%**	**152**	**74.3%**	**25.7%**
Year round in summer and during the school year — Elementary	121	28	85.7%	14.3%	93	78.5%	21.5%
Year round in summer and during the school year — Middle	37	11	63.6%	36.4%	26	76.9%	23.1%
Year round in summer and during the school year — High	50	17	70.6%	29.4%	33	60.6%	39.4%
Total	**205**	**57**	**77.2%**	**22.8%**	**148**	**87.8%**	**12.2%**
At night — Elementary	119	29	89.7%	10.3%	90	90.0%	10.0%
At night — Middle	36	11	63.6%	36.4%	25	84.0%	16.0%
At night — High	50	17	64.7%	35.3%	33	84.8%	15.2%
Total	**206**	**57**	**89.5%**	**10.5%**	**149**	**94.0%**	**6.0%**
On weekends — Elementary	120	29	96.6%	3.4%	91	94.5%	5.5%
On weekends — Middle	36	11	81.8%	18.2%	25	96.0%	4.0%
On weekends — High	50	17	82.4%	17.6%	33	90.9%	9.1%

Table 19 (continued). Please indicate your participation in previous professional development in mathematics within the past 5 years. I have participated in mathematics professional development…

			3-10 years' experience			10+ years' experience	
		Total n	n	Never + Rarely	Occasionally + Frequently	n	Never + Rarely	Occasionally + Frequently
Through Professional Learning Communities	**Total**	**215**	**57**	**47.4%**	**52.6%**	**158**	**52.5%**	**47.5%**
	Elementary	128	29	58.6%	41.4%	99	56.6%	43.4%
	Middle	37	11	27.3%	72.7%	26	26.9%	73.1%
	High	50	17	41.2%	58.8%	33	60.6%	39.4%
Through coaching in mathematics at my school	**Total**	**208**	**57**	**78.9%**	**21.1%**	**151**	**69.5%**	**30.5%**
	Elementary	121	29	82.8%	17.2%	92	71.7%	28.3%
	Middle	37	11	63.6%	36.4%	26	46.2%	53.8%
	High	50	17	82.4%	17.6%	33	81.8%	18.2%
Using vlogs or blogs	**Total**	**210**	**57**	**63.2%**	**36.8%**	**153**	**82.4%**	**17.6%**
	Elementary	123	29	62.1%	37.9%	94	80.9%	19.1%
	Middle	37	11	72.7%	27.3%	26	84.6%	15.4%
	High	50	17	58.8%	41.2%	33	84.8%	15.2%
Using webinars	**Total**	**210**	**57**	**75.4%**	**24.6%**	**153**	**83.7%**	**16.3%**
	Elementary	123	29	72.4%	27.6%	94	78.7%	21.3%
	Middle	37	11	72.7%	27.3%	26	84.6%	15.4%
	High	50	17	82.4%	17.6%	33	97.0%	3.0%
Using social media (Twitter, etc.)	**Total**	**212**	**57**	**64.9%**	**35.1%**	**155**	**82.6%**	**17.4%**
	Elementary	124	29	72.4%	27.6%	95	85.3%	14.7%
	Middle	38	11	63.6%	36.4%	27	81.5%	18.5%
	High	50	17	52.9%	47.1%	33	75.8%	24.2%

Organization of Results

Along with the demographics section, the survey contained a series of Likert-scale items related to six themes:

(1) mathematics teaching practices,
(2) beliefs about teaching and learning mathematics,
(3) perceived abilities and knowledge related to teaching mathematics,
(4) preferences regarding professional development in mathematics,
(5) amount and type of peer collaboration, and
(6) confidence in teaching mathematics.

The survey also contained three open-ended questions related to mathematics challenges and difficult content.

The results of the survey are presented in several ways. They are organized into five main sections.

The first section (*Analysis of Results by Theme*) provides general frequency results for each Likert-scale item, organized according to the first five themes defined just above. A later section contains these results in further detail, in particular broken out by years of teaching experience and school level (elementary, middle, or high school); see the section titled *Analysis of Results by other Demographic Variables.*

The second section (*Analysis of Results by Teacher Profiles*) focuses on the role and impact of four teacher profiles defined by four key teacher characteristics:

(1) number of same-building peer teachers,
(2) years' experience teaching mathematics,
(3) school level taught, and
(4) possessing a mathematics endorsement.

The first part of this section describes the teacher profiles corresponding to each of these four characteristics. The second part of this section includes summaries of statistically significant relationships between these four characteristics and responses to items related to several of the themes, including teaching practices, teachers' perceived abilities and knowledge for teaching, preferences for professional development, and amount and type of peer collaboration.

The third section (*Theme 6: Confidence in Teaching Mathematics*) presents results pertaining to the final survey theme – teachers' confidence in teaching mathematics – organized by main grade level taught.

The fourth section (*Analysis of Results by other Demographic Variables*) expands on the first two sections by examining the impact of demographic variables other than those considered in the Teacher Profiles section on the teacher themes from the first section.

Results are presented showing the effect of gender, district size, educational level, and years of K-12 teaching experience upon participant responses. In particular, the first part of this section summarizes the statistically significant relationships between these four additional teacher demographic variables and themes 1-5 listed above. This section also breaks out the results given in Section 1 by years of teaching experience and school level, showing combined effects of these variables on teacher themes 1-5.

The final section of results (*Open-Ended Responses*) contains a summary of open-ended responses grouped by school level.

Analysis of Results by Theme

This section presents results organized by the first five themes.

Theme 1: Mathematics Teaching Practices

This section of the survey is related to mathematics teaching practices. Teachers were asked how often a series of statements describe their classroom when teaching mathematics (Tables 20 and 21), and how often their lessons helped students achieve the Standards of Mathematical Practice (Table 22).

The results (Table 20) indicate that teachers frequently employ student collaboration when teaching mathematics – over 60% of teachers responded that they often or very often have students work together on mathematics, work together to figure out mathematical ideas and methods, explain their solutions and reasoning to other students, and talk to each other about mathematics. Interestingly, nearly three-quarters of teachers (74%) also reported that they have their students work independently on problems in mathematics often or very often, suggesting that teachers commonly utilize a combination of group and individual activities when teaching mathematics.

About a quarter of teachers said they never have students use calculators during class to carry out calculations or explore mathematics ideas and methods. This might partially be explained by the large representation of elementary teachers in the sample.

Additionally, while the results suggest that teachers are unlikely to give lectures when teaching mathematics often or very often, a large majority explain solutions to problems step by step and do worked out examples on the board often or very often (Table 21). More than three-quarters carefully explain mathematical ideas and methods often or very often. Fewer than 40% of teachers focus on computational skills often or very often.

The final set of items asked teachers how often their lessons helped students achieve the Standards of Mathematical Practice (Table 22). Teachers reported that they least often accomplish the standard of constructing viable arguments and critiquing the reasoning of others. On the other hand, teachers reported that their lessons most often help students achieve the standards of making sense of problems and persevere in solving them, and using appropriate tools strategically.

Table 20. Please indicate how often these statements describe your classroom when teaching mathematics. Students in my mathematics classes…

	n	Never	Rarely	Sometimes	Often	Very Often
Work independently on problems in mathematics	217	0.5%	3.2%	22.6%	47.5%	26.3%
Work together (in groups or pairs) on mathematics	216	0.5%	1.9%	20.8%	48.6%	28.2%
Use calculators during class to carry out calculations	217	23.5%	17.1%	26.7%	15.2%	17.5%
Use calculators during class to explore mathematical ideas and methods	216	26.9%	20.4%	28.2%	13.4%	11.1%
Work together to figure out mathematical ideas and methods	217	1.4%	5.5%	28.6%	39.2%	25.3%
Explain their solutions and reasoning to other students	217	1.8%	5.5%	24.4%	39.2%	29.0%
Work on rich tasks	217	2.8%	12.0%	44.2%	28.6%	12.4%
Talk to each other about mathematics	217	0.5%	6.9%	32.3%	31.8%	28.6%

Table 21. Please indicate how often these statements describe your classroom when teaching mathematics. When teaching mathematics…

	n	Never	Rarely	Sometimes	Often	Very Often
I give lectures	218	15.6%	34.9%	33.5%	11.0%	5.0%
I do worked out examples on the board	218	1.8%	7.8%	23.9%	34.4%	32.1%
I carefully explain mathematical ideas and methods to my students	218	1.8%	1.8%	20.2%	42.2%	33.9%
I focus on teaching computational skills.	218	3.2%	18.8%	40.8%	22.0%	15.1%
I explain how to solve problems step by step	218	2.3%	5.5%	29.8%	34.4%	28.0%

Table 22. How often do your lessons help students achieve the Standards of Mathematical Practice?

	n	Never	Rarely	A few times monthly	A few times weekly	Daily	I'm unsure
Make sense of problems and persevere in solving them	209	1.0%	0.5%	12.9%	36.8%	45.5%	3.3%
Reason abstractly and quantitatively	209	1.0%	3.8%	20.1%	45.9%	22.5%	6.7%
Construct viable arguments and critique the reasoning of others	208	2.4%	13.9%	29.3%	27.4%	23.1%	3.8%
Model with mathematics	209	1.4%	2.4%	16.7%	33.0%	45.5%	1.0%
Use appropriate tools strategically	209	1.4%	1.4%	13.4%	33.0%	48.8%	1.9%
Attend to precision	206	1.5%	3.4%	10.7%	30.6%	48.5%	5.3%
Look for and make use of structure	208	1.4%	2.4%	14.4%	31.3%	33.2%	17.3%
Look for and express regularity in repeated reasoning	207	1.4%	2.4%	13.0%	40.6%	29.5%	13.0%

Theme 2: Teacher Beliefs about Teaching and Learning Mathematics

The next set of items within this section asked teachers to rate their level of agreement with a series of statements about teaching mathematics (Table 23). The highest level of agreement, with more than 80% of teachers responding Agree or Strongly Agree, was with the statements:

> 'An effective way to teach is to carefully explain mathematical ideas and methods to students,'
> 'When teaching mathematics, I do more asking than telling,'
> 'It is important for students to struggle a bit when learning mathematics,' and
> 'When teaching mathematics, students should learn basic skills through problem solving.'

The lowest level of agreement, on the other hand, was with the statements:

> 'The most effective way to teach and learn mathematics is through direct instruction,' and
> and 'When teaching mathematics, students should learn basic skills first, then do problem-solving.'

Only one-third of teachers agreed or strongly agreed with these statements.

There was also a low level of agreement with two other statements:

> 'Since the teacher already knows the mathematics, it is her or his job to explain that knowledge to the students,' and
> 'Calculators should not be used in the lower elementary school grades.'

Table 23. Please indicate your level of agreement with the following statements about teaching mathematics.

	n	Strongly Disagree	Disagree	Agree	Strongly Agree
An effective way to teach mathematics is to show students many worked out examples.	209	6.2%	34.4%	47.8%	11.5%
An effective way to teach is to carefully explain mathematical ideas and methods to students.	208	0.5%	19.2%	67.3%	13.0%
When teaching mathematics, I do more asking than telling.	210	0.0%	11.4%	61.4%	27.1%
Since the teacher already knows the mathematics, it is her or his job to explain that knowledge to the students.	209	7.7%	51.7%	36.4%	4.3%
Calculators should not be used in the lower elementary school grades.	209	7.2%	49.8%	30.6%	12.4%
It is important for students to struggle a bit when learning mathematics.	209	0.0%	11.5%	51.7%	36.8%
The most effective way to teach and learn mathematics is through direct instruction.	210	6.7%	54.3%	35.7%	3.3%
When teaching mathematics, students should learn basic skills first, then do problem-solving.	208	4.8%	58.2%	30.3%	6.7%
When teaching mathematics, students should learn basic skills through problem solving.	210	0.5%	16.2%	68.6%	14.8%

Theme 3: Perceived Abilities and Knowledge Related to Teaching Mathematics

In this section, teachers were asked to rate from poor to excellent their ability and knowledge regarding various aspects of teaching mathematics (Table 24). Teachers gave the lowest rating to their ability to use technology more effectively to support teaching and learning and ability to provide both access and challenge in my lessons ("low floor, high ceiling"), while their depth of knowledge of mathematics for teaching and ability to identify and devise strategies for addressing common student misconceptions were rated the highest.

Table 24. On a scale from poor ability/knowledge to excellent ability/knowledge, rate your…

	n	Poor Ability/ Knowledge	Fair Ability/ Knowledge	Good Ability/ Knowledge	Excellent Ability/ Knowledge
Depth of knowledge of mathematics for teaching	192	2.1%	7.3%	65.6%	25.0%
Ability to identify and devise strategies for addressing common student misconceptions	192	0.5%	16.1%	60.4%	22.9%
Ability to provide the right amount of scaffolding (guidance and support for effective student learning)	192	1.6%	16.7%	63.0%	18.8%
Ability to use technology more effectively to support teaching and learning	192	4.2%	37.5%	51.6%	6.8%
Ability to help my students develop their problem-solving skills	192	0.5%	27.1%	59.9%	12.5%
Ability to help my students develop their reasoning skills	190	0.0%	26.8%	62.1%	11.1%
Understanding of the Iowa Core Standards for Mathematical Practice	191	2.1%	28.8%	51.8%	17.3%

Table 24 (continued). On a scale from poor ability/knowledge to excellent ability/knowledge, rate your…

	n	Poor Ability/ Knowledge	Fair Ability/ Knowledge	Good Ability/ Knowledge	Excellent Ability/ Knowledge
Ability to teach with the Iowa Core Standards for Mathematical Practice	191	1.6%	27.2%	52.9%	18.3%
Ability to provide both access and challenge in my lessons ("low floor, high ceiling")	192	4.2%	40.1%	45.8%	9.9%
Ability to ask good questions that promote effective teaching and learning	192	0.5%	18.2%	59.4%	21.9%
Ability to organize and facilitate collaborative student work in my classes	192	3.1%	22.4%	54.7%	19.8%
Ability to design instruction where I find out what my students know and alter instruction based on that knowledge	191	2.1%	17.8%	58.1%	22.0%

Theme 4: Preferences Regarding Professional Development in Mathematics

Questions on the survey also related to teachers' professional development preferences. The majority of teachers (56%) responded that they rarely seek out professional development beyond district-mandated activities (Table 25).

Almost half of the teachers (48%) reported that their most valuable professional development experience was a combination of professional development delivered online, informal study groups or learning communities, and traditional face to face. The second highest percentage of teachers reported traditional face to face as their most valuable professional development experience (35%) (Table 26).

More than half of the teachers (57%) were interested in earning college credit for participating in professional development in mathematics (Table 27). Among teachers who did not have an endorsement, six percent reported that they would like to pursue an endorsement, and 27% would maybe like to pursue one (Table 28). In addition, of those without an advanced degree, about 19% were interested in seeking one (Table 29).

When asked about the top-three barriers limiting their ability to participate in professional development (Table 30), most teachers (81%) responded time; the next three most frequent responses were cost to participate (46%), location of the activity (45%), and personal responsibilities (38%).

Further analysis was undertaken to explore the association between professional development preferences and teacher characteristics such as school level, gender, and years teaching experience. Two tables (Tables 31 and 32) summarize these findings, described as statistically significant relationships that exist between teacher characteristics and professional development preferences.

This analysis featured a multinomial regression on the survey question that asked, 'My most valuable professional development experience in mathematics was:….' The four response options were delivered online, informal study groups or learning communities, traditional face-to-face, and a combination of these. In particular, traditional face-to-face served as the reference category, so this analysis captures whether teachers' characteristics were associated with a decrease or increase in the likelihood of teachers selecting each of the other options relative to traditional face-to-face. Similar to other regression analyses, these tests were conducted on two samples – one for all teachers and excluding endorsements as a predictor variable (Table 31) and another that comprised only teachers in elementary and/or middle school and included endorsements as a predictor variable (Table 32). More detailed versions of these results appear following the full regression models in Appendices A and B.

Table 25. I seek out professional development opportunities in…

	n	Never	Rarely	Occasionally	Frequently
mathematics development beyond district-mandated activities.	226	7.5%	56.2%	9.7%	26.5%

Table 26. My most valuable professional development experience is mathematics was:

	n	Count	Percent
Delivered online	224	10	4.5%
Informal study groups or learning communities	224	27	12.1%
Traditional face to face	224	79	35.3%
A combination of these	224	108	48.2%

Note: 224 teachers answered this question. The count represents the number of teachers who indicated each professional development option.

Table 27. Are you interested in earning college credit for professional development in mathematics?

	n	Percent
Yes	129	57.3%
No	96	42.7%
Total	225	

Table 28. Would you like to seek an endorsement in mathematics in the future?

	n	Percent
Yes	12	6.4%
No	126	67.0%
Maybe	50	26.6%
Total	188	

Note: Only respondents who did not have an endorsement answered this question.

Table 29. Are you interested in earning advanced degree in mathematics or mathematics education?

	n	Percent
Yes	28	18.8%
No	121	81.2%
Total	149	

Note: Only respondents who did not have an advanced degree answered this question.

Table 30. What are the top-three barriers that currently limit your ability in professional development activities?

	n	Count	Percent
Time to participate	222	180	81.1%
Cost to participate	222	103	46.4%
Location of the activity	222	100	45.0%
Personal responsibilities	222	85	38.3%
Access to substitute teachers	222	65	29.3%
Don't need additional college credit	222	46	20.7%
School extra-curricular responsibilities	222	30	13.5%
Administrative support	222	17	7.7%
Other	222	17	7.7%

Note: 222 teachers answered this question. The count represents the number of teachers who indicated each barrier.

Note regarding the interpretation of Tables 31 and 32: The first column in each table lists the teacher characteristic (variable) for which there is a statistically significant relationship with teachers' professional development preferences. The second column gives the direction of that relationship. Negative means that increases in the particular variable decreases the likelihood that teachers find the method of professional development delivery more valuable than face-to-face. Positive means that increases in the particular variable increases the likelihood that teachers find the method of professional development delivery more valuable than face-to-face.

Table 31. Summary of statistically significant relationships between PD preferences and demographic variables, comparing face-to-face PD to other PD modalities for K-12 Teachers

Variable	Direction	Interpretation
Number of same-building peer teachers	+	Teachers who have more same-building peer teachers were more likely to value a combination of PD modalities (face-to-face, online, informal study groups or professional learning communities) more than face-to-face PD only.
Years' teaching mathematics	-	Teachers with more years' experience teaching mathematics were less likely to value online more than face-to-face.
Years' teaching mathematics	-	Teachers with more years' experience teaching mathematics were less likely to value a combination of PD modalities more than face-to-face.
School level	-	Teachers who teach at a higher school level were less likely to value a combination of PD modalities more than face-to-face.
Education level	+	Teachers with a higher education level value a combination of PD modalities more than face-to-face PD alone.

Table 32. Summary of statistically significant relationships between PD preferences and demographic variables, comparing face-to-face PD to other PD modalities for K-8 Teachers

Variable	Direction	Interpretation
District size	-	K-8 teachers in larger districts were less likely to value a combination of PD modalities (face-to-face, online, informal study groups or professional learning communities) more than face-to-face PD only.
Number of same-building peer teachers	-	K-8 teachers who have more same-building peer teachers were less likely to value informal study groups or professional learning communities more than face-to-face PD only.
Number of same-building peer teachers	+	K-8 teachers who have more same-building peer teachers were more likely to value a combination of PD modalities (face-to-face, online, informal study groups or professional learning communities) more than face-to-face PD only.
Years' teaching mathematics	-	K-8 teachers with more years' experience teaching mathematics were less likely to value online PD more than face-to-face PD.
School level	-	K-8 teachers who teach at a higher school level were less likely to value a combination of PD modalities (face-to-face, online, informal study groups or professional learning communities) more than face-to-face PD only.
Education level	-	K-8 teachers with a higher education degree were less likely to value online PD more than face-to-face PD.
Math endorsement	+	K-8 teachers with a math endorsement were more likely to value a combination of PD modalities (face-to-face, online, informal study groups or professional learning communities) more than face-to-face PD only.

Theme 5: Amount and Type of Peer Collaboration

Teachers were asked to describe their collaboration on mathematics topics. The results indicate that when collaborating on mathematics topics with other teachers in their district, teachers more frequently worked with other teachers at their grade level than other teachers at different grade levels (Table 33). Additionally, over half of teachers (55%) reported that they were either never or rarely given regularly scheduled time during the school day to work collaboratively to plan mathematics instruction and review student assessment data. Compared to that item, teachers more frequently received high-quality training on collaboration models and collaborated to analyze data to make long-term instructional decisions, although only a quarter of teachers reported that they did so often or very often (Table 34).

Table 33. Tell us about how often you collaborate with others on mathematical topics or how to teach mathematics.

	n	Never	Rarely	A few times monthly	A few times weekly	Daily
How often do you do so with other teachers at your grade level in your district?	252	11.1%	26.2%	27.0%	27.0%	8.7%
How often do you do so with other teachers at a different grade level?	245	13.5%	46.9%	29.0%	9.4%	1.2%

Table 34. At your school, how often…

	n	Never	Rarely	Sometimes	Often	Very Often
Are teachers given regularly scheduled time, during the school day, to work collaboratively to plan mathematics instruction and review student assessment data?	221	27.1%	28.1%	25.8%	10.9%	8.1%
Have teachers received high-quality training on collaboration models (i.e., professional learning communities)?	220	14.1%	25.9%	35.5%	18.2%	6.4%
Do teachers collaborate to analyze data to make long-term instructional decisions?	218	8.3%	30.7%	34.4%	21.6%	5.0%

Analysis of Results by Teacher Profiles

An additional factor this study sought to investigate was the role and impact of a variety of demographic characteristics on teachers' practices, beliefs, perceived abilities and knowledge, preferences for professional development, and amount and type of peer collaboration. In particular, this section analyzes results for four teacher profiles defined by four key teacher demographic characteristics:

- the number of same-building peer teachers,
- years' experience teaching mathematics,
- school level taught, and
- having a mathematics endorsement.

The influence of additional but less impactful demographic variables is described in the later section *Analysis of Results by other Demographic Variables.* Those additional variables are gender, district size, educational level, and years' K-12 teaching experience.

The following section contains two subsections. The first contains descriptive characteristics of respondents corresponding to each of the four profiles mentioned above. The second subsection contains summaries of statistically significant relationships between these profiles and several of the themes, including teaching practices, teacher beliefs, and teachers' perceived abilities and knowledge for teaching.

Descriptions of the Four Teacher Profiles

Number of Same-building Peer Teachers Teacher Profile

This profile is based on teacher responses summarized in Table 5, which asks 'How many other teachers teach mathematics at your level in your building?' We refer to these other teachers who teach mathematics at the same grade in the same building as *same-building peer teachers*. This profile provides descriptive characteristics of respondents by number of same-building peer teachers.

The results indicate that both genders tended to have at least one or two peer teachers (Table 35), although men were more likely to be the only mathematics teachers in their building, and women were much more likely to have 10 or more peer teachers. Additionally, the number of peer teachers increased with district size (Table 36). High school teachers were least likely to have no peer teachers in their building, while elementary teachers were most likely to work with at least six other peer teachers (Table 37). Teachers with two or fewer years teaching experience and math teaching experience were likely to have three or more peer teachers, whereas teachers with three or more years' teaching experience and math teaching experience were more likely to have one or two peer teachers (Tables 38 and 39). Although there were not very large percentage

differences in the number of peer teachers for teachers with bachelor's degrees, teachers with coursework beyond bachelor's and teachers with master's degrees tended to have one or two peer teachers (Table 40). Finally, teachers with endorsements were most likely to have at least one or two peer teachers, while there was no major difference in the number of peer teachers for people without endorsements (Table 41).

Table 35. Same-building peer teachers by gender

	n	Just me	1-2	3-5	6-10	10+
Men	37	24.3%	40.5%	13.5%	10.8%	10.8%
Women	201	8.0%	33.3%	18.4%	17.4%	22.9%
Total	238					

Table 36. Same-building peer teachers by district size

	n	Just me	1-2	3-5	6-10	10+
<=999	137	16.8%	44.5%	10.2%	14.6%	13.9%
1,000-2,499	52	7.7%	26.9%	34.6%	13.5%	17.3%
>=2,500	52	0.0%	13.5%	23.1%	25.0%	38.5%
Total	241					

Table 37. Same-building peer teachers by school level

	n	Just me	1-2	3-5	6-10	10+
Elementary	150	12.0%	24.0%	14.7%	19.3%	30.0%
Middle	45	20.0%	40.0%	26.7%	6.7%	6.7%
High	55	0.0%	52.7%	20.0%	18.2%	9.1%
Total	250					

Table 38. Same-building peer teachers by years teaching experience

	n	Just me	1-2	3-5	6-10	10+
2 or fewer years	13	7.7%	0.0%	38.5%	23.1%	30.8%
3-6 years	42	11.9%	38.1%	16.7%	14.3%	19.0%
7-10 years	24	4.2%	37.5%	12.5%	20.8%	25.0%
10+ years	174	11.5%	35.1%	17.2%	16.1%	20.1%
Total	253					

Table 39. Same-building peer teachers by math teaching experience

	n	Just me	1-2	3-5	6-10	10+
2 or fewer years	20	10.0%	15.0%	20.0%	40.0%	15.0%
3-6 years	48	14.6%	41.7%	14.6%	8.3%	20.8%
7-10 years	25	4.0%	36.0%	12.0%	20.0%	28.0%
10+ years	156	10.9%	34.6%	17.9%	16.0%	20.5%
Total	249					

Table 40. Same-building peer teachers by highest degree earned

	n	Just me	1-2	3-5	6-10	10+
Bachelor's	43	14.0%	27.9%	14.0%	25.6%	18.6%
Coursework Beyond Bachelor's	107	14.0%	36.4%	17.8%	15.0%	16.8%
Master's	103	5.8%	34.0%	19.4%	14.6%	26.2%
Total	253					

Table 41. Same-building peer teachers by endorsement

	n	Just me	1-2	3-5	6-10	10+
Yes	85	8.2%	50.6%	20.0%	12.9%	8.2%
No	168	11.9%	25.6%	16.7%	18.5%	27.4%
Total	253					

Years' Experience Teaching Mathematics Teacher Profile

This profile is based on participant responses to the question 'How many years have you taught mathematics at the K-12 level?' that are summarized in Table 10.

The results indicate that a higher proportion of men (83.4%) than women (69.7%) have taught mathematics for seven years or more (Table 42). Additionally, the proportion of teachers with two or fewer years of experience teaching mathematics decreases by school level (Table 44). Whereas 10.5% of elementary teachers have taught mathematics two or fewer years, only 5.4% of high school teachers have this amount of experience. The results also indicate that years teaching experience increases by highest degree earned (Table 46). While 69.1% of teachers with a master's degree have taught ten or more years, only 17.4% of teachers with only a bachelor's degree have this much experience.

Smaller and larger districts (fewer than 1,000 students and more than 2,500 students) have a higher proportion of teachers with 10 or more years' experience teaching mathematics than mid-size districts (1,000 to 2,499 students) (Table 43). Additionally, a much lower proportion of teachers with endorsements (3.5%) have taught mathematics two or fewer years than teachers without endorsements (14.4%).

Table 42. Years' experience teaching mathematics by gender

	n	2 years or fewer	3-6 years	7-10 years	10+years
Men	36	5.6%	11.1%	16.7%	66.7%
Women	198	8.6%	21.7%	8.6%	61.1%
Total	234				

Table 43. Years' experience teaching mathematics by district size

	n	2 years or fewer	3-6 years	7-10 years	10+years
<=1000	143	9.1%	19.6%	9.1%	62.2%
1,000-2,499	56	16.1%	23.2%	8.9%	51.8%
>=2,5000	55	9.1%	16.4%	9.1%	65.5%
Total	254				

Table 44. Years' experience teaching mathematics by school level

	n	2 years or fewer	3-6 years	7-10 years	10+years
Elementary	157	10.2%	19.1%	8.3%	62.4%
Middle	46	8.7%	23.9%	8.7%	58.7%
High	56	5.4%	17.9%	14.3%	62.5%
Total	259				

Table 45. Years' experience teaching mathematics by years teaching mathematics

	n	2 years or fewer	3-6 years	7-10 years	10+years
2 years or fewer	14	92.9%	0.0%	0.0%	7.1%
3-6 years	45	8.9%	88.9%	0.0%	2.2%
7-10 years	26	11.5%	7.7%	76.9%	3.8%
10+ years	182	4.9%	4.9%	2.7%	87.4%
Total	267				

Table 46. Years' experience teaching mathematics by highest degree earned

	n	2 years or fewer	3-6 years	7-10 years	10+years
Bachelor's	46	28.3%	37.0%	17.4%	17.4%
Coursework Beyond Bachelor's	111	8.1%	16.2%	5.4%	70.3%
Master's	110	6.4%	14.5%	10.0%	69.1%
Total	267				

Table 47. Years' experience teaching mathematics by mathematics endorsement

	N	2 years or fewer	3-6 years	7-10 years	10+years
Yes	86	3.5%	18.6%	12.8%	65.1%
No	181	14.4%	19.3%	7.7%	58.6%
Total	267				

Table 48. Years' experience teaching mathematics by number of same-building peer teachers

	N	2 years or fewer	3-6 years	7-10 years	10+years
Just me	27	7.4%	25.9%	3.7%	63.0%
1-2	86	3.5%	23.3%	10.5%	62.8%
3-5	42	9.5%	16.7%	7.1%	66.7%
6-10	42	19.0%	9.5%	11.9%	59.5%
10+	52	5.8%	19.2%	13.5%	61.5%
Total	249				

School Level Taught Teacher Profile

This profile was developed based on responses to the questions 'Please indicate the grade levels you are currently teaching' summarized in Table 4 and 'Pick the primary grade you teach' summarized in Table 68. The following tables feature descriptive characteristics by school level taught. The results indicate that a higher proportion of men teachers are at the middle and high school levels relative to women teachers (Table 49). Additionally, the proportion of teachers with an endorsement increases by school level (Table 54). Regarding experience, the lowest school levels tend to have the highest proportion of teachers with two years or fewer experience teaching mathematics and K-12 more generally (Tables 51 and 52). The results also indicate that no high school teachers responding are the only math teachers in their building, although they are the most likely to have only one or two same-building peer teachers (Table 55).

Table 49. School level taught by gender

	n	Elementary	Middle	High
Men	37	37.8%	27.0%	35.1%
Women	200	66.0%	15.0%	19.0%
Total	237			

Table 50. School level taught by district size

	n	Elementary	Middle	High
<=999	126	63.5%	15.9%	20.6%
1,000-2,499	49	53.1%	24.5%	22.4%
>=2,500	49	55.1%	16.3%	28.6%
Total	224			

Table 51. School level taught by years teaching experience

	n	Elementary	Middle	High
2 years or fewer	13	76.9%	15.4%	7.7%
3-6 years	40	60.0%	20.0%	20.0%
7-10 years	23	47.8%	17.4%	34.8%
10+ years	161	62.7%	16.1%	21.1%
Total	237			

Table 52. School level taught by math experience

	n	Elementary	Middle	High
2 years or fewer	17	76.5%	23.5%	0.0%
3-6 years	47	59.6%	23.4%	17.0%
7-10 years	23	56.5%	13.0%	30.4%
10+ years	145	62.1%	15.2%	22.8%
Total	232			

Table 53. School level taught by highest degree earned

	n	Elementary	Middle	High
Bachelor's	42	71.4%	14.3%	14.3%
Coursework Beyond Bachelor's	95	67.4%	15.8%	16.8%
Master's	100	52.0%	19.0%	29.0%
Total	237			

Table 54. School level taught by mathematics endorsement

	n	Elementary	Middle	High
Yes	81	11.1%	29.6%	59.3%
No	156	87.8%	10.3%	1.9%
Total	237			

Table 55. School level taught by number of same-building peer teachers

	n	Elementary	Middle	High
Just me	25	72.0%	28.0%	0.0%
1-2	80	43.8%	22.5%	33.8%
3-5	42	52.4%	23.8%	23.8%
6-10	39	69.2%	7.7%	23.1%
10+	50	86.0%	4.0%	10.0%
Total	236			

Mathematics Endorsements Teacher Profile

The profile in this subsection features the descriptive characteristics of teachers possessing mathematics endorsements and is based on responses to the question 'Do you have an endorsement in mathematics?' summarized within Table 7.

The most notable pattern is that the percentage of teachers with an endorsement increases with school level (Table 58). Whereas only six percent of elementary teachers have endorsements, 85% of teachers at the high school level have an endorsement. Furthermore, a higher percentage of men have endorsements than women (Table 56), although this may be attributable to the fact that a higher percentage of men teach at the high school level. The results also indicate that teachers who had endorsements were more likely to be in larger districts (Table 57) and have seven to 10 years of teaching experience and math teaching experience (Table 60 and 61). Additionally, teachers with higher education levels were more likely to have endorsements (Table 62), and there were more likely to be one or two other teachers with endorsements at the building level (Table 63).

Table 56. Mathematics Endorsement by gender

	n	Percent with Endorsement
Men	38	52.6%
Women	201	30.3%
Total	239	

Table 57. Mathematics Endorsement by district size

	n	Percent with Endorsement
<=999	147	28.6%
1,000-2,499	58	34.5%
>=2,500	56	42.9%
Total	261	

Table 58. Mathematics Endorsement by school level

	n	Percent with Endorsement
Elementary	160	5.6%
Middle	46	54.3%
High	60	85.0%
Total	266	

Table 59. Percent of teachers with mathematics endorsements by school level and number of same-building peer teachers

	Just me	1-2	3-5	6-10	10+	Total
Elementary	1/18 5.6%	2/36 5.6%	4/22 18.2%	1/29 3.4%	1/45 2.2%	9/150 6.0%
Middle	6/9 66.7%	12/18 66.7%	5/12 41.7%	1/3 33.3%	1/3 33.3%	25/45 55.6%
High	0/0 0.0%	28/29 96.6%	8/11 72.7%	9/10 90.0%	5/5 100.0%	50/55 90.9%
Total	7/27 25.9%	42/83 50.6%	17/45 37.8%	11/42 26.2%	7/53 13.2%	84/250 33.6%

Figure 1. Percent of teachers with mathematics endorsements by school level and number of same-building peer teachers

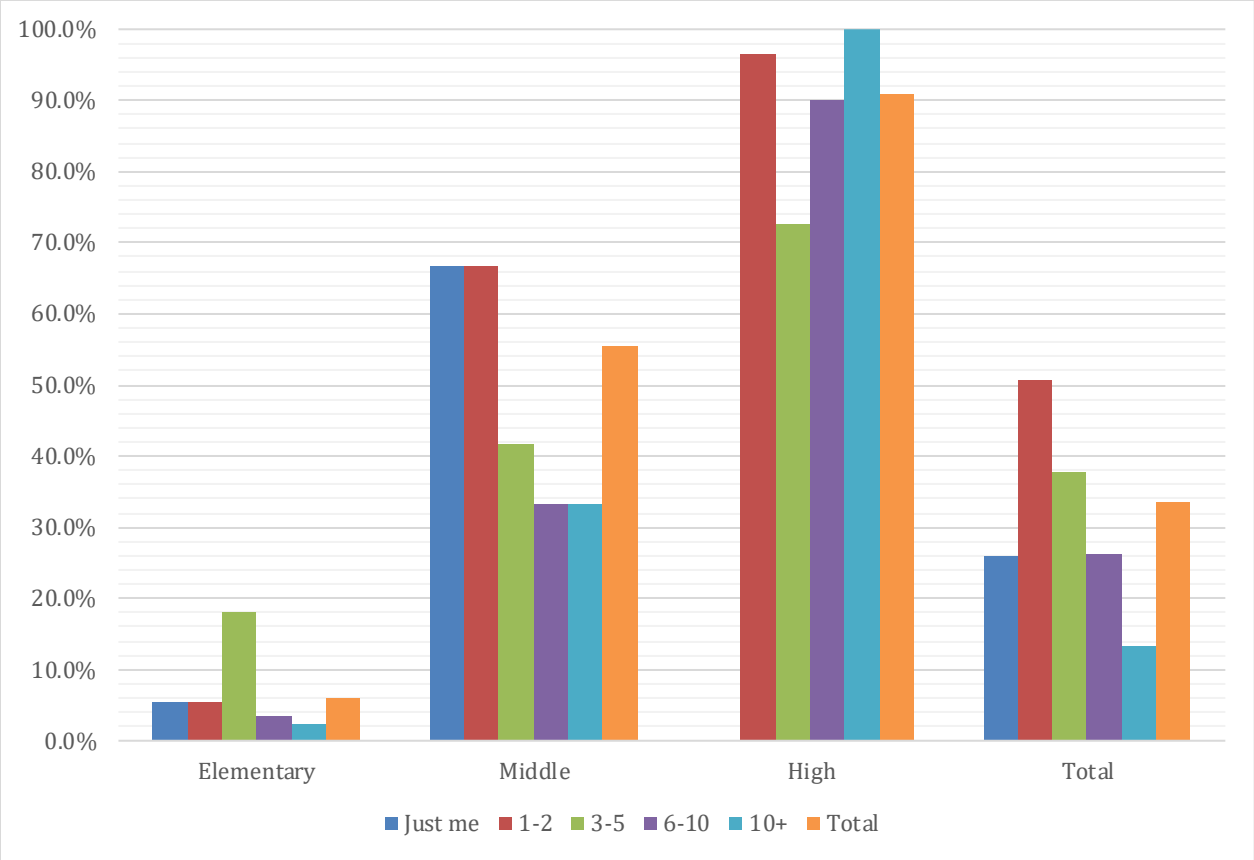

Table 60. Mathematics Endorsement by years teaching experience

	n	Percent with Endorsement
2 or fewer years	15	13.3%
3-6 years	46	32.6%
7-10 years	26	42.3%
10+ years	187	31.0%
Total	274	

Table 61. Mathematics Endorsement by math teaching experience

	n	Percent with Endorsement
2 or fewer years	29	10.3%
3-6 years	51	31.4%
7-10 years	25	44.0%
10+ years	162	34.6%
Total	267	

Table 62. Mathematics Endorsement by highest degree earned

	n	Percent with Endorsement
Bachelor's	46	23.9%
Coursework Beyond Bachelor's	113	25.7%
Master's	115	40.0%
Total	274	

Table 63. Mathematics Endorsement by number of math teachers at your building level

	n	Percent with Endorsement
Just me	27	25.9%
1-2	86	50.0%
3-5	45	37.8%
6-10	42	26.2%
10+	53	13.2%
Total	253	

Statistically Significant Relationships between the Profiles and Themes

The following tables contain summaries of statistically significant relationships between the four characteristics that define the four different profiles and several of the themes, including mathematics teaching practices, abilities and knowledge related to teaching mathematics, amount and type of peer collaboration, and preferences regarding professional development. These summaries are organized by the four profiles.

The first column of each table contains the subtopic/item, the Direction column indicates whether the relationship was negative (-) or positive (+), and the Interpretation column features an explanation of the relationship.

These relationships were modeled using a multivariate linear regression approach, which seeks to identify the association between a predictor variable and an outcome while controlling for the effect of a set of other predictor variables. Predictor variables used in this study include district size, number of same-building peer teachers, years' experience teaching mathematics, education level, school level taught, and gender, and possessing a mathematics endorsement.

Four of these predictor variables were used to identify the four teacher profiles (number of same-building peer teachers, years' experience teaching mathematics, school level taught, and having a mathematics endorsement). These are analyzed here in the present section, with the other variables controlled. Other predictor variables are specifically analyzed in the section below titled *Analysis of Results for Other Demographic Variables*.

Full results for these models are included in Appendices A-D, and Appendix E contains variable coding and significance scales.

The significance threshold for inclusion in these tables was 90%, meaning there is only a 10% chance that these relationships were due to chance. The convention for significance thresholds is typically 95% in academic scholarship, but as stated in the study overview, these analyses are simply attempting to uncover potential relationships between variables rather than make predictions or establish causality.

The first three analyses (Table 64-66) examine the relationship between same-building peer teachers, years teaching mathematics experience, and school level taught and item responses. These analyses included the responses of all teachers but excluded endorsements as a variable. Endorsements were omitted from these models because such a high proportion of high school teachers (85%) have endorsements that a significant relationship between endorsements and item responses may simply reflect teaching at a higher grade level. For the same reason, the final analysis (Table 67), which examines the

relationship between having an endorsement and item responses, excludes high school teachers.

As indicated by superscripts in the tables below, the coding for item responses was:

a: 1 = Never, 2 = Rarely, 3 = A few times monthly, 4 = A few times weekly, 5 = Daily
b: 1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Very Often
c: 1 = Never, 2 = Rarely, 3 = Occasionally, 4 = Frequently
d: 1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree
e: 1 = Poor ability/Knowledge, 2 = Fair ability/Knowledge, 3 = Good ability/Knowledge, 4 = Excellent Ability/Knowledge

Statistically Significant Relationships for the Same-building Peer Teacher Profile

Table 64. Summary of statistically significant relationships between number of same-building peer teachers and themes

Theme/Question	Direction	Interpretation
Theme 5: Amount and Type of Peer Collaboration		
Tell us about how often you collaborate with others on mathematical topics or how to teach mathematics. - How often do you do so with other teachers at your grade level in your district?[a]	+	As the number of same-building peer teachers increases, teachers collaborate with teachers at the same grade levels more often.
Tell us about how often you collaborate with others on mathematical topics or how to teach mathematics. - How often do you do so with other teachers at a different grade level?[a]	-	As the number of same-building peer teachers increases, teachers collaborate with teachers at different grade levels less often.
At your school, how often... - are teachers given regularly scheduled time, during the school day, to work collaboratively to plan mathematics instruction and review student assessment data?[b]	+	As the number of same-building peer teachers increases, teachers are more often given regularly schedule time to work collaboratively to plan mathematics instruction and review student assessment data.
Theme 4: Preferences Regarding Professional Development in Mathematics		
Please indicate your participation in previous professional development in mathematics within the past 5 years. I have participated in mathematics professional development... - using webinars.[c]	-	As the number of same-building peer teachers increases, teachers participate in professional development via webinars less frequently.

Table 64 (continued). Summary of statistically significant relationships between number of same-building peer teachers and themes

Theme 1: Mathematics Teaching Practices		
Please indicate how often these statements describe your classroom when teaching mathematics. Students in my mathematics classes... - work together (in groups or pairs) on mathematics.[b]	-	As the number of same-building peer teachers increases, students less often work together on mathematics.
Please indicate how often these statements describe your classroom when teaching mathematics. Students in my mathematics classes... - use calculators during class to carry out calculations.[b]	-	As the number of same-building peer teachers increases, students less often use calculators to carry out calculations.
Please indicate how often these statements describe your classroom when teaching mathematics. Students in my mathematics classes... - use calculators during class to explore mathematical ideas and methods.[b]	-	As the number of same-building peer teachers increases, students less often use calculators to explore mathematical ideas and methods.
Please indicate how often these statements describe your classroom when teaching mathematics. Students in my mathematics classes... - work on rich tasks.[b]	+	As the number of same-building peer teachers increases, students work on rich tasks more often.

Table 64 (continued). Summary of statistically significant relationships between number of same-building peer teachers and themes

Theme 3: Perceived Abilities and Knowledge related to Teaching Mathematics		
On a scale from poor ability/knowledge to excellent ability/knowledge, rate your... - Ability to use technology more effectively to support teaching and learning.[e]	+	As the number of same-building peer teachers increases, teachers have more confidence in their ability to use technology more effectively to support teaching and learning.
On a scale from poor ability/knowledge to excellent ability/knowledge, rate your... - Ability to help my students develop their reasoning skills.[e]	+	As the number of same-building peer teachers increases, teachers have more confidence in their ability to help their students develop their reasoning skills.
On a scale from poor ability/knowledge to excellent ability/knowledge, rate your... - Ability to ask good questions that promote effective teaching and learning.[e]	+	As the number of same-building peer teachers increases, teachers have more confidence in their ability to ask good questions that promote effective teaching and learning.
On a scale from poor ability/knowledge to excellent ability/knowledge, rate your... - Ability to organize and facilitate collaborative student work in my classes.[e]	+	As the number of same-building peer teachers increases, teachers have more confidence in their ability to organize and facilitate collaborative student work in my classes.

Statistically Significant Relationships for the Years' Experience Teaching Mathematics Profile

Table 65. Summary of statistically significant relationships between years' experience teaching mathematics and themes

Theme/Question	Direction	Interpretation
Theme 1: Mathematics Teaching Practices		
Please indicate how often these statements describe your classroom when teaching mathematics. Students in my mathematics classes... - use calculators during class to carry out calculations.[b]	+	Teachers with more experience have their students use calculators to carry out calculations more often.
Please indicate how often these statements describe your classroom when teaching mathematics. Students in my mathematics classes... - use calculators during class to explore mathematical ideas and methods.[b]	+	Teachers with more experience have their students use calculators to explore mathematical ideas and methods more often.
Please indicate how often these statements describe your classroom when teaching mathematics. Students in my mathematics classes... - work on rich tasks.[b]	-	Teachers with more experience have their students work on rich tasks less often.
Please indicate how often this describes your classroom when teaching mathematics. When teaching mathematics... - I explain how to solve problems step by step.[b]	-	Teachers with more experience explain how to solve problems step by step less often.
Please indicate your level of agreement with the following statements about teaching mathematics. - An effective way to teach mathematics is to show students many worked out examples.[d]	-	Teachers with more experience have a lower level of agreement that an effective way to teach mathematics is to show students many worked out examples.

Table 65 (continued). Summary of statistically significant relationships between years' experience teaching mathematics and themes

Theme 1: Mathematics Teaching Practices		
Please indicate your level of agreement with the following statements about teaching mathematics. - An effective way to teach is to carefully explain mathematical ideas and methods to students.[d]	-	Teachers with more experience have a lower level of agreement that an effective way to teach is to carefully explain mathematical ideas and methods to students.
Please indicate your level of agreement with the following statements about teaching mathematics. - Since the teacher already knows the mathematics, it is her or his job to explain that knowledge to the students.[d]	-	Teachers with more experience have a lower level of agreement that since they already know the mathematics, it is their job to explain that knowledge to the students.
Please indicate your level of agreement with the following statements about teaching mathematics. - Calculators should not be used in the lower elementary school grades.[d]	-	Teachers with more experience have a lower level of agreement that calculators should not be used in the lower elementary school grades.
Please indicate your level of agreement with the following statements about teaching mathematics. - When teaching mathematics, students should learn basic skills first, then do problem-solving.[d]	-	Teachers with more experience have a lower level of agreement that when teaching mathematics, students should learn basic skills first, then do problem-solving.
Theme 3: Perceived Abilities and Knowledge related to Teaching Mathematics		
On a scale from poor ability/knowledge to excellent ability/knowledge, rate your... - Ability to use technology more effectively to support teaching and learning.[e]	-	Teachers with more experience have lower confidence in their ability to use technology more effectively to support teaching and learning.

Statistically Significant Relationships for the School Level Taught Profile

Table 66. Summary of statistically significant relationships between school level taught and themes

Theme/Question	Direction	Interpretation
Theme 5: Amount and Type of Peer Collaboration		
Tell us about how often you collaborate with others on mathematical topics or how to teach mathematics. - How often do you do so with other teachers at a different grade level?[a]	+	Teachers at higher school levels collaborate with other teachers at a different grade level more often.
Tell us how often you have been offered mathematics-specific professional development within the past 5 years. - from your AEA.[c]	+	Teachers at higher school levels have been offered mathematics-specific professional development within the past 5 years from their AEA more often.
Tell us how often you have been offered mathematics-specific professional development within the past 5 years. - from your district[c]	-	Teachers at higher school levels have been offered mathematics-specific professional development within the past 5 years from their district less often.
Tell us how often you have been offered mathematics-specific professional development within the past 5 years. - from your school[c]	-	Teachers at higher school levels have been offered mathematics-specific professional development within the past 5 years from their school less often.

Table 66 (continued). Summary of statistically significant relationships between school level taught and themes

Theme 4: Preferences Regarding Professional Development in Mathematics		
Please indicate your participation in previous professional development in mathematics within the past 5 years. I have participated in mathematics professional development... - in the summer only[c]	+	Teachers at higher school levels have participated in mathematics professional development in the summer only more often.
Please indicate your participation in previous professional development in mathematics within the past 5 years. I have participated in mathematics professional development... - year-round in summer and during the school year[c]	+	Teachers at higher school levels have participated in mathematics professional development year-round in summer and during the school year more often.
Please indicate your participation in previous professional development in mathematics within the past 5 years. I have participated in mathematics professional development... - at night[c]	+	Teachers at higher school levels have participated in mathematics professional development at night more often.

Table 66 (continued). Summary of statistically significant relationships between school level taught and themes

Theme 4: Preferences Regarding Professional Development in Mathematics		
Please indicate your participation in previous professional development in mathematics within the past 5 years. I have participated in mathematics professional development... - on weekends[c]	+	Teachers at higher school levels have participated in mathematics professional development on weekends more often.
Please indicate your participation in previous professional development in mathematics within the past 5 years. I have participated in mathematics professional development... - through Professional Learning Communities[c]	+	Teachers at higher school levels have participated in mathematics professional development through Professional Learning Communities more often.
Please indicate your participation in previous professional development in mathematics within the past 5 years. I have participated in mathematics professional development... - using social media (Twitter, etc.)[c]	+	Teachers at higher school levels have participated in mathematics professional development using social media more often.

Table 66 (continued). Summary of statistically significant relationships between school level taught and themes

Theme 1: Mathematics Teaching Practices		
Please indicate how often these statements describe your classroom when teaching mathematics. Students in my mathematics classes... - work independently on problems in mathematics.[b]	-	Teachers at higher school levels have their students work independently on problems in mathematics less often.
Please indicate how often these statements describe your classroom when teaching mathematics. Students in my mathematics classes... - use calculators during class to carry out calculations.[b]	+	Teachers at higher school levels have their students use calculators during class to carry out calculations more often.
Please indicate how often these statements describe your classroom when teaching mathematics. Students in my mathematics classes... - use calculators during class to explore mathematical ideas and methods.[b]	+	Teachers at higher school levels have their students use calculators during class to explore mathematical ideas and methods more often.
Please indicate how often these statements describe your classroom when teaching mathematics. Students in my mathematics classes... - explain their solutions and reasoning to other students.[b]	-	Teachers at higher school levels have their students explain their solutions and reasoning to other students less often.
Please indicate how often these statements describe your classroom when teaching mathematics. Students in my mathematics classes... - work on rich tasks.[b]	-	Teachers at higher school levels have their students work on rich tasks less often.

Table 66 (continued). Summary of statistically significant relationships between school level taught and themes

Theme 1: Mathematics Teaching Practices		
Please indicate how often this describes your classroom when teaching mathematics. When teaching mathematics... - I give lectures.[b]	+	Teachers at higher school levels give lectures when teaching mathematics more often.
Please indicate how often this describes your classroom when teaching mathematics. When teaching mathematics... - I carefully explain mathematical ideas and methods to my students.[b]	-	Teachers at higher school levels carefully explain mathematical ideas and methods to my students when teaching mathematics less often.
Please indicate how often this describes your classroom when teaching mathematics. When teaching mathematics... - I focus on teaching computational skills.[b]	-	Teachers at higher school levels focus on teaching computational skills when teaching mathematics less often.
Please indicate how often this describes your classroom when teaching mathematics. When teaching mathematics... - I explain how to solve problems step by step.[b]	-	Teachers at higher school levels explain how to solve problems step by step less often.
Please indicate your level of agreement with the following statements about teaching mathematics. - Calculators should not be used in the lower elementary school grades.[d]	+	Teachers at higher school levels have a higher level of agreement that calculators should not be used in the lower elementary school grades.

Table 66 (continued). Summary of statistically significant relationships between school level taught and themes

Theme 1: Mathematics Teaching Practices		
Please indicate your level of agreement with the following statements about teaching mathematics. - It is important for students to struggle a bit when learning mathematics.[d]	+	Teachers at higher school levels have a higher level of agreement that it is important for students to struggle a bit when learning mathematics.
How often do your lessons help students achieve the Standards of Mathematical Practice? - Model with mathematics.[a]	-	Teachers at higher school levels believe their lessons help students achieve the standard of modeling with mathematics less often.
How often do your lessons help students achieve the Standards of Mathematical Practice? - Attend to precision.[a]	-	Teachers at higher school levels believe their lessons help students achieve the standard of attending to precisions less often.
Theme 3: Perceived Abilities and Knowledge related to Teaching Mathematics		
On a scale from poor ability/knowledge to excellent ability/knowledge, rate your... - Depth of knowledge of mathematics for teaching.[e]	+	Teachers at higher school levels have a higher level of confidence in their depth of knowledge of mathematics for teaching.
On a scale from poor ability/knowledge to excellent ability/knowledge, rate your... - Ability to identify and devise strategies for addressing common student misconceptions.[e]	+	Teachers at higher school levels have a higher level of confidence in their ability to identify and devise strategies for addressing common student misconceptions.

Statistically Significant Relationships for the Mathematics Endorsement Profile

Table 67. Summary of statistically significant relationships between possessing a mathematics endorsement and themes

Theme/Question	Direction	Interpretation
Theme 4: Preferences Regarding Professional Development in Mathematics		
Please indicate your participation in previous professional development in mathematics within the past 5 years. I have participated in mathematics professional development... - throughout the school year. [c]	+	Teachers with a math endorsement participate in mathematics professional development throughout the school year more often.
Please indicate your participation in previous professional development in mathematics within the past 5 years. I have participated in mathematics professional development... - year round in summer and during the school year [c]	+	Teachers with a math endorsement participate in mathematics professional development year-round in summer and during the school year more often.
Theme 1: Mathematics Teaching Practices		
Please indicate your level of agreement with the following statements about teaching mathematics. - It is important for students to struggle a bit when learning mathematics.[d]	+	Teachers with a math endorsement have a higher level of agreement that it is important for students to struggle a bit when learning mathematics.
Please indicate your level of agreement with the following statements about teaching mathematics. - When teaching mathematics, students should learn basic skills through problem solving.[d]	+	Teachers with a math endorsement have a higher level of agreement that students should learning basic skills through problem solving.

Table 67 (continued). Summary of statistically significant relationships between possessing a mathematics endorsement and themes

Theme 3: Perceived Abilities and Knowledge related to Teaching Mathematics		
On a scale from poor ability/knowledge to excellent ability/knowledge, rate your... - Depth of knowledge of mathematics for teaching.[e]	+	Teachers with a math endorsement have more confidence in their depth of knowledge of mathematics for teaching.
On a scale from poor ability/knowledge to excellent ability/knowledge, rate your... - Ability to organize and facilitate collaborative student work in my classes.[e]	+	Teachers with an endorsement have more confidence in their ability to organize and facilitate collaborative student work.

Note: Because nearly all high school teachers have an endorsement, the sample for the analyses in this table included only elementary and middle school teachers

Theme 6: Confidence in Teaching Mathematics

The final survey theme related to confidence in teaching mathematics. Teachers were first asked to choose the primary grade level they teach (Table 68). Teachers who selected a K-8 grade were presented with a series of statements regarding the mathematics standards of their particular grade level and asked to rate their level confidence in achieving those standards (Tables 69-77).

Teachers who responded that they taught grades 9 to 12, as well as teachers who responded that their primary grade level was 6th, 7th, or 8th grade but also taught high school mathematics, were asked to select two topics for which they believed they would benefit from professional development in mathematics (Table 78). They were then presented with a series of statements and asked to rate their level of confidence in achieving the standards associated with those topics (Table 79-83).

Because of the small number of teachers within each grade level, further breakdowns of confidence by the various demographic characteristics were inconclusive. Broad analyses suggested that as grade level increases, teachers' confidence in achieving grade-specific mathematics standards tends to decrease. Additionally, the responses of high school mathematics teachers suggested that they have the most professional development need in regard to function and statistics and probability, while they have the least professional development need when it comes to numbers and quantity.

Table 68. Pick the primary grade you teach.

	n	Percent
K-8 Mathematics Content		
Kindergarten	14	7.3%
1st Grade	13	6.7%
2nd Grade	26	13.5%
3rd Grade	21	10.9%
4th Grade	16	8.3%
5th Grade	19	9.8%
6th Grade	16	8.3%
7th Grade	9	4.7%
8th Grade	9	4.7%
High School Mathematics Content		
8th Grade	2	1.0%
9-12th Grade	48	24.9%
TOTAL	**193**	**100.0%**

K-8 Teachers

Table 69. Please rate your confidence in teaching the following standards for **kindergarten** in mathematics.

	n	Not confident	A little confident	Moderately confident	Very confident
Know number names and the count sequence	14	0.0%	0.0%	0.0%	100.0%
Count to tell the number of objects	14	0.0%	0.0%	0.0%	100.0%
Compare numbers	14	0.0%	0.0%	14.3%	85.7%
Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from	14	0.0%	0.0%	7.1%	92.9%
Work with numbers 11-19 to gain foundations for place value	14	0.0%	0.0%	0.0%	100.0%
Describe and compare measurable attributes	14	0.0%	0.0%	7.1%	92.9%
Classify objects and count the number of objects in categories	14	0.0%	0.0%	0.0%	100.0%
Identify and describe shapes	14	0.0%	0.0%	7.1%	92.9%
Analyze, compare, create, and compose shapes	14	0.0%	0.0%	7.1%	92.9%

Table 70. Please rate your confidence in teaching the following standards for **1st grade** in mathematics.

	n	Not confident	A little confident	Moderately confident	Very confident
Represent and solve problems involving addition and subtraction	13	0.0%	0.0%	30.8%	69.2%
Understand and apply properties of operations and the relationship between addition and subtraction	13	0.0%	0.0%	38.5%	61.5%
Add and subtract within 20	13	0.0%	0.0%	23.1%	76.9%
Work with addition and subtraction equations	13	0.0%	0.0%	23.1%	76.9%
Extend the counting sequence	13	0.0%	0.0%	30.8%	69.2%
Understand place value	13	0.0%	7.7%	38.5%	53.8%
Use place value understanding and properties of operations to add and subtract	13	0.0%	7.7%	38.5%	53.8%
Measure lengths directly and by iterating length units	13	0.0%	0.0%	38.5%	61.5%
Tell and write time	13	0.0%	7.7%	23.1%	69.2%
Represent and interpret data	13	0.0%	0.0%	30.8%	69.2%
Reason with shapes and their attributes	13	0.0%	0.0%	38.5%	61.5%

Table 71. Please rate your confidence in teaching the following standards for **2nd grade** in mathematics.

	n	Not confident	A little confident	Moderately confident	Very confident
Represent and solve problems involving addition and subtraction	26	0.0%	0.0%	26.9%	73.1%
Add and subtract within 20	26	0.0%	3.8%	19.2%	76.9%
Work with equal groups of objects to gain foundations for multiplication	26	0.0%	3.8%	30.8%	65.4%
Understand place value	26	0.0%	0.0%	30.8%	69.2%
Use place value understanding and properties of operations to add and subtract	26	0.0%	7.7%	23.1%	69.2%
Measure and estimate lengths in standard units	26	3.8%	0.0%	30.8%	65.4%
Relate addition and subtraction to length	26	3.8%	0.0%	26.9%	69.2%
Work with time and money	26	0.0%	11.5%	15.4%	73.1%
Represent and interpret data	26	0.0%	0.0%	34.6%	65.4%
Reason with shapes and their attributes	26	0.0%	3.8%	34.6%	61.5%

Table 72. Please rate your confidence in teaching the following standards for **3rd grades** in mathematics.

	n	Not confident	A little confident	Moderately confident	Very confident
Represent and solve problems involving multiplication and division	21	0.0%	4.8%	47.6%	47.6%
Understand properties of multiplication and the relationship between multiplication and division	21	0.0%	4.8%	42.9%	52.4%
Multiply and divide within 100	21	0.0%	0.0%	42.9%	57.1%
Solve problems involving the four operations, and identify and explain patterns in arithmetic	21	0.0%	14.3%	42.9%	42.9%
Use place value understanding and properties of operations to perform multi-digit arithmetic	20	0.0%	10.0%	45.0%	45.0%
Develop understanding of fractions as numbers	21	0.0%	9.5%	57.1%	33.3%
Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects	21	0.0%	23.8%	42.9%	33.3%
Represent and interpret data	21	0.0%	9.5%	42.9%	47.6%
Geometric measurement: understand concepts of area and relate area to multiplication and to addition	21	0.0%	0.0%	47.6%	52.4%
Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures	21	0.0%	4.8%	57.1%	38.1%
Reason with shapes and their attributes	21	0.0%	9.5%	52.4%	38.1%

Table 73. Please rate your confidence in teaching the following standards for **4th grade** in mathematics.

	n	Not confident	A little confident	Moderately confident	Very confident
Use the four operations with whole numbers to solve problems	16	0.0%	0.0%	12.5%	87.5%
Gain familiarity with factors and multiples	16	0.0%	0.0%	25.0%	75.0%
Generate and analyze patterns	16	0.0%	0.0%	43.8%	56.3%
Generalize place value understanding for multi-digit whole numbers	16	0.0%	6.3%	25.0%	68.8%
Use place value understanding and properties of operations to perform multi-digit arithmetic	16	0.0%	0.0%	31.3%	68.8%
Extend understanding of fraction equivalence and ordering	16	0.0%	0.0%	31.3%	68.8%
Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers	16	0.0%	6.3%	56.3%	37.5%
Understand decimal notation for fractions, and compare decimal fractions	16	0.0%	0.0%	43.8%	56.3%
Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit	16	0.0%	12.5%	31.3%	56.3%
Represent and interpret data	16	0.0%	0.0%	25.0%	75.0%
Geometric measurement: understand concepts of angle and measure angles	16	0.0%	0.0%	50.0%	50.0%
Draw and identify lines and angles, and classify shapes by properties of their lines and angles	16	0.0%	0.0%	50.0%	50.0%

Table 74. Please rate your confidence in teaching the following standards for **5th grade** in mathematics.

	n	Not confident	A little confident	Moderately confident	Very confident
Write and interpret numerical expressions	17	0.0%	0.0%	35.3%	64.7%
Analyze patterns and relationships	17	0.0%	0.0%	58.8%	41.2%
Understand the place value system	17	0.0%	0.0%	11.8%	88.2%
Perform operations with multi-digit whole numbers and with decimals to hundredths	17	0.0%	0.0%	29.4%	70.6%
Use equivalent fractions as a strategy to add and subtract fractions	17	0.0%	0.0%	23.5%	76.5%
Apply and extend previous understandings of multiplication and division to multiply and divide fractions	17	0.0%	5.9%	47.1%	47.1%
Convert like measurement units within a given measurement system	17	0.0%	11.8%	64.7%	23.5%
Represent and interpret data	17	0.0%	0.0%	52.9%	47.1%
Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition	17	0.0%	0.0%	47.1%	52.9%
Graph points on the coordinate plane to solve real- world and mathematical problems	17	0.0%	0.0%	35.3%	64.7%
Classify two-dimensional figures into categories based on their properties	17	0.0%	0.0%	58.8%	41.2%

Table 75. Please rate your confidence in teaching the following standards for **6th grade** in mathematics.

	n	Not confident	A little confident	Moderately confident	Very confident
Understand ratio concepts and use ratio reasoning to solve problems	15	0.0%	6.7%	60.0%	33.3%
Apply and extend previous understandings of multiplication and division to divide fractions by fractions	15	0.0%	13.3%	26.7%	60.0%
Compute fluently with multi-digit numbers and find common factors and multiples	15	0.0%	6.7%	33.3%	60.0%
Apply and extend previous understandings of numbers to the system of rational numbers	14	0.0%	7.1%	50.0%	42.9%
Apply and extend previous understandings of arithmetic to algebraic expressions	15	0.0%	0.0%	53.3%	46.7%
Reason about and solve one-variable equations and inequalities	15	0.0%	0.0%	40.0%	60.0%
Represent and analyze quantitative relationships between dependent and independent variables	15	0.0%	0.0%	60.0%	40.0%
Solve real-world and mathematical problems involving area, surface area, and volume	15	0.0%	6.7%	46.7%	46.7%
Develop understanding of statistical variability Summarize and describe distributions	15	0.0%	6.7%	80.0%	13.3%
Summarize and describe distributions	15	6.7%	0.0%	60.0%	33.3%

Table 76. Please rate your confidence in teaching the following standards for **7th grade** in mathematics.

	n	Not confident	A little confident	Moderately confident	Very confident
Analyze proportional relationships and use them to solve real-world and mathematical problems	7	0.0%	0.0%	28.6%	71.4%
Apply and extend previous understandings of operations with fractions to add, subtract, multiply and divide rational numbers	7	0.0%	0.0%	0.0%	100.0%
Use properties of operations to generate equivalent expressions	7	0.0%	0.0%	28.6%	71.4%
Solve real-life and mathematical problems using numerical and algebraic expressions and equations	7	0.0%	0.0%	14.3%	85.7%
Draw, construct and describe geometrical figures and describe the relationships between them	7	0.0%	14.3%	57.1%	28.6%
Solve real-life and mathematical problems involving angle measure, area, surface area, and volume	7	0.0%	14.3%	14.3%	71.4%
Use random sampling to draw inferences about a population	7	0.0%	28.6%	28.6%	42.9%
Draw informal comparative inferences about two populations	7	0.0%	14.3%	57.1%	28.6%
Investigate chance processes and develop, use, and evaluate probability models	7	0.0%	28.6%	42.9%	28.6%

Table 77. Please rate your confidence in teaching the following standards for **8th grade** in mathematics.

	n	Not confident	A little confident	Moderately confident	Very confident
Know that there are numbers that are not rational, and approximate them by rational numbers	8	0.0%	0.0%	50.0%	50.0%
Work with radicals and integer exponents	8	0.0%	0.0%	37.5%	62.5%
Understand the connections between proportional relationships, lines, and linear equations	8	0.0%	0.0%	37.5%	62.5%
Analyze and solve linear equations and pairs of simultaneous linear equations	8	0.0%	0.0%	37.5%	62.5%
Define, evaluate, and compare functions	8	0.0%	37.5%	12.5%	50.0%
Use functions to model relationships between quantities	8	0.0%	25.0%	25.0%	50.0%
Understand congruence and similarity using physical models, transparencies, or geometry software	8	0.0%	0.0%	62.5%	37.5%
Understand and apply the Pythagorean Theorem	8	0.0%	0.0%	25.0%	75.0%
Solve real-world and mathematical problems involving volume of cylinders, cones and spheres	8	0.0%	0.0%	37.5%	62.5%
Investigate patterns of association in bivariate data	8	0.0%	25.0%	25.0%	50.0%

High School Teachers

Table 78. Pick two of the following for which you believe you would benefit from professional development.

	n	Count	Percent
Number and Quantity	50	8	16.0%
Algebra	50	19	38.0%
Functions	50	24	48.0%
Geometry	50	19	38.0%
Statistics and Probability	50	25	50.0%

Note: 50 teachers answered this question. The count represents the number of teachers who indicated topic area.

Table 79. Please rate your confidence in teaching the following standards for **Number and Quantity**.

	n	Not confident	A little confident	Moderately confident	Very confident
Extend the properties of exponents to rational exponents	8	0.0%	12.5%	25.0%	62.5%
Use properties of rational and irrational numbers	8	0.0%	0.0%	37.5%	62.5%
Reason quantitatively and use units to solve problems	8	0.0%	0.0%	50.0%	50.0%
(IA) Understand and apply the mathematics of voting	8	25.0%	62.5%	12.5%	0.0%
(IA) Understand and apply some basic mathematics of information processing and the internet	8	25.0%	62.5%	12.5%	0.0%
Perform arithmetic operations with complex numbers	8	0.0%	12.5%	25.0%	62.5%
Represent complex numbers and their operations on the complex plane	8	0.0%	25.0%	50.0%	25.0%
Use complex numbers in polynomial identities and equations	8	12.5%	12.5%	50.0%	25.0%
Represent and model with vector quantities	8	12.5%	62.5%	12.5%	12.5%
Perform operations on vectors	8	12.5%	50.0%	25.0%	12.5%
Perform operations on matrices and use matrices in applications	8	0.0%	37.5%	12.5%	50.0%

Table 80. Please rate your confidence in teaching the following standards for **Algebra**.

	n	Not confident	A little confident	Moderately confident	Very confident
Interpret the structure of expressions	19	0.0%	0.0%	42.1%	57.9%
Write expressions in equivalent forms to solve problems	19	0.0%	0.0%	15.8%	84.2%
Perform arithmetic operations on polynomials	19	0.0%	0.0%	15.8%	84.2%
Understand the relationship between zeros and factors of polynomials	19	0.0%	0.0%	26.3%	73.7%
Use polynomial identities to solve problems	19	0.0%	15.8%	36.8%	47.4%
Rewrite rational expressions	19	0.0%	5.3%	31.6%	63.2%
Create equations that describe numbers or relationships	19	0.0%	0.0%	47.4%	52.6%
Understand solving equations as a process of reasoning and explain the reasoning	19	0.0%	0.0%	63.2%	36.8%
Solve equations and inequalities in one variable	19	0.0%	0.0%	5.3%	94.7%
Solve systems of equations	19	0.0%	0.0%	15.8%	84.2%
Represent and solve equations and inequalities graphically	19	0.0%	0.0%	15.8%	84.2%

Table 81. Please rate your confidence in teaching the following standards for **Functions**.

	n	Not confident	A little confident	Moderately confident	Very confident
Understand the concept of a function and use function notation	24	0.0%	12.5%	29.2%	58.3%
Interpret functions that arise in applications in terms of the context	24	4.2%	12.5%	37.5%	45.8%
Analyze functions using different representations	24	0.0%	8.3%	58.3%	33.3%
Build a function that models a relationship between two quantities	24	0.0%	16.7%	50.0%	33.3%
Build new functions from existing functions	24	4.2%	20.8%	29.2%	45.8%
Construct and compare linear, quadratic, and exponential models and solve problems	23	0.0%	26.1%	43.5%	30.4%
Interpret expressions for functions in terms of the situation they model	22	4.5%	13.6%	50.0%	31.8%
Extend the domain of trigonometric functions using the unit circle	23	8.7%	39.1%	17.4%	34.8%
Model periodic phenomena with trigonometric functions	23	17.4%	30.4%	26.1%	26.1%
Prove and apply trigonometric identities	23	13.0%	26.1%	34.8%	26.1%

Table 82. Please rate your confidence in teaching the following standards for **Geometry**.

	n	Not confident	A little confident	Moderately confident	Very confident
Experiment with transformations in the plane	17	0.0%	23.5%	58.8%	17.6%
Understand congruence in terms of rigid motions	17	0.0%	11.8%	41.2%	47.1%
Prove geometric theorems	17	0.0%	23.5%	35.3%	41.2%
Make geometric constructions	17	5.9%	35.3%	29.4%	29.4%
Understand similarity in terms of similarity transformations	17	0.0%	17.6%	47.1%	35.3%
Prove theorems involving similarity	17	5.9%	29.4%	35.3%	29.4%
Define trigonometric ratios and solve problems involving right triangles	17	5.9%	11.8%	29.4%	52.9%
Apply trigonometry to general triangles	17	5.9%	11.8%	29.4%	52.9%

Table 82 (continued). Please rate your confidence in teaching the following standards for **Geometry**.

	n	Not confident	A little confident	Moderately confident	Very confident
Understand and apply theorems about circles	16	18.8%	12.5%	37.5%	31.3%
Find arc lengths and areas of sectors of circles	17	11.8%	5.9%	29.4%	52.9%
Translate between the geometric description and the equation for a conic section	17	35.3%	29.4%	23.5%	11.8%
Use coordinates to prove simple geometric theorems algebraically	17	11.8%	5.9%	58.8%	23.5%
Explain volume formulas and use them to solve problems	17	0.0%	17.6%	29.4%	52.9%
Visualize relationships between two-dimensional and three-dimensional objects	17	5.9%	5.9%	52.9%	35.3%
Apply geometric concepts in modeling situations	17	5.9%	11.8%	76.5%	5.9%
(IA) Use diagrams consisting of vertices and edges (vertex-edge graphs) to model and solve problems related to networks	17	17.6%	29.4%	52.9%	0.0%

Table 83. Please rate your confidence in teaching the following standards for **Statistics and Probability**.

	n	Not confident	A little confident	Moderately confident	Very confident
Summarize, represent, and interpret data on a single count or measurement variable	23	4.3%	4.3%	43.5%	47.8%
Summarize, represent, and interpret data on two categorical and quantitative variables	23	4.3%	21.7%	34.8%	39.1%
Interpret linear models	23	0.0%	8.7%	34.8%	56.5%
Understand and evaluate random processes underlying statistical experiments	23	8.7%	52.2%	26.1%	13.0%
Make inferences and justify conclusions from sample surveys, experiments and observational studies	23	4.3%	34.8%	43.5%	17.4%
Understand independence and conditional probability and use them to interpret data	23	13.0%	30.4%	30.4%	26.1%
Use the rules of probability to compute probabilities of compound events in a uniform probability model	23	13.0%	13.0%	52.2%	21.7%
Calculate expected values and use them to solve problems	23	8.7%	26.1%	43.5%	21.7%
Use probability to evaluate outcomes of decisions	23	8.7%	30.4%	47.8%	13.0%

Analysis of Results by Other Demographic Variables

This section contains additional results organized into two subsections. The first contains statistically significant relationships that exist between teachers' responses regarding their beliefs and practices and four other demographic variables not considered as primary predictors in previous analyses. The second subsection features the results organized by theme that were contained in the first part of this report, this time broken out by years of K-12 teaching experience (3-10 years versus 10+ years) and school level (elementary, middle, and high school).

Statistically Significant Relationships between other Variables and Themes

The teacher profile section earlier in this report described associations between four key teacher characteristics and teacher beliefs and instructional practices. These characteristics were the number of same-building peer teachers, years teaching mathematics, school level, and mathematics endorsement. In what follows, we highlight results regarding the role and impact of four additional characteristics on teachers and their behaviors. These four additional characteristics are:

- Gender
- District size
- Educational level
- Years of K-12 teaching experience

District size and educational level are included here rather than in the primary Teacher Profiles section because there are few statistically significant implications that follow from these two variables. Results for Years Teaching Experience are also contained here because they are of secondary importance relative to the results for years' teaching mathematics.

In particular, the following tables summarize statistically significant relationships between the four additional characteristics named just above and several of the themes, including mathematics teaching practices, abilities and knowledge related to teaching mathematics, amount and type of peer collaboration, and preferences regarding professional development.

As was the case within the Teacher Profiles section, the first column of each summary table identifies the subtopic/item, the Direction column indicates whether the relationship was negative (-) or positive (+), and the Interpretation column features an explanation of the relationship. Once again, the significance threshold for inclusion in these tables was 90%, meaning there is only a 10% chance that these relationships were due to chance.

Statistically Significant Relationships for Gender

The effect of gender would appear to be remarkably influential. A substantial number of effective teaching practices, constructive beliefs about teaching and learning, and key abilities and knowledge for teaching are associated with *female* teachers.

Important Note on Interpreting the Tables for Gender: a positive direction indicates increased levels of the response variable are associated with female respondents, while a negative direction indicates decreased levels of the response variable are associated with females.

Table 84. Summary of statistically significant relationships between gender and themes

Theme/Question	Direction	Interpretation
Theme 1: Mathematics Teaching Practices		
Please indicate how often these statements describe your classroom when teaching mathematics. Students in my mathematics classes... - talk to each other about mathematics [b]	+	Female teachers have students talk to each other about mathematics more often than do male teachers.
Please indicate how often this describes your classroom when teaching mathematics. When teaching mathematics... - I give lectures [b]	-	Female teachers are less likely to agree with the statement "When teaching mathematics…I give lectures" than do male teachers.
Please indicate how often this describes your classroom when teaching mathematics. When teaching mathematics... - I do worked out examples on the board [b]	-	Female teachers are less likely to agree with the statement "When teaching mathematics…I do worked out examples on the board."
Please indicate how often this describes your classroom when teaching mathematics. When teaching mathematics... - I focus on teaching computational skills. [b]	-	Female teachers are less likely to agree with the statement "When teaching mathematics…I focus on teaching computational skills."

Table 84 (continued). Summary of statistically significant relationships between gender and themes

Theme 1: Mathematics Teaching Practices		
Please indicate how often this describes your classroom when teaching mathematics. When teaching mathematics... - I explain how to solve problems step by step [b]	-	Female teachers are less likely to agree with the statement "When teaching mathematics…I explain how to solve problems step by step."
How often do your lessons help students achieve the Standards of Mathematical Practice? - Construct viable arguments and critique the reasoning of others [a]	+	Female teachers are more likely to believe their lessons help students achieve the specific Standard for Mathematical Practice: Construct viable arguments and critique the reasoning of others.
How often do your lessons help students achieve the Standards of Mathematical Practice? - Model with mathematics [a]	+	Female teachers are more likely to believe their lessons help students achieve the specific Standard for Mathematical Practice: Model with mathematics.
How often do your lessons help students achieve the Standards of Mathematical Practice? - Attend to precision [a]	+	Female teachers are more likely to believe their lessons help students achieve the specific Standard for Mathematical Practice: Attend to precision.
How often do your lessons help students achieve the Standards of Mathematical Practice? - Look for and make use of structure [a]	+	Female teachers are more likely to believe their lessons help students achieve the specific Standard for Mathematical Practice: Look for and make use of structure.

Table 84 (continued). Summary of statistically significant relationships between gender and themes

Theme 2: Teacher Beliefs about Teaching and Learning Mathematics		
Please indicate your level of agreement with the following statements about teaching mathematics. - An effective way to teach mathematics is to show students many worked out examples. [d]	-	Female teachers are less likely to agree with the statement "An effective way to teach mathematics is to show students many worked out examples."
Please indicate your level of agreement with the following statements about teaching mathematics. - Since the teacher already knows the mathematics, it is her or his job to explain that knowledge to the students. [d]	-	Female teachers are less likely to agree with the statement "Since the teacher already knows the mathematics, it is her or his job to explain that knowledge to students."
Please indicate your level of agreement with the following statements about teaching mathematics. - When teaching mathematics, students should learn basic skills first, then do problem-solving. [d]	-	Female teachers are less likely to agree with the statement "When teaching mathematics, students should learn basic skills first, then do problem-solving."
ONLY K-8 TEACHERS Please indicate your level of agreement with the following statements about teaching mathematics. - When teaching mathematics, students should learn basic skills through problem solving. [d]	+	Female K-8 teachers are more likely to agree with the statement "When teaching mathematics, students should learn basic skills through problem-solving."

Table 84 (continued). Summary of statistically significant relationships between gender and themes

Theme 3: Perceived Abilities and Knowledge related to Teaching Mathematics		
On a scale from poor ability/knowledge to excellent ability/knowledge, rate your... - Ability to use technology more effectively to support teaching and learning [e]	-	Male teachers have higher confidence in their ability to use technology to more effectively support teaching and learning.
ONLY K-8 TEACHERS On a scale from poor ability/knowledge to excellent ability/knowledge, rate your... - Depth of knowledge of mathematics for teaching [e]	+	Female K-8 teachers have higher confidence in their depth of knowledge of mathematics for teaching.
ONLY K-8 TEACHERS On a scale from poor ability/knowledge to excellent ability/knowledge, rate your... - Ability to provide both access and challenge in my lessons ("low floor, high ceiling") [e]	+	Female K-8 teachers have higher confidence in their ability to provide both access and challenge in my lessons.
ONLY K-8 TEACHERS On a scale from poor ability/knowledge to excellent ability/knowledge, rate your... - Ability to organize and facilitate collaborative student work in my classes [e]	+	Female K-8 teachers have higher confidence in their ability to organize and facilitate collaborative student work in my classes.

Table 84 (continued). Summary of statistically significant relationships between gender and themes

Theme 4: Preferences Regarding Professional Development in Mathematics		
Please indicate your participation in previous professional development in mathematics within the past 5 years. I have participated in mathematics professional development... - in the summer only [c]	+	Female teachers have participated in mathematics-specific professional development in the summer only within the past 5 years more often.
Please indicate your participation in previous professional development in mathematics within the past 5 years. I have participated in mathematics professional development... - using vlogs or blogs [c]	+	Female teachers have participated in mathematics-specific professional development using vlogs or blogs within the past 5 years more often.
ONLY K-8 TEACHERS Please indicate your participation in previous professional development in mathematics within the past 5 years. I have participated in mathematics professional development... - throughout the school year [c]	+	Female K-8 teachers have participated in mathematics-specific professional development throughout the school year within the past 5 years more often.
ONLY K-8 TEACHERS Please indicate your participation in previous professional development in mathematics within the past 5 years. I have participated in mathematics professional development... - year round in summer and during the school year [c]	+	Female K-8 teachers have participated in mathematics-specific professional development year round within the past 5 years more often.

Statistically Significant Relationships for District Size

Table 85. Summary of statistically significant relationships between district size and themes

Theme/Question	Direction	Interpretation
Theme 4: Preferences Regarding Professional Development in Mathematics		
Tell us how often you have been offered mathematics-specific professional development within the past 5 years. - from your AEA [c]	-	Teachers in larger districts have been offered mathematics-specific professional development within the past 5 years from their AEA less often.
Please indicate your participation in previous professional development in mathematics within the past 5 years. I have participated in mathematics professional development... - using webinars [c]	+	Teachers in larger districts have participated in mathematics-specific professional development via webinars within the past 5 years more often.
ONLY FOR K-8 TEACHERS Please indicate your participation in previous professional development in mathematics within the past 5 years. I have participated in mathematics professional development... - using vlogs or blogs [c]	+	K-8 teachers in larger districts have participated in mathematics-specific professional development via vlogs or blogs within the past 5 years more often.

Table 85 (continued). Summary of statistically significant relationships between district size and themes

Theme 1: Mathematics Teaching Practices		
Please indicate how often these statements describe your classroom when teaching mathematics. Students in my mathematics classes... - use calculators during class to carry out calculations [b]	+	Teachers in larger districts have their students use calculators during class to carry out calculations more often.
Students in my mathematics classes... - use calculators during class to explore mathematical ideas and methods [b]	+	Teachers in larger districts have their students use calculators during class to explore mathematical ideas and methods more often.
How often do your lessons help students achieve the Standards of Mathematical Practice? - Attend to precision [a]	+	Teachers in larger districts believe their lessons help students achieve the standard of attending to precision more often.

Table 85 (continued). Summary of statistically significant relationships between district size and themes

Theme 3: Perceived Abilities and Knowledge related to Teaching Mathematics		
On a scale from poor ability/knowledge to excellent ability/knowledge, rate your... - Ability to organize and facilitate collaborative student work in my classes [e]	-	Teachers in larger districts have a lower level of confidence in their ability to organize and facilitate collaborative student work in class.
ONLY FOR K-8 TEACHERS On a scale from poor ability/knowledge to excellent ability/knowledge, rate your... - Ability to identify and devise strategies for addressing common student misconceptions [e]	-	K-8 teachers in larger districts have a lower level of confidence in their ability to devise strategies for addressing common student misconceptions.
ONLY FOR K-8 TEACHERS On a scale from poor ability/knowledge to excellent ability/knowledge, rate your... - Ability to provide the right amount of scaffolding (guidance and support for effective student learning) [e]	-	K-8 teachers in larger districts have a lower level of confidence in their ability to provide the right amount of scaffolding (guidance and support for effective student learning).
ONLY FOR K-8 TEACHERS On a scale from poor ability/knowledge to excellent ability/knowledge, rate your... - Ability to help my students develop their reasoning skills [e]	-	K-8 teachers in larger districts have a lower level of confidence in their ability to help their students develop their reasoning skills.

Statistically Significant Relationships for Educational Level

Table 86. Summary of statistically significant relationships between educational level and themes

Theme/Question	Direction	Interpretation
Theme 1: Mathematics Teaching Practices		
Please indicate how often these statements describe your classroom when teaching mathematics. Students in my mathematics classes... - work independently on problems in mathematics [b]	-	Teachers with higher levels of education have their students work independently on problems in mathematics less often.
Theme 3: Perceived Abilities and Knowledge related to Teaching Mathematics		
On a scale from poor ability/knowledge to excellent ability/knowledge, rate your... - Ability to provide the right amount of scaffolding (guidance and support for effective student learning) [e]	+	Teachers with higher levels of education have higher confidence in their ability to provide the right amount of scaffolding (guidance and support for effective student learning).
Theme 4: Preferences Regarding Professional Development in Mathematics		
Tell us how often you have been offered mathematics-specific professional development within the past 5 years. - from your school [c]	-	Teachers with higher levels of education have been offered mathematics-specific professional development within the past 5 years from their schools less often.

Statistically Significant Relationships for Years' K-12 Teaching Experience

Table 87. Summary of statistically significant relationships between years teaching experience and themes

Theme/Question	Direction	Interpretation
Theme 1: Mathematics Teaching Practices		
Please indicate how often these statements describe your classroom when teaching mathematics. Students in my mathematics classes... - use calculators during class to carry out calculations.[b]	+	Teachers with more experience have their students use calculators to carry out calculations more often.
Please indicate how often these statements describe your classroom when teaching mathematics. Students in my mathematics classes... - use calculators during class to explore mathematical ideas and methods.[b]	+	Teachers with more experience have their students use calculators to explore mathematical ideas and methods more often.
Please indicate your level of agreement with the following statements about teaching mathematics. - An effective way to teach mathematics is to show students many worked out examples.[d]	-	Teachers with more experience have a lower level of agreement that an effective way to teach mathematics is to show students many worked out examples.
Please indicate your level of agreement with the following statements about teaching mathematics. - Calculators should not be used in the lower elementary school grades.[d]	-	Teachers with more experience have a lower level of agreement that calculators should not be used in the lower elementary school grades.

Table 87 (continued). Summary of statistically significant relationships between years teaching experience and themes

Theme 5: Amount and Type of Peer Collaboration		
At your school, how often... - do teachers collaborate to analyze data to make long-term instructional decisions?[b]	+	Teachers with more experience collaborate to analyze data to make long-term instructional decisions more often.

Additional Analysis of Themes broken out by Years Teaching Experience and Level

The following section presents the results organized by theme broken out by years of K-12 teaching experience (3-10 years versus 10+ years) and school level (elementary, middle, and high school). Specifically, the tables appearing in this subsection contain joint relative frequencies for each Likert-scale item related to Themes 1-5 in terms of these two variables.

This section provides additional insight into the analyses in previous sections. Previous sections have examined results separately for each theme, and also relating school level to themes 1-5, and relating years' *math* teaching experience to themes 1-5. In this section, results are examined for *all* years' teaching experience, and the years' teaching experience results are analyzed jointly with school level so that combined effects of these variables on teacher themes 1-5 can be observed.

Teachers with two or fewer years of experience were excluded from these analyses because they represented only a small proportion of the sample (approximately five percent). Years' teaching experience were grouped as such to enable a comparison of the responses of newer teachers and more experienced teachers. Elementary school included grades K-5, middle school included grades 6-8, and high school included grades 9-12.

Theme 1: Mathematics Teaching Practices

Results from the first section of results contained in this report showed that teachers frequently use both individual and group activities in class. Table 88 shows that this is the case for more and less experienced teachers and across school levels. The same table indicates that calculator use increases with school level. Elementary age students use calculators infrequently, while a strong majority of those in middle and high school do so often or very often. Students in classes taught by more experienced teachers use calculators in class more often than do students taught by less experienced teachers. This is especially true concerning calculator use for the purposes of exploring mathematical ideas and methods. It is also apparent that the frequency with which teachers have students explain their solutions and reasoning to other students, work on rich tasks, and talk to each other about mathematics, decreases with school level.

While teachers at the elementary and middle school level report giving lectures infrequently, use of lecturing increases in high school (Table 89). Nearly half of responding high school teachers with 10 or fewer years of experience report giving lectures often or very often. This drops off for more experienced teachers. While overall only a minority of teachers focus on computational skills, this is much more a focus in elementary schools, with a majority of K-5 teachers reporting doing so often or very often (Table 89). In addition, while overall a majority of teachers explain solutions to problems step by step, the use of this practice decreases with grade level. Veteran high school teachers would appear to give step by step solutions least frequently of all subgroups.

The final set of items asked teachers how often their lessons helped students achieve the Standards of Mathematical Practice (Table 90). Teachers with 10 or fewer years of experience report teaching lessons that promote student achievement with these standards more often than their more veteran counterparts. From the previous section we know that teachers reported that their lessons most often achieve the standards of making sense of problems and persevere in solving them, as well as using appropriate tools strategically. It would appear that success with this standard is consistent across school levels and regardless of teacher experience. In addition, teachers reported that they least often accomplish the standard of constructing viable arguments and critiquing the reasoning of others, but Table 90 further indicates that this is especially true at the high school level.

Table 88. Please indicate how often these statements describe your classroom when teaching mathematics. Students in my mathematics classes…

			3-10 years' experience				10+ years' experience		
		Total n	n	Never	Rarely + Some-times	Often + Very Often	n	Never	Rarely + Some-times	Often + Very Often
	Total	**207**	**33**	**0%**	**21%**	**79%**	**174**	**1%**	**26%**	**74%**
Work independently on problems in mathematics	Elementary	121	18	0%	22%	78%	103	1%	18%	81%
	Middle	38	7	0%	14%	86%	31	0%	29%	71%
	High	48	8	0%	25%	75%	40	0%	43%	58%
	Total	**206**	**33**	**0%**	**21%**	**79%**	**173**	**1%**	**24%**	**76%**
Work together (in groups or pairs) on mathematics	Elementary	120	18	0%	28%	72%	102	1%	24%	75%
	Middle	38	7	0%	0%	100%	31	0%	19%	81%
	High	48	8	0%	25%	75%	40	0%	28%	73%
	Total	**207**	**33**	**30%**	**39%**	**30%**	**174**	**22%**	**44%**	**34%**
Use calculators during class to carry out calculations	Elementary	121	18	56%	44%	0%	103	36%	60%	4%
	Middle	38	7	0%	43%	57%	31	3%	29%	68%
	High	48	8	0%	25%	75%	40	0%	13%	88%
	Total	**206**	**33**	**33%**	**55%**	**12%**	**173**	**25%**	**47%**	**28%**
Use calculators during class to explore mathematical ideas and methods	Elementary	120	18	56%	44%	0%	102	40%	55%	5%
	Middle	38	7	0%	71%	29%	31	3%	32%	65%
	High	48	8	13%	63%	25%	40	3%	38%	60%

Table 88 (continued). Please indicate how often these statements describe your classroom when teaching mathematics. Students in my mathematics classes…

			3-10 years' experience				10+ years' experience			
		Total n	n	Never	Rarely + Some-times	Often + Very Often	n	Never	Rarely + Some-times	Often + Very Often
Work together to figure out mathematical ideas and methods	**Total**	**207**	**54**	**0%**	**30%**	**70%**	**153**	**2%**	**35%**	**63%**
	Elementary	121	27	0%	30%	70%	94	3%	36%	61%
	Middle	38	11	0%	36%	64%	27	0%	33%	67%
	High	48	16	0%	25%	75%	32	0%	34%	66%
Explain their solutions and reasoning to other students	**Total**	**207**	**54**	**4%**	**31%**	**65%**	**153**	**1%**	**30%**	**69%**
	Elementary	121	27	4%	30%	67%	94	2%	23%	74%
	Middle	38	11	0%	27%	73%	27	0%	22%	78%
	High	48	16	6%	38%	56%	32	0%	56%	44%
Work on rich tasks	**Total**	**207**	**54**	**0%**	**57%**	**43%**	**153**	**4%**	**57%**	**39%**
	Elementary	121	27	0%	41%	59%	94	5%	49%	46%
	Middle	38	11	0%	64%	36%	27	4%	56%	41%
	High	48	16	0%	81%	19%	32	0%	81%	19%
Talk to each other about mathematics	**Total**	**207**	**54**	**0%**	**43%**	**57%**	**153**	**1%**	**38%**	**61%**
	Elementary	121	27	0%	41%	59%	94	1%	36%	63%
	Middle	38	11	0%	45%	55%	27	0%	26%	74%
	High	48	16	0%	44%	56%	32	0%	53%	47%

Table 89. Please indicate how often these statements describe your classroom when teaching mathematics. When teaching mathematics…

			3-10 years' experience				10+ years' experience		
		Total n	n	Never	Rarely + Some-times	Often + Very Often	n	Never	Rarely + Some-times	Often + Very Often
I give lectures	**Total**	**208**	**54**	**15%**	**63%**	**22%**	**154**	**16%**	**71%**	**12%**
	Elementary	122	27	22%	63%	15%	95	24%	68%	7%
	Middle	38	11	9%	82%	9%	27	7%	78%	15%
	High	48	16	6%	50%	44%	32	0%	75%	25%
I do worked out examples on the board	**Total**	**208**	**54**	**2%**	**31%**	**67%**	**154**	**1%**	**32%**	**67%**
	Elementary	121	27	4%	33%	63%	94	1%	31%	68%
	Middle	38	11	0%	36%	64%	27	4%	41%	56%
	High	49	16	0%	25%	75%	33	0%	27%	73%
I carefully explain mathematical ideas and methods to my students	**Total**	**208**	**54**	**2%**	**22%**	**76%**	**154**	**1%**	**21%**	**77%**
	Elementary	122	27	4%	19%	78%	95	1%	16%	83%
	Middle	38	11	0%	36%	64%	27	4%	26%	70%
	High	48	16	0%	19%	81%	32	0%	34%	66%
I focus on teaching computational skills.	**Total**	**208**	**54**	**6%**	**63%**	**31%**	**154**	**2%**	**61%**	**37%**
	Elementary	122	27	7%	37%	56%	95	1%	53%	46%
	Middle	38	11	0%	91%	9%	27	7%	63%	30%
	High	48	16	6%	88%	6%	32	0%	84%	16%
I explain how to solve problems step by step	**Total**	**208**	**54**	**2%**	**31%**	**67%**	**154**	**2%**	**38%**	**60%**
	Elementary	122	27	4%	19%	78%	95	1%	34%	65%
	Middle	38	11	0%	45%	55%	27	4%	37%	59%
	High	48	16	0%	44%	56%	32	3%	50%	47%

Table 90. How often do your lessons help students achieve the Standards of Mathematical Practice?

			3-10 years' experience					10+ years' experience			
		Total n	n	Never + Rarely	A few times monthly + weekly	Daily	Don't Know	n	Never + Rarely	A few times monthly + weekly	Daily	Don't Know
	Total	**199**	**50**	**2%**	**38%**	**56%**	**4%**	**149**	**1%**	**54%**	**44%**	**2%**
Make sense of problems and persevere in solving them	Elementary	114	24	4%	29%	58%	8%	90	1%	46%	51%	2%
	Middle	37	11	0%	45%	55%	0%	26	0%	50%	46%	4%
	High	48	15	0%	47%	53%	0%	33	0%	79%	21%	0%
	Total	**199**	**50**	**4%**	**60%**	**28%**	**8%**	**149**	**4%**	**69%**	**21%**	**5%**
Reason abstractly and quantitatively	Elementary	114	24	8%	46%	33%	13%	90	4%	67%	21%	8%
	Middle	37	11	0%	73%	27%	0%	26	4%	73%	19%	4%
	High	48	15	0%	73%	20%	7%	33	3%	73%	24%	0%
	Total	**198**	**50**	**14%**	**50%**	**30%**	**6%**	**148**	**16%**	**60%**	**22%**	**3%**
Construct viable arguments and critique the reasoning of others	Elementary	113	24	21%	42%	29%	8%	89	19%	54%	25%	2%
	Middle	37	11	0%	45%	55%	0%	26	8%	65%	23%	4%
	High	48	15	13%	67%	13%	7%	33	12%	73%	12%	3%
	Total	**199**	**50**	**4%**	**56%**	**40%**	**0%**	**149**	**3%**	**48%**	**48%**	**1%**
Model with mathematics	Elementary	114	24	4%	33%	63%	0%	90	2%	34%	63%	0%
	Middle	37	11	0%	73%	27%	0%	26	8%	58%	31%	4%
	High	48	15	7%	80%	13%	0%	33	3%	79%	18%	0%

Table 90 (continued). How often do your lessons help students achieve the Standards of Mathematical Practice?

			3-10 years' experience					10+ years' experience				
		Total n	n	Never + Rarely	A few times monthly + weekly	Daily	Don't Know	n	Never + Rarely	A few times monthly + weekly	Daily	Don't Know
Use appropriate tools strategically	**Total**	**199**	**50**	**2%**	**46%**	**52%**	**0%**	**149**	**3%**	**47%**	**48%**	**2%**
	Elementary	114	24	4%	29%	67%	0%	90	2%	39%	57%	2%
	Middle	37	11	0%	64%	36%	0%	26	0%	62%	35%	4%
	High	48	15	0%	60%	40%	0%	33	6%	58%	36%	0%
Attend to precision	**Total**	**196**	**50**	**8%**	**38%**	**50%**	**4%**	**146**	**3%**	**42%**	**49%**	**5%**
	Elementary	112	24	13%	25%	54%	8%	88	2%	35%	55%	8%
	Middle	36	11	0%	55%	45%	0%	25	4%	48%	44%	4%
	High	48	15	7%	47%	47%	0%	33	6%	58%	36%	0%
Look for and make use of structure	**Total**	**198**	**50**	**4%**	**42%**	**36%**	**18%**	**148**	**3%**	**47%**	**33%**	**17%**
	Elementary	113	24	4%	33%	33%	29%	89	3%	43%	35%	19%
	Middle	37	11	0%	55%	45%	0%	26	0%	42%	38%	19%
	High	48	15	7%	47%	33%	13%	33	3%	64%	24%	9%
Look for and express regularity in repeated reasoning	**Total**	**197**	**50**	**4%**	**46%**	**32%**	**18%**	**147**	**3%**	**58%**	**29%**	**11%**
	Elementary	113	24	8%	33%	29%	29%	89	2%	52%	33%	13%
	Middle	36	11	0%	73%	27%	0%	25	0%	64%	28%	8%
	High	48	15	0%	47%	40%	13%	33	6%	70%	18%	6%

Theme 2: Teacher Beliefs about Teaching and Learning Mathematics

Survey participants were asked to respond to several questions aimed at exploring their beliefs about the teaching and learning of mathematics. Survey data (Table 91) show teacher beliefs are fairly consistent between more and less experienced teachers and across school levels (elementary, middle, and high school).

However, some differences become apparent on some items. More than 60% of teachers with 10 or fewer years of experience believe calculators should not be used in the lower elementary school grades, while only about 35% teachers with more experience have the same belief. Opposition to calculator use by elementary school students is greatest from high school teachers regardless of their level of experience.

These data also indicate that a greater proportion of more experienced teachers believe in direct instruction as the most effective method for teaching and learning mathematics than do their less experienced counterparts.

Table 91. Please indicate your level of agreement with the following statements about teaching mathematics.

			3-10 years' experience			10+ years' experience	
		Total n	n	Strongly Disagree + Disagree	Agree + Strongly Agree	n	Strongly Disagree + Disagree	Agree + Strongly Agree
An effective way to teach mathematics is to show students many worked out examples.	**Total**	**199**	**51**	**37%**	**63%**	**148**	**43%**	**57%**
	Elementary	113	24	38%	63%	89	44%	56%
	Middle	37	11	27%	73%	26	38%	62%
	High	49	16	44%	56%	33	45%	55%
An effective way to teach is to carefully explain mathematical ideas and methods to students.	**Total**	**198**	**51**	**22%**	**78%**	**147**	**19%**	**81%**
	Elementary	113	24	21%	79%	89	21%	79%
	Middle	36	11	9%	91%	25	24%	76%
	High	49	16	31%	69%	33	9%	91%
When teaching mathematics, I do more asking than telling.	**Total**	**200**	**51**	**18%**	**82%**	**149**	**9%**	**91%**
	Elementary	114	24	21%	79%	90	7%	93%
	Middle	37	11	18%	82%	26	8%	92%
	High	49	16	13%	88%	33	15%	85%
Since the teacher already knows the mathematics, it is her or his job to explain that knowledge to the students.	**Total**	**199**	**51**	**57%**	**43%**	**148**	**61%**	**39%**
	Elementary	114	24	63%	38%	90	60%	40%
	Middle	36	11	36%	64%	25	68%	32%
	High	49	16	63%	38%	33	58%	42%
Calculators should not be used in the lower elementary school grades.	**Total**	**199**	**51**	**37%**	**63%**	**148**	**64%**	**36%**
	Elementary	113	24	42%	58%	89	72%	28%
	Middle	37	11	55%	45%	26	58%	42%
	High	49	16	19%	81%	33	48%	52%

Table 91 (continued). Please indicate your level of agreement with the following statements about teaching mathematics.

		Total n	3-10 years' experience			10+ years' experience		
			n	Strongly Disagree + Disagree	Agree + Strongly Agree	n	Strongly Disagree + Disagree	Agree + Strongly Agree
It is important for students to struggle a bit when learning mathematics.	**Total**	**199**	**51**	**12%**	**88%**	**148**	**10%**	**90%**
	Elementary	113	24	17%	83%	89	15%	85%
	Middle	37	11	18%	82%	26	4%	96%
	High	49	16	0%	100%	33	3%	97%
The most effective way to teach and learn mathematics is through direct instruction.	**Total**	**200**	**51**	**69%**	**31%**	**149**	**57%**	**43%**
	Elementary	114	24	67%	33%	90	54%	46%
	Middle	37	11	82%	18%	26	62%	38%
	High	49	16	63%	38%	33	61%	39%
When teaching mathematics, students should learn basic skills first, then do problem-solving.	**Total**	**198**	**51**	**65%**	**35%**	**147**	**65%**	**35%**
	Elementary	113	24	71%	29%	89	65%	35%
	Middle	37	11	64%	36%	26	54%	46%
	High	48	16	56%	44%	32	72%	28%
When teaching mathematics, students should learn basic skills through problem solving.	**Total**	**200**	**51**	**10%**	**90%**	**149**	**19%**	**81%**
	Elementary	114	24	8%	92%	90	16%	84%
	Middle	37	11	0%	100%	26	23%	77%
	High	49	16	19%	81%	33	24%	76%

Theme 3: Perceived Abilities and Knowledge Related to Teaching Mathematics

Participants were asked to respond regarding their knowledge and abilities on various aspects related to teaching mathematics. Data from the survey show that teachers' perceived knowledge and abilities associated with their teaching responsibilities were generally similar across subgroups with differing amounts of experience and at different school levels (Table 92).

Nevertheless, a few differences may be observed. More seasoned teachers perceive greater ability to provide both access and challenge in their lessons ("low floor, high ceiling") than do less experienced teachers with 10 or fewer years. These data also suggest that elementary teachers have greater perceived knowledge of and ability to teach the Iowa Core standards for mathematical practice than do teachers at higher levels, although this decreases somewhat for more experienced teachers.

Table 92. On a scale from poor ability/knowledge to excellent ability/knowledge, rate your…

			3-10 years' experience			10+ years' experience	
		Total n	n	Poor + Fair Ability/ Knowledge	Good + Excellent Ability/ Knowledge	n	Poor + Fair Ability/ Knowledge	Good + Excellent Ability/ Knowledge
	Total	**185**	**51**	**8%**	**92%**	**134**	**10%**	**90%**
Depth of knowledge of mathematics for teaching	Elementary	105	23	9%	91%	82	12%	88%
	Middle	33	12	8%	92%	21	10%	90%
	High	47	16	6%	94%	31	6%	94%
	Total	**184**	**50**	**12%**	**88%**	**134**	**19%**	**81%**
Ability to identify and devise strategies for addressing common student misconceptions	Elementary	105	23	13%	87%	82	21%	79%
	Middle	32	11	18%	82%	21	19%	81%
	High	47	16	6%	94%	31	13%	87%
	Total	**184**	**50**	**18%**	**82%**	**134**	**19%**	**81%**
Ability to provide the right amount of scaffolding (guidance and support for effective student learning)	Elementary	105	23	17%	83%	82	18%	82%
	Middle	32	11	9%	91%	21	24%	76%
	High	47	16	25%	75%	31	16%	84%
	Total	**184**	**50**	**36%**	**64%**	**134**	**45%**	**55%**
Ability to use technology more effectively to support teaching and learning	Elementary	105	23	39%	61%	82	50%	50%
	Middle	32	11	27%	73%	21	48%	52%
	High	47	16	38%	63%	31	29%	71%

Table 92 (continued). On a scale from poor ability/knowledge to excellent ability/knowledge, rate your…

			3-10 years' experience			10+ years' experience	
		Total n	n	Poor + Fair Ability/ Knowledge	Good + Excellent Ability/ Knowledge	n	Poor + Fair Ability/ Knowledge	Good + Excellent Ability/ Knowledge
	Total	**184**	**50**	**28%**	**72%**	**134**	**28%**	**72%**
Ability to help my students develop their problem solving skills	Elementary	105	23	17%	83%	82	30%	70%
	Middle	32	11	45%	55%	21	14%	86%
	High	47	16	31%	69%	31	29%	71%
	Total	**182**	**50**	**30%**	**70%**	**132**	**26%**	**74%**
Ability to help my students develop their reasoning skills	Elementary	104	23	22%	78%	81	30%	70%
	Middle	31	11	45%	55%	20	15%	85%
	High	47	16	31%	69%	31	23%	77%
	Total	**183**	**50**	**28%**	**72%**	**133**	**32%**	**68%**
Understanding of the Iowa Core Standards for Mathematical Practice	Elementary	104	23	22%	78%	81	30%	70%
	Middle	32	11	36%	64%	21	33%	67%
	High	47	16	31%	69%	31	39%	61%
	Total	**183**	**50**	**24%**	**76%**	**133**	**31%**	**69%**
Ability to teach with the Iowa Core Standards for Mathematical Practice	Elementary	104	23	17%	83%	81	27%	73%
	Middle	32	11	36%	64%	21	33%	67%
	High	47	16	25%	75%	31	39%	61%

Table 92 (continued). On a scale from poor ability/knowledge to excellent ability/knowledge, rate your…

		Total n	3-10 years' experience			10+ years' experience		
			n	Poor + Fair Ability/ Knowledge	Good + Excellent Ability/ Knowledge	n	Poor + Fair Ability/ Knowledge	Good + Excellent Ability/ Knowledge
Ability to provide both access and challenge in my lessons ("low floor, high ceiling")	**Total**	**184**	**50**	**52%**	**48%**	**134**	**40%**	**60%**
	Elementary	105	23	52%	48%	82	40%	60%
	Middle	32	11	64%	36%	21	38%	62%
	High	47	16	44%	56%	31	42%	58%
Ability to ask good questions that promote effective teaching and learning	**Total**	**184**	**50**	**22%**	**78%**	**134**	**16%**	**84%**
	Elementary	105	23	22%	78%	82	22%	78%
	Middle	32	11	27%	73%	21	5%	95%
	High	47	16	19%	81%	31	10%	90%
Ability to organize and facilitate collaborative student work in my classes	**Total**	**184**	**50**	**22%**	**78%**	**134**	**26%**	**74%**
	Elementary	105	23	22%	78%	82	21%	79%
	Middle	32	11	9%	91%	21	29%	71%
	High	47	16	31%	69%	31	39%	61%
Ability to design instruction where I find out what my students know and alter instruction based on that knowledge	**Total**	**183**	**50**	**12%**	**88%**	**133**	**23%**	**77%**
	Elementary	104	23	4%	96%	81	25%	75%
	Middle	32	11	27%	73%	21	29%	71%
	High	47	16	13%	88%	31	13%	87%

Theme 4: Preferences Regarding Professional Development in Mathematics

A number of items on the survey were aimed at identifying teacher preferences regarding professional development in mathematics. Once again, responses are broken out by teacher experience and school level.

Regardless of years teaching experience, teachers far prefer professional development delivered through a combination of methods over any particular individual delivery method (Table 93). More veteran teachers far prefer face-to-face models over other delivery modes. The preference for face-to-face delivery persists, but isn't as strong, for less experienced teachers.

Teachers with fewer years of experience seek out professional development opportunities at higher rates than do more experienced teachers (Table 94). In addition, there is a high level of interest in gaining college credit for professional development among newer teachers (Table 95). This drops off noticeably for more veteran teachers.

Lastly, time to participate is the primary barrier to participating in professional development; cost is second (Table 96). These vary little across subgroups defined by experience and school level.

Table 93. My most valuable professional development experience is mathematics was:

	Total n	3-10 years' experience n	Delivered online	Informal study groups or learning communities	Traditional face to face	A combination of these
Total	**214**	**57**	**7.0%**	**17.5%**	**24.6%**	**50.9%**
Elementary	127	29	13.8%	17.2%	24.1%	44.8%
Middle	37	11	0.0%	0.0%	27.3%	72.7%
High	50	17	0.0%	29.4%	23.5%	47.1%

	Total n	10+ years' experience n	Delivered online	Informal study groups or learning communities	Traditional face to face	A combination of these
Total	**214**	**157**	**2.5%**	**10.2%**	**37.6%**	**49.7%**
Elementary	127	98	3.1%	7.1%	45.9%	43.9%
Middle	37	26	0.0%	15.4%	26.9%	57.7%
High	50	33	3.0%	15.2%	21.2%	60.6%

Table 94. I seek out professional development opportunities in mathematics development beyond district-mandated activities.

		3-10 years' experience			10+ years' experience	
	Total n	n	Never + Rarely	Occasionally + Frequently	n	Never + Rarely	Occasionally + Frequently
Total	**216**	**57**	**22.8%**	**77.2%**	**159**	**35.8%**	**64.2%**
Elementary	128	29	31.0%	69.0%	99	40.4%	59.6%
Middle	37	11	9.1%	90.9%	26	42.3%	57.7%
High	51	17	17.6%	82.4%	34	17.6%	82.4%

Table 95. Are you interested in earning college credit for professional development in mathematics?

		3-10 years' experience			10+ years' experience	
	Total n	n	Yes	No	n	Yes	No
Total	**215**	**57**	**71.9%**	**28.1%**	**158**	**51.9%**	**48.1%**
Elementary	127	29	65.5%	34.5%	98	48.0%	52.0%
Middle	37	11	90.9%	9.1%	26	42.3%	57.7%
High	51	17	70.6%	29.4%	34	70.6%	29.4%

Table 96. What are the top-three barriers that currently limit your ability in professional development activities?

	3-10 years' experience			10+ years' experience		
	Barrier 1	Barrier 2	Barrier 3	Barrier 1	Barrier 2	Barrier 3
Total	**Time to participate**	**Cost to participate**	**Access to substitute teachers**	**Time to participate**	**Cost to participate**	**Location of the activity**
Elementary	Time to participate	Access to substitute teachers	Cost to participate	Time to participate	Cost to participate	Location of the activity
Middle	Time to participate	Personal responsibilities	Cost to participate	Time to participate	Location of the activity	Cost to participate
High	Cost to participate	Time to participate	Location of the activity	Time to participate	Location of the activity	Personal responsibilities

Note: Participants were asked to rank their top three barriers. A rank sum score was calculated with the top barrier receiving a rating of three, barrier two receiving a rating of two, and barrier three receiving a rating of one. The three barriers with the highest weighted rank sum score were included in this table.

Theme 5: Amount and Type of Peer Collaboration

Several items on the survey addressed the amount and type of collaboration among teachers. HS teachers with 3-10 years of experience are more likely to collaborate at grade level while their more experienced colleagues are far less likely to do so (Table 97). At the same time, less experienced teachers at the elementary and middle school levels are *less likely* to collaborate at grade level than their more experienced counterparts. Overall, more seasoned teachers appear to collaborate slightly more at grade level than do less experienced teachers.

Regardless of school level and years teaching experience, few teachers report being given regularly scheduled time to work collaboratively often or very often (Table 98). Similarly, few teachers have received training on collaboration models. It would appear however, that elementary school teachers were most likely to receive such training.

Table 97. Tell us about how often you collaborate with others on mathematical topics or how to teach mathematics.

			3-10 years' experience			10+ years' experience			
		Total n	n	Never + Rarely	A few times monthly	A few times weekly or daily	n	Never + Rarely	A few times monthly	A few times weekly or daily
How often do you do so with other teachers at your grade level in your district?	**Total**	**236**	**65**	**41.5%**	**50.8%**	**7.7%**	**171**	**36.3%**	**55.0%**	**8.8%**
	Elementary	140	34	38.2%	58.8%	2.9%	106	35.8%	54.7%	9.4%
	Middle	42	13	76.9%	15.4%	7.7%	29	44.8%	41.4%	13.8%
	High	54	18	22.2%	61.1%	16.7%	36	30.6%	66.7%	2.8%
How often do you do so with other teachers at a different grade level?	**Total**	**229**	**65**	**55.4%**	**41.5%**	**3.1%**	**164**	**60.4%**	**39.0%**	**0.6%**
	Elementary	135	35	71.4%	28.6%	0.0%	100	70.0%	30.0%	0.0%
	Middle	41	12	25.0%	75.0%	0.0%	29	41.4%	58.6%	0.0%
	High	53	18	44.4%	44.4%	11.1%	35	48.6%	48.6%	2.9%

Table 98. At your school, how often…

			3-10 years' experience				10+ years' experience		
		Total n	n	Never	Rarely + Some-times	Often + Very Often	n	Never	Rarely + Some-times	Often + Very Often
Are teachers given regularly scheduled time, during the school day, to work collaboratively to plan mathematics instruction and review student assessment data?	**Total**	**211**	**55**	**42%**	**35%**	**24%**	**156**	**22%**	**60%**	**18%**
	Elementary	122	27	37%	41%	22%	95	23%	61%	16%
	Middle	39	12	33%	50%	17%	27	15%	59%	26%
	High	50	16	56%	13%	31%	34	26%	56%	18%
Have teachers received high-quality training on collaboration models (i.e., professional learning communities)?	**Total**	**210**	**54**	**20%**	**56%**	**24%**	**156**	**12%**	**63%**	**26%**
	Elementary	122	27	19%	44%	37%	95	11%	60%	29%
	Middle	38	11	18%	73%	9%	27	11%	67%	22%
	High	50	16	25%	63%	13%	34	15%	68%	18%
Do teachers collaborate to analyze data to make long-term instructional decisions?	**Total**	**208**	**54**	**19%**	**63%**	**19%**	**154**	**5%**	**66%**	**29%**
	Elementary	121	27	19%	63%	19%	94	5%	64%	31%
	Middle	38	11	9%	73%	18%	27	11%	56%	33%
	High	49	16	25%	56%	19%	33	0%	82%	18%

Open-Ended Response Summaries

The following section presents summaries of teachers' responses to open-ended questions from the survey related to the challenges they face when teaching mathematics and difficult mathematics content. These responses are broken out by school level – elementary (K-5), middle (6-8), and high school (9-12). Included next to each school level above each summary is the number of respondents at that school level (n=).

What are the top-five challenges you face as a teacher of mathematics?

Elementary School (n=81)

The most common theme in challenges for elementary school math teachers was a lack of time (66 comments). Within time, two themes emerged. The first was a lack of time within class to address the entire curriculum for students at all levels (30 comments), and the second was a lack of time to plan and find materials for the classes (13 comments). The next most common theme was dealing with different levels within the classroom (31 comments). Within levels, most teachers found that extreme differences in student learning abilities were difficult to accommodate in the classroom, though some teachers felt that they were specifically unable to sufficiently challenge high-level learners (7 comments), while other teachers expressed that they were not meeting the needs of low-level learners (3 comments). The next challenge for teachers was learners' current level of knowledge and skills (31 comments), primarily that students were lacking fundamental skills they had not learned before advancing to the next class. Another challenge was students' behaviors and attitudes (22 comments), particularly short attention spans and problems focusing in class (6 comments), lack of perseverance (5 comments), and a general disinterest in math (4 comments). Finally, teachers expressed that their own lack of knowledge and skills was a challenge (21 comments). Teachers would like more instruction on curriculum and teaching practices.

Middle School (n=30)

The most common theme in challenges for middle school math teachers was a lack of time (21 comments). Teachers felt that they did not have enough time within class to cover the entire curriculum (8 comments), and that they did not have sufficient time for planning or collaborating with fellow teachers (6 comments). The next common theme was students' behavior and attitudes (17 comments). Teachers commented that students generally lacked motivation and confidence in math (7 comments), and that students had a tendency to quit when the work was difficult (4 comments). Students' lack of knowledge and skills was also a challenge for teachers (11 comments), mainly that their students did not have

knowledge in basic skills required for the class (7 comments). Another challenge was resources and technology (10 comments), particularly the lack of resources to assist with teaching (7 comments) and having to use technology (3 comments). Finally, teachers felt that they would like increased access to training and professional development to improve their teaching skills (10 comments).

High School (n=33)

The most common theme in challenges for high school math teachers was a lack of time (35 comments). Most teachers felt that they did not have enough time for preparation and planning for their classes (23 comments), as well as not having enough time within class to cover the required materials (9 comments). The second most common challenge mentioned was related to students' behavior and attitudes (31 comments), over half of which were that students lacked motivation or interest in math (18 comments). Another common theme was that students lacked basic knowledge and skills because they had not sufficiently learned math in earlier school years (19 comments). Teachers also discussed the need for more teacher training (12 comments), particularly in finding different teaching methods (7 comments) and working with other teachers (5 comments). Finally, teachers said that they had problems with a wide variety of levels in their classrooms (9 comments), and that they might not be offering classwork that sufficiently challenges the high-level students (2 comments).

What mathematical content is most difficult for your students to learn?

Elementary School (n=78)

When participants were asked what content is most difficult for elementary school students to learn, the most common topic area was in fractions and decimals (18 comments), particularly doing the four operations with them. The second most frequently mentioned topic was place values and multiple digits (17 comments), meaning doing any math work involving numbers larger than 10. The third most commonly indicated topic was problem solving (13 comments), which referred to working with word or reading problems and translating them into math solutions. Two topic areas were discussed the same number of times, with 10 comments each—addition and subtraction, and multiplication and division. There were no subtopics for either of these general topic areas, which primarily consisted of teachers writing "addition and subtraction" without further explanation.

Middle School (n=22)

When participants were asked what content is most difficult for middle school students to learn, the most common topic area was in fractions (9 comments), particularly doing the four operations with fractions. Two topics were mentioned four times each. The first was integers, and the second was percents, with no subtopics for either of those topic areas. Three topics were mentioned three times each—geometry, rational numbers, and ratios, with no subtopics for any of them. Where there were no subtopics indicated, it means that teachers generally wrote only one or two words and did not give any further details.

High School (n=28)

When participants were asked what content is most difficult for high school students to learn, the most common topic area was in students' reasoning ability, meaning their ability to make logical sense of the principles and problems they must complete in class. Three topic categories were mentioned the same number of times, with five (5) comments for each. One was factoring in general, which had two subtopics indicated: polynomials (1 comment) and factoring with leading coefficient greater than 1 (1 comment). Statistics and probability were mentioned, with no distinguishable subtopics. Rational functions comprised the third topic specified, and there were no subtopics indicated. The fifth most frequently mentioned topic was exponents (4 comments), which included simplifying (2 comments) and properties (2 comments) as subtopics.

What mathematical content is most difficult for you to teach?

Elementary (n=84)

When asked what mathematical content was most difficult for elementary teachers to teach, the most frequent topic indicated was fractions and decimals (17 comments), with subtopics including multiplication and division (2 comments) and comparing (2 comments). The second most frequently mentioned topic was geometry (13 comments), which included shapes (5 comments) and angles (1 comment). Another topic frequently specified by elementary teachers was number stories (11 comments), referring to any tasks that required students solve a problem that was in the form of a story (word problem). Measurement was the fourth most frequent topic indicated as difficult to teach (10 comments); the only subtopic here was converting to metric (4 comments). Two topics had 7 comments each. One was place values and multiple digit numbers, which refers to doing any mathematical operations that involved numbers larger than 10. The other topic was reasoning, meaning the students' thought processes when approaching math problems.

Middle School (n=24)

When asked what mathematical content was most difficult for middle school teachers to teach, the most frequent topic indicated was probability and statistics (6 comments). The second most common topic stated as being difficult for teachers was rational numbers (3 comments), particularly dealing with a lack of knowledge carried over from lower levels. Three topics were mentioned twice each as being difficult to teach. One was algebra, which no subtopics indicated; another was geometry; the final was solving problems with multiple steps, suggesting difficulties with reasoning and logic.

High School (n=30)

When asked what mathematical content was most difficult for high school teachers to teach, the most frequent topic indicated was probability and statistics (11 comments). The second most common topic mentioned was geometry (6 comments), with two comments specifically about proofs and one about application. College preparation and content standards were the third most commonly specified topic (5 comments), with subtopics including calculus (2 comments), algebra (1 comment), statistics (1 comment) and standards (1 comment). Application, referring to the application of mathematics skills to real life, was mentioned the same number of times as college preparation. Three topics were stated three times each—proofs, with no indication if these were geometry proofs; reasoning, meaning the logic required to solve math problems; and trigonomet