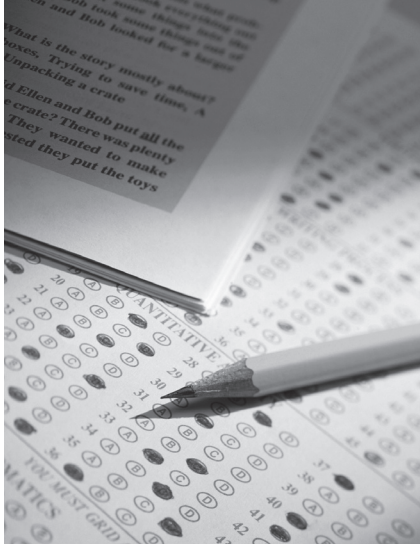


3 Analyzing Data for Schoolwide and Individual Student Improvement

What separates the schools that will be successful in their reform efforts from the ones that won't is the use of one, often neglected, essential element—data.

—*Victoria Bernhardt*

The principal must make effective use of student performance data to identify and guide all instructional decisions—most especially for those decisions influencing school improvement. "When teachers and administrators examine data as part of the school improvement process, school improvement teams become more efficient and effective, decision making becomes more collaborative, teachers develop more positive attitudes about their own and their students' abilities, and educators begin to feel more in charge of their own destinies," according to Craig Jerald in a 2006 brief on collecting and using data to increase student achievement (p. 2). Assessment data empower teachers to make informed instructional choices. The analysis of external and internal assessments by the numeracy team not only can support differentiated instruction but also can identify potential interdisciplinary mathematics instructional topics and professional development needs and set schoolwide goals to leverage improvement in mathematics. The team should analyze *three to five years of data* to establish the mastery and nonmastery trends.

Analyzing Data to Complete the School Numeracy Profile

The outcome of the numeracy team data study will be to capture the *School Numeracy Profile*, a powerful tool in defining schoolwide numeracy initiatives and in committing the resources necessary to guide improvement. The School Numeracy Profile is a summary of the mathematics content standards mastered or not mastered by each grade level and by each of the 10 subgroups required for federal reporting. However, the depth of data analysis should go beyond just reviewing standardized data. Members of the numeracy team are tasked with collecting and analyzing multiple forms of student, school, and teacher data to identify the mathematics learning needs of student groups and then to identify the professional learning needs of the teachers. The School Numeracy Profile analyzes and interprets trends in four types of schoolwide data: perceptual, summative, formative, and demographic. Principals who have no experience analyzing this type of school data might consider seeking professional development in this area through district or state resources.

Perceptual data

Perceptual data reflect the opinions and views of stakeholders concerning the school culture, much like the Numeracy Capacity Survey (Appendix 1) completed by all stakeholders. Before the staff discusses the findings in the School Numeracy Profile, all staff members should be given an opportunity, in focus groups, meetings, or conferences, to discuss their perceptions about why individual student groups have achieved Proficient or above in mathematics on assessment tests and why other student groups have not. As a staff, investigate and record the answers to key questions such as:

- What do I think it would take for every subgroup (economically disadvantaged, Hispanic, etc.) to score at least Proficient in mathematics?
- Why are there achievement gaps?
- What am I doing in my classroom to promote learning that's most effective?
- What am I doing in my classroom to promote learning that's least effective?
- How well do I know my curriculum standards?
- Am I teaching to the standards?
- What do I do when students don't master the standards?
- What can I do to improve parent participation?

Involve other stakeholders in the formulation of the key questions, to ensure wide coverage of perceptions. One value of this analysis of perceptual data is to dispel commonly held assumptions about what causes poor student achievement. For example, a focus discussion may show that teachers commonly believe that eighth-grade students from certain low-income housing areas have poor attendance or poor achievement levels. After analyzing the eighth-grade data in the School Numeracy Profile, they find no correlation between income and poor attendance or poor performance for those students.

Changing the Perception of Advanced Placement Participation…Imagine That

Students selected for enrollment in an AP English Literature class by high grades and teacher recommendation continued to score average to below on the annual AP exam. Finally, the AP teacher with the support of the school guidance counselor, identified additional students for the upcoming year by looking at high ACT, PSAT, or SAT verbal scores. The teacher interviewed each of the new students during the summer and informed parents and students of teacher and peer support systems available to students who struggle. Throughout the academic year, the teacher continued with periodic progress meetings. Compared with the previous year, twice as many students received a score of 3 on the AP exam, several more students achieved a 4, and, for the first time, four students achieved the highest rating of 5.

Summative data

Summative data include the annual state standardized mathematics assessment test mastery and nonmastery group report results. Student group scores are reported by grade level and by subgroup. Since group reports give data for a single testing year, the team should collect group reports from 2007 to the present and organize them into tables or graphs for easy reference. Tables 3-1, 3-2, 3-3, and 3-4 represent several examples of summative trend data, which are explained in sample tables with analysis hints, analysis questions, and numeracy team discussion items that will help you organize and represent your own school data.

For high schools, the team should also collect data from college entrance or AP mathematics exams. If you have a local university or community college, request several years' mathematics placement exam results of freshmen from your school.

TABLE 3-1
Summative Trend Data 3–5 Years
Schoolwide Mathematics Scores
% Proficient or Above

GRADE	2007	2008	2009	2010
5	57↘	61	63	60
6	51	59↘	62	64
7	55	56	56↘	63
8	50	56	58	58

Analysis hint: The 2007 fifth graders became eighth graders in 2010 (follow the diagonal).

Analysis questions:

- What percentage of eighth graders were Proficient or above in 2010?
- Did the eighth graders' scores improve when compared with the previous year's scores (follow the diagonal up and left)?

Numeracy team discussion: Do your students' mathematics test scores improve as time in the school's educational program increases? What instructional strategies, grouping by grade-level teams or departmental teams, and intervention activities may be employed?

Since the numeracy team is in search of specific content standards not mastered and effective instructional strategies or interventions that the grade-level or content teachers might be able to employ, your team now needs to investigate what student groups are Proficient in mathematics assessment skill areas and what student groups are not. Further analyses of student performance data can be found by analyzing the student group report. This is information that your district reports to the state as required by federal law and this report is, in many cases, also sent to your school. If you do not receive data

by subgroup, request it from the district office before compiling it on site. Compiling the data in a format such as in Table 3-2 enables the team to look at mathematics performance levels by student groups.

TABLE 3-2
Summative Test Scores by Student Grade and Group

Student Group Grade 10	2007				2008				2009				2010			
Performance ➜	BB	B	Pro	Adv	BB	B	Pro	Adv	BB	B	Pro	Adv	BB	B	Pro	Adv
Asian	27%	46%	27%	0	27%	18%	46%	9%	13%	27%	47%	13%	6%	33%	43%	18%
Black	45%	37%	18%	0	29%	21%	36%	14%	31%	28%	16%	25%	19%	20%	36%	25%
White	27%	55%	13%	5%	22%	62%	11%	5%	21%	49%	20%	10%	13%	52%	23%	12%
Hispanic	61%	17%	22%	0	48%	36%	16%	0	29%	36%	26%	9%	18%	51%	22%	9%
Male	34%	26%	28%	12%	25%	30%	30%	15%	20%	27%	35%	18%	15%	23%	40%	22%
Female	30%	42%	20%	8%	24%	41%	25%	10%	18%	42%	30%	10%	15%	35%	35%	15%
Economically disadvantaged	45%	40%	10%	5%	42%	35%	15%	8%	38%	35%	20%	7%	35%	30%	25%	10%
Economically advantaged	30%	40%	25%	5%	25%	35%	30%	10%	18%	30%	25%	27%	15%	25%	30%	30%
Special education	65%	35%	0%	0%	62%	38%	0%	0%	58%	40%	2%	0%	46%	38%	16%	0%
English language learners	40%	55%	5%	0%	35%	65%	0%	0%	30%	55%	13%	2%	33%	51%	11%	5%

BB = Below Basic | B = Basic | Pro = Proficient | Adv = Advanced

Analysis hint: Check to see that all measurable subgroups in your school are represented in the table. Be sure you look at and record 3–5 years of school profile data. Cluster groups from the table (ethnic, gender, economics, educational program).

Analysis questions:

- What ethnic group has the highest percentage of students who are Proficient and above for 2010?
- In which groups has the percentage of BB (Below Basic) students decreased from 2007 to 2010?
- In what groups have the percentage of students that are Proficient and above increased from 2007 to 2010?

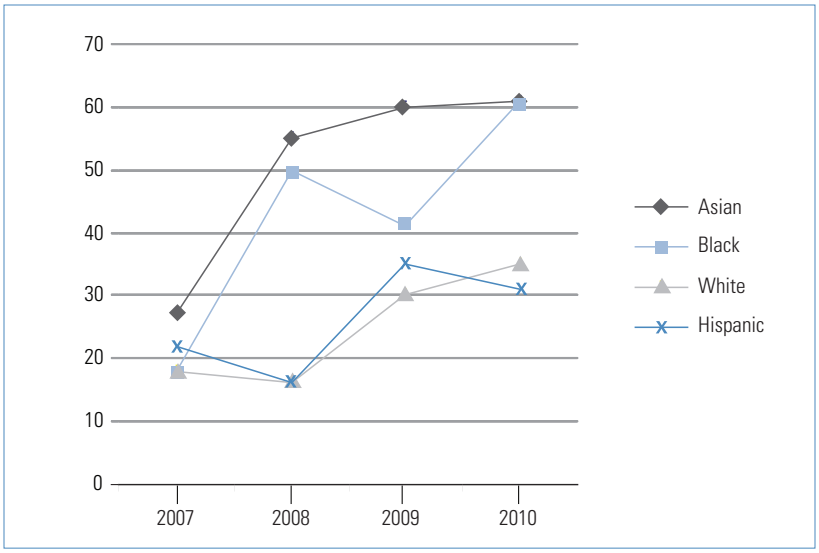
Charting the improvement of scores by subgroups may be more clearly seen when represented in a line graph or bar graph. In the sample table below, the percentage of student ethnic groups scoring Proficient or above is shown. (In calculating the percentage of students scoring at Proficient or above, add the percentage Proficient and percentage Advanced in the same year.) The resulting line graph answers the following analyses question more clearly: Has the percentage of student groups scoring at Proficient or above, increased over the trend years?

FIGURE 3-1

Summary Table for Graph from Table 3-2—Groups Proficient or Above

% of Ethnic Students Proficient or Above

Ethnic Group	2007	2008	2009	2010
Asian	27	55	60	61
Black	18	50	41	61
White	18	16	30	35
Hispanic	22	16	35	31



Analysis hint: It might be beneficial to graph all of the student groups scoring at Proficient or above and also to graph all student groups scoring at basic and below. These graphs may facilitate answers to the analysis questions and numeracy team discussions identified for Table 3-2 and the line graph.

Numeracy team discussion: What student groups have or have not improved each year? What grade-level or mathematics initiatives have been implemented with various subgroups and has the percentage of Proficient and above increased in these groups? What groups are NOT achieving Proficient (BB + B)? What groups need to be targeted for instructional support?

Table 3-3 shows the results of an item analysis of the mathematics assessment skill areas and the student group (grade 7) scoring below Proficient.

TABLE 3-3

Grade-Level Mathematics Performance Summary

Mathematics Assessment Content Standard Skill

Standardized Mathematics Group Profile, Part I: 48 questions

MATHEMATICS—GRADE 7		
(48 questions)		
Skill	**No. of Questions**	**% of Students Below Proficient**
Numbers and Number Relations	5	40
Measurement	6	45
Statistics	5	25
Number Systems/Number Theory	5	30
Algebra	5	15
Probability	6	38
Patterns & Functions	5	35
Geometry	5	20
Problem-Solving Strategies	6	55

Analysis hint: Note the following information in Table 3-3: 40% of all seventh-grade students scored less than Proficient in Numbers and Number Relations; 45% of all seventh graders scored less than Proficient in Measurement; 25% of all seventh graders scored less than Proficient in Statistics; 30% of all seventh graders scored less than Proficient in Number Systems/Number Theory.

Analysis questions:

- What mathematics skill areas need greatest reinforcement?
- Has the team matched the mathematics skill assessment areas with the grade-level curriculum standards?

Numeracy team discussion: Focus on the areas of greatest need. Most seventh graders need problem-solving examples (55% below Proficient) for practice. Has the team identified the mathematics grade-level curriculum standards that are not mastered? (This alignment has already been done by most states and/or districts.) Has the team identified the cross-content mathematics standards that also were not mastered in the mathematics skill areas of the profile? For ease in identifying what skill areas need highest instructional priority, rank the skill areas from the highest area of nonmastery to the lowest, as in Table 3-4.

TABLE 3-4

Grade-Level Mathematics Performance Summary

Ranked Standardized Mathematics Group Profile, Part I: 48 questions

MATHEMATICS—GRADE 7 (48 questions)			
Skill	**No. of Questions**	**% of Students Below Proficient**	**Priority Ranking**
Problem-Solving Strategies	6	55	1
Measurement	6	45	2
Number & Number Relations	5	40	3
Probability	6	38	4
Patterns & Functions	5	35	5
Number Systems/Number Theory	5	30	6
Statistics	5	25	7
Geometry	5	20	8
Algebra	5	15	9

Analysis questions:

- How many priority areas will be emphasized and what is the timeline?
- How many skills will be reinforced during each grading period?
- What content standards are embedded in each skill area?
- When will the skills be evaluated by the benchmark exam?
- What skills can be reinforced in mathematics classes?
- What activities can reinforce needed mathematics skills in other content classes?
- What interdisciplinary projects and activities will provide practice in the priority skill areas?

Numeracy team discussion: Seventh-grade teachers should spend about 9 weeks teaching/reinforcing skills ranked 1 to 4 in Table 3-4: Problem-Solving Strategies, Measurement, Numbers and Number Relations, and Probability. The benchmark exam will be taken in week 10. For example:

Mathematics class reinforcement—Sample lessons in Problem solving can be found in the seventh-grade mathematics text as follows: Measurement, pp. 26–27; Probability & Statistics, pp. 30–35; Number systems & Relations, pp. 40–45; problem-solving strategies, pp. 50–60.
Content classes—A sample interdisciplinary project will be identified for implementation by grade-level teams.

The team should identify performance objectives, outcomes, timelines, and resources for content-area teachers and ask teachers to maintain a mastery log containing the following items: performance, outcome, time, resources, test score.

- As the numeracy team becomes more experienced with reading, analyzing, and manipulating school trend data, tables such as these may be summarized in fewer documents to facilitate review. However, **caution is urged to limit the complexity of these tables. Too much data in one table may result in a loss of utility for you, your staff, and/or other stakeholders.**

Formative data

Formative data are collected throughout the year but are also summarized at the close of the school year. Compile these data by grade level and by subgroup. These data include mathematics grades, local school benchmark exams, interim mathematics exam results, mathematics final exam grades, etc.

Demographic data

Demographic data give a summary of the characteristics of the school population. They describe the common characteristics and variations of the school's subgroups. The number of students in each of the 10 federal reporting subgroups, the number in each grade level, the number of students who receive free and reduced-price meals in each grade, the number of students completing mathematics courses in each grade level by subgroup, school absences and tardies in each group, ages, number of students retained in each grade level by subgroup, etc.

The following is a sample of schoolwide demographic data points that can be effectively summarized in table form:

- Population—show across 5 years
- Attendance—show monthly for 1 year by subgroups
- Suspensions—show number of days missed/student group test scores
- Benchmark testing—show group score gains over 1 year
- Student subgroups—show group size, scores over 4 years
- Educational program (gifted and talented, special education, ELL, bilingual, etc.)—show population.

Table 3-5 represents a performance data sample using one of the demographic data points. In this sample, mathematics performance is summarized by economic status as measured by the percentage of students eligible for free and reduced-price meals and those eligible for paid meals.

TABLE 3-5

Mathematics Scores by Economic Status

Grade	Economic Status	Performance	2008		2009		2010	
			No.	%	No.	%	No.	%
9	Free/Reduced-Price Meals	Below Standard	30	50	25	42	20	33
		Meets Standard	20	33	25	42	28	47
		Advanced	10	17	10	17	12	20
	Paid	Below Standard	10	25	10	25	8	20
		Meets Standard	25	62	26	65	25	62
		Advanced	5	13	4	10	7	18
10	Free/Reduced-Price Meals	Below Standard	30	67	25	55	20	44
		Meets Standard	10	22	15	33	20	44
		Advanced	5	11	5	11	5	11
	Paid	Below Standard	15	27	13	24	10	18
		Meets Standard	30	55	30	55	33	60
		Advanced	10	18	12	22	12	22

Analysis hint: Note that 67% of the students in grade 9 who receive free and reduced-price lunch in 2010 are Proficient or above (47% + 20%), while 33 % are not; 80% of the grade 9 paid-lunch students in 2010 are Proficient or above (62% + 18%).
Note: rounded total may be between 99 and 101.

Analysis questions:

- Did the percentage of Below Standard students decrease between 2008 and 2010?
- Did the percentage of Proficient students increase between 2008 and 2010?
- Did the percentage of the Proficient and above students in all groups increase between 2008 and 2010?

Numeracy team discussions: Who were the students in the Below Standard group in 2010? Are these students also identified in the poor attendance or suspension group? If an early-morning or after-school intervention is planned, will some students need additional resources to participate (costs for transportation, supplemental materials, etc.)? What specific interventions are possible for small-group or individual instruction?

Creating the School Numeracy Profile

The School Numeracy Profile is informed by analysis of the data collected in each of the four types of assessment data. To truly create a culture of numeracy, staff should focus first on collecting perceptual data in focus groups and then on the analysis of summative, formative, and demographic group data. See Appendix 6 for a profile template.

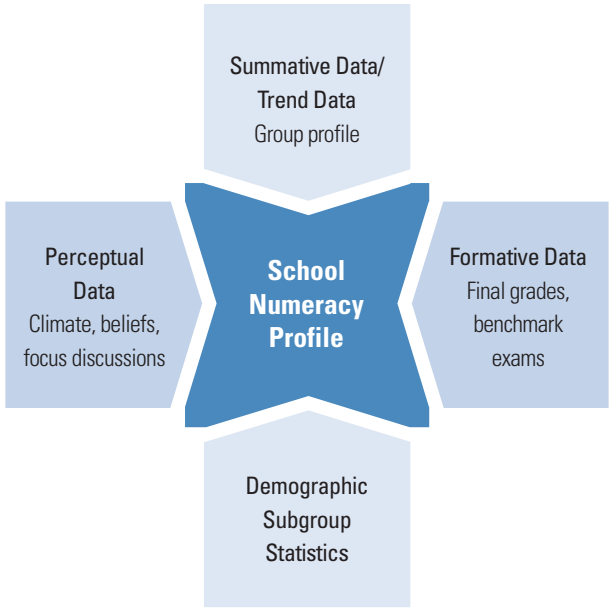
The School Numeracy Profile is a document that should be provided to all staff members for study and discussion. Teachers should be assisted in analyzing variables, discussing correlations, and utilizing the data to plan long-term mathematics improvement strategies. This document can also be used to help frame the discussion about your teachers' professional development needs as you build capacity for mathematics improvement within the school culture.

Gathering the data and finding the answers to the questions below should reveal the areas of student nonmastery that need to be addressed both by individual mathematics classes and in content-area classrooms:

- What are the mathematics concepts that students have mastered at each grade level?
- What are the mathematics concepts that students have not effectively mastered?
- What mathematics standards are effectively mastered after completing the grade-level mathematics course?
- How are specific groups of students performing in mathematics?
- How has attendance affected mathematics performance?
- What are the longitudinal trends for mathematics mastery for groups of students in your school?
- How does completion of specific mathematics courses affect mastery of mathematics concepts?
- Are additional data needed to successfully answer these questions?
- How can feeder elementary schools and middle schools support student areas of mastery and nonmastery?

The school staff can focus the data analysis by developing key analysis questions. The numeracy team, supported by its findings in asking and answering key questions, should complete the school profile and identify the mathematics concepts to be the instructional focus during the upcoming school year. Answering key questions will not only help to focus what concepts have or have not been mastered but will also identify the appropriate grade-level content classes where mathematics skills may be met and the curriculum standards addressed by the grade-level mathematics curriculum. Instructional areas where staff members seem unsure or underprepared are areas to be strongly supported by professional development.

FIGURE 3-2
Four types of assessment data formulating the School Numeracy Profile



Analyzing Data to Complete the Personal Plan for Mathematics Proficiency

The numeracy team should collect current data to build a Personal Plan for Mathematics Proficiency (PP4MP) for each student. In comparison with the School Numeracy Profile and its analyses of student group data, the PP4MP compiles data to identify the mathematics concepts mastered and not mastered by individual students. To complete this individual profile, the numeracy team collect a variety of data from many school sources. The team will disaggregate multiple sources of student data, looking at grade-level mathematics areas of mastery and nonmastery for each student.

The PP4MP is completed by the student or team member and is based on the attitudes about mathematics achievement from the student focus interview and from the mastery skills information data collected from school sources and the assessment student profile data. Establish a process for the completion of the personal plan by each student. It might be completed by the student or teacher in advisory or by a counselor or mentor in a student interview session. If the plan is completed by team members or teachers, provide time for student and teacher discussion and review.

Numeracy team data analysis will provide individual student data to complete the PP4MP. This plan is a summary of the mathematics content standards mastered or not mastered by each student, and data analysis should go deeper than standardized data. Members of the numeracy team are responsible for analyzing multiple forms of assessment as well as school and teacher data to identify the mathematics skills accomplished

■ Suggested data sources for the PP4MP are student results on state assessments, district assessment exams, school benchmark tests, diagnostic assessments, classroom assessments, and mathematics final exams, mathematics advisory grades; attendance information; and records from the perception focus discussion.

and those needing reinforcement. The PP4MP identifies the learning needs of each student so that staff members and the student can plan for progress. As with the school profile, the PP4MP comes from analyzing and carefully representing four types of schoolwide data. Principals who have had little or no experience analyzing this type of individual student data might consider professional development in this area through district or state resources.

Perceptual data

Perceptual data reflect the opinions and views of each student about his or her own mathematics mastery and ability. Preceding the examination of the data compiled for the PP4MP, students should participate in a focus discussion regarding their perception about what mathematics concepts they think they have mastered, trouble areas, and why they have achieved proficiency or why they have not achieved proficiency in mathematics on assessment tests. These focused discussions are preferably completed in individual or small groups. The numeracy team or staff should compile pertinent discussion questions and identify teacher or counselor interviewers to ask and record the answers to key questions such as:

- Are you good at mathematics? Why do you think that?
- In which mathematics courses have you experienced the most success?
- Where have you had the least success in mathematics? Why do you think that is?
- How many hours a week do you study mathematics?

Be sure to include other stakeholders in the formulation of these key questions to give a broader perspective. Many times the value of this perception analysis may be to dispel commonly held assumptions about poor achievement. For example, many mathematics students commonly believe that fractions or geometry are areas of poor achievement and find, after analyzing the data compiled for the PP4MP, that they have sufficient skills in those areas to be scored as Proficient. Students who believe that mathematics is not related to practice and preparation may discover that too few hours are spent studying mathematics to be successful. Students may be presented with an opportunity to see the inconsistency between their common beliefs and the data.

Summative data

Summative data include the annual student profiles provided by the standardized mathematics assessment test results. These individual student reports are traditionally provided by the state or district. If profiles are not provided, they can be requested from the district or state or they can be compiled from the scored test item analysis of each student. Scores from benchmark mathematics exams, college entrance mathematics exams, or AP mathematics exams should also be included. Table 3-6 is a sample individual student profile provided by the state.

TABLE 3-6

Sample Individual Mathematics State Performance Report

Mathematics Assessment by Individual and Content Skill

MATHEMATICS—GRADE 9 Scaled Score = 344		
Skill	**No. of Questions**	**Number Correct**
Numbers and Number Relations	9	6
Geometry and Measurement	12	9
Patterns & Functions	6	6
Algebra	7	7
Probability and Statistics	7	4
Computation and Estimation	8	5
Problem-Solving Strategies	11	7

Analysis hints: Identify the content standards that are tested in each of the skill areas. Note the mastered skills and the skills that need reinforcement. Find the scale score range of the next performance level and determine how many points this student needs to score at the next performance level.

Analysis question: What reinforcement activities can be accomplished by this student either individually with learning packets or in small groups with instruction that will improve mastery in the identified skill area?

Numeracy team/teacher discussion: What skills will be addressed in mathematics classes or what skills can be reinforced in content classes? How many classroom students need reinforcement in the same skills areas? What skills can be reinforced individually, in small groups or in pull-out groups?

Formative data

Formative data are classroom and school data collected throughout the year and used to inform instruction decisions. At the beginning of the year, compile these data by examining grades from previous marking periods, unit tests, mathematics exam grades, and final exams in mathematics. These data include local school benchmark mathematics exam results. Establish a plan to store and display the formative data and an update process throughout the school year that identifies current mastered and nonmastered skills so that each student and teacher can monitor mastery changes.

Demographic data

Demographic data describe the common characteristics and variations of each student in the population, the number of mathematics courses completed in each grade level, grades, school absences and tardies, etc.

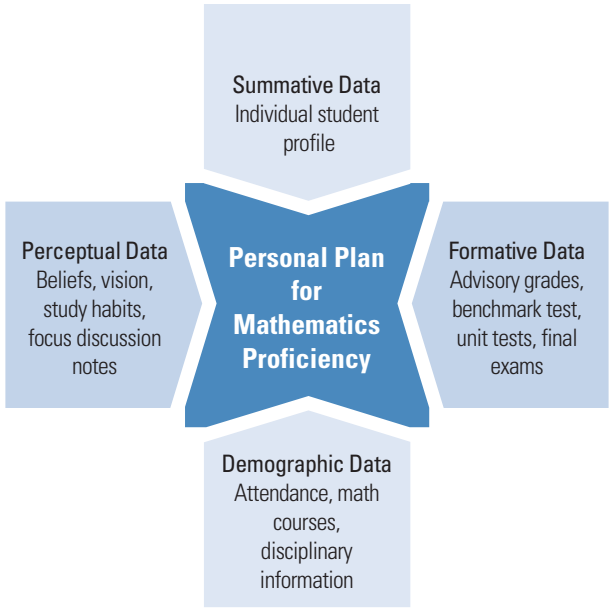
Creating the Personal Plan for Mathematics Proficiency

The PP4MP is a four-part document that is informed by the data collected in each of the four categories. To truly create a culture of numeracy, the initial focus for the PP4MP should be on recording the perceptual data followed by analyzing the data compiled for the other three types. See Appendix 7 for a PP4MP template.

The mastered and nonmastered mathematics skills/concepts should be presented for discussion by the numeracy team, grade level, and/or departmental teams. They will inform the content of the schoolwide Numeracy Improvement Plan and provide information about meeting standards in both the grade-level mathematics course and in the interdisciplinary mathematics skills in content courses. The student plan compiled from assessment data will provide information for teachers, parents, and students.

Effective use of the student personal plan will provide factual information to make appropriate mathematics instructional decisions. By reviewing the collective personal plans in a classroom, the teacher will be able to make grouping and reinforcement decisions to address mathematics deficiencies. Utilizing formative assessment data throughout the year will update instructional decisions and focus reinforcement where it is currently needed. (See figure 3-2.)

FIGURE 3-3
Four types of assessment data formulating the PP4MP



- Analyze the School Numeracy Profile built from mathematics assessment data and school and classroom assessments to determine the specific mathematics learning needs of student groups. Group and regroup to address the nonmastered skills identified for each student in the Personal Plans for Mathematics Proficiency.
- Initiate strategies to "plug the gaps!"

Informing the School Improvement Planning Process

Your staff and stakeholders must understand that testing will focus the school on what it is doing right as well as what needs to be improved.

A successful schoolwide improvement initiative in mathematics (i.e., Numeracy Improvement Plan), depends on authentic interpretation of school information in two major areas: rigor and mastery in mathematics courses and rigor and mastery in cross-content reinforcement of mathematics skills.

Rigor in mathematics courses

The numeracy team should analyze mathematics mastery based on the number of mathematics courses students have completed. This provides an environment to ask if proficiency improves with successful completion of yearly mathematics classes. This process will inform additional key questions:

- Is there equity of participation in all school mathematics courses?
- Does completion of a rigorous mathematics course in sequence improve mathematics proficiency for all students?

Table 3-7 is a sample of the percentage of students from each school subgroup enrolled in two secondary mathematics courses. Your team should complete these demographics for all school mathematics courses. Underrepresented groups in each course are identified by shading, and equity of participation can easily be seen. Table 3-8 is a sample of the data to be collected and summarized by the team, showing how students

in each mathematics course scored on the mathematics section of the most recent state exam. In a large school with a large number of mathematics courses, a random sample of students can be utilized; or, where there are many sections of the same course, a random selection of one or two sections can be used.

TABLE 3-7
Mathematics Class Demographics

2008–09 School Year	Total	Male	Female	Free/ Reduce	Paid	Black	White	Hispanic	Asian	Special Education
School	N=600 100%	N=280 47%	N=320 53%	N=175 29%	N=425 71%	N=80 13%	N=270 45%	N=200 33%	N=50 8%	N=5 1%
Calculus	N=30 100%	N=20 **67%**	N=10 33%	N=1 3%	N=29 **97%**	N=2 7%	N=14% **47%**	N=2 7%	N=12 **40%**	N=0 0%
Pre-Calculus	N=60 100%	N=40 **67%**	N=20 33%	N=5 8%	N=55 **92%**	N=3 5%	N=35 **58%**	N=5 8%	N=17 **28%**	N=0 0%

Boxed numbers = underrepresented
Bolded numbers = overrepresented

Analysis hint: Shading and bolding will help you identify overrepresentation and underrepresentation at a glance so that time may be better spent on identifying strategies for class balancing. The team should complete the table for every mathematics course.

Analysis questions:

- Is there equity of participation in my classes? (See White students in Calculus.)
- Have those student groups identified as below Proficient completed sequentially challenging mathematics courses?

Numeracy team discussion: The demographics in your school's mathematics classes should parallel the demographics in your school. The numeracy team may need to identify recruitment strategies in your plan to increase the number of underrepresented subgroups in mathematics course electives. Traditionally, finding the same ethnic and economic demographics across the mathematics curriculum is a challenge and certainly may need a concerted effort by the team, counselors, and teachers.

TABLE 3-8

Performance Levels by Mathematics Course

Course	9th Grade	2009	10th Grade	2009	Level
	No.	%	No.	%	
Pre-Algebra	50	70	10	60	Nearing
		20		40	Proficient
		10			Advanced
Algebra	100	40	20	50	Nearing
		50		40	Proficient
		10		10	Advanced
Geometry	40	30	90	30	Nearing
		50		50	Proficient
		20		20	Advanced
Int. Algebra	10	5	25	10	Nearing
		60		50	Proficient
		35		40	Advanced
Pre-Calculus	0	0	5	0	Nearing
		0		70	Proficient
		0		30	Advanced
Calculus	0	0	0	0	Nearing
		0		0	Proficient
		0		0	Advanced
TOTAL	200		150		

Analysis hint: Depending on the number of students enrolled in your school and the availability of prepared assessment profiles, your team may need to randomly select the assessment scores of a subset of students in each grade.

Analysis questions:

- What are the demographic data of the student groups nearing Proficient (include points such as attendance, mathematics grades, etc.)?
- What are the demographics of the student groups that are Proficient or above?
- Do students who stay in rigorous mathematics courses continue to score higher than students who do not?

Numeracy team discussion: Does mathematics mastery (percentage of Proficient or above) improve as students complete more rigorous mathematics courses? Look at the demographics of each group and identify the variables that affect their achievement.

Crosscontent mathematics skills

Mathematics skills are embedded in content areas and are identified in the course curriculum content standards. It is the challenge of the numeracy team to identify nonmastered mathematics concepts and devise interdisciplinary and disciplinary instructional activities to reinforce the mastery of these skills. The designed activities should be enriched by real-life examples utilizing technology and the problem-solving process.

Determining the schoolwide attitudes/perceptions, strengths, and weaknesses of the mathematics program in the process of developing the School Numeracy Profile and the strengths and weaknesses of individual students in the Personal Plan for Mathematics Proficiency make them powerful tools in designing schoolwide initiatives that will improve mathematics instruction for *every* student. Changing your school to a culture that supports numeracy and encourages engagement of all students and faculty members in mathematics mastery means that *test* does not become just another "four-letter word" but has the power to improve student performance.

Simulated Numeracy Discussion

Participants: Numeracy team with the grade-level or departmental team(s).

Materials: Content standards and curriculum, School Numeracy Profile with nonmastered mathematics standards identified.

Key questions: What real-life situation exemplifies the mathematics concept that many students have not mastered? What interdisciplinary mathematics skills can be taught in those activities and/or projects? What mathematics skills can be reinforced in content classrooms? What problem-solving skills and technology skills can be utilized in solving or simulating the solution to the instructional activity?

Discussion: If 10th-grade students have not mastered graphics representation and data summarization concepts, perhaps social studies teachers can integrate graphs and mapping exercises into classroom instruction. Science teachers can ask students to summarize laboratory data in tables and graph the results. English teachers can demonstrate the use of graphic organizers that can be used by mathematics teachers to translate verbal problems. Computer teachers can teach Excel pie and bar graph representation. Simultaneously, the grade-level mathematics class can teach Cartesian coordinate systems, functions, and graphing. Each rigorous content-area teacher can reinforce the identified mathematics standard in the classroom as well as work within his/her team to design real-life cross-curricular projects and activities that provide students with opportunities to problem solve in groups, utilize technology, and practice nonmastered mathematics concepts.

As you and your numeracy team begin to evaluate assessment data, plan strategies for interventions or supports, and develop the schoolwide Numeracy Improvement Plan, use the focus discussion in Figure 3-4 as the framework for the plan.

FIGURE 3-4
Focus Discussion Framework

COMPONENT	KEY QUESTIONS
School Numeracy Profile	What are the math concepts that are effectively mastered by grade-level students? What percentage of students are enrolled in sequentially difficult mathematics courses each year? How will you address the specific mathematics needs of all students? How can all content teachers contribute to improving mathematics mastery?
OUTCOMES	
Determining strengths and weaknesses of the mathematics program identified in the School Numeracy Profile can give the numeracy team an opportunity to plan interdisciplinary activities and projects that will support and reinforce needed mathematics skills/concepts both in mathematics classes and in content classes.	

COMPONENT	KEY QUESTIONS
Professional Development Needs	Do teachers have the knowledge to identify and develop instructional materials that utilize mathematics skills as a tool? Can teachers utilize data to differentiate instruction? Can teachers identify real-life activities and interdisciplinary projects that utilize problem-solving skills, mathematics skills, and technology skills? Have teachers had an opportunity to identify their own professional development needs?
OUTCOMES	
Since effective teaching of students with diverse mathematics preparation relies heavily on a repertoire of instructional strategies, the numeracy team may need to address the acquisition of these skills in the plan for the professional development of the staff. Facilitating classroom team activities, integrating technology, and developing higher-level thinking skills may be additional needs. In addition, the numeracy team needs to provide aggregate data to the feeder schools to improve and reinforce the mathematics skills of transition students. Perhaps a joint staff development can be planned with school and feeder-school faculty. Long-term nonmastery trend data should be addressed in collaboration with feeder-school faculty. Strategies for building effective collaborative leadership teams may also need to be addressed in the professional development plan.	

COMPONENT	KEY QUESTIONS
Strategies to Close the Achievement Gap	Has each teacher received the PP4MP for each student in the classroom? How many students need to be targeted for intervention or support in each mathematics content skill area? Should reinforcement occur individually or in small groups? Which interdisciplinary groups of teachers may address specific topics in content classrooms or in pull-out groups? Are additional resources needed to "level the playing field" for specific subgroups?

OUTCOMES

As more and more teachers are facilitating classrooms with increased diversity, "what we teach and how we teach it" is a critical issue in addressing the achievement gap for every student. Closing the achievement gap for students means that teachers must deliver instruction to students with a variety of learning styles, differing socioeconomic backgrounds, and a disparity of prior knowledge. Requiring mathematics proficiency of all students will require an individualized look by all staff members at what each student has mastered and what needs to be mastered as identified in the Personal Plan for Mathematics Proficiency and what learning style is most effective with individual students?

COMPONENT	KEY QUESTIONS
Personal Plan for Mathematics Mastery	Has each student set goals based on individual skill profiles? Are students given opportunities for practice and support? Are students given ample opportunities during the year to demonstrate growth on benchmark tests? Are personal plans revised/updated throughout the year? Has the teacher compiled a classroom profile using the student PP4MPs? Are teachers addressing the specific learning needs of the students in large or small groups within their classes? Are content-specific instructional activities and resources available to teachers, parents, and students? Are students encouraged to continue mathematics in sequence each year?

OUTCOMES

The personal plan completed with the data elements previously described must be analyzed by each teacher and each teacher team responsible for that student's learning. In standardized assessments, students are given a grade equivalent or a criterion standard with specific content strengths and weaknesses identified. Your school team must examine and discuss the data to identify individual students who are scoring below grade level or below Proficient in mathematics and analyze the particular skills that a student needs to master to improve mathematics competency and identify the effective learning styles of the student. That means, to fully and properly evaluate student strengths and weaknesses in mathematics, the team must use valid and reliable benchmark exams given several times during the school year with individual student data results. The numeracy team should schedule several team meetings during the school year to evaluate the progress of individual students toward mathematics mastery and revise the school improvement support plan as needed for individual students. Benchmark testing can inform the monitoring process by determining the success of embedded classroom activities in meeting mathematics standards.

COMPONENT	KEY QUESTIONS
Rigorous Mathematics Instruction	Have your mathematics teachers worked to design common course objectives, assessments, and activities to reinforce nonmastered skills in the personal plans? Have your content-area teachers, working closely with the mathematics resource person/department chair (or designee), worked to design specific content activities that support the mathematics learning needs of their content areas? Has the numeracy team collected commercial, district, or teacher-prepared best-practice mathematics activities for embedded classroom instruction? Does every teacher know and understand what the data reveal about the mathematics content mastery of each student within his or her classroom?
OUTCOMES	
Standardized tests can serve as a baseline to determine which skills have not been mastered by your students. Many state and local assessments can identify specific areas of student mastery and nonmastery aligned to state or local mathematics content standards. Identify what mathematics skills/content standards are taught in each course and plot a sequential skills progression for each student matriculating in your school. A review of the skills aggregate of the PP4MP can identify teaming and instructional strategies.	

Understanding the four types of data, what local school data to collect, the procedures for analyzing this data, and the representation of data in table and graphic form are essential to the process of identifying actions and initiatives for your schoolwide Numeracy Improvement Plan. The School Numeracy Profile and the Personal Plans for Mathematics Proficiency are documents that will inform the design, focus, and training needed to make your plan successful. Remember that accurately interpreting and analyzing data will serve as the foundations for school improvement decisions. Asking key questions and seeking answers verified by data are important techniques for the numeracy team that verifies what the school is doing right and identifies what the school needs to improve. All stakeholders must study the techniques for data representation from this chapter to accurately set learning goals and track student progress. It is now time to make *data* your favorite "four-letter word."