Appendix C

Profiles of Selected Top-Quartile Classes

Fourth-Grade Observed Top-Quartile Classes

Eighth-Grade Observed Top-Quartile Classes

Fourth-Grade Observed Top-Quartile Classes: Profile #1

Classroom Profile

School 1999 API Ranking: 1 (statewide); 2 (similar schools)

Class Size (according to questionnaire): 29 fourth-grade students

Classroom Composition (according to STAR data): Of 25 test-takers, 32% African American, 68% Hispanic; 48% LEP, 92% Free/Reduced Lunch; 8% Sp. Ed.

Mathematics SAT-9 Average Scaled Scores: 594 in 1999, up from 547 in 1998

The lesson observed in this classroom focused on equivalent fractions and the reduction of fractions to their simplest form. During the 30 minutes of observation time, the teacher engaged in instruction with the class as a whole. She appeared confident with the material and fluent with the use of manipulatives, which she modeled constantly to demonstrate how fractions "look" and to help students make sense of this mathematical concept.

The primary level of discourse in this classroom was between student and teacher. Class participation was initiated and maintained by the teacher calling on a variety of students to solve problems, both teacher-generated and textbook-derived. Individual students were asked to compute a problem on the board while the other students were working individually in their seats. After asking the student at the board to explain his/her answer, the teacher surveyed the class by asking students to raise their hands if they thought the problem on the board was solved correctly. If the answer was correct, the entire class applauded.

At times, the teacher would ask students individually to provide short answers to questions such as, "When you cut something in half, you divide by what?" Some wait time was used; however, if a student did not respond fairly quickly, the teacher would ask another student. One real-world application was used, in making a reference to a pie and eating portions of it.

During the lesson, the teacher circulated throughout the room to observe each student's work. Students were attentive and focused on the lesson.

In this classroom where approximately half of the students are LEP, the teacher used English when speaking with the class as a whole. The use of mathematical terminology was emphasized: the teacher used math terms frequently while posing questions to students, and students were asked to use the terminology in their explanation of how they arrived at an answer. The use of synonyms to describe concepts and the repetition of clear and concise

terms were methods used by this teacher to address remedial needs. The teacher also "checked in" with particular students to see if they had questions or were unclear about something. During the interview, the teacher noted that the manipulatives are helpful in overcoming language barriers, and that she works one-on-one with two students who have very limited English skills.

Fourth-Grade Observed Top-Quartile Classes: Profile #2

Classroom Profile
School 1999 API Ranking: 4 (statewide); 10 (similar schools)
Class Size (according to questionnaire): 31 fourth-grade students
Classroom Composition (according to STAR data): Of 23 test-takers, 100% Hispanic; 91.3% LEP, 100% Free/Reduced Lunch
Mathematics SAT-9 Average Scaled Scores: 631 in 1999, up from 571 in 1998

The lesson observed in this classroom dealt with computational exercises, with a focus on the conversion of measurements. The teacher seemed to have a good understanding of and confidence in mathematics. For the first quarter of the lesson (25 minutes), the students worked on problems individually. During this time, the teacher circulated among the students. Following this was a whole-class review of the problems using an overhead projector (another 25 minutes of the lesson), during which the teacher questioned students about methods used to solve the problems.

The teacher then proceeded to provide instruction in measurement conversion, for another 20 minutes, through reviewing equations and applying them in sample problems which involved real-world examples (i.e., converting Shaquille O'Neil's height from feet to inches, and a baby's height from inches to feet). She then introduced, gave instructions, and did a demonstration for an activity where students were to figure out their own height in inches. For 15 minutes, students worked in pairs using rulers to measure each others' heights in feet and inches and then convert their height into inches. Following this, for 15 minutes, the teacher guided a whole-class graphing activity using data derived from the student measurements to create a histogram.

The focus of classroom discourse was on getting the right answers. There were some instances where some sense was being made of the mathematical concepts. In the second component of the lesson, the teacher exhibited equitable treatment for all segments of the

class (e.g., gender, language ability, ethnicity) and provided students with ample wait time when they were called upon to respond to questions. To encourage all students to focus on the problems, while also providing LEP students the opportunity to hear and simultaneously see the problems, the teacher had students read the problems on the board aloud before addressing how they solved them. In addition, students were allowed to interpret for each other.

Assessment took place when the teacher interacted with students individually to monitor their understanding of a problem, and when she posed questions to students while reviewing their work.

The students in this classroom were very well behaved, and most seemed engaged and on-task. When asked in a follow-up interview to attribute the reasons for her students' success on the SAT-9, the teacher replied:

> *I really believe that once you've introduced a new concept in math, whether it be addition or subtraction, you can't just introduce it, work on it for a couple of weeks, and expect the children to have acquired the knowledge… It's not possible for them—they need time to practice. So, I essentially begin with addition, and begin to build. So, once I have completed addition, and move on to subtraction, I'll have subtraction problems daily, but I also have addition-subtraction. So it's like building a house. I lay the foundation, and I don't take away that foundation, I begin to build on top of that foundation. We never take away anything. So math gets progressively longer as the year goes on, because there's a lot more to do…. I never let go of a concept that has been taught prior to the new concept. And so by the end, they feel so comfortable, and they know exactly what to do, in every circumstance, because they've had months to practice…. I never stop reviewing—it's like a daily thing.*

Fourth-Grade Observed Top-Quartile Classes: Profile #3

Classroom Profile

School 1999 API Ranking: 4 (statewide); 7 (similar schools)

Class Size (according to questionnaire): 28 fourth-grade students

Classroom Composition (according to STAR data): Of 24 test-takers, 100% Asian; 50% LEP, 16.7% GATE, 87.5% Free/Reduced Lunch

Mathematics SAT-9 Average Scaled Scores: 658 in 1999, up from 629 in 1998

During this classroom observation, the teacher began the lesson with 10 minutes' worth of teacher-directed warm-up exercises involving number "puzzles." In the first one, the teacher wrote "4-1=5-1=6-1=7-1=8" on the board and asked, "Is this true?" He then related the puzzle to the number of sides of various polygons that would be generated if a corner were to be cut off. For the second exercise, the teacher asked, "If we cut a cake three times, what is the greatest number of pieces you can get? Imagine." In response, a few students went up to the board to draw diagrams producing 6 "pieces" and then 8 "pieces."

Following these puzzles, the teacher used the board and spent three minutes modeling how to solve equations involving fractions. (As the teacher sat on a stool, several students were unable to see the board because they were blocked by the teacher's body.) He then involved students in an interactive activity involving fractions, where students holding fraction cards were asked to pair up with fellow students holding a card with the same value, and then pair up with other fellow students to add up to 1. When students made mistakes, the teacher probed to a limited extent. About 3/4 of the students participated in this activity at first, during which time those who remained seated seemed to pay attention but the teacher did not involve them. The teacher brought up to the board one group that was having difficulty, and asked one student if he knew why $1/3 + 1/3 + 2/6 = 1$. When the student replied "no," the teacher said that he would talk with him later. To address the dilemma that one group of students had refrained from participating in the activity, the teacher asked the group to come to the front of the room so that other students could help them do the activity. When the two groups changed places, those who returned to their seats spent the time socializing.

The teacher then proceeded to model and review some problem-solving techniques on the board, which included drawing pictures and reviewing the meaning of the symbols for "more than" and "less than." Students were then given a worksheet that involved comparing fractions and recognizing equivalent fractions. Most students began working on the worksheet. During this time, the teacher brought a student up to the board and showed him how to solve a problem, explaining the concepts in Chinese.

The students did not ask questions during the lesson. The discourse in this classroom was limited to the teacher asking closed-ended questions at several points during the lesson. The students were all extremely well-behaved.

Fourth-Grade Observed Top-Quartile Classes: Profile #4

Classroom Profile

School 1999 API Ranking: 8 (statewide); 10 (similar schools)

Class Size (according to questionnaire): 31 students total; 15 fourth-grade students (4/5 combo)

Classroom Composition (according to STAR data): Of 13 fourth-grade test-takers, 7.7% Hispanic, 92.3% white; 23.1% Free/Reduced Lunch; 7.7% Sp. Ed.

Mathematics SAT-9 Average Scaled Scores: 664 in 1999, up from 624 in 1998

At the beginning of this observation, the class was starting the group lesson after spending 30 minutes doing their daily *Excel* worksheet. The lesson began as a whole-class discussion which focused on percentages and used about 1/3 (17 minutes) of the observation time. The purpose of the lesson was for students to gain a better understanding of what fractional parts look like. The teacher first elicited ideas about how to find the area of a rectangle without counting the boxes inside. This led to a discussion of how one might shade a percentage of the box. The teacher called on many students during the discussion in an attempt to determine their level of understanding prior to the activity. When questions were posed, many students were allowed to explain their reasoning, and the teacher often probed for clarity or deeper understanding. She made generous use of "wait time." The discussion introduced and included instructions for the activity that followed.

In the remainder of class time (33 minutes), students worked in pairs to draw different shapes and shade a percent of each one. Students were allowed to choose their own representations of percents. During this time, the teacher circulated throughout the room. Within and between groups, students discussed and shared ideas and explanations. The two LEP students in the class were paired together so they could work with the classroom aide.

Assessment was ongoing through the lesson. The teacher called on many students during the discussion, and during the activity she visited each group and monitored understanding, asking students to explain their thinking. Students were asked to reflect on what they learned: as homework, students were to describe in their journal what they know about size and percent. The class was well-behaved and respectful.

During the interview, the applicability and relevancy of the lesson became apparent. The teacher explained that the students had been doing math surveys and will need to graph their results, and she feels they will be able to interpret their results with more understanding if they have a clear conceptual understanding of fractions and percent.

Eighth-Grade Observed Top-Quartile Classes: Profile #1

Classroom Profile

School 1999 API Ranking: 7 (statewide); 6 (similar schools)

Class Size (according to questionnaire): 36 eighth-grade students

Classroom Composition (according to STAR data): Of 31 test-takers, 9.7% African American, 12.9% Asian, 22.6% Hispanic, 51.6% white; 19.4% LEP, 19.4% Free / Reduced Lunch

Mathematics SAT-9 Average Scaled Scores: 689 in 1999, up from 659 in 1998

Course: Math 8

The purpose of the lesson observed was to extend the concept of combining like terms when adding polynomials. This included checking homework for the first l4 minutes of class. After the homework review was finished, a worksheet was handed out and the teacher modeled several problems using the overhead projector. He told those who understood to continue alone or with a partner while he continued to model more problems. The organization of the class remained the same throughout the period: the teacher remained at the overhead and demonstrated problems while the students worked at their desks. The teacher encouraged students to draw models to simplify the problems but there was no dialogue around the models. Most of the work was practice of a procedure.

The teacher monitored student understanding throughout the lesson by asking individual students to talk him through a problem or by asking for a show of hands from those who either did or did not understand. He did not probe for students to explain their thinking but asked questions that elicited simple responses (e.g., “Which one should I do?” “What is the answer?”)

The teacher was very organized and his expectations were very clear. The students seemed very comfortable with the class—even those who were struggling.

Eighth-Grade Observed Top-Quartile Classes: Profile #2

Classroom Profile

School 1999 API Ranking: 3 (statewide); 4 (similar schools)

Class Size (according to questionnaire): 28 eighth-grade students

Classroom Composition (according to STAR data): Of 23 test-takers, 26.1% African American, 39.1% Hispanic, 8.7% white, 26.1% other; 4.4% LEP, 21.8% GATE, 56.5% Free / Reduced Lunch

Mathematics SAT-9 Average Scaled Scores: 690 in 1999, up from 676 in 1998

Course: Integrated Math 1

The lesson observed in this classroom focused on building student understanding of factoring binomial expressions.

This teacher-guided, demonstration lesson built upon students' previous work with solving algebraic equations. With the use of Algebra tiles, students connected the abstract distributive property to the concrete by relating the dimensions of the rectangle formed with Algebra tiles to the area of the entire rectangle. Following some vocabulary review, the class used the tiles to "work backwards" to find common factors in the area of the rectangle to come up with the dimensions of the rectangle. Students extended this process to factor more complex binomial expressions.

The class began with a five-problem warm-up displayed on the overhead. The students worked on the problems and then the teacher explained the solutions to the problems using traditional algebraic algorithms.

Next a transparency was used to display the answers to the previous day's assignment. The teacher responded to questions and explained procedures. At one point, a student corrected an error the teacher made and was rewarded with a piece of candy.

The teacher then reviewed how Algebra tiles can be used to find areas (the distributive property) and segued into how the tiles can be used to factor (undo the distributive property). The teacher provided examples of expressions and asked for common factors. She provided one factor and asked students to find the others. Students were engaged as they worked on these examples—some worked independently and asked for harder problems while others clearly needed the assistance being provided by the teacher.

At the end of the period, the teacher used the previous day's homework as the base for a short quiz. She put the numbers for five of the homework problems on the board and asked students to copy their solutions to these five problems on a separate sheet of paper.

The teacher seemed both confident and competent in her teaching, using terminology such as "numerical coefficients" accurately and describing processes correctly. She guided the students at a seemingly quick pace, asked questions that required short answers, and did not encourage discussions or student explanations (which may have been due to this being a review). The classroom discourse was primarily teacher directed.

Eighth-Grade Observed Top-Quartile Classes: Profile #3

Classroom Profile
School 1999 API Ranking: 3 (statewide); 3 (similar schools)
Class Size (according to questionnaire): 34 eighth-grade students
Classroom Composition (according to STAR data): Of 27 test-takers, 100% Hispanic; 96.3% LEP, 81.5% Free/Reduced Lunch
Mathematics SAT-9 Average Scaled Scores: 650 in 1999, up from 628 in 1998
Course: 8th Grade Math Bilingual

The purpose of the lesson observed was to introduce students to the use of tree diagrams in solving probability problems.

At the beginning of the period, the students worked individually on warm-up problems while the teacher moved around the room checking homework and talking with students about individual problems. The warm-up problems involved supplying the missing measures of angles and sides in right triangles when the length of two sides was given. When the warm-up problems were completed, the class discussed them as a whole.

A brief presentation by the teacher on tree diagrams preceded the main class activity. In the remainder of the class the students worked through two extensive examples of tree diagrams: one involved the various combinations of three different types of dolls and the other had to do with a three-color spinner and a coin. For each example, the students constructed the tree diagram by starting as a class and then finishing it individually. They then answered several questions about probabilities based on the diagram, such as "What is the probability of spinning red and flipping heads?" Some students used calculators.

Throughout the activity, the teacher assessed student understanding by questioning students and listening carefully to their answers. When students provided an incorrect answer, the teacher probed for understanding and led the students to the correct answer. Later on, when one student said he didn't understand something, the teacher provided an explanation.

The students appeared to be comfortable answering questions, discussing answers, correcting each other, and asking questions. The entire class was conducted in Spanish. The teacher was confident and inspired confidence on the part of her students. During the interview she said, "Anybody is able to do mathematics, as long as they put the effort in."

Eighth-Grade Observed Top-Quartile Classes: Profile #4

Classroom Profile

School 1999 API Ranking: 6 (statewide); 6 (similar schools)

Class Size (according to questionnaire): 35 students total; 23 eighth-grade students (7/8 combo)

Classroom Composition (according to STAR data): Of 24 eighth-grade test-takers, 12.5% Asian, 41.7% Hispanic, 33.3% white, 12.5% other; 16.7% GATE, 45.8% Free/Reduced Lunch

Mathematics SAT-9 Average Scaled Scores: 699 in 1999, up from 672 in 1998

Course: Algebra Topics

The primary purpose of the lesson observed was for students to learn that there may be more than one way to approach a problem and that for some problems there may be multiple solutions. The specific focus was on the use of diagrams as a tool for solving problems.

The first few minutes of the period were spent on taking roll and preparing for the homework review. Students checked their homework problems as the teacher provided the correct answers. Whenever a student had a question, the teacher would work the problem using the overhead projector; other students would assist the teacher as she solved the problem. One problem involved pattern recognition and estimation as a way to save time in finding the correct answer. The teacher had students guess a number she had picked to show how high and low estimations were used to inform subsequent estimations. She likened the estimation process to the game show "The Price is Right." The homework review lasted 20 minutes.

The next activity was a game where students formed four groups of 6 to 8 students each. Each person was to join hands with another non-adjacent person in the group. When all connections were completed, the group was to untangle itself to form a circle. When the game ended, the teacher explained that how quickly a group got untangled was a function of how the arms were joined and not a function of how smart they were. She also noted that in each group someone usually emerges as a leader.

Following the group-building exercise, the class focus was on solving story problems from the textbook. The teacher, with student input, demonstrated how to approach some of the problems using the overhead projector. These problems had more than one possible solution and involved the use of diagrams. Then students worked individually on the remainder of the problems as homework.

The teacher appeared confident and knowledgeable about the material. She could easily explain mathematical concepts in a variety of ways to help students understand.

In terms of making sense of mathematics, the teacher was good at providing alternative examples and real world applications for students, yet never required students to come up with their own examples.

When asked in a follow-up interview to attribute the reasons for the success of this class, the teacher commented that previously, the students had not been challenged, having been in classes that had not been "stretching their abilities." She also mentioned her 30 years of teaching experience and the inclusion on the SAT-9 of many of the topics covered in the class. The school principal, when asked the same question, discussed efforts made by the mathematics department as a whole:

> *The year before, the students [in the school] didn't do well on computation and context. As a department, the math teachers got together, and put more emphasis on computation as well as the other concepts, and it paid off…We gained about 13 percentile points in math. So, it was just working with the students, taking them from where they are, and moving from that point to get them to succeed. It was a schoolwide phenomenon.*

Indeed, the other class observed in this school also fell into the top achievement quartile.

Eighth-Grade Observed Top-Quartile Classes: Profile #5

Classroom Profile

School 1999 API Ranking: 10 (statewide); 5 (similar schools)

Class Size (according to questionnaire): 32 students total; 22 eighth-grade students (7/8 combo)

Classroom Composition (according to STAR data): Of 22 eighth-grade test-takers, 45.5% Asian, 13.6% Hispanic, 36.4% white; 40.9% GATE

Mathematics SAT-9 Average Scaled Scores: 751 in 1999, up from 747 in 1998

Course: Integrated Math 1

The lesson began with a 13-minute warm-up exercise that connected the concept of volume to the story of *Gulliver's Travels.* The students worked individually and then the entire class reviewed the problems. Next, the teacher asked if there were any questions about the homework from the previous night. There were none, so the next homework assignment was discussed for a few minutes.

The remainder of the period focused on building a conceptual understanding of volume and the relative volumes of various three-dimensional shapes (prism, cone, and pyramid). A review of the names of the shapes took place and then the students were asked to guess how many of the cones could fit into a cylinder (with bases of the same diameter). Two student volunteers then filled the cylinder and cone with water to determine the relative volumes of each container. Then the class discussed the relative volume of different sized-cones. This activity involved work on two problems displayed on a transparency: one concerning two cones with the same size base but one of twice the height; the other was about two cones having the same height but one having a base with half the radius of the other.

Next the students worked in groups of four where each student had a specific role. They concentrated on a problem from the textbook about the relationship in volume between a pyramid and a rectangular prism where they needed to construct each type of shape using stiff paper, scissors, and tape and use rice to compare volumes. Most of the students were engaged in the activity and interacted collaboratively within their groups and with other groups. During this time, the teacher circulated, monitoring the activity and addressing student questions. The students did not finish the exercise, largely due to an error that nearly all of the groups made in constructing their shapes. At the end of the class, students put their materials away and were told they would talk about what went wrong tomorrow. The class ended with a brief discussion of question, "What would you *expect* for the volume of the pyramid as compared to the prism?"

Classroom discourse focused on making sense of mathematics and the students were invited to hypothesize about answers to problems.