The Mathematics Assessment Collaborative

Preliminary Results of the 2003
MARS Performance Exam

The Mathematics Assessment Collaborative has steadily increased the number of students assessed each year and the number of teachers administering the exam, while the number of districts has remained fairly constant.

Years of Exam	Districts	Teachers	Students
1999	21	462	23,128
2000	27	701	35,061
2001	26	1,036	51,806
2002	26	1,088	54,409
2003	28	1,201	70,437

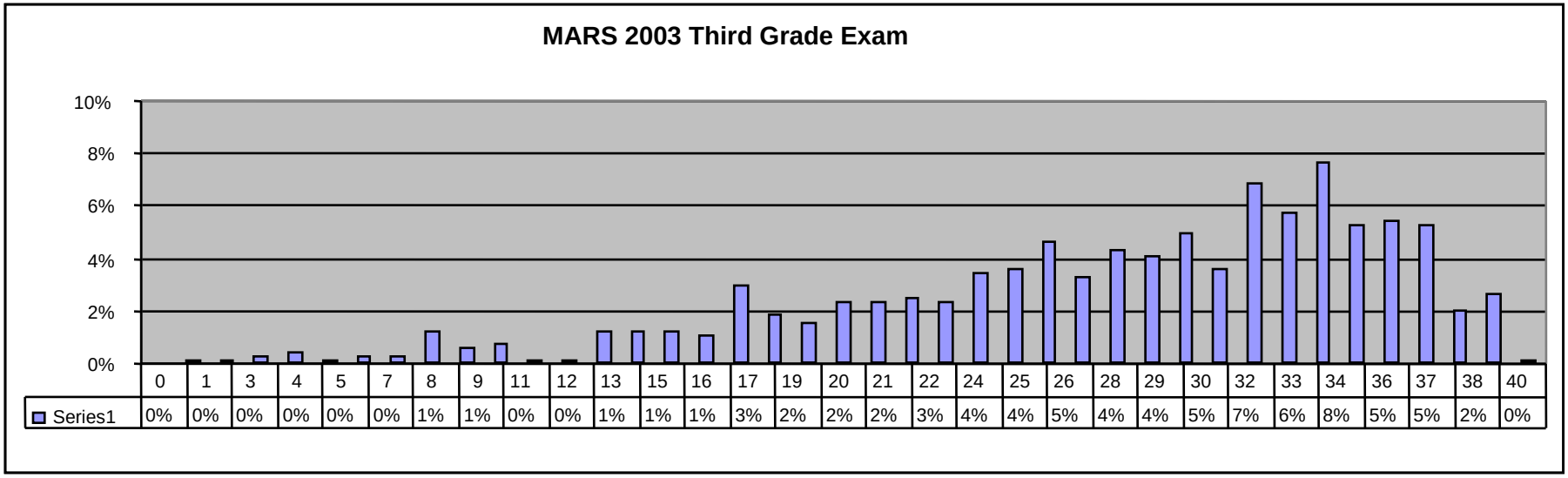
Performance Level Cuts Score and Distribution Data

- The data is based on a random 5% sample of student papers collected by the member districts and forwarded to the MAC Director.

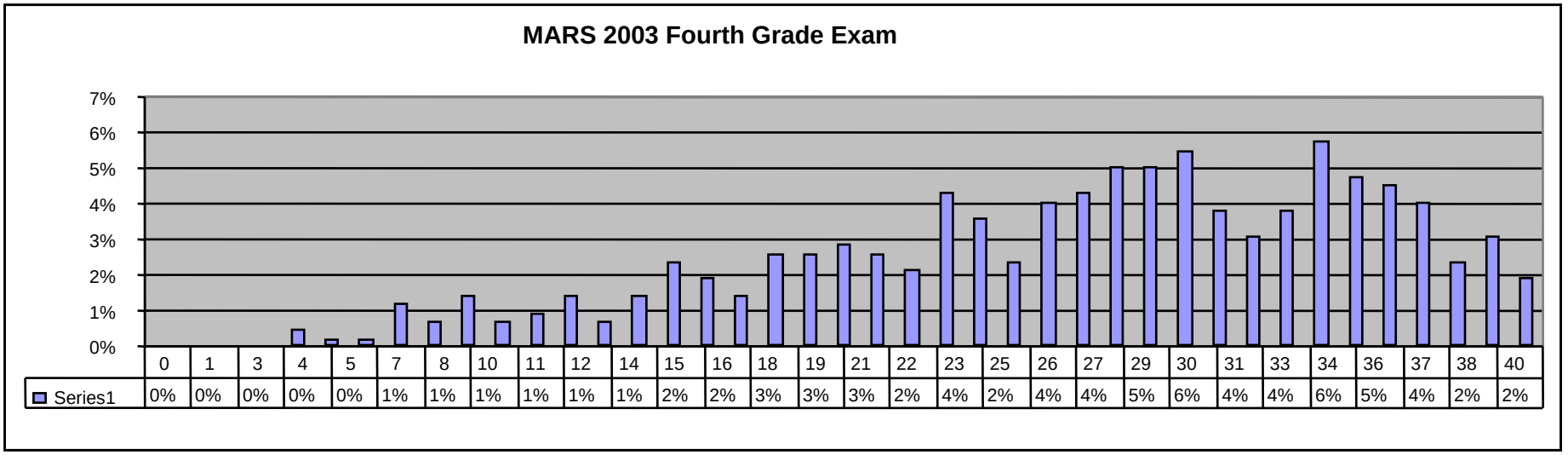
- The level of performance are based on a process that involves local and national professional judgement, student paper reviews, and analysis of data from current and past years.

- During the process of establishing levels of performance, efforts are made to anchor the judgements to allow for longitudinal analysis.

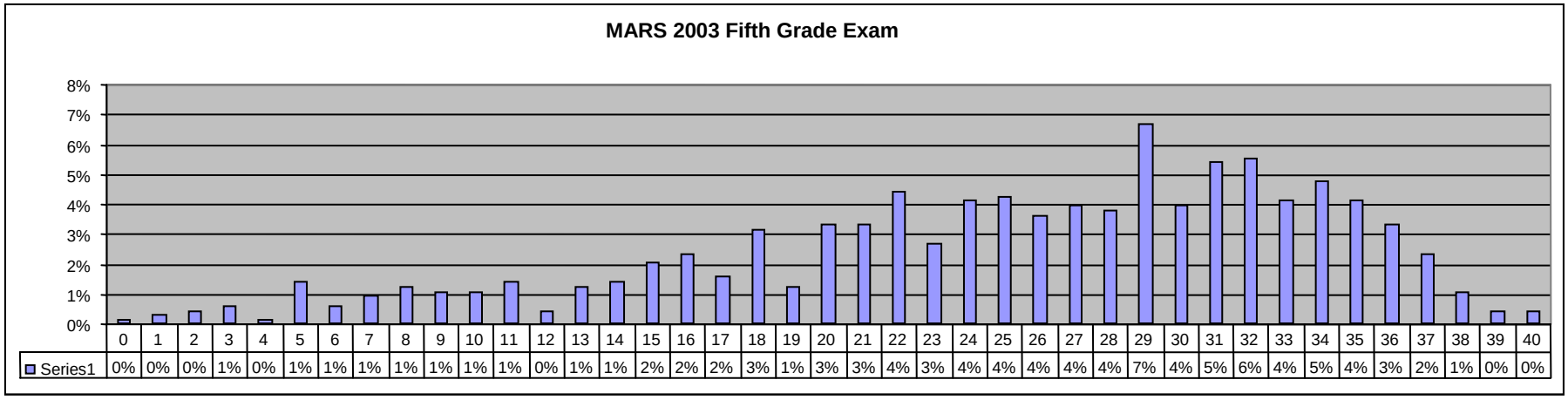
2003 Grade 3	Core Idea	Total Pts	Core Pts	% Core+
Even and Odd	Number	5	3	73%
Addition Trains	Number	5	3	88%
Vending Machines	Data	10	6	86%
Chérie's Shapes	Algebra	10	4	68%
Patchwork Quilt	Geometry	10	5	74%
Perf. Boundaries	Cut Point Range	% at	% at least	No. Students
1 Minimal Success	0 - 13	6%	100%	874
2 Below Standards	14 - 20	13%	94%	1,893
3 At Standards	21 - 29	38%	81%	5,535
4 Standards at HL	30 - 40	43%	43%	6,263
Total		100%		14,565



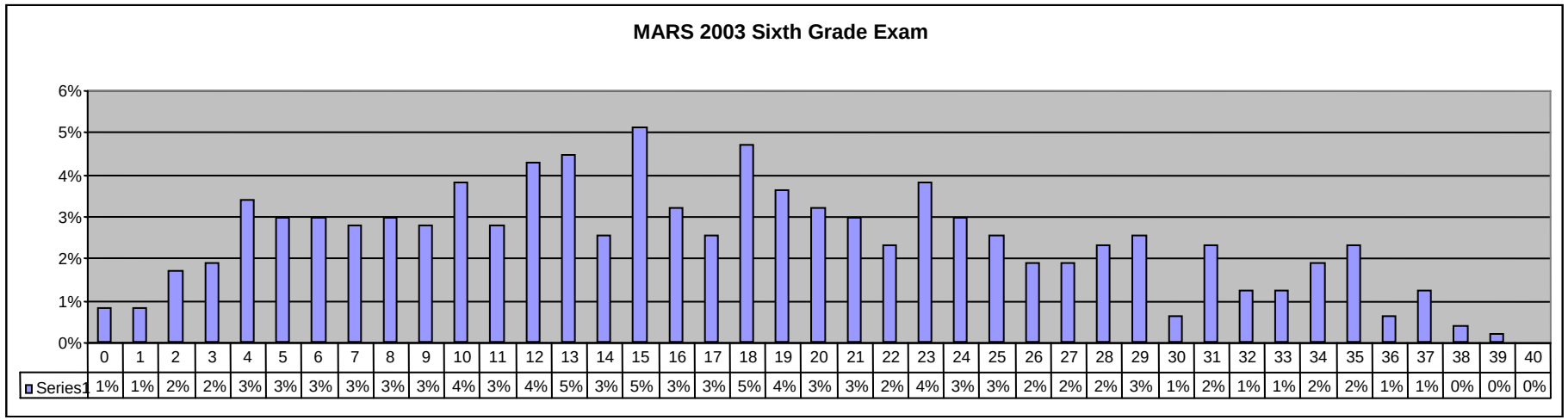
2003 Grade 4	Core Idea	Total Pts	Core Pts	% Core+
Shapes with Straws	Geometry	8	4	77%
Number Trains	Number	8	4	88%
Hexagon Desks	Algebra	10	5	77%
Flower Arranging	Number	6	3	55%
Traveling to School	Data	8	4	80%
Perf. Boundaries	Cut Point Range	% at	% at least	No. Students
1 Minimal Success	0 - 12	7%	100%	684
2 Below Standards	13 - 19	14%	93%	1,368
3 At Standards	20 - 29	36%	79%	3,518
4 Standards at HL	30 -40	43%	43%	4,202
Total		100%		9,773



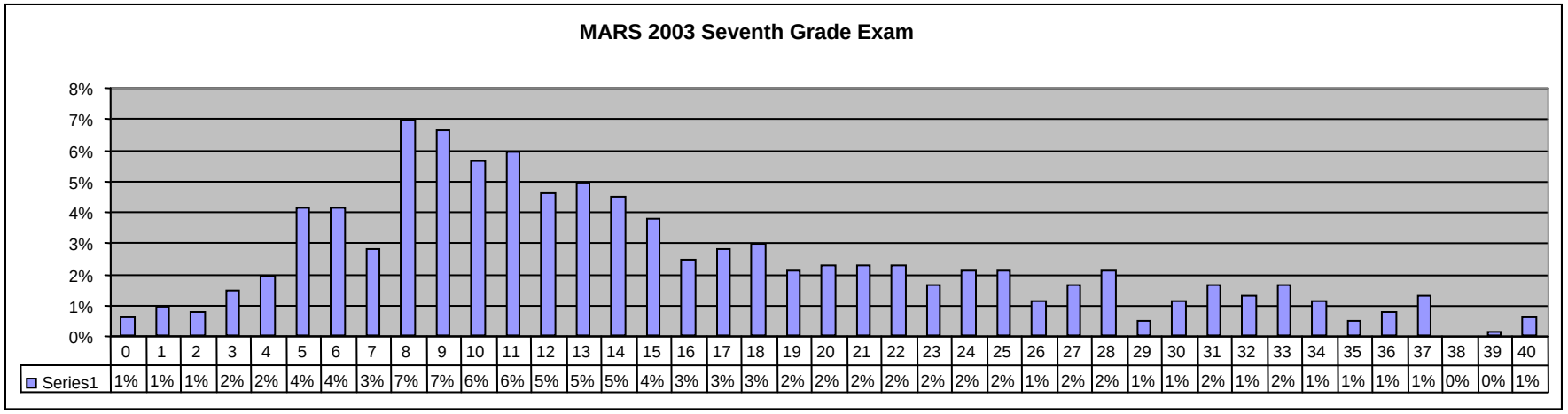
2003 Grade 5	Core Idea	Total Pts	Core Pts	% Core+
Number Story Time	Number	6	4	57%
Raspberry Cake	Number	9	5	69%
Buttons	Algebra	8	4	83%
Winter Sports	Data	9	5	65%
Juan's Shapes	Geometry	8	4	71%
Perf. Boundaries	Cut Point Range	% at	% at least	No. Students
1 Minimal Success	0 - 11	10%	100%	1,418
2 Below Standards	12 - 21	20%	90%	2,835
3 At Standards	22 - 29	34%	70%	4,820
4 Standards at HL	30 -40	36%	36%	5,103
Total		100%		14,176



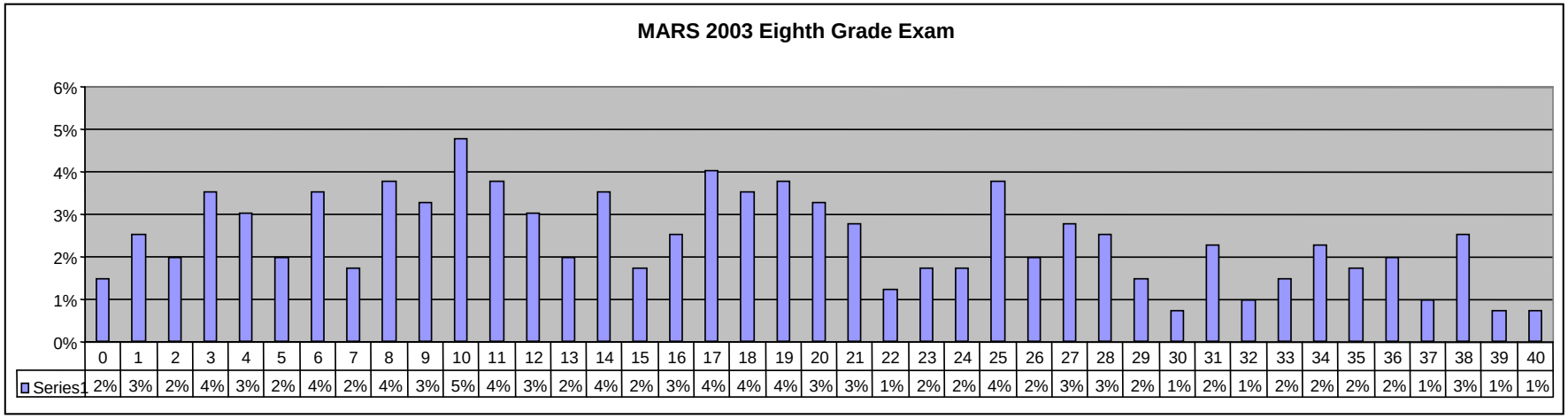
2003 Grade 6	Core Idea	Total Pts	Core Pts	% Core+
Baseball Players	Data	7	3	43%
Gym	Algebra	8	3	64%
Square Elk	Geometry	8	4	52%
Spinners	Probability	9	4	69%
Rabbit Costumes	Number	8	3	43%
Perf. Boundaries	Cut Point Range	% at	% at least	No. Students
1 Minimal Success	0 - 8	21%	100%	2,141
2 Below Standards	9 - 16	29%	79%	2,957
3 At Standards	17 - 26	31%	50%	3,161
4 Standards at HL	27 - 40	19%	19%	1,937
Total		100%		10,196



2003 Grade 7	Core Idea	Total Pts	Core Pts	% Core+
Mixing Paint	Number	5	2	45%
Hexagons	Algebra	10	6	52%
Pattern	Geometry	9	4	35%
Fair Game	Probability	8	4	30%
Yogurt	Number	8	4	27%
Perf. Boundaries	Cut Point Range	% at	% at least	No. Students
1 Minimal Success	0 - 9	31%	100%	3,823
2 Below Standards	10 - 19	40%	69%	4,932
3 At Standards	20 - 27	16%	29%	1,973
4 Standards at HL	28 - 40	13%	13%	1,603
Total		100%		12,331

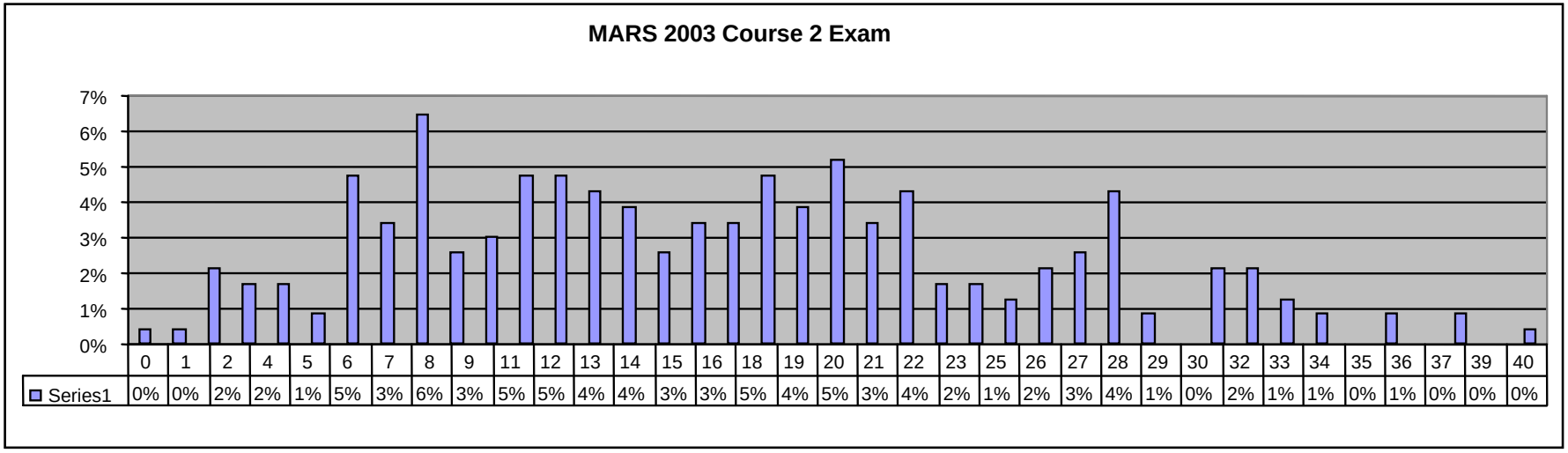


2003 Grade 8	Core Idea	Total Pts	Core Pts	% Core+
Pete's Numbers	Reasoning	8	5	54%
Squares and Rectangle	Geometry	12	6	44%
Sport Injuries	Data	5	3	48%
Dots and Squares	Function	10	3	49%
Number Pairs	Algebra	5	3	50%
Perf. Boundaries	Cut Point Range	% at	% at least	No. Students
1 Minimal Success	0 - 10	32%	100%	2,933
2 Below Standards	11 - 19	28%	68%	2,566
3 At Standards	20 - 27	19%	40%	1,741
4 Standards at HL	28 - 40	21%	21%	1,925
Total		100%		9,165



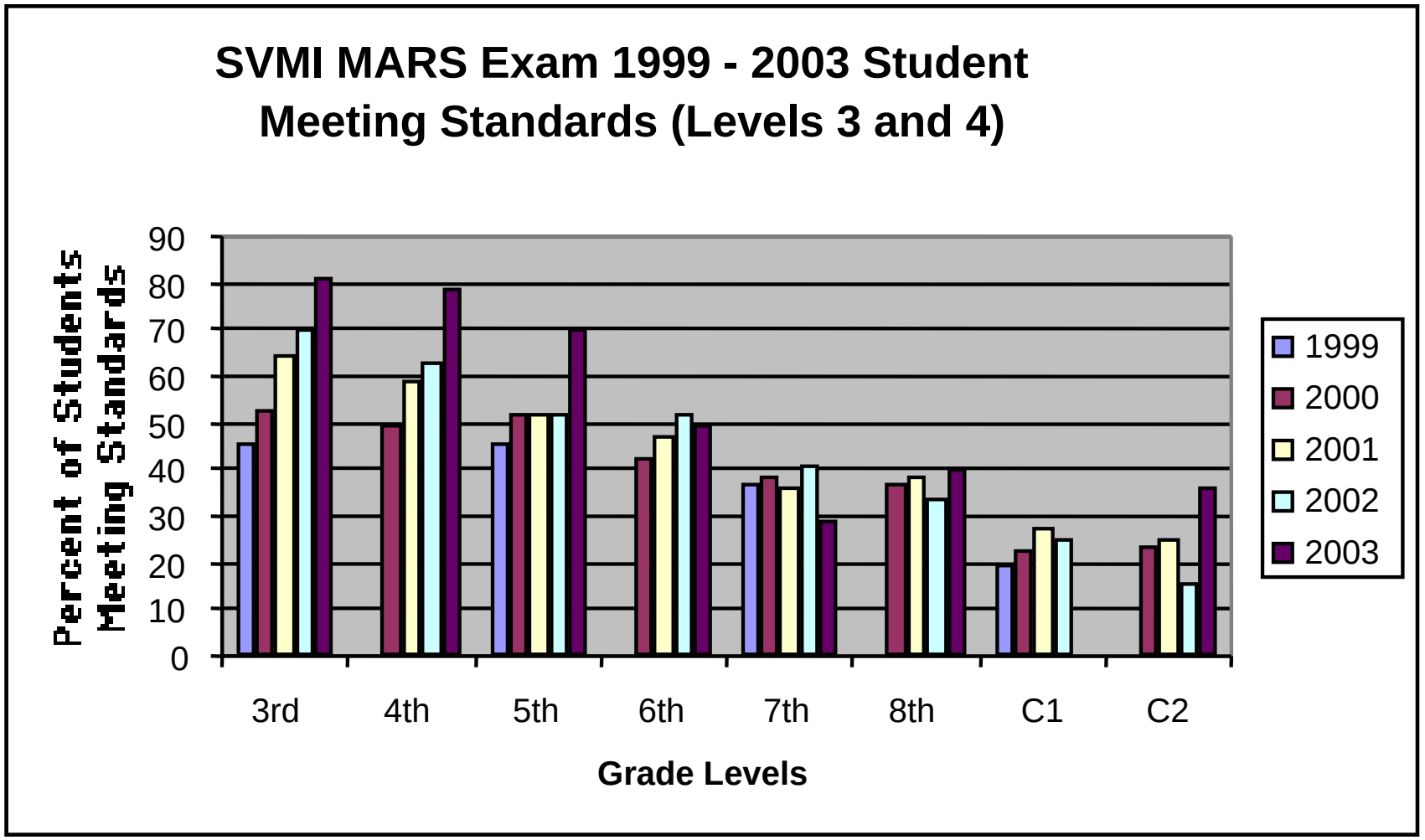
2000 Grade 9	Core Idea	Total Pts	Core Pts	% Core+
Vacuum Cleaning	Geometry	5	3	
Snakes	Data	5	3	
Crisscross Numbers	Geometry	10	5	
Conference Tables	Algebra	10	5	
Number Towers	Algebra	10	4	
Perf. Boundaries	Cut Point Range	% at	% at least	No. Students
1 Minimal Success	0 - 9	0%	0%	0
2 Below Standards	10 - 19	0%	0%	0
3 At Standards	20 - 26	0%	0%	0
4 Standards at HL	27 - 40	0%	0%	0
Total		0%		

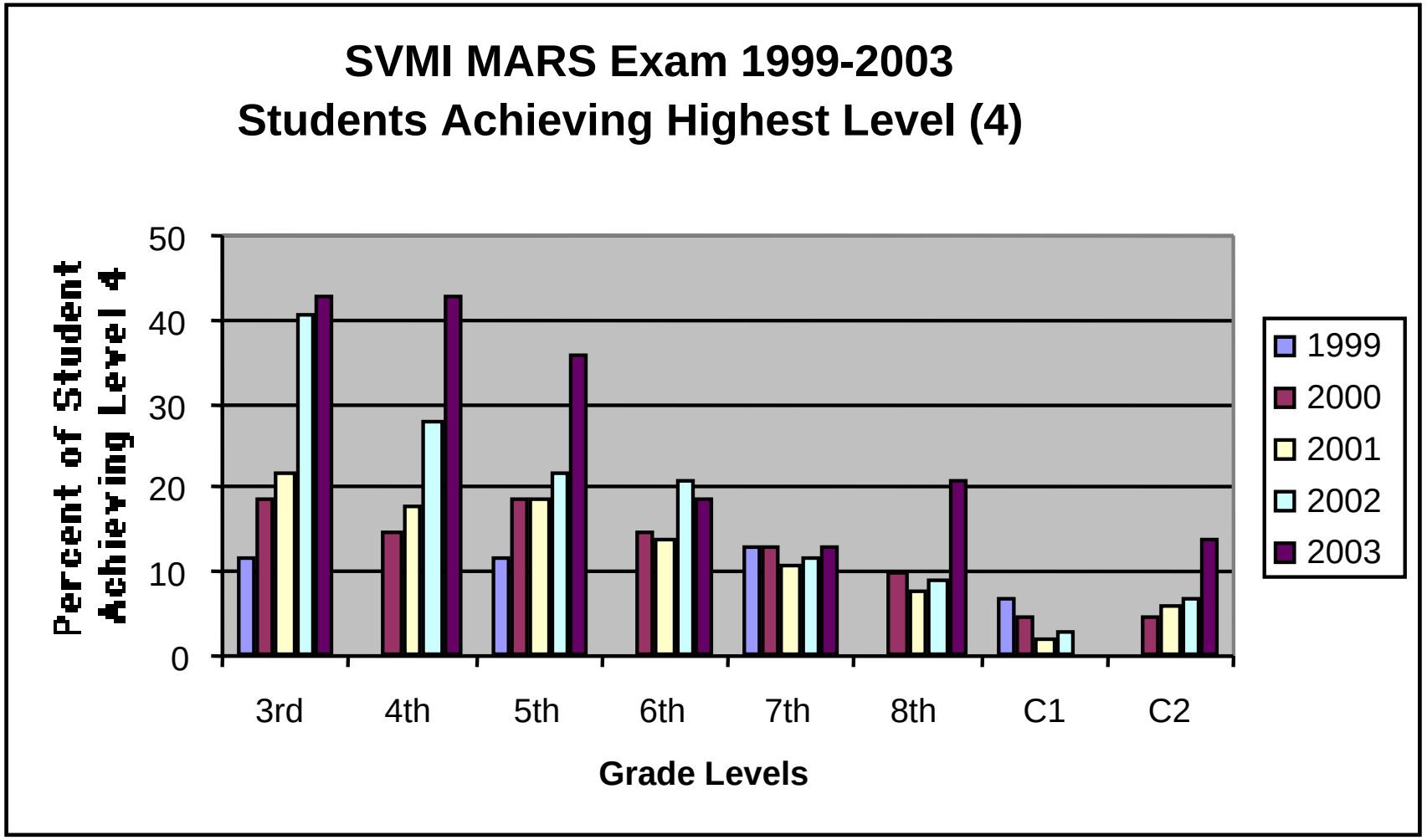
2003 Grade 10	Core Idea	Total Pts	Core Pts	% Core+
Taxi Times	Data	8	4	34%
Number Patterns	Algebra	8	4	35%
Garden Chair	Geometry	8	5	57%
Lampshade	Geometry	5	3	21%
Rectangle and Square	Reasoning	5	4	57%
Perf. Boundaries	Cut Point Range	% at	% at least	No. Students
1 Minimal Success	0 - 9	25%	100%	58
2 Below Standards	10 - 19	39%	75%	90
3 At Standards	20 - 27	22%	36%	51
4 Standards at HL	28 - 40	14%	14%	32
Total		100%		231



Examining MARS Achievement

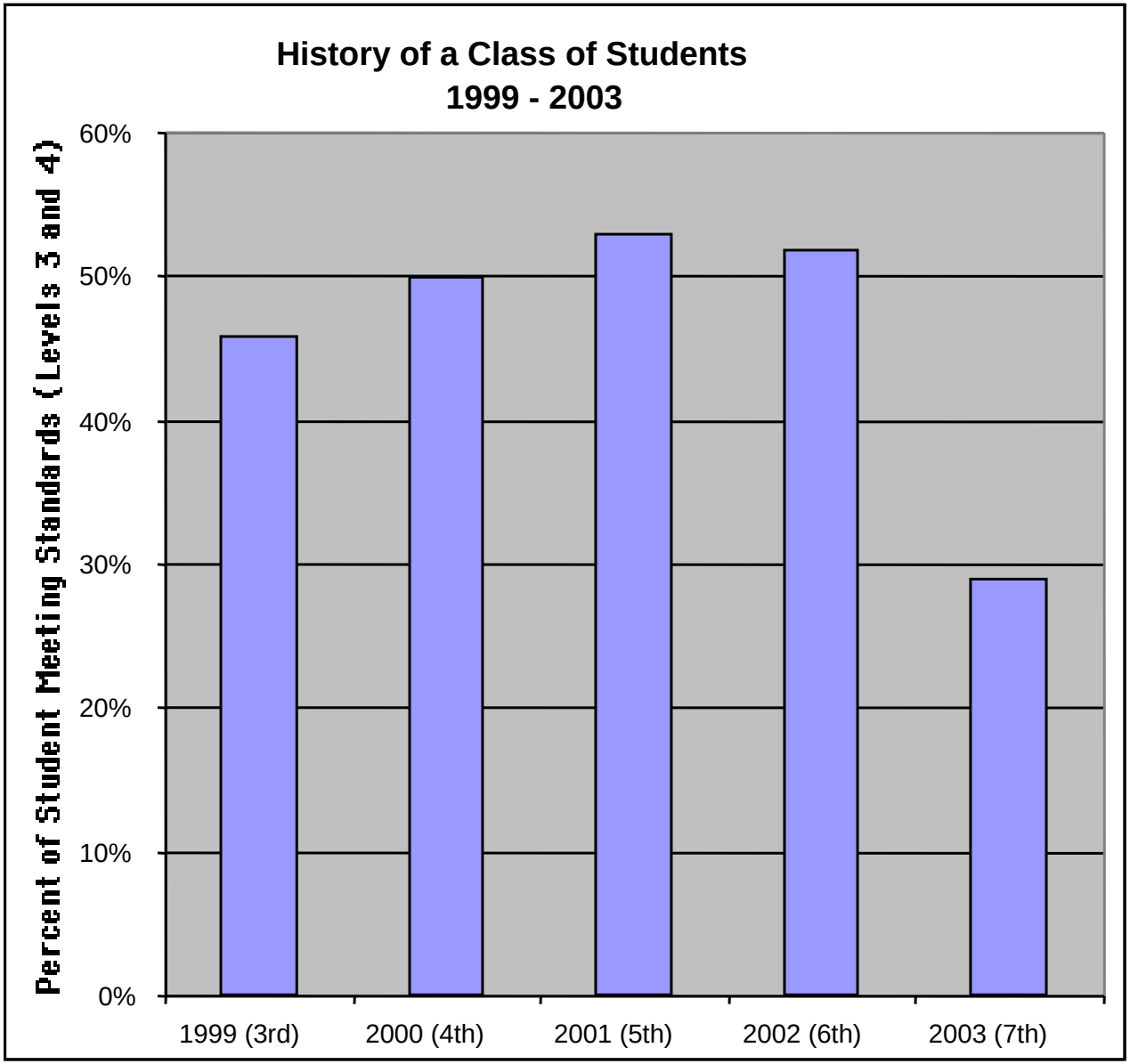
- What trends do we see in the data?
- Where have we been most successful?
- Where have we seen the most recent growth?
- Where do we need to center our focus?


SVMI MARS Exam 1999 - 2003 Student Meeting Standards (Levels 3 and 4)
Percent of Students Meeting Standards
90
80
70
60
50
40
30
20
10
0
3rd
4th
5th
6th
7th
8th
C1
C2
Grade Levels
1999
2000
2001
2002
2003


SVMI MARS Exam 1999-2003
Students Achieving Highest Level (4)
Percent of Student Achieving Level 4
50
40
30
20
10
0
3rd
4th
5th
6th
7th
8th
C1
C2
Grade Levels
1999
2000
2001
2002
2003

Tracking Trends Over Time

- How have students performed over time?
- What factors and variables affect the data?
- What conclusions can we draw?
- How should this inform our work?


History of a Class of Students
1999 - 2003
Percent of Student Meeting Standards (Levels 3 and 4)
60%
50%
40%
30%
20%
10%
0%
1999 (3rd)
2000 (4th)
2001 (5th)
2002 (6th)
2003 (7th)

Common Threads

Learning from Student Work

Areas of Strength and Growth

- Computation
- Explanations for work
- Greater Variety of Strategies
- Graphic Representations
- Algebraic Thinking at Lower Grades
- Comparison Subtraction
- Alternative Strategies for Percents

Areas for Focus

Types of Division Problems

- Cognitively Guided Instruction
- Implications for Fractions- Liping Ma

- Sharing/ Finding equal groups (Partitive)
- Measurement/ want so many in a group - How many groups can be made?
- Factors and Products

The area of a room is 60 square yards. The width is 6 yards. What is the length?

Making A Comparison

Gail has ten yards of white fur fabric, seven yards of blue striped fabric, and one and three quarter yards of pink felt.

- How many costumes can Gail make?
- Which type of fabric does Gail use put first?

- Show that Norway has the most points?

Other Observations

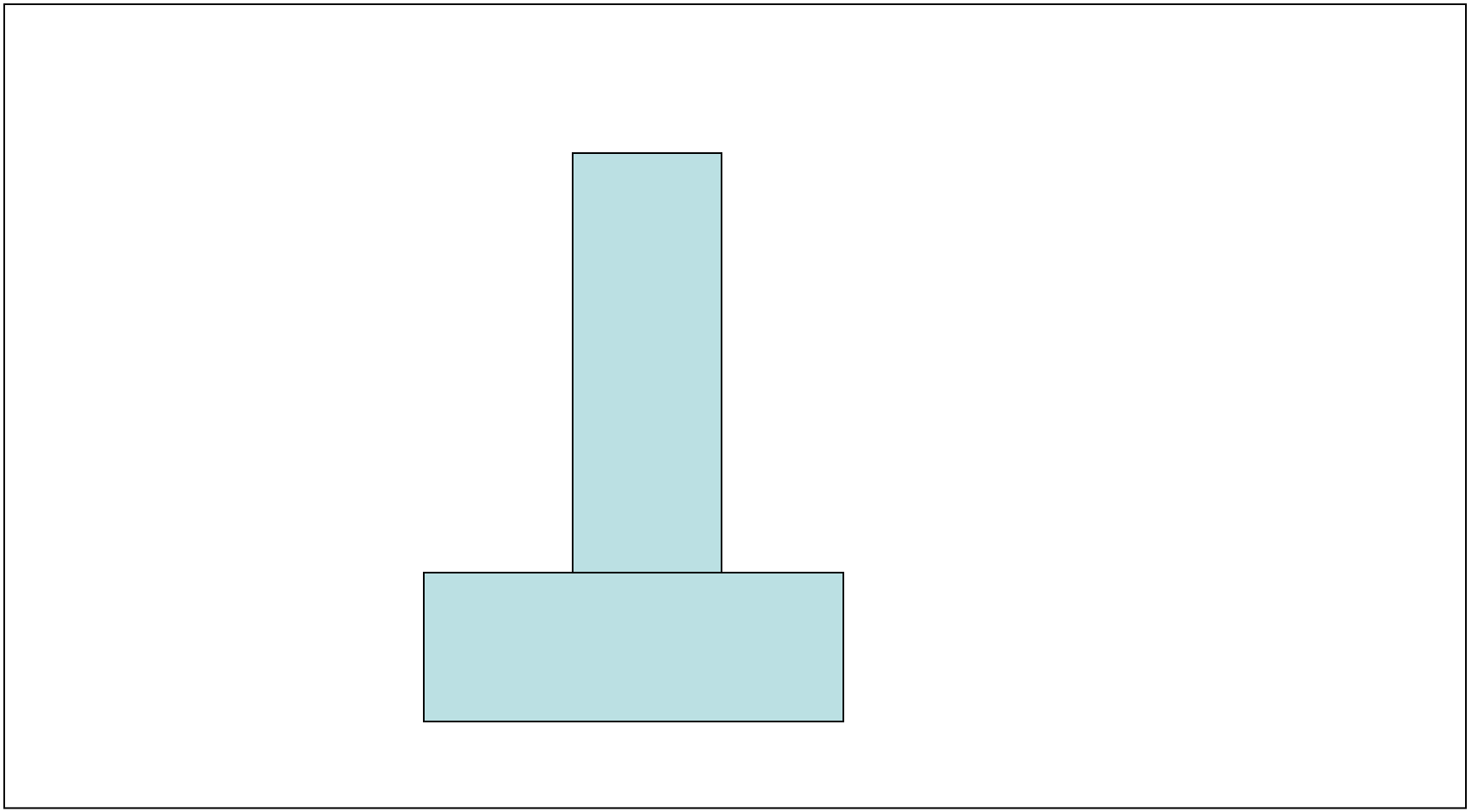
- Students can work with fractional parts, but have difficulty when working with mixed numbers.
- Students still struggle with composing and decomposing geometric shapes.
- Students can use tools provided, but don’t generate their own to solve problems.

Task Complexity

Third Grade - Graphing more demanding, multiplication tasks about the same, geometry questions for the last two years very complex, level of justification in algebra more sophisticated than in the past.

- In Fourth and Fifth grade, one task was easier, some were about the same, and a couple were more complex.

Underlying Logic
Transitive Reasoning



Transitive Reasoning and Unit Iteration

Grade	Strip	Blocks	Either	Unit Iteration
1	21	8	29	10
2	56	16	72	33
3	77	8	85	55
4	83	1	84	76
5	89	3	92	78

Depth of Knowledge

- **Level 1: Recalling and Recognizing:**
- Student is able to recall routine facts of knowledge and can recognize shape, symbols, attributes or other qualities.

- **Level 2: Using Procedures**:
- Student uses or applies procedures and techniques to arrive at solutions or answers.

- **Level 3: Explaining and Concluding:**

  Student reasons and derives conclusions. Student explains reasoning and processes. Student communicates procedures and findings.
- **Level 4: Making Connections, Extending and Justifying:**

  Student makes connections between different concepts and strands of mathematics. Student extends and builds on knowledge to a situation to arrive at a conclusion. Students use reason and logic to prove and justify conclusions.

  Adapted from the work of Norman L. Webb

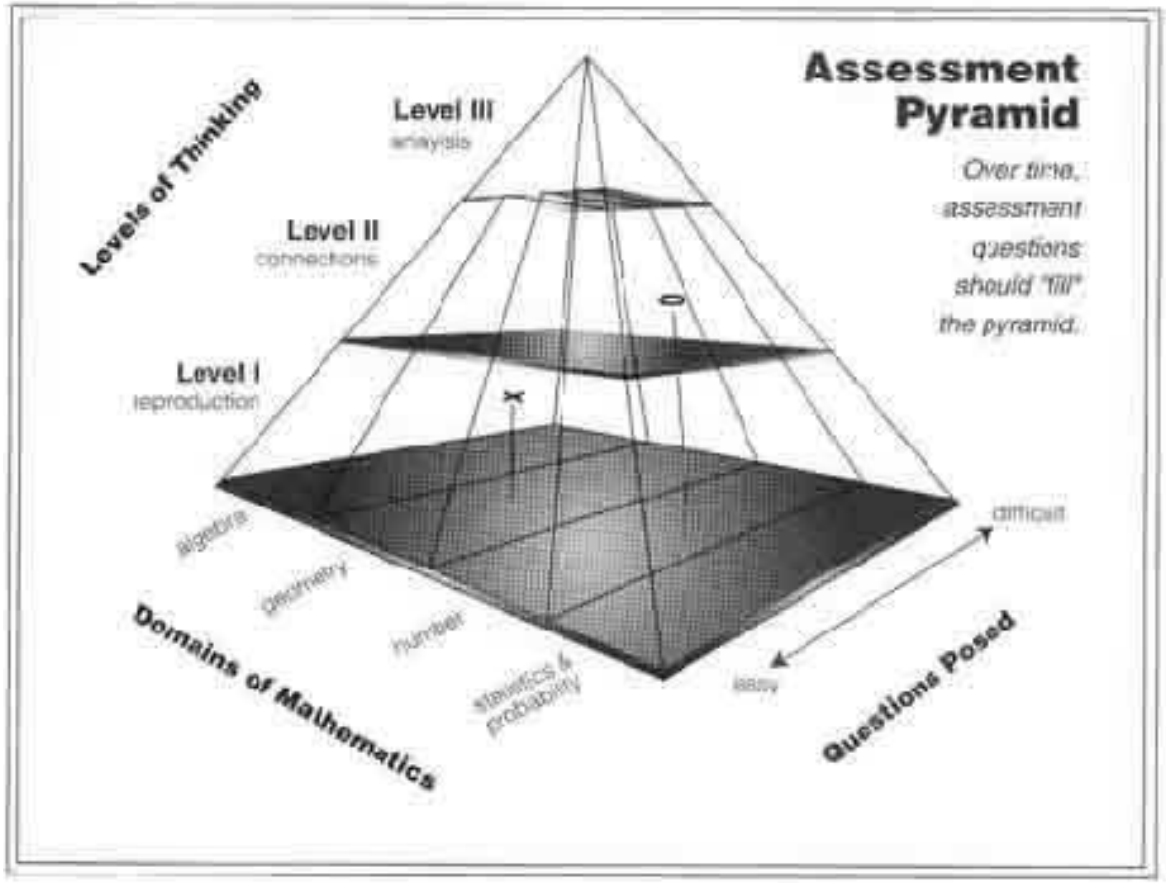
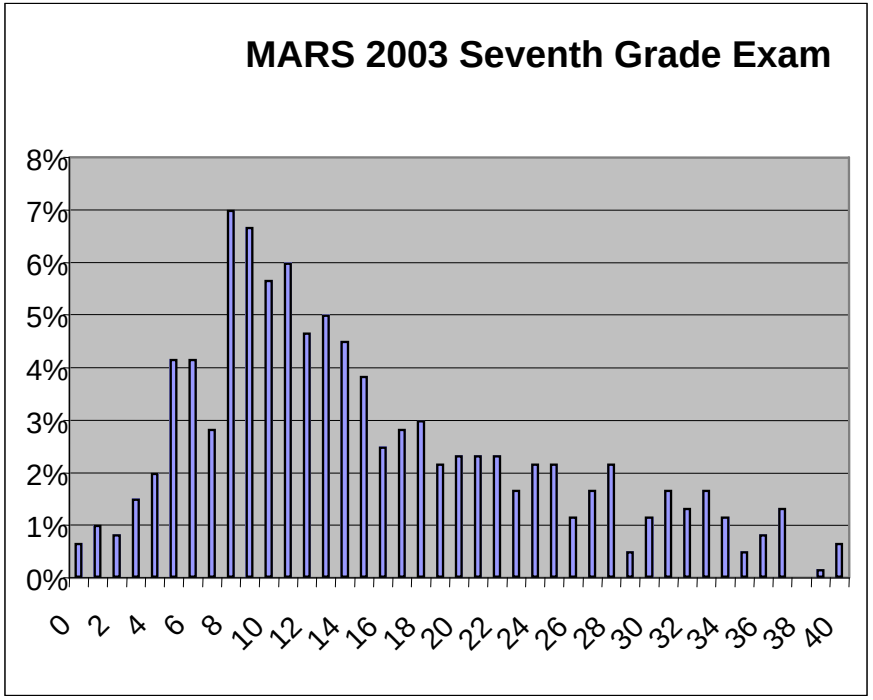


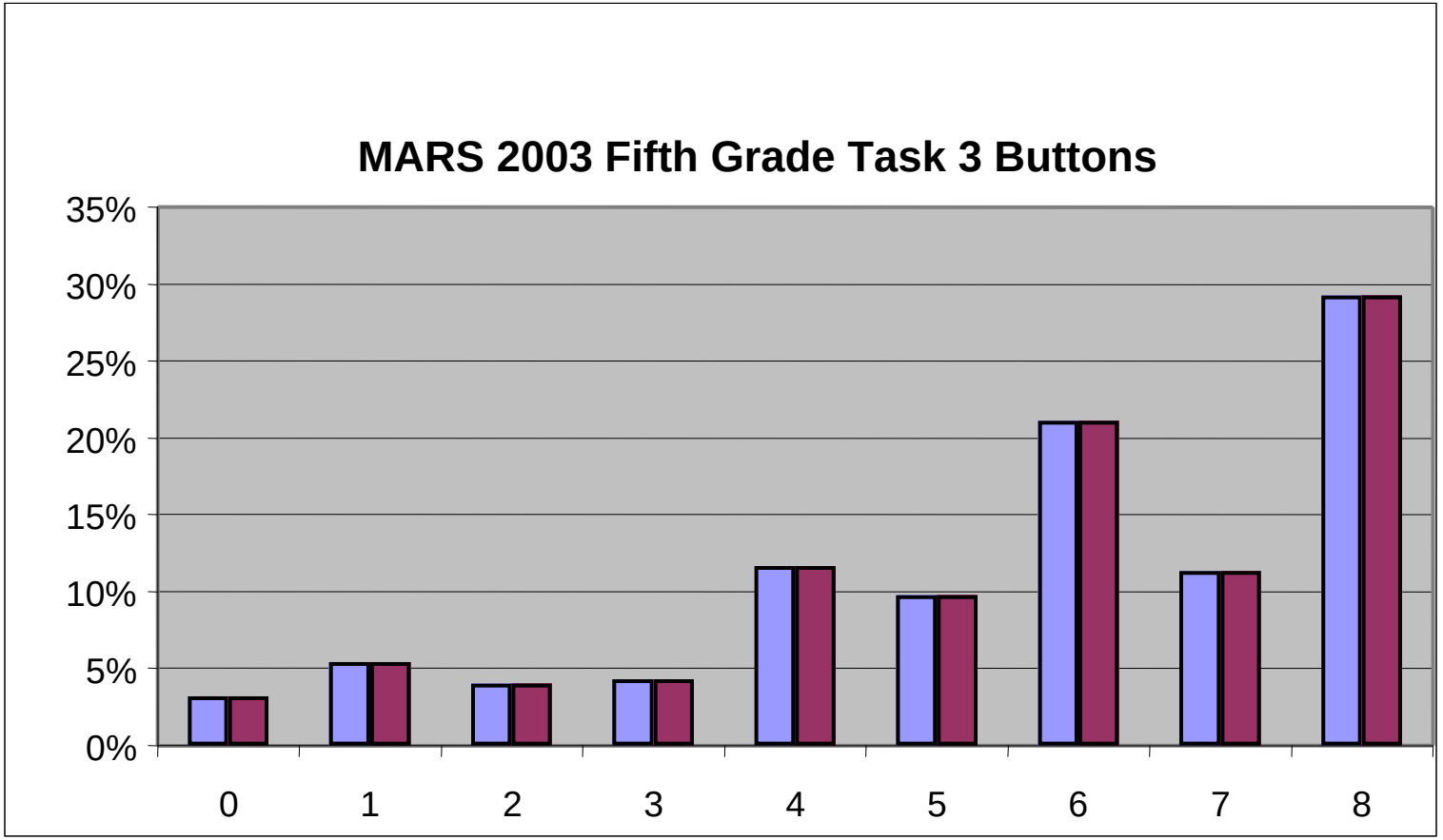
Figure 1. Assessment pyramid

What's Happening at the middle grades?

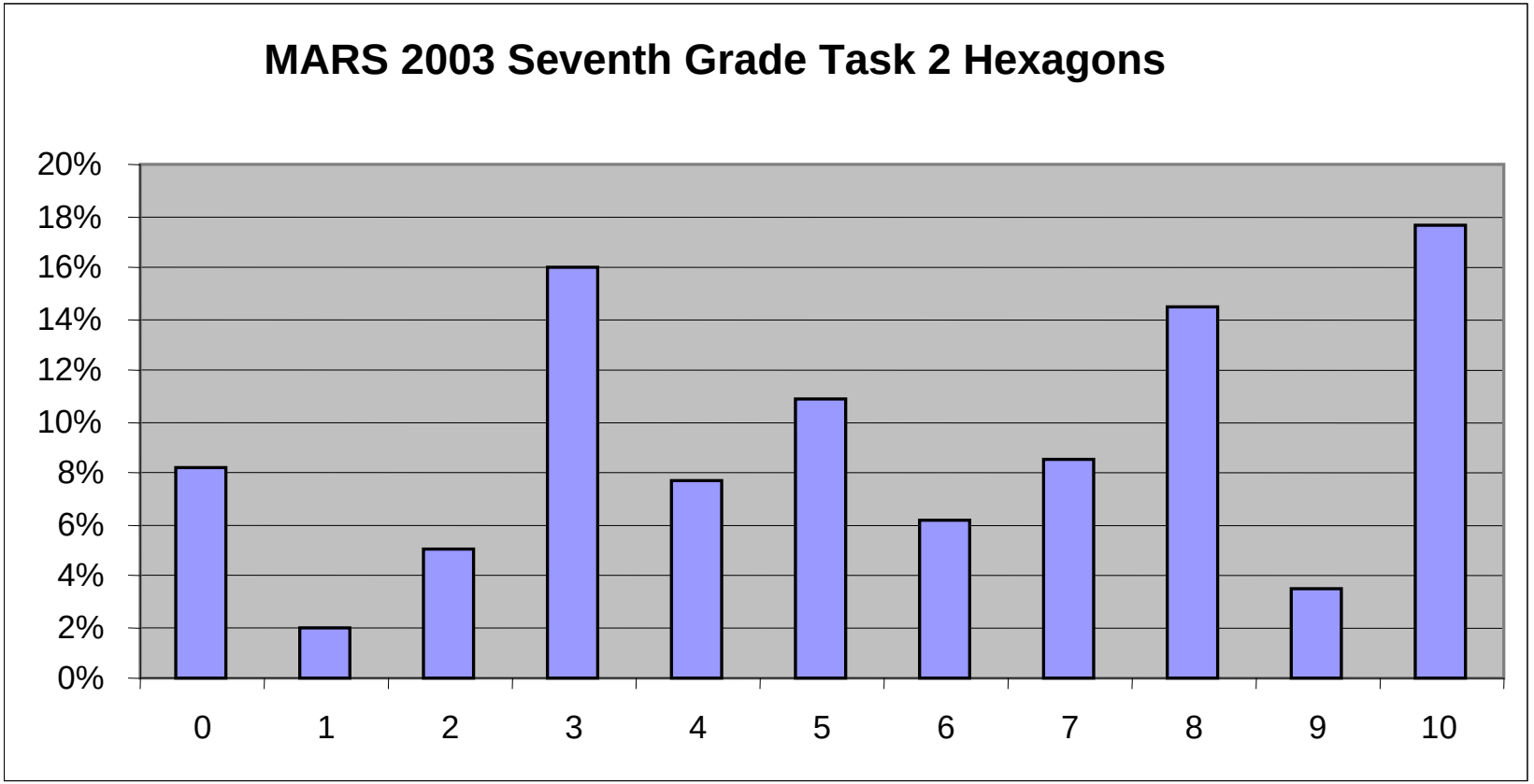
- Graphs show a nice growth for elementary grades, but middle grades continue to fall short.
- What are some of the factors that may be contributing to these low marks?



Fifth Grade Algebra Task



Comparing Algebraic Thinking



Setting the Scene

- Level of difficulty in problems increases
- Problem solving load increases
- Number of topics covered/ sample space increases
- Material is building on foundations from previous grades; so holes or misconceptions cause problems
- Students have more designated time for mathematics

Conjecture

Do we try to help students too much by breaking things down into small parts?

Do these small parts then fail to have meaning and become hard for students to connect?

In an attempt to make things easy for students do we take away their chances to think and make connections?

Who’s doing the thinking?

“unless the framework was provided for them, students didn’t create charts to help them come to solutions.”

MAC Facilitator, reviewing student work for grades 3,4,and 5

- Teachers, who looked at student work and focused on not breaking down the thinking into tiny pieces quadrupled their test scores.

Focus Magazine

Conjecture #2

Do teachers feel that direct instruction will save time? That they don’t have time to have students investigate and find relationships?

What does research have to say on this issue?

Teaching for Understanding-Field Test on Area and Perimeter

Control Group

- **5 days direct instruction using formulas**
- **3 days relational instructions, students devise their own strategies**

Experimental Group

- **Nothing on area and perimeter**
- **3 days relational instructions, students devise their own strategies**

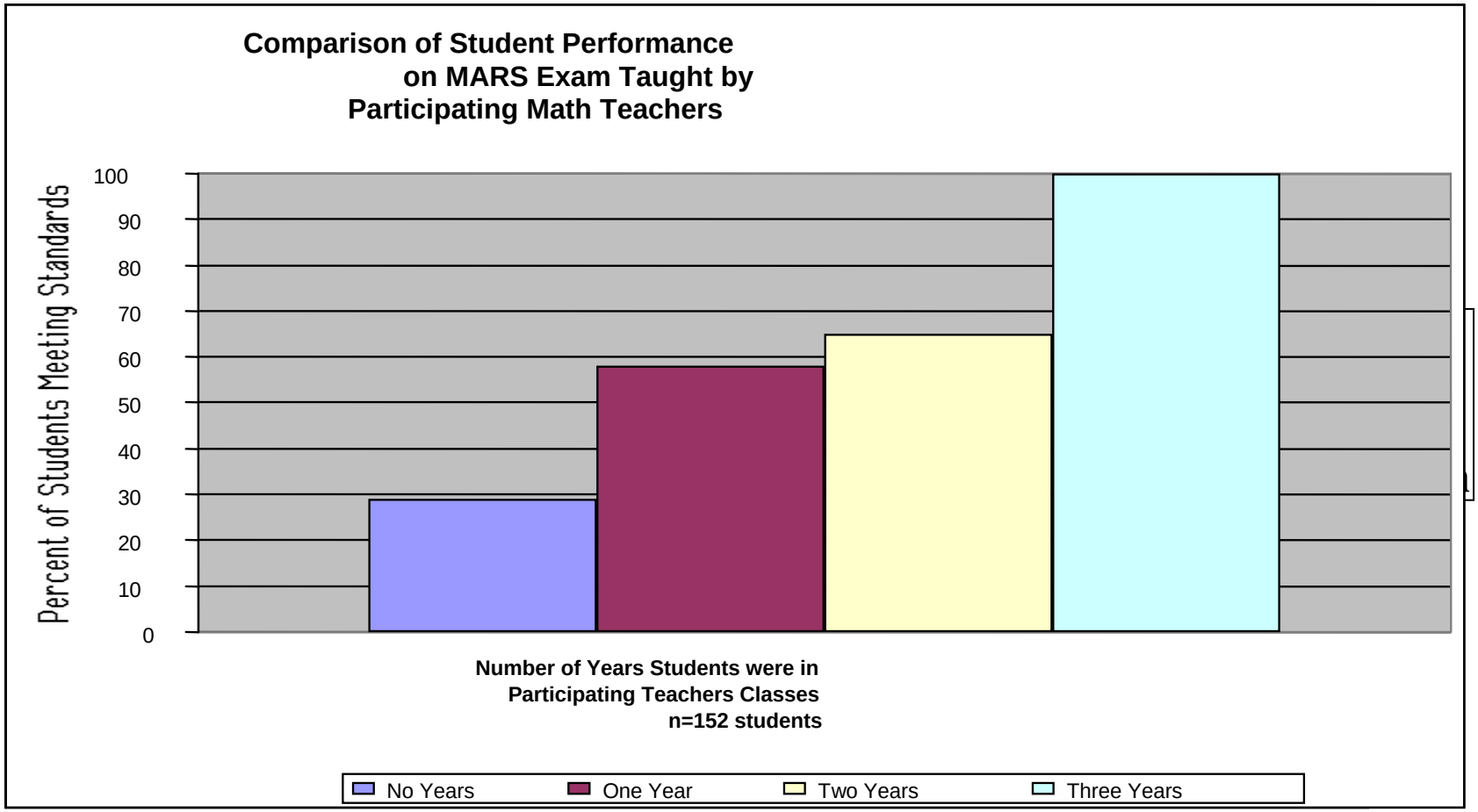
Test Results

	Control Group	**Experimental Group**
Post Test	14.36	16.42
Retention Score	14.31	16.49

Other Factors which might be affecting middle grades

- Tracking
- Textbooks, State Testing Pressures
- The Algebra Issue
- Opportunity to learn

Students in participating classrooms were significantly more successful on the MARS exam.



Building a comprehensive District Team

- Summer Coaching Institute
- MAC Professional Development Calendar/ Building District Leadership
- Intensive Sessions
- Using Toolkits as part of on-going District Professional Development