

***Minnesota and TIMSS:
Insights from 2007
and 1995***

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2007 TIMSS Overview

❖ Trends in International Math and Science Study

- ❖ Math and Science Tested at grades 4 and 8 (“finishing grade” tested in some years)
- ❖ Participants must guarantee a representative sample of all students; selection reviewed
- ❖ The study includes surveys of students and staff, comparison of curriculum and standards, video of classroom instruction in some years

2007 TIMSS Overview

- ❖ **MN Participates as a mini-nation**
 - ❖ **99 MN schools and close to 4000 students sampled**
 - ❖ **Allows MN student performance to be compared to other nations and our 1995 results**
 - ❖ **Participation and analysis fees paid by business partners, MDE; SciMathMN, Michigan State University with Dr. William Schmidt performing analysis**

2007 Grade 8 Mathematics

Nation	Mean
Chinese Taipei	598
Korea, Rep. of	597
Singapore	593
Hong Kong SAR	572
Japan	570
Massachusetts, US	547

Nation	Mean
Minnesota, US	532

Significantly Higher than MN
Not Significantly Different from MN
Significantly Lower than MN

Nation	Mean
Hungary	517
England	513
Russian Federation	512
United States	508
Lithuania	506
Czech Republic	504
Slovenia	501
Armenia	499
Australia	496
Sweden	491
Malta	488
Scotland	487
Serbia	486
Italy	480
Malaysia	474
Norway	469
Cyprus	465
Bulgaria	464
Israel	463
Ukraine	462
Romania	461
Bosnia and Herzegovina	456
Lebanon	449
Thailand	441
Turkey	432
Jordan	427
Tunisia	420
Georgia	410
Iran, Islamic Rep. of	403

Nation	Mean
Bahrain	398
Indonesia	397
Syrian Arab Republic	395
Greece	391
Romania	387
Lithuania	381
Colombia	380
Oman	372
Palestinian Nat'l Auth.	367
Botswana	364
Kuwait	354
El Salvador	340
Saudi Arabia	329
Ghana	309
Qatar	307

2007 Grade 4 Mathematics

Nation	Mean
Hong Kong SAR	607
Singapore	599
Chinese Taipei	576
Massachusetts, US	572
Japan	568

Nation	Mean
Minnesota, US	554
Kazakhstan	549
Russian Federation	544
England	541

Nation	Mean
Latvia	537
Netherlands	535
Lithuania	530
United States	529
Germany	525
Denmark	523
Australia	516
Hungary	510
Italy	507
Austria	505
Sweden	503
Slovenia	502
Armenia	500
Slovak Republic	496
Scotland	494
New Zealand	492
Czech Republic	486
Norway	473
Ukraine	469
Georgia	438
Iran, Islamic Rep. of	402
Algeria	378
Colombia	355
Morocco	341
El Salvador	330
Tunisia	327
Kuwait	316
Qatar	296
Yemen	224

Significantly Higher than MN
Not Significantly Different from MN
Significantly Lower than MN

2007 Grade 8 Science

Nation	Mean
Singapore	567
Chinese Taipei	561
Massachusetts, US	556
Japan	554
Korea, Rep. of	553

Nation	Mean
England	542
Hungary	539
Czech Republic	539
Minnesota, US	539
Slovenia	538
Hong Kong SAR	530
Russian Federation	530

Significantly Higher than MN
Not Significantly Different from MN
Significantly Lower than MN

Nation	Mean
United States	520
Lithuania	519
Australia	515
Sweden	511
Scotland	496
Italy	495
Armenia	488
Norway	487
Ukraine	485
Jordan	482
Malaysia	471
Thailand	471
Serbia	470
Bulgaria	470
Israel	468
Bahrain	467
Bosnia and Herzegovina	466
Romania	462
Iran, Islamic Rep. of	459
Malta	457
Turkey	454
Syrian Arab Republic	452
Cyprus	452
Tunisia	445

Nation	Mean
Indonesia	427
Oman	423
Georgia	421
Kuwait	418
Colombia	417
Lebanon	414
Egypt	408
Algeria	408
Palestinian Nat'l Auth.	404
Saudi Arabia	403
Morocco	402
El Salvador	387
Botswana	355
Qatar	319
Ghana	303

2007 Grade 4 Science

Nation	Mean
Singapore	587
Massachusetts, US	571

Nation	Mean
Chinese Taipei	557
Hong Kong SAR	554
Minnesota, US	551
Japan	548
Russian Federation	546
Latvia	542
England	542
United States	539

Nation	Mean
Hungary	536
Italy	535
Kazakhstan	533
Germany	528
Australia	527
Slovak Republic	526
Austria	526
Sweden	525
Netherlands	523
Slovenia	518
Denmark	517
Czech Republic	515
Lithuania	514
New Zealand	504
Scotland	500
Armenia	484
Norway	477
Ukraine	474
Iran, Islamic Rep. of	436
Georgia	418
Colombia	400
El Salvador	390
Algeria	354
Kuwait	348
Tunisia	318
Morocco	297
Qatar	294
Yemen	197

Significantly Higher than MN
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Grade 4 Mathematics: 1995 & 2007

Nation	Mean
Singapore	590
Japan	567
Hong Kong SAR	557
Netherlands	549
Czech Republic	541
Austria	531
Slovenia	525
Hungary	521
United States	518
Australia	517
Minnesota, US	516
Latvia	499
Scotland	493
England	484
Norway	476
New Zealand	469
Iran, Islamic Rep. of	387

Nation	Mean
Hong Kong SAR	607
Singapore	599
Japan	568
Minnesota, US	554
England	541
Latvia	537
Netherlands	535
United States	529
Australia	516
Hungary	510
Austria	505
Slovenia	502
Scotland	494
New Zealand	492
Czech Republic	486
Norway	473
Iran, Islamic Rep. of	402

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Grade 4 Mathematics: 1995 & 2007

Country	Mathematics		2007-1995
	1995	2007	Gain
1 Australia	495 (3.4)	516 (3.5)	22 ♦
2 Austria	531 (2.9)	505 (2.0)	-25 ♦
3 Czech Republic	541 (3.1)	486 (2.8)	-54 ♦
4 England	484 (3.3)	541 (2.9)	57 ♦
5 Hong Kong SAR	557 (4.0)	607 (3.6)	50 ♦
6 Hungary	521 (3.6)	510 (3.5)	-12 ♦
7 Iran, Islamic Rep. of	387 (5.0)	402 (4.1)	15 ♦
8 Japan	567 (1.9)	568 (2.1)	1
9 Latvia	499 (4.6)	537 (2.3)	38 ♦
10 Netherlands	549 (3.0)	535 (2.1)	-14 ♦
11 New Zealand	469 (4.4)	492 (2.3)	23 ♦
12 Norway	476 (3.0)	473 (2.5)	-3
13 Scotland	493 (4.2)	494 (2.2)	1
14 Singapore	590 (4.5)	599 (3.7)	9
15 Slovenia	462 (3.1)	502 (1.8)	40 ♦
16 United States	518 (3.0)	529 (2.4)	11 ♦
Benchmarking Participants			
Minnesota, US	516 (7.4)	554 (5.9)	38 ♦
TIMSS Scale Mean	500	500	
16 Country Average	509	519	

Grade 8 Mathematics: 1995 & 2007

Nation	Mean
Singapore	609
Japan	581
Korea, Rep. of	581
Hong Kong SAR	569
Czech Republic	546
Sweden	540
Slovenia	531
Bulgaria	527
Hungary	527
Russian Federation	524
Australia	519
Minnesota, US	518
Norway	498
England	498
Scotland	493
United States	492
Romania	474
Lithuania	472
Cyprus	468
Iran, Islamic Rep. of	418
Colombia	360

Nation	Mean
Korea, Rep. of	597
Singapore	593
Hong Kong SAR	572
Japan	570
Minnesota, US	532
Hungary	517
England	513
Russian Federation	512
United States	508
Lithuania	506
Czech Republic	504
Slovenia	501
Australia	496
Sweden	491
Scotland	487
Norway	469
Cyprus	465
Bulgaria	464
Romania	461
Iran, Islamic Rep. of	403
Colombia	380

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Grade 8 Mathematics: 1995 & 2007

Country	Mathematics		2007-1995
	1995	2007	Gain
1 Australia	509 (3.7)	496 (3.9)	-13
2 Bulgaria	527 (5.8)	464 (5.0)	-63
3 Colombia	332 (5.6)	380 (3.6)	47
4 Cyprus	468 (2.2)	465 (1.6)	-2
5 Czech Republic	546 (4.5)	504 (2.4)	-42
6 England	498 (3.0)	513 (4.8)	16
7 Hong Kong SAR	569 (6.1)	572 (5.8)	4
8 Hungary	527 (3.2)	517 (3.5)	-10
9 Iran, Islamic Rep. of	418 (3.9)	403 (4.1)	-15
10 Japan	581 (1.6)	570 (2.4)	-11
11 Korea, Rep. of**	581 (2.0)	597 (2.7)	17
12 Lithuania**	472 (4.1)	506 (2.3)	34
13 Norway	498 (2.2)	469 (2.0)	-29
14 Romania	474 (4.6)	461 (4.1)	-12
15 Russian Federation	524 (5.3)	512 (4.1)	-12
16 Scotland	493 (5.7)	487 (3.7)	-6
17 Singapore	609 (4.0)	593 (3.8)	-16
18 Slovenia	494 (2.9)	501 (2.1)	7
19 Sweden	540 (4.3)	491 (2.3)	-48
20 United States	492 (4.7)	508 (2.8)	16
Benchmarking Participants			
Minnesota, US	518 (7.3)	532 (4.4)	14
TIMSS Scale Mean	500	500	
20 Country Average	508	500	

Instructional Content Constructs

❖ **Curricular Coherence**

- **Curricular Structure**

❖ **Curricular Focus**

- **Exposure Time (OTL)**

❖ **Curricular Rigor**

- **Level of Cognitive Complexity**

Top Achieving 1995 TIMSS Countries' Mathematics Curriculum

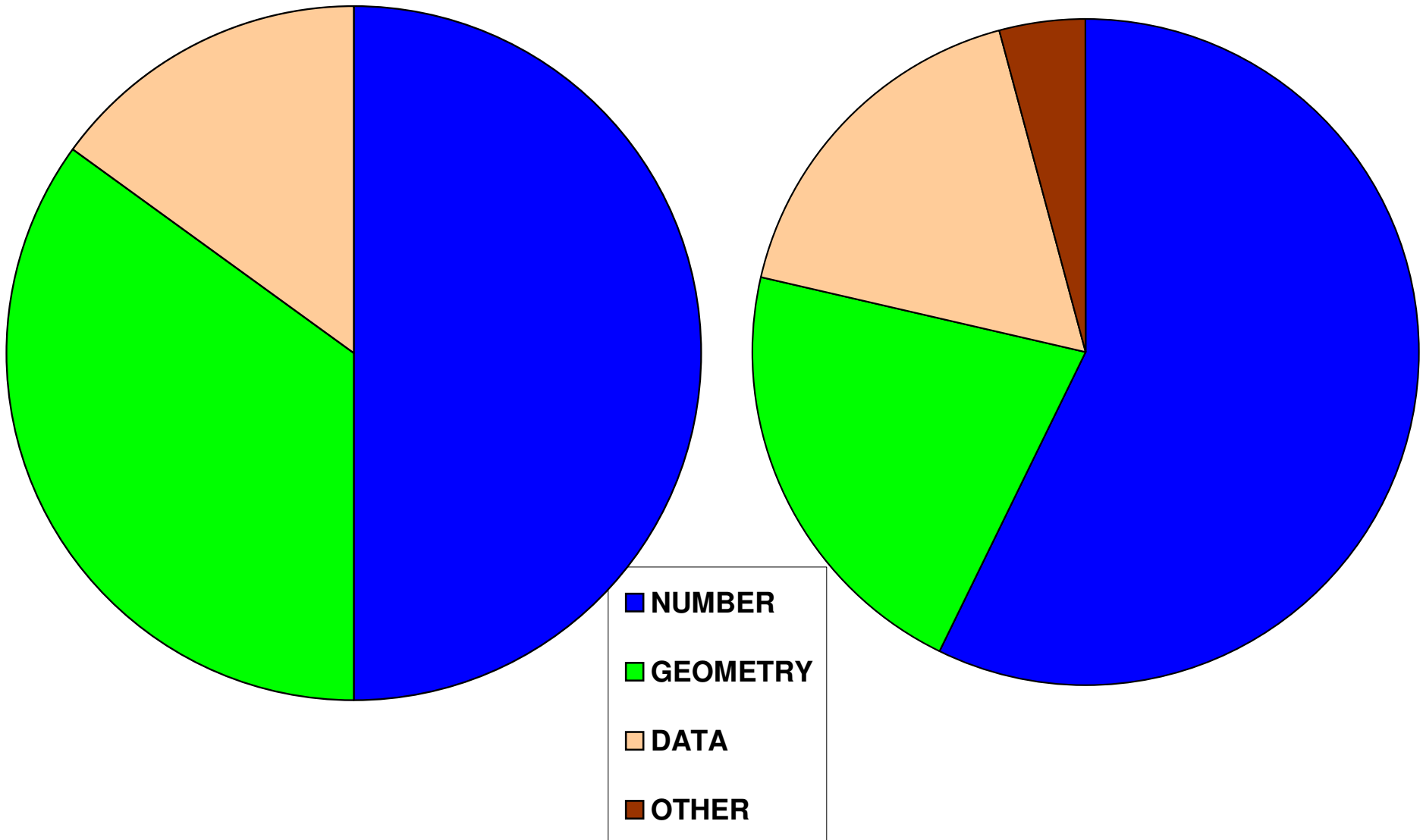
Topic	Grade							
	1	2	3	4	5	6	7	8
Whole Number: Meaning	■	■	■	●	●			
Whole Number: Operations	■	■	■	■	●			
Measurement Units	◆	■	■	■	■	■	●	
Common Fractions			◆	■	■	●		
Equations & Formulas			◆	●	●	●	■	■
Data Representation & Analysis			◆	◆	●	●		◆
2-D Geometry: Basics			◆	●	●	●	■	■
2-D Geometry: Polygons & Circles				◆	●	●	■	■
Measurement: Perimeter, Area & Volume				●	●	●	●	◆
Rounding & Significant Figures				●	●			
Estimating Computations				●	●	●		
Whole Numbers: Properties of Operations				●	●			
Estimating Quantity & Size				◆	◆			
Decimal Fractions				●	■	●		
Relation of Common & Decimal Fractions				◆	■	●		
Properties of Common & Decimal Fractions					●	●		
Percentages					●	●		
Proportionality Concepts					●	●	●	◆
Proportionality Problems					●	●	■	■
2-D Geometry: Coordinate Geometry					◆	◆	●	●
Geometry: Transformations						●	●	●
Negative Numbers, Integers, & Their Properties						◆	●	
Number Theory							●	◆
Exponents, Roots & Radicals							●	●
Exponents & Orders of Magnitude							◆	◆
Measurement: Estimation & Errors							◆	
Constructions Using Straightedge & Compass							■	◆
3-D Geometry							●	■
Geometry: Congruence & Similarity								■
Rational Numbers & Their Properties								◆
Patterns, Relations & Functions								◆
Proportionality: Slope & Trigonometry								◆

- ◆ Intended by 4 out of the 6 top-achieving countries
- Intended by all but *one* of the top-achieving countries (5 out of 6).
- Intended by *all* of the top-achieving countries.

Grade 4 Mathematics Mean Teaching Emphasis

2007 TIMSS TEST EMPHASIS

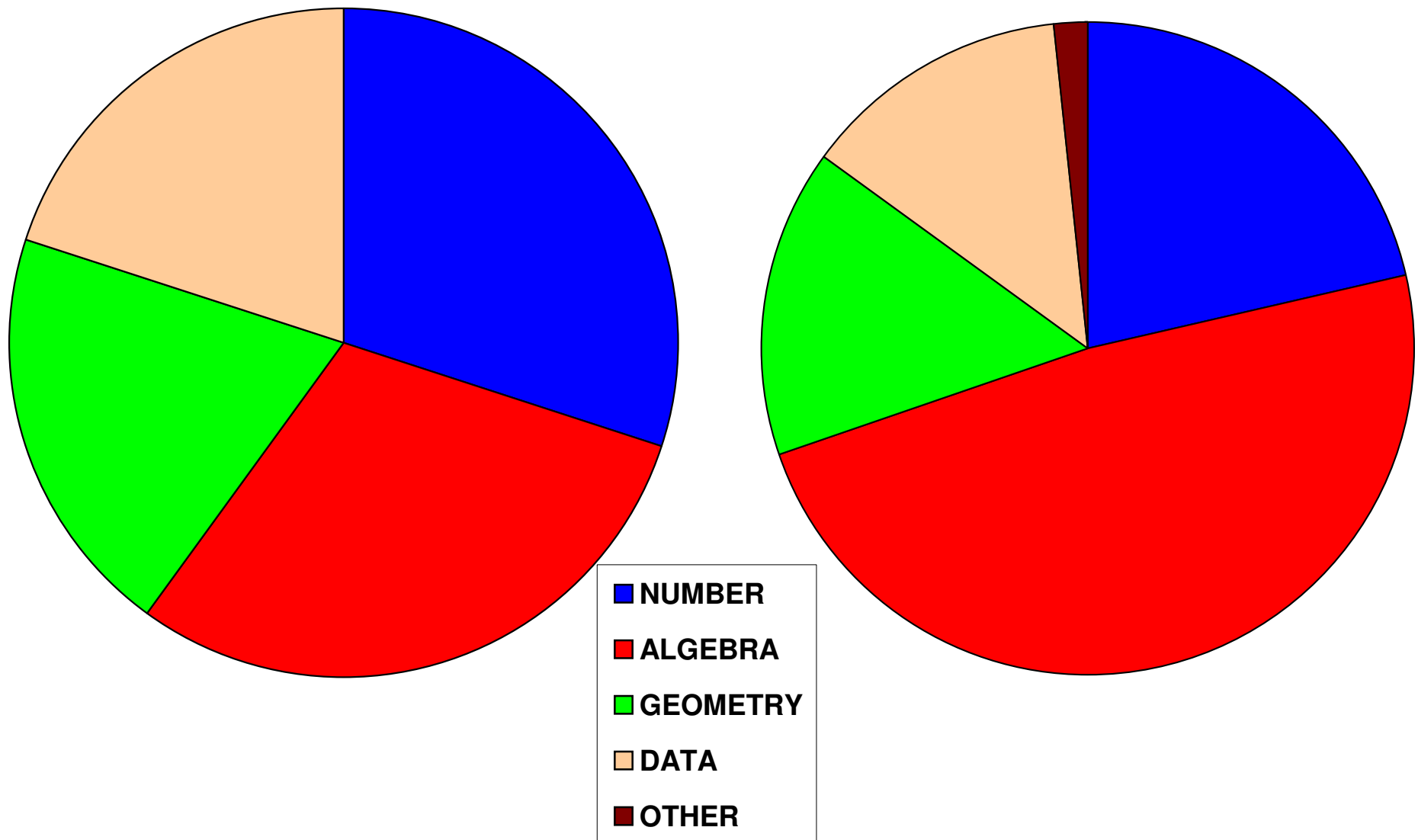
2007



Grade 8 Mathematics Mean Teaching Emphasis

2007 TIMSS TEST EMPHASIS

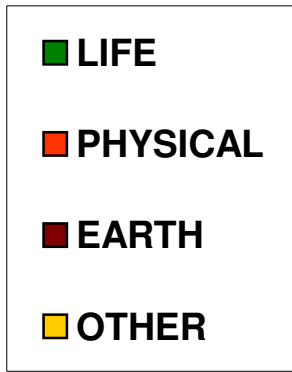
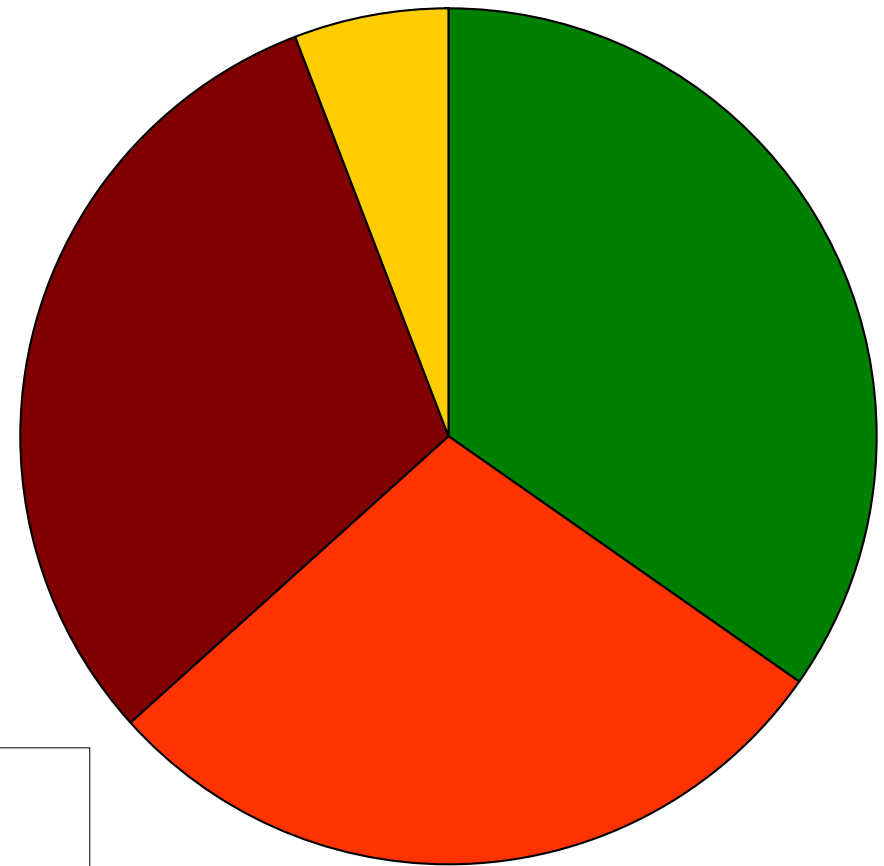
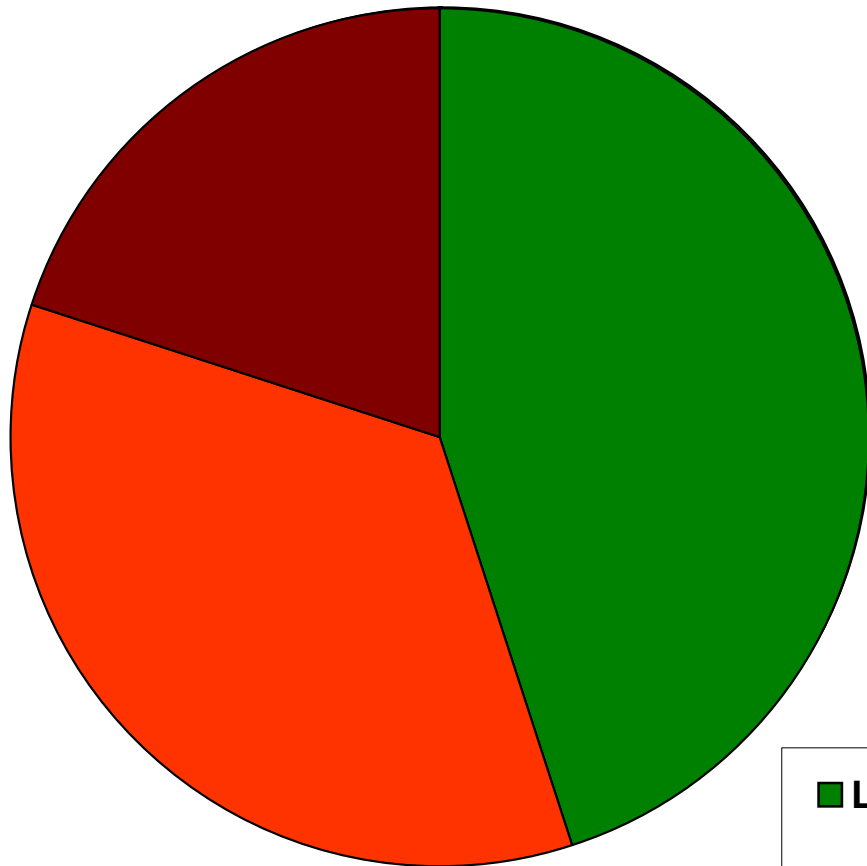
2007



Grade 4 Science Mean Teaching Emphasis

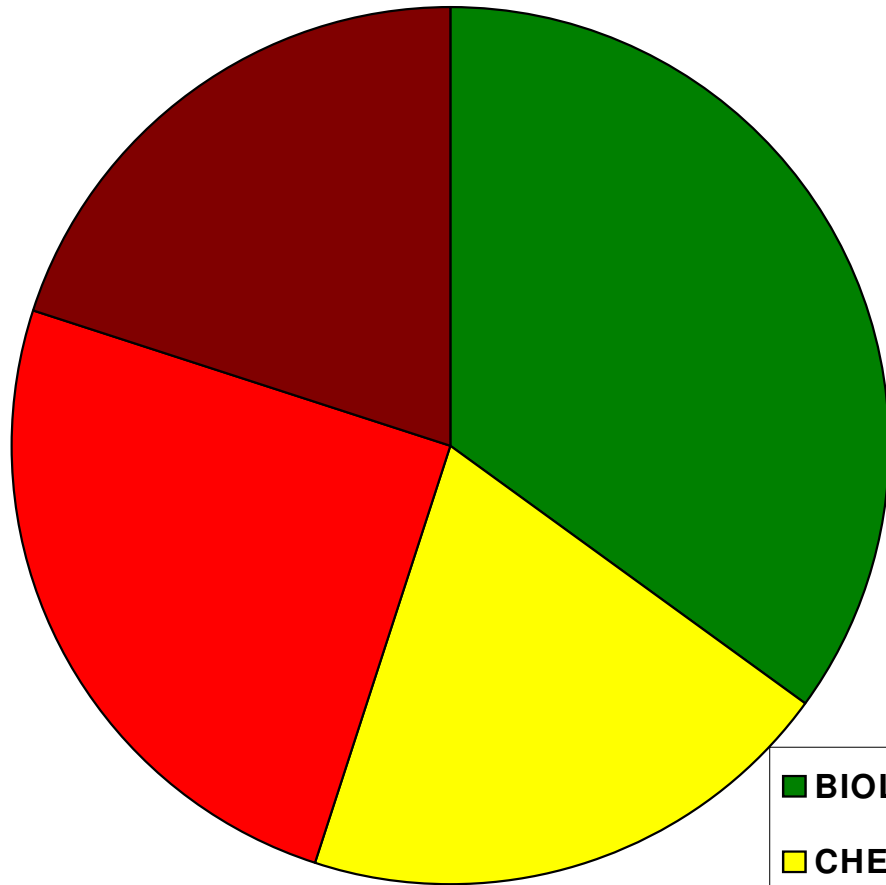
2007 TIMSS TEST EMPHASIS

2007

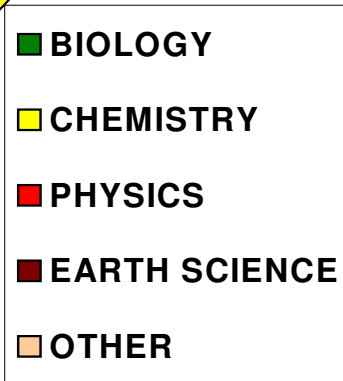
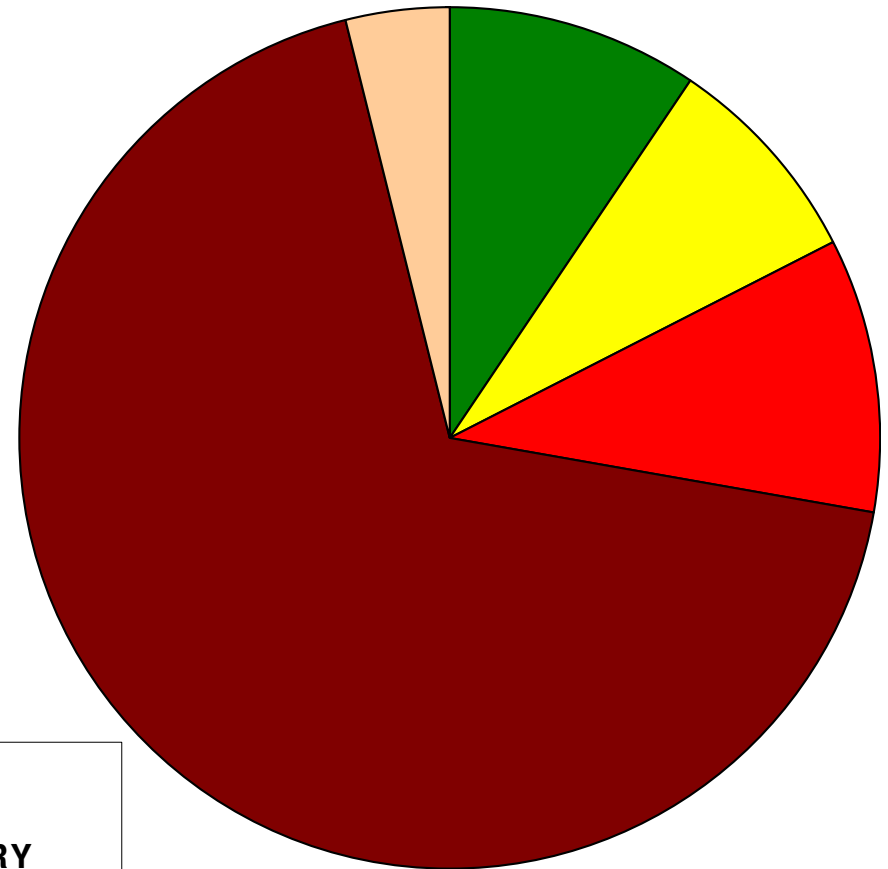


Grade 8 Science Mean Teaching Emphasis

2007 TIMSS TEST EMPHASIS



2007



Variables in the Gain Equation...

- ❖ **MN had no math or science standards in 1995; now in third iteration**
- ❖ **Standards-based math curricula widely used**
- ❖ **MCA Testing in math since 1998 (high stakes); science started in 2008**
- ❖ **Frameworks for delivering the standards developed by SciMathMN and used in many districts**

Variables in the Gain Equation...

- ❖ **Legislation requiring Algebra I in grade 8 by 2011; Alg II for graduation in 2015**
- ❖ **Graduation requirements significantly increased in math and science since 1995**
- ❖ **Recommendations from 1995 TIMSS results used to guide change**