

PROM/SE Summer Science Institutes
June 20-24, 2005

**The American PROM/SE:
Providing Challenging,
Coherent Curriculum
for All**

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Some Preliminary Findings

The Relationship between Curricular Content and Achievement

International Grade Placement of Curriculum Content Across Districts



PROM/SE Grade 5 Student Achievement vs Grade Placement of Curriculum Content

Preliminary Data

Do Not Cite or Distribute

Grade Student Achievement



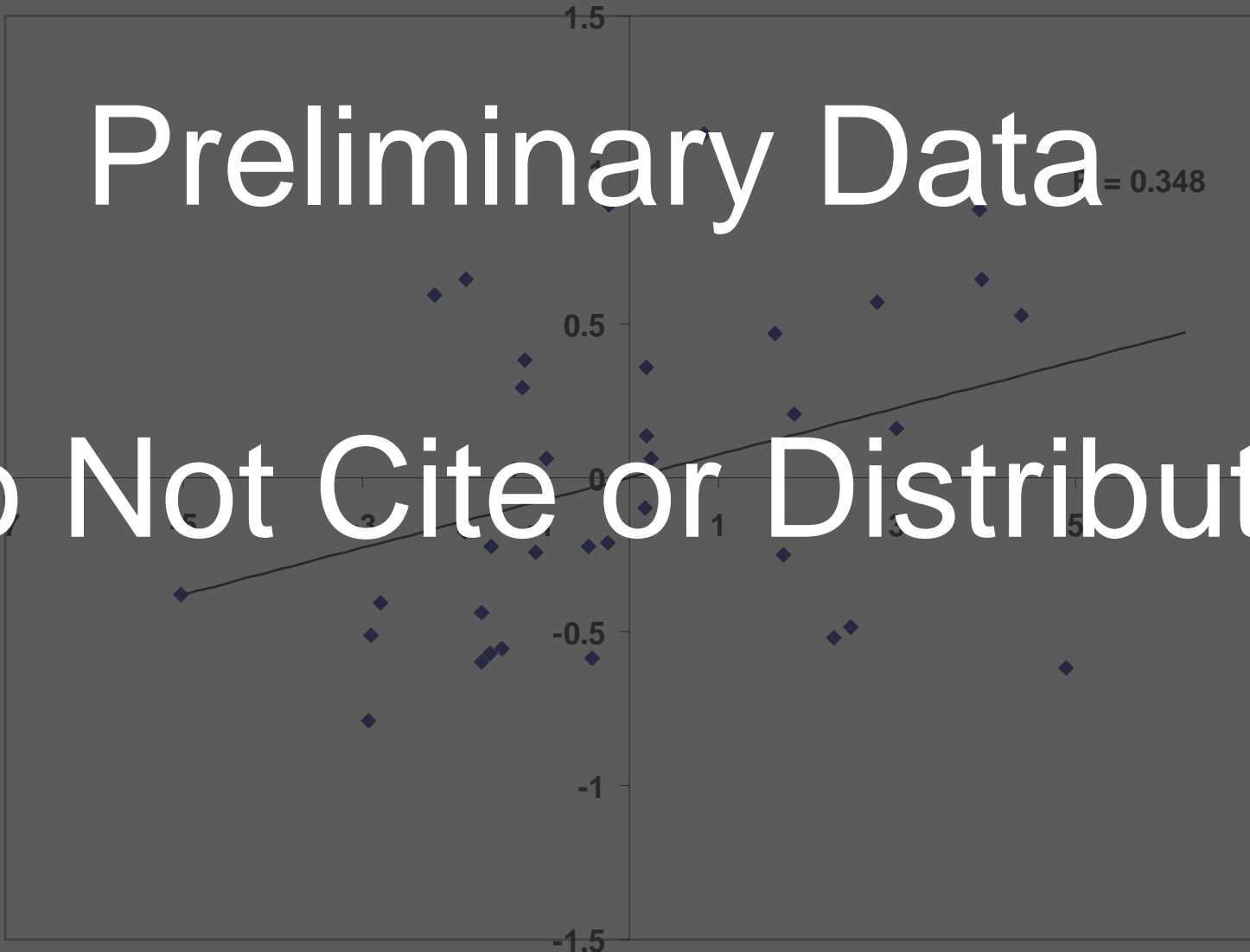
Grade Placement of Curriculum Content

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PROM/SE Grade 8 Student Achievement vs Grade Placement of Curriculum Content

Preliminary Data

Grade 8 Student Achievement



Do Not Cite or Distribute

Grade Placement of Curriculum Content

Tripartite Model of Curriculum

Attained curriculum:
pupil knowledge, skills,
& attitudes

Implemented curriculum: goals, strategies, &
practices carried out in classrooms

Intended Curriculum: system-wide policies, plans,
& goals

TIMSS 1995 Science Framework - An Example

1.1 Earth Sciences

1.2 Life Sciences

1.3 Physical Science

1.4 Science, Technology
and Mathematics

1.5 History of Science
and Technology

1.6 Environmental and
Resource Issues
Related to Science

1.7 Nature of Science

1.8 Science and Other
Disciplines

1.1.1 Earth Features

1.1.2 Earth Processes

1.1.3 Earth in the Universe

1.1.1.1 Composition

1.1.1.2 Landforms

1.1.1.3 Bodies of Water

1.1.1.4 Atmosphere

1.1.1.5 Rocks, Soil

1.1.1.6 Ice Forms

Curriculum Sensitive Assessment

- **Primary School (for Grades 3, 4 and 5)**
 - 360 items in Math from 22 strands
 - **180 items in Science from 15 strands**
 - 15 forms (1 form per student)
- **Middle School (for Grades 6, 7 and 8)**
 - 450 items in Math from 28 strands
 - **225 items in Science from 15 strands**
 - 15 forms (1 form per student)
- **High School (for Grades 9, 10, 11 and 12)**
 - 450 items in Math from 27 strands
 - **240 items in Science from 15 strands**
 - 15 forms (1 form per student)
- **Multiple Choice items with 2 constructed response items**

Sources of Data in Reports

- **From the District**
 - **Topic Trace Maps**

Intended

- **From Teachers**
 - **Teacher Content Goals**

Implemented

- **From Students**
 - **Student Assessment**

Attained

Response Rates

Instrument	Number of Responses Expected	Number of Responses Received	Response Rate
Student Assessments:			
Grades 3-5	73,751	65,869	89.3%
Grades 6-8	66,895	60,468	90.4%
Grades 9-12	71,186	58,235	81.8%
Teacher Background	7,260	4,216	58.1%
Teacher Content Goals	13,665	6,457	47.3%
Topic Trace Map	62	62	100 %
District “Road Map”	62	45	72.6%

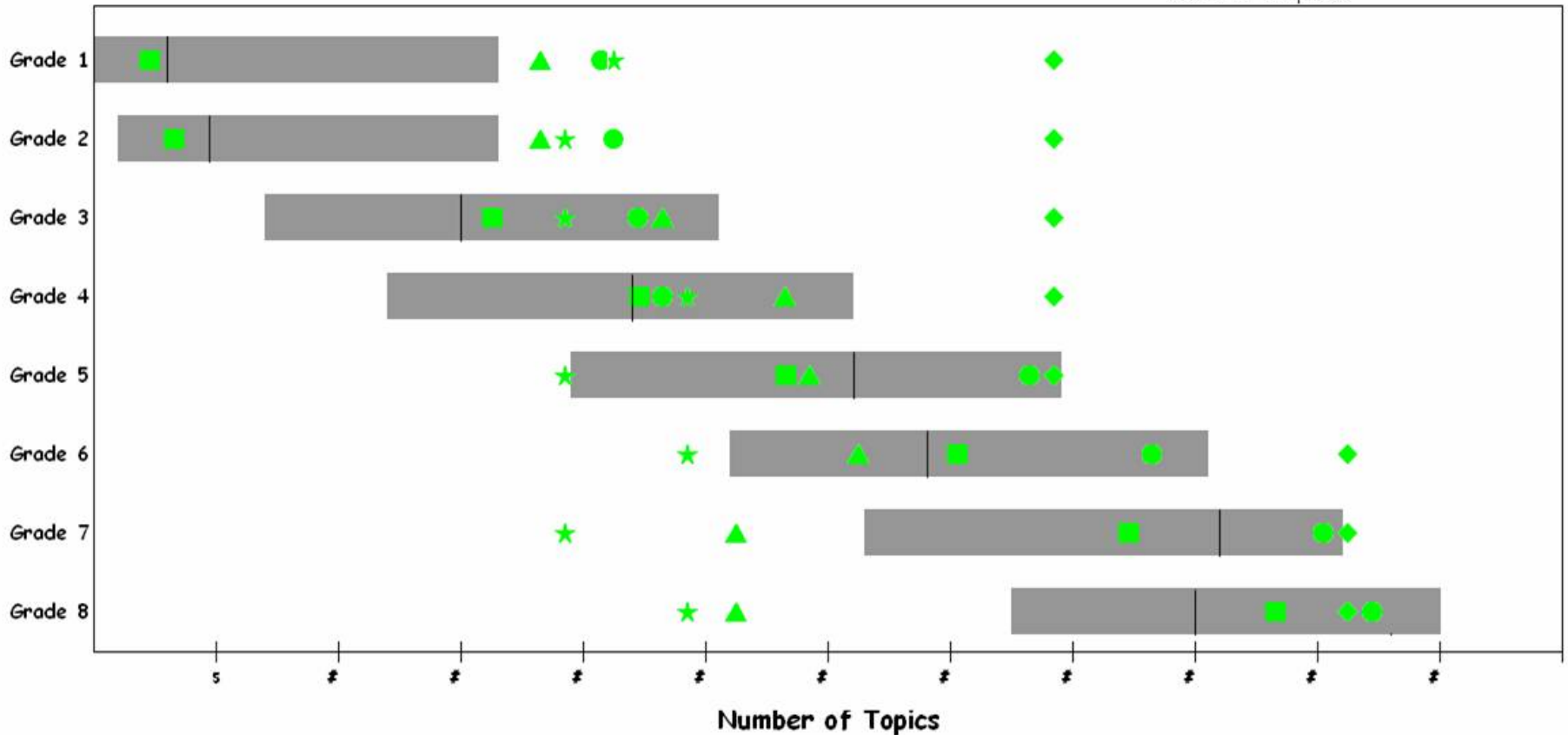
Some Preliminary Findings

Curricular Variation Across Districts: The Intended Curriculum

Number of Science Topics Intended by Standards for Each Grade

- Gray bars show how many science topics were intended to be covered at each grade in the 1995 TIMSS countries. The bars represent the middle 50 percent of 1995 TIMSS countries. The black line indicates the median number of topics at each grade.
- The bars represent the middle 50 percent of 1995 TIMSS countries.
- The black line indicates the median number of topics at each grade.

- = U.S. Composite
- ◆ = Michigan
- ★ = Ohio
- ▲ = Your district
- = Top Achieving Countries' Composite



High Achieving Countries' Science Standards

Topics	Grade							
	1	2	3	4	5	6	7	8
Organs, Tissues			■	■	■	■	■	■
Physical Properties of Matter			■	■	■	■	■	■
Plants, Fungi			■	■	■	■	■	●
Animals			■	■	■	■	●	■
Classification of Matter			●	●	●	●	■	■
Rocks, Soil			●	●	●	●	■	■
Light			●				■	■
Electricity				●		●	■	■
Life Cycles				■	■	■	■	■
Physical Changes of Matter				■	■	■	■	■
Heat & Temperature				■	■	■	■	■
Bodies of Water			●	●	●	●	■	■
Interdependence of Life					●	■	●	●
Habitats & Niches					●	●	●	●
Biomes & Ecosystems					●	■	●	●
Reproduction					●			●
Time, Space, Motion					■	■	■	■
Types of Forces					●	●	■	■
Weather & Climate					●	●	■	■
Planets in the Solar System					●	●	●	■
Magnetism						■	■	■
Earth's Composition						●	■	■
Organism Energy Handling						●	●	■
Land, Water, Sea Resource Conservation						●	●	■
Earth in the Solar System						●	●	●
Atoms, Ions, Molecules							■	■
Chemical Properties of Matter							■	■
Chemical Changes of Matter							■	■
Physical Cycles							●	■
Land Forms							●	■
Material & Energy Resource Conservation							●	■
Explanations of Physical Changes							●	●
Pollution							●	■
Atmosphere							●	●
Sound & Vibration							●	●
Cells							●	●
Human Nutrition							●	●
Building & Breaking								■
Energy Types, Sources, Conversions								■
Dynamics of Motion								●
Organism Sensing & Responding								●

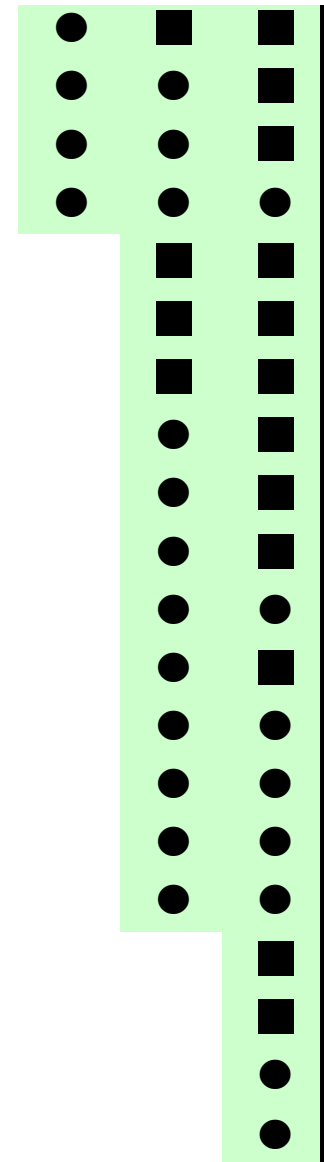
Intended by all but *one* of the top-achieving countries (3 out of 4). ●
 Intended by *all* of the top-achieving countries. ■

High Achieving Countries' Science Standards

Topics	Grade							
	1	2	3	4	5	6	7	8
Organs, Tissues			■	■	■	■	■	■
Physical Properties of Matter			■	■	■	■	■	■
Plants, Fungi			■	■	■	■	■	●
Animals			■	■	■	■	●	■
Classification of Matter			●	●	●	●	■	■
Rocks, Soil			●	●	●	●	■	■
Light			●				■	■
Electricity				●		●	■	■
Life Cycles				■	■	■	■	■
Physical Changes of Matter				■	■	■	■	■
Heat & Temperature				■	■	■	■	■
Bodies of Water				●	●	●	■	■
Interdependence of Life					●	■	●	●
Habitats & Niches					●	●	●	●
Biomes & Ecosystems					●	■	●	●
Reproduction					●			●
Time, Space, Motion					■	■	■	■
Types of Forces					●	●	■	■
Weather & Climate					●	●	■	■
Planets in the Solar System					●	●	●	●
Magnetism						■	■	■

High Achieving Countries' Science Standards

Earth's Composition
 Organism Energy Handling
 Land, Water, Sea Resource Conservation
 Earth in the Solar System
 Atoms, Ions, Molecules
 Chemical Properties of Matter
 Chemical Changes of Matter
 Physical Cycles
 Land Forms
 Material & Energy Resource Conservation
 Explanations of Physical Changes
 Pollution
 Atmosphere
 Sound & Vibration
 Cells
 Human Nutrition
 Building & Breaking
 Energy Types, Sources, Conversions
 Dynamics of Motion
 Organism Sensing & Responding



High Achieving Countries' Life Science Standards

Topics	Grade							
	1	2	3	4	5	6	7	8
<i>Life Science</i>								
Organs, Tissues			■	■	■	■	■	■
Plants, Fungi			■	■	■	■	■	●
Animals			■	■	■	■	●	■
Life Cycles				■	■	■	■	■
Interdependence of Life					●	■	●	●
Habitats & Niches					●	●	●	●
Biomes & Ecosystems					●	■	●	●
Reproduction					●			●
Organism Energy Handling						●	●	■
Cells							●	●
Human Nutrition							●	●
Organism Sensing & Responding								●

Intended by all but *one* of the top-achieving countries (3 out of 4). ●

Intended by *all* of the top-achieving countries. ■

High Achieving Countries' Physical Science Standards

Topics	Grade							
	1	2	3	4	5	6	7	8
<i>Physical Science</i>								
Physical Properties of Matter			■	■	■	■	■	■
Classification of Matter			●	●	●	●	■	■
Light			●				■	■
Electricity				●		●	■	■
Physical Changes of Matter				■	■	■	■	■
Heat & Temperature				■	■	■	■	■
Time, Space, Motion					■	■	■	■
Types of Forces					●	●	■	■
Magnetism						■	■	■
Atoms, Ions, Molecules							■	■
Chemical Properties of Matter							■	■
Chemical Changes of Matter							■	■
Explanations of Physical Changes							●	●
Sound & Vibration							●	●
Energy Types, Sources, Conversions								■
Dynamics of Motion								●

Intended by all but *one* of the top-achieving countries (3 out of 4). ●

Intended by *all* of the top-achieving countries. ■

High Achieving Countries' Earth Science Standards

Topics	Grade							
	1	2	3	4	5	6	7	8
<i>Earth Science</i>								
Rocks, Soil			●	●	●	●	■	■
Bodies of Water				●	●	●	■	■
Weather & Climate					●	●	■	■
Planets in the Solar System					●	●	●	●
Earth's Composition						●	■	■
Earth in the Solar System						●	●	●
Physical Cycles							●	■
Land Forms							●	■
Atmosphere							●	●
Building & Breaking								■

Intended by all but *one* of the top-achieving countries (3 out of 4). ●

Intended by *all* of the top-achieving countries. ■

High Achieving Countries' Environmental Science Standards

Topics	Grade							
	1	2	3	4	5	6	7	8
<i>Environmental Science</i>								
Land, Water, Sea Resource Conservation						●	●	■
Material & Energy Resource Conservation							●	■
Pollution							●	■

Intended by all but *one* of the top-achieving countries (3 out of 4). ●
 Intended by *all* of the top-achieving countries. ■

Standards Compared with Top-Achieving Countries' Profile

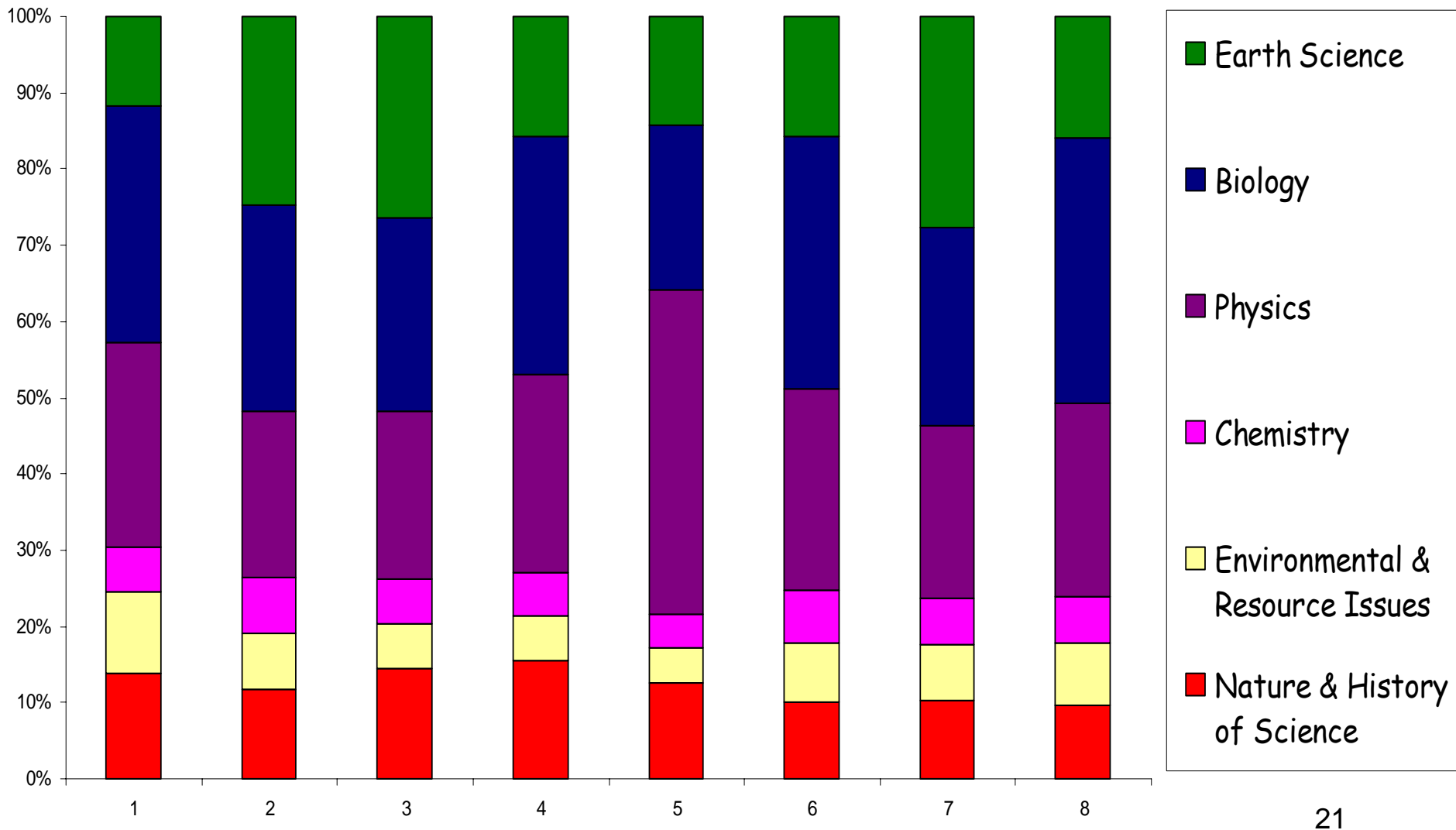
Intended by your district ●
 Top-achieving countries' intended-topics profile ■

Topics	Grade							
	1	2	3	4	5	6	7	8
Life Science								
Organs, Tissues			●					●
Plants, Fungi			■	●	●	■	■	●
Animals			■	■	■	■	■	●
Life Cycles			■		●	■	■	●
Interdependence of Life				●		■	■	●
Habitats & Niches						■	■	●
Biomes & Ecosystems					●	■	■	●
Reproduction					■	■	■	●
Organism Energy Handling						■	■	●
Cells							■	●
Human Nutrition	●		●	●	●		■	●
Organism Sensing & Responding						●	■	●
Physical Science								
Physical Properties of Matter		●		●		●		●
Classification of Matter			■	■	■	■	■	●
Light	●		■	■	■	■	■	●
Electricity		●		■	■	■	■	●
Physical Changes of Matter	●		■	■	■	■	■	●
Heat & Temperature			■	■	■	■	■	●
Time, Space, Motion	●		■	■	■	■	■	●
Types of Forces				■	■	■	■	●
Magnetism						■	■	●
Atoms, Ions, Molecules						■	■	●
Chemical Properties of Matter				●	●		■	●
Chemical Changes of Matter			●	●	●	●	■	●
Explanations of Physical Changes				●	●	●	■	●
Sound & Vibration							■	●
Energy Types, Sources, Conversions							■	●
Dynamics of Motion			●		●		■	●
Earth Science								
Rocks, Soil		●	■	■	■	●	■	●
Bodies of Water	●	●	●	●	■	■	■	●
Weather & Climate			■	■	■	■	■	●
Planets in the Solar System			●		■	■	■	●
Earth's Composition		●		●	■	■	■	●
Earth in the Solar System					●	■	■	●
Physical Cycles		●	●				■	●
Land Forms		●	●				■	●
Atmosphere					●		■	●
Building & Breaking							■	●
Environmental Science								
Land, Water, Sea Resource Conservation				●	●	■	■	●
Material & Energy Resource Conservation				●	●	■	■	●
Pollution				●	●	■	■	●

Some Preliminary Findings

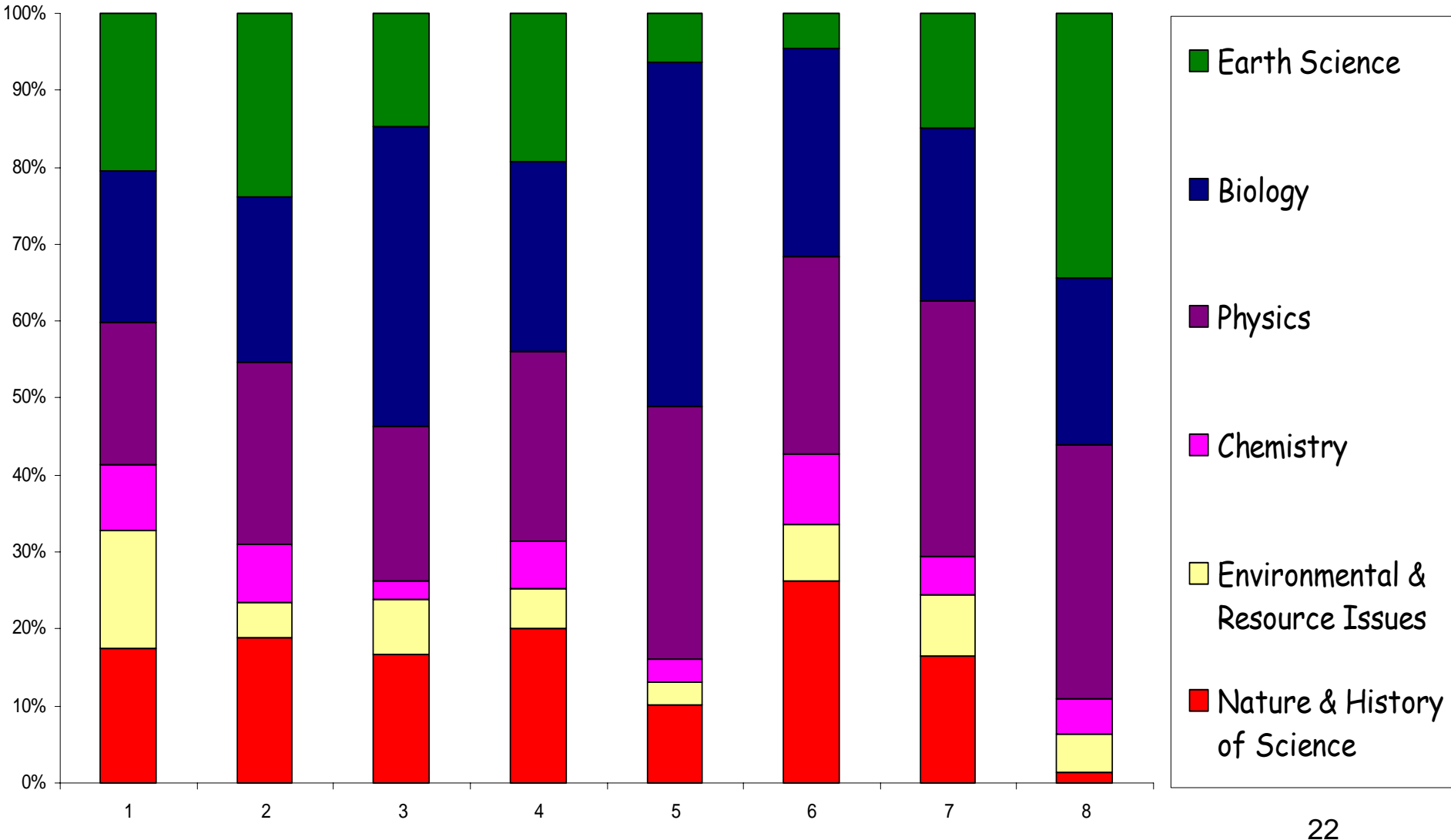
Curricular Variation Across Districts: The Implemented Curriculum

Average Percent Teaching Time in Science Areas at Each Grade for District 1

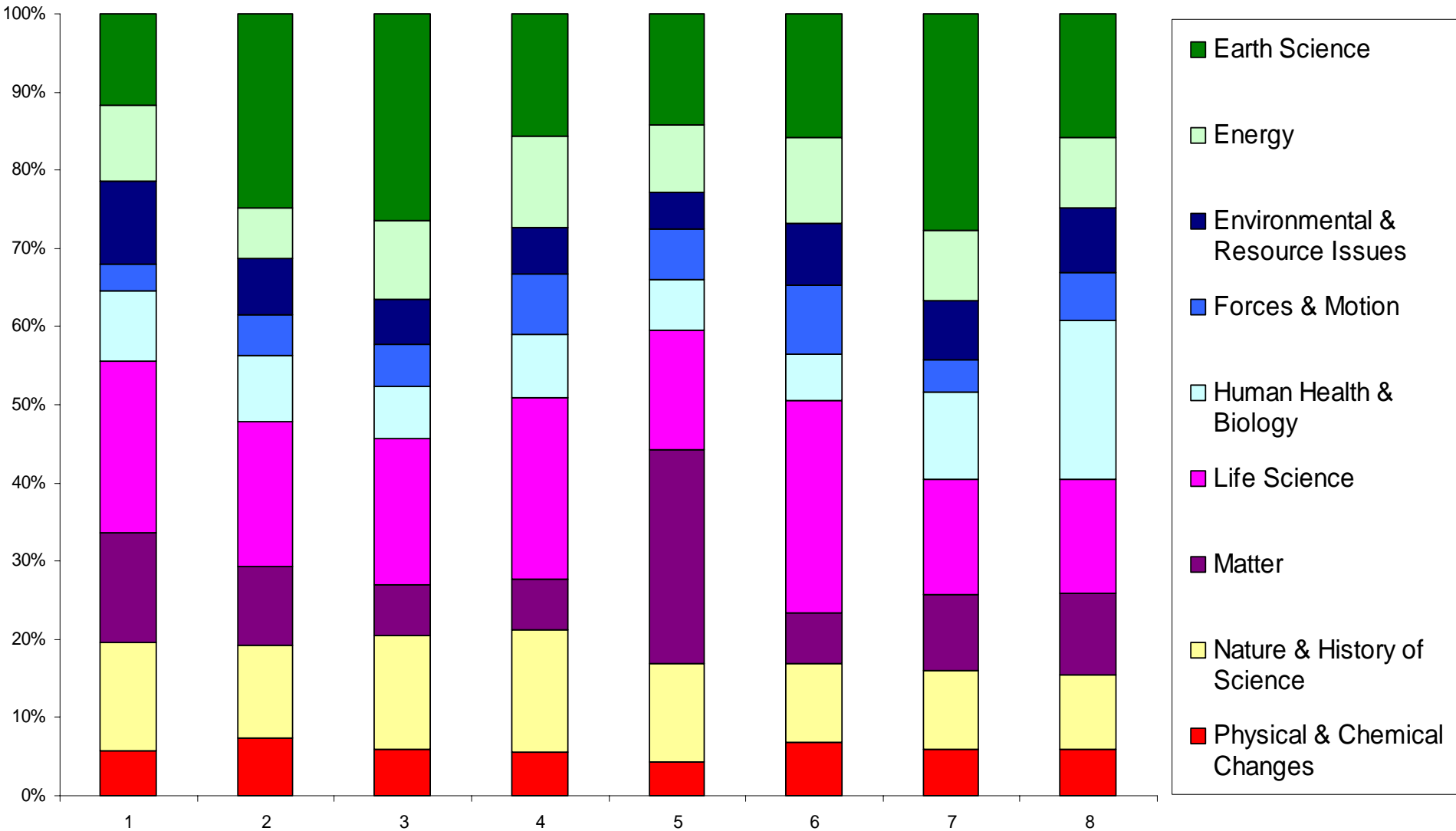


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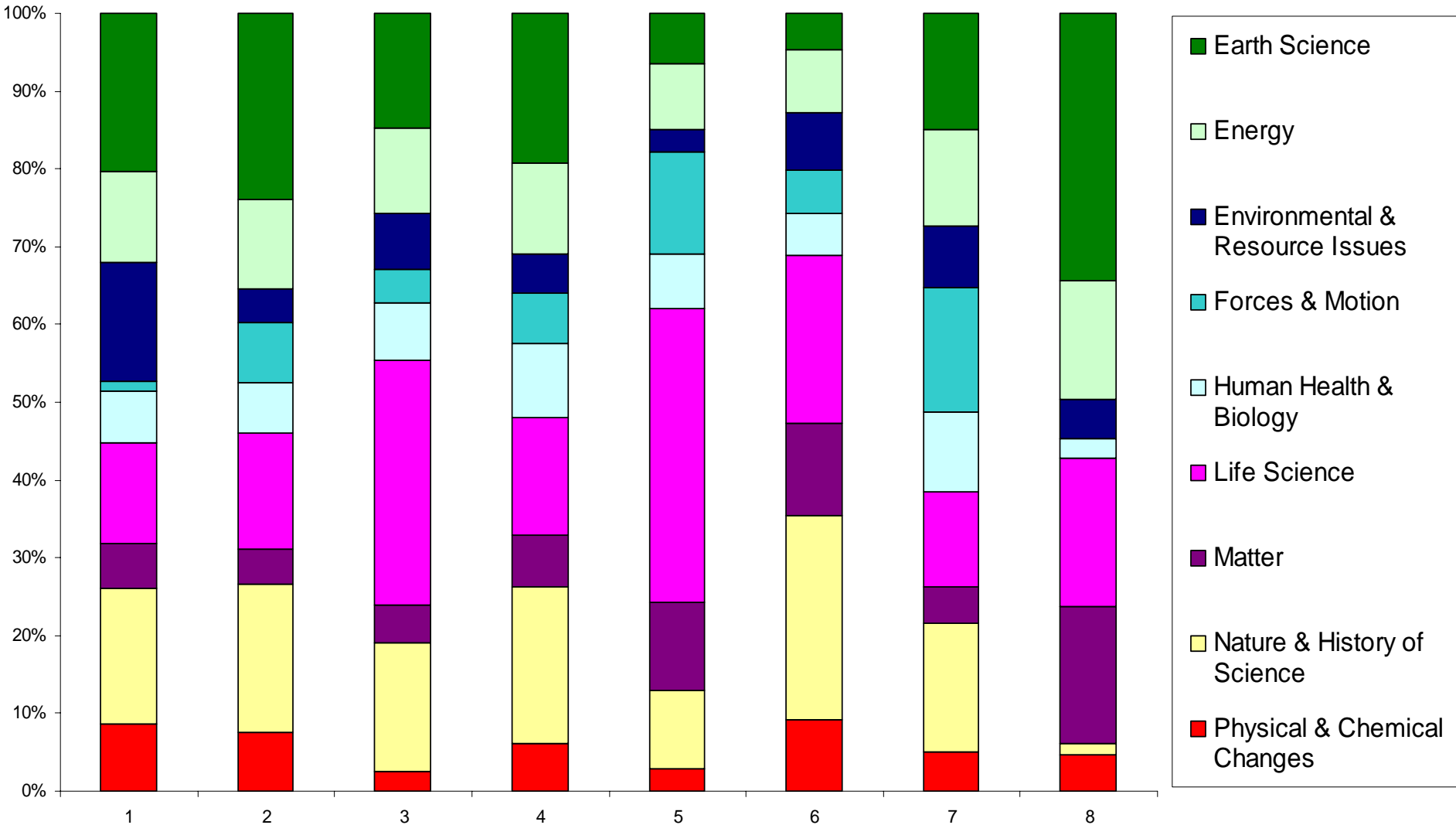
Average Percent Teaching Time in Science Areas at Each Grade for District 2



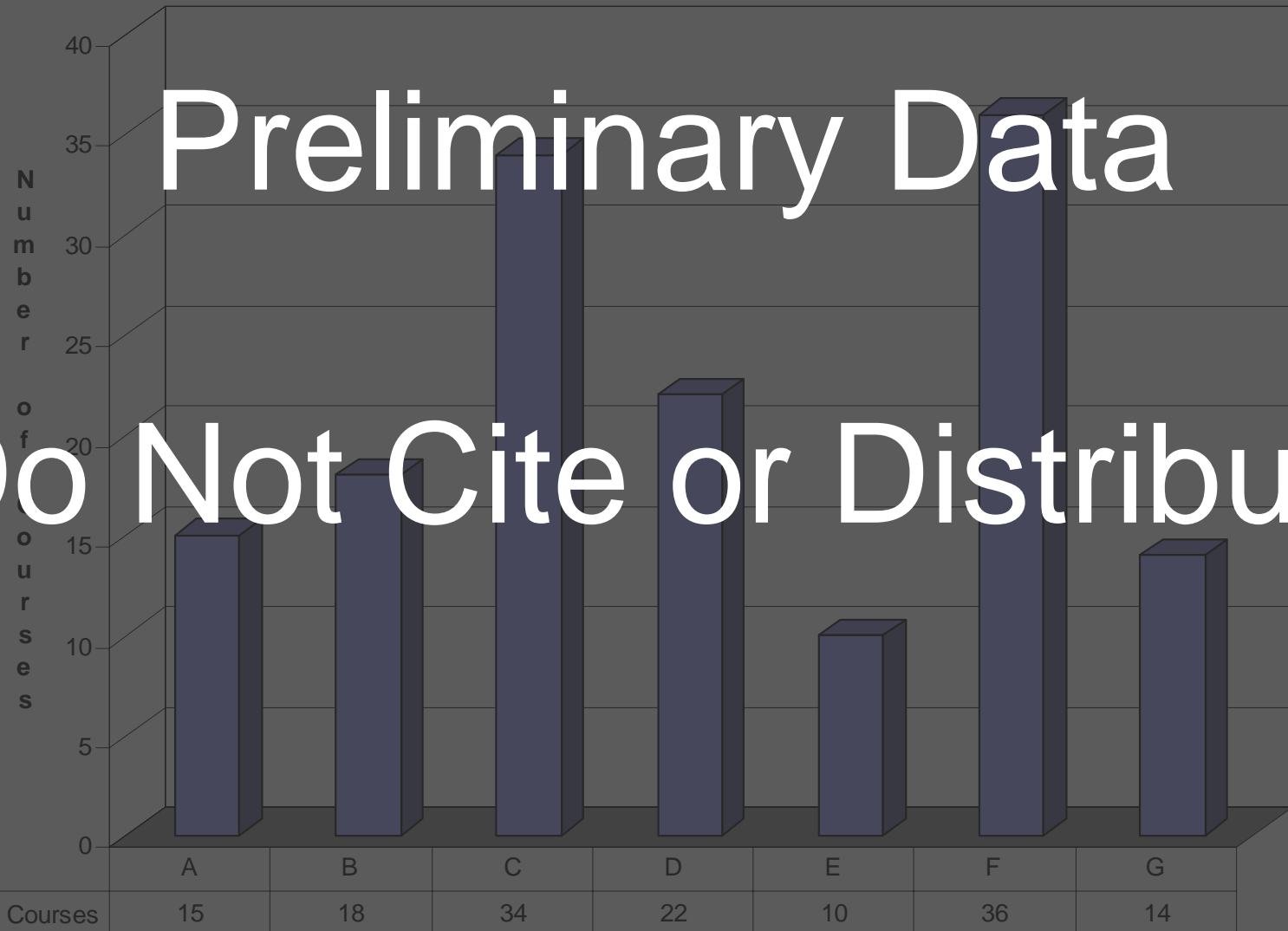
Average Percent Teaching Time in Nine Broad Science Areas at Each Grade for District 1



Average Percent Teaching Time in Nine Broad Science Areas at Each Grade for District 2



Number of Science Courses Offered in 7 Districts



Preliminary Data

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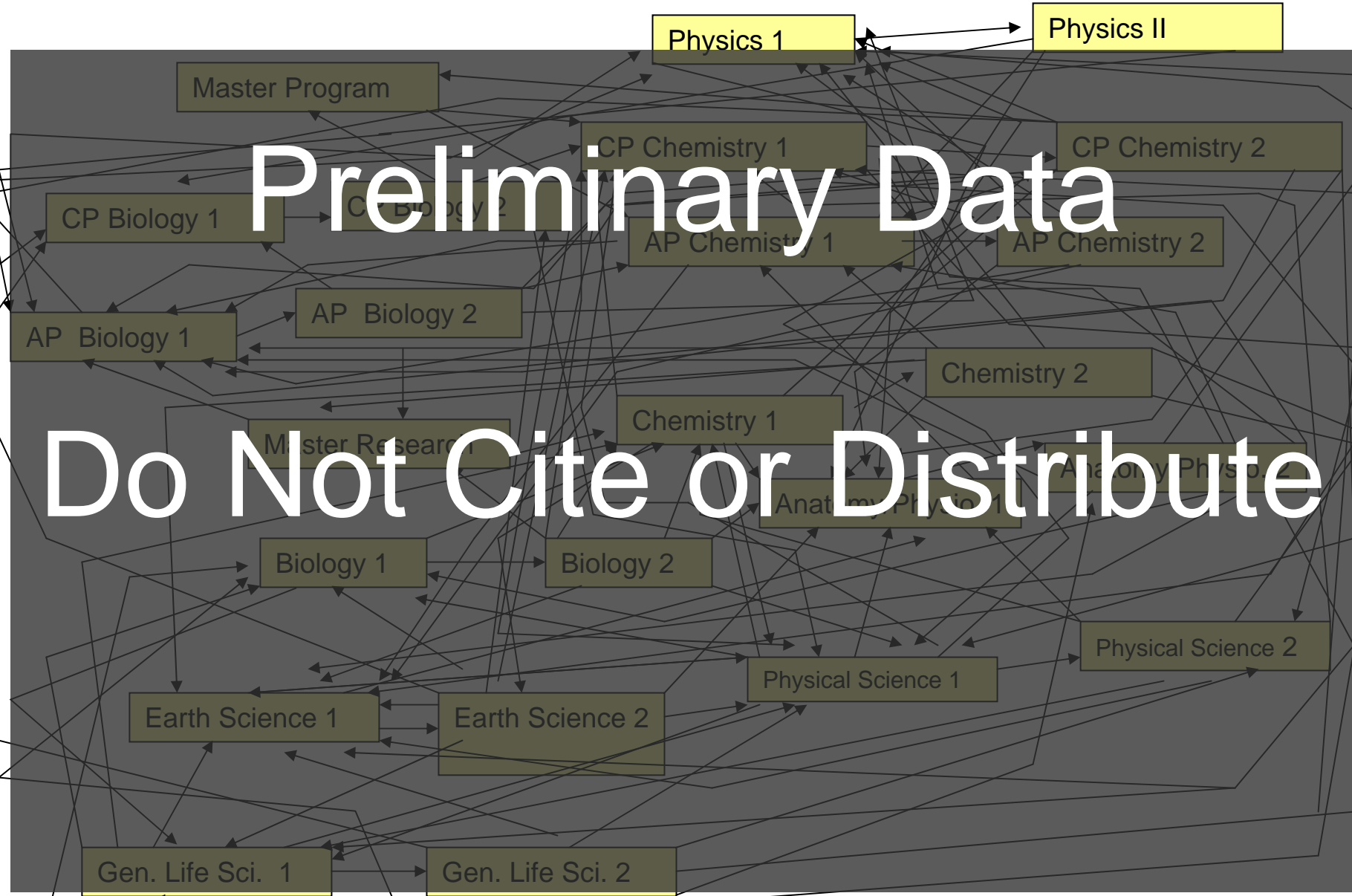
Number of Course Patterns for Meeting High School Science Requirement in 7 Districts

Preliminary Data

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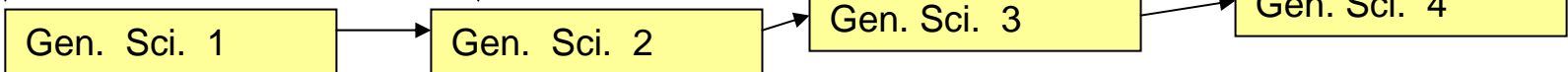


Diagram of Science Course-Taking Sequences in District F



Preliminary Data

Do Not Cite or Distribute



Some Preliminary Findings

Teacher Subject Matter Readiness

Middle School Science Teacher Preparedness - Self Reported

Preliminary Data

Do Not Cite or Distribute

	% of Science Teachers with Degree Type	% of Science Teachers Prepared to Teach All Topics in Their Area
Earth Science Major	10.9	73.9
Earth Science Minor	.	.
Others	59.4	26.5
Biology Major	17.1	60.7
Biology Minor	2.5	30.8
Others	59.4	15.2
Physical Science Major	3.7	21.1
Physical Science Minor	0.8	75.0
Others	59.4	9.7
Environmental Science major	0.2	100.0
Environmental Science minor	0.2	0.0
Others	59.4	15.9
General Science Major	7.7	5.0
General Science Minor	5.6	6.9
Others	59.4	6.5

High School Science Teacher Preparedness - Self Reported

Preliminary Data
Do Not Cite or Distribute

	% of Science Teachers with Degree Type	% of Science Teachers Prepared to Teach All Topics
Earth Science Major	4.9	38.0
Earth Science Minor	9.0	35.6
Others	20.0	39.4
Biology Major	40.1	72.3
Biology Minor	2.4	72.7
Others	20.0	37.2
Physical Science Major	17.5	52.4
Physical Science Minor	2.8	30.8
Others	20.0	17.0
Environmental Science major	0.9	25.0
Environmental Science minor	0.2	0.0
Others	20.0	33.0
General Science Major	9.4	15.9
General Science Minor	1.3	0.0
Others	20.0	11.7

Some Preliminary Findings

The Achievement of PROM/SE Students: The Attained Curriculum

Grade 3	
Nation	Average
Korea	68
Japan	65
PROM/SE	61
Australia	59
Austria	59
USA	58
Netherlands	58
Czech Republic	58
England	57
Hong Kong	56
Slovenia	56
Canada	56
Singapore	56
Scotland	54
International Mean	54
New Zealand	54
Ireland	53
Hungary	53
Latvia	51
Norway	50
Iceland	49
Greece	48
Thailand	46
Portugal	46
Cyprus	44
Iran	35

Grade 4	
Nation	Average
Korea	74
Japan	73
PROM/SE	70
Czech Republic	68
Austria	68
Netherlands	67
Australia	67
USA	67
Singapore	66
Canada	65
Hong Kong	65
Slovenia	64
England	64
Hungary	64
Norway	62
New Zealand	62
International Mean	62
Scotland	61
Ireland	61
Iceland	60
Latvia	58
Israel	58
Greece	57
Cyprus	54
Thailand	53
Portugal	53
Iran	45
Kuwait	44

Grade 7	
Nation	Average
Korea	68
Japan	66
Singapore	65
Slovenia	64
Bulgaria	64
Czech Republic	63
Belgium (FI)	62
Hong Kong	61
Austria	60
Slovak Republic	60
England	60
USA	60
Netherlands	59
Australia	59
Canada	58
Germany	58
Thailand	58
Hungary	57
Sweden	57
PROM/SE	57
Russian Federation	56
Ireland	56
Spain	55
Switzerland	55
International Mean	55
Norway	54
France	54
New Zealand	54
Scotland	52
Belgium (Fr)	51
Iceland	51
Romania	50
Greece	50
Denmark	49
Portugal	48
Latvia	46
Cyprus	45
Iran	45
Lithuania	44
Philippines	42
Colombia	39
South Africa	31

Grade 8	
Nation	Average
Korea	72
Japan	72
Singapore	71
Czech Republic	69
Slovenia	69
Bulgaria	68
Austria	67
Slovak Republic	66
Hong Kong	65
Netherlands	65
Sweden	65
Belgium (FI)	64
Germany	64
Russian Federation	64
England	64
Australia	64
Hungary	63
USA	63
Thailand	63
Canada	62
France	62
Norway	62
Israel	61
Ireland	61
New Zealand	61
Spain	61
Switzerland	61
International Mean	60
PROM/SE	60
Scotland	59
Greece	57
Iceland	57
Belgium (Fr)	57
Portugal	56
Denmark	56
Lithuania	55
Romania	55
Latvia	55
Cyprus	53
Iran	49
Kuwait	49
Colombia	43
Philippines	43
South Africa	32

Significantly Higher than the U.S.
Not Significantly Different from U.S.
Significantly Lower than the U.S.

Average Percent Correct on 1995 TIMSS Science Items

Average Percent Correct on TIMSS 1995 End-of-Secondary Science Literacy Test

Nation	Average
Sweden	73
Iceland	71
Norway	70
Netherlands	69
Canada	69
Denmark	68
Slovenia	67
New Zealand	67
Austria	67
Switzerland	67
Australia	67
France	66
USA - Grade 12	65
Germany	65
International Mean	64
Russian Federation	64
Italy	63
Lithuania	63
Czech Republic	62
Hungary	58
PROM/SE - Grade 9	57
Israel	56
Cyprus	54
South Africa	39

Nation	Average
Sweden	73
Iceland	71
Norway	70
Netherlands	69
Canada	69
Denmark	68
Slovenia	67
New Zealand	67
Austria	67
Switzerland	67
Australia	67
France	66
USA - Grade 12	65
Germany	65
International Mean	64
Russian Federation	64
Italy	63
Lithuania	63
Czech Republic	62
PROM/SE - Grade 10	58
Hungary	58
Israel	56
Cyprus	54
South Africa	39

Nation	Average
Sweden	73
Iceland	71
Norway	70
Netherlands	69
Canada	69
Denmark	68
Slovenia	67
New Zealand	67
Austria	67
Switzerland	67
Australia	67
France	66
USA - Grade 12	65
Germany	65
International Mean	64
Russian Federation	64
Italy	63
Lithuania	63
Czech Republic	62
PROM/SE - Grade 11	59
Hungary	58
Israel	56
Cyprus	54
South Africa	39

Nation	Average
Sweden	73
Iceland	71
Norway	70
Netherlands	69
Canada	69
Denmark	68
Slovenia	67
New Zealand	67
Austria	67
Switzerland	67
Australia	67
France	66
USA - Grade 12	65
Germany	65
International Mean	64
Russian Federation	64
Italy	63
Lithuania	63
Czech Republic	62
PROM/SE - Grade 12	60
Hungary	58
Israel	56
Cyprus	54
South Africa	39

Significantly Higher than the U.S.
Not Significantly Different from U.S.
Significantly Lower than the U.S.

Significantly Higher than the U.S.
Not Significantly Different from U.S.
Significantly Lower than the U.S.

Significantly Higher than the U.S.
Not Significantly Different from U.S.
Significantly Lower than the U.S.

Significantly Higher than the U.S.
Not Significantly Different from U.S.
Significantly Lower than the U.S.

PROM/SE Grade 5 Student Assessment

PROM/SE Grade 5 Category Label	% of Students in each category				
	Fail	C	B	A	A+
Earth Features	47	11	13	11	16
Earth Processes	29	12	15	16	29
Earth & the Universe	24	15	17	11	20
Classifying Plants and Animals	9	7	11	17	56
Life Processes & Systems	27	13	14	17	29
Life Cycles & Genetics	13	10	15	22	41
Human Biology	25	11	14	15	35
Interactions of Living Things	30	15	17	17	20
Environmental & Resource Issues	37	12	13	13	26
Matter	29	11	14	16	30
Energy	39	14	13	13	20
Physical Processes	25	12	15	17	30
Physical & Chemical Changes	40	19	17	13	11
Forces & Motion	44	14	14	12	17
Science Processes	51	15	14	10	10

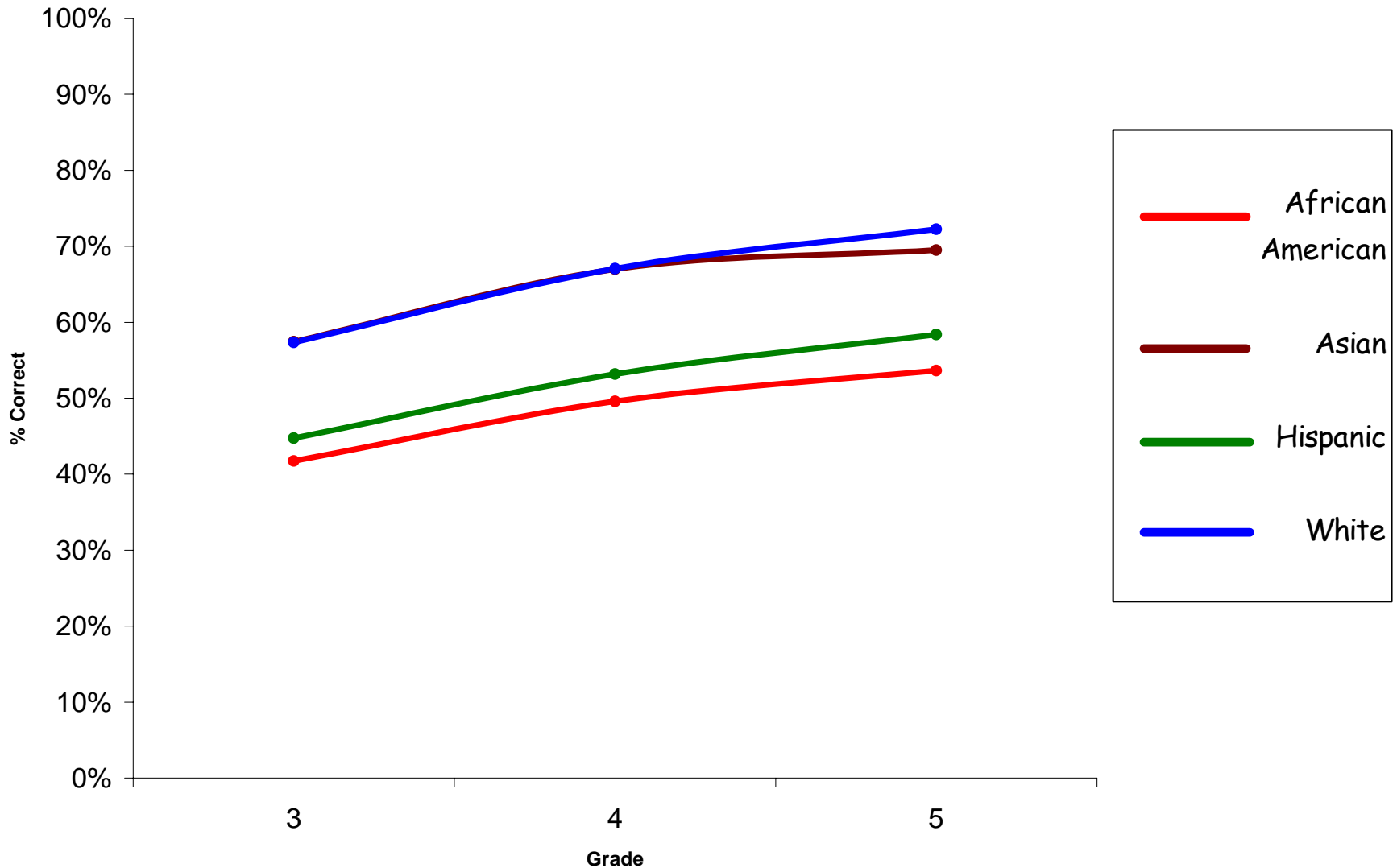
Preliminary Data
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PROM/SE Grade 8 Student Assessment

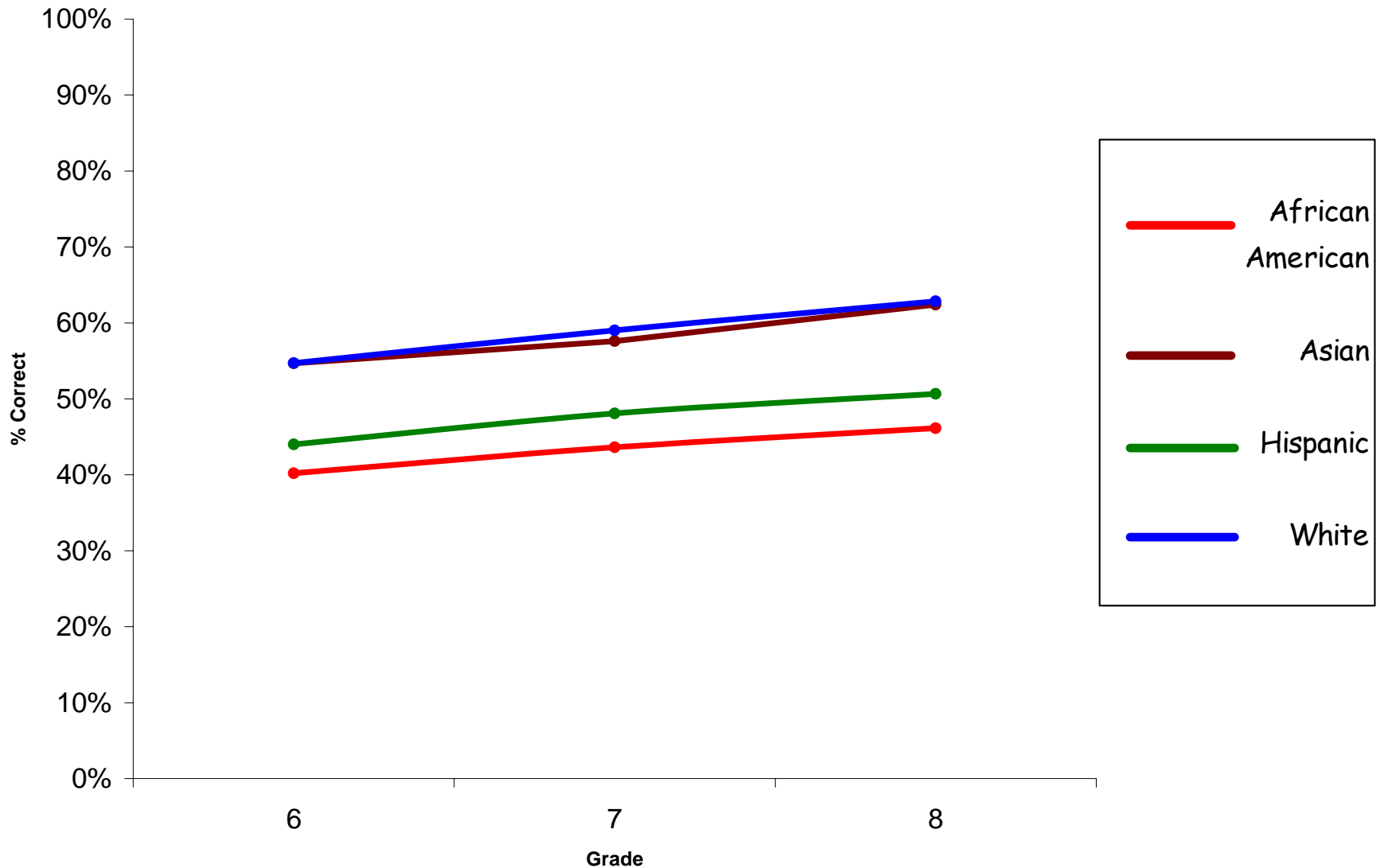
PROM/SE Grade 8 Category Label	% of Students in each category				
	Fail	C	B	A	A+
Earth Features	60	19	11	10	9
Earth Processes	32	14	16	16	22
Earth & the Universe	49	18	15	10	7
Classifying Plants and Animals	24	15	17	13	20
Life Processes & Systems	44	19	17	12	8
Life Cycles & Genetics	34	18	16	19	12
Human Biology	18	11	19	22	30
Interactions of Living Things	37	18	18	13	15
Environmental & Resource Issues	69	7	7	6	10
Matter	47	16	16	11	10
Energy	47	13	13	13	14
Physical Processes	33	18	19	15	16
Physical & Chemical Changes	38	18	21	11	12
Forces & Motion	36	15	16	15	19
Science Processes	44	18	17	12	9

**Preliminary Data
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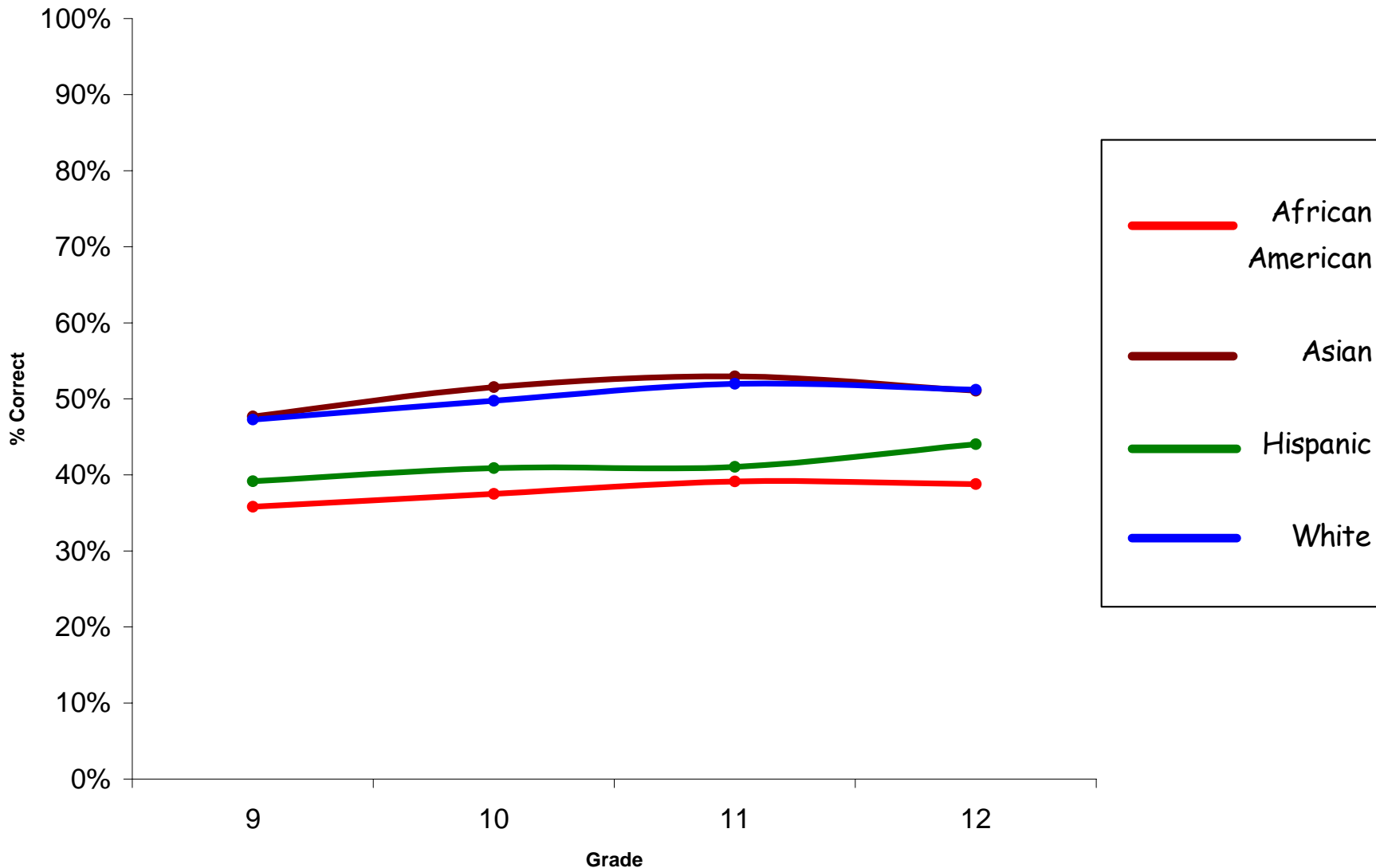
PROM/SE Elementary Science Total Score for Subgroups



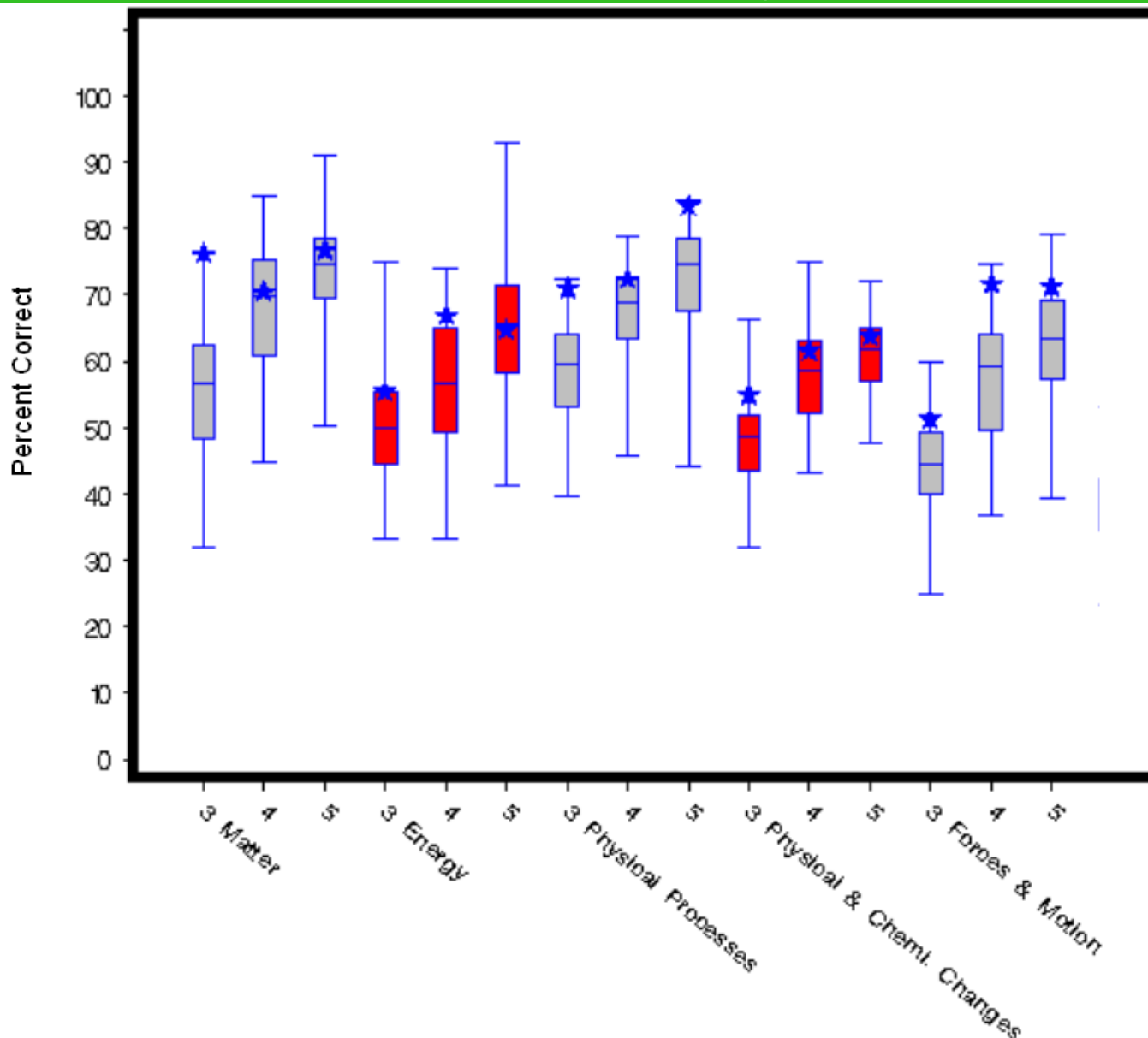
PROM\SE Middle School Science Total Score for Subgroups



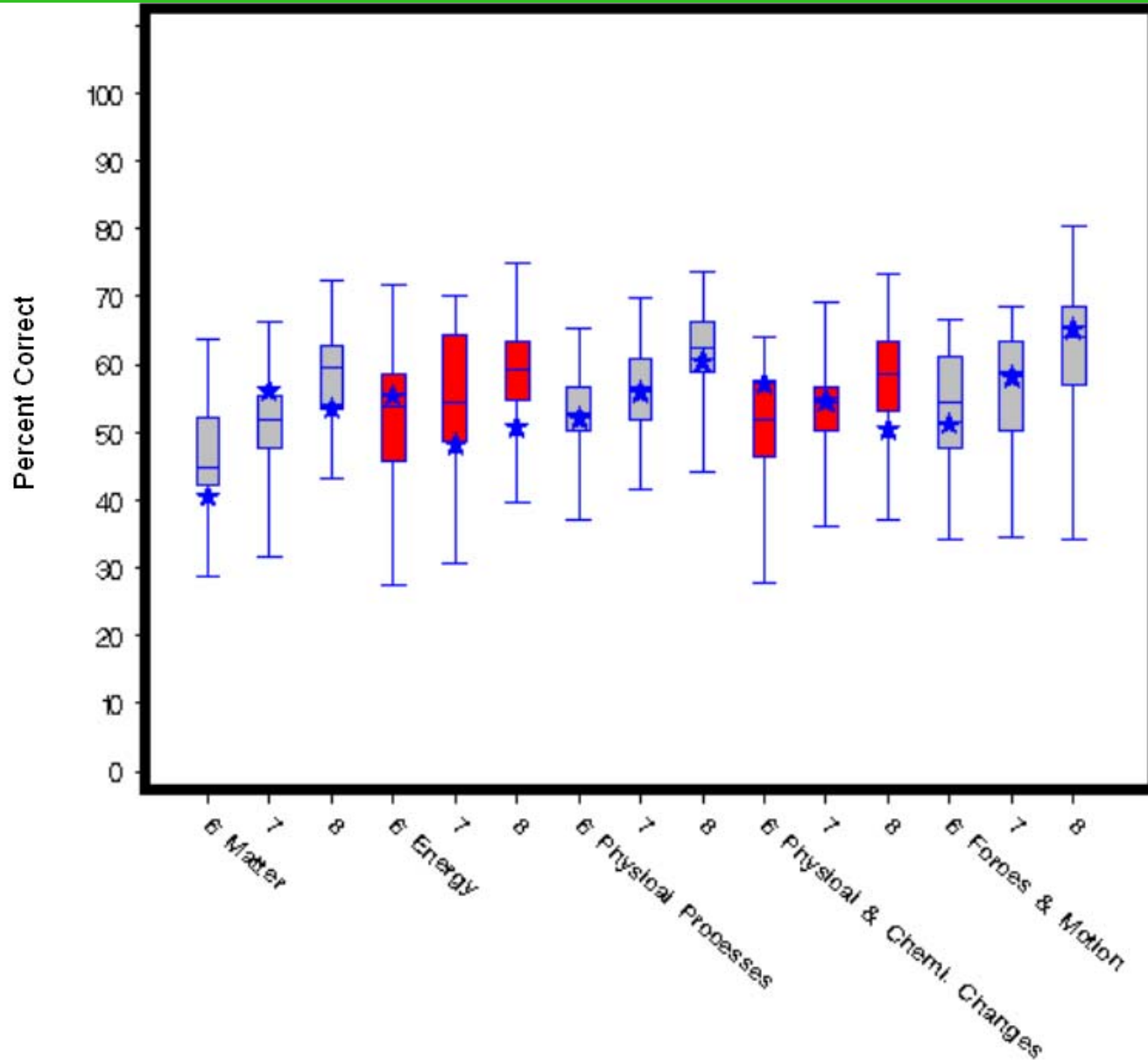
PROM/SE High School Science Total Score for Subgroups



Boxplots of Average Percent Correct on Physical Science Strands for All PROM/SE Elementary Schools at Each Grade



Boxplots of Average Percent Correct on Physical Science Strands for All PROM/SE Middle Schools at Each Grade



Average Percent Correct on PROM/SE Science Items
by Type of High School Science Courses

Preliminary Data
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