

PISA GOLD

A Wealth of Potential Evidence

Advocating Policy for

Gifted & Talented Education

2019 - WCGTC - 23rd Biennial World Conference
July 24-28, 2019 - Nashville, Tennessee, USA

Kathleen Stone, Ph.D
INSTEAD International, LLC
www.insteadinternational.com
kstonegift@aol.com



PISA Program for International Student Assessment

WEBSITE:

www.oecd.org/publications/pisa-2015-results-volume-i

2000 **2009** **READING** **2018**
2003 **2012** **MATH**
2006

2015 SCIENCE

2015 PISA TEST SAMPLE

72 **Countries/Economies**

35 OECD Countries

37 Partner & Economies

**OECD - Organization for Economic
Cooperation & Development**

- ✓ **Functional Skills**
- ✓ **AGE 15**
- ✓ **End of Mandatory Schooling**
- ✓ **2015 – COMPUTER BASED**
- ✓ **APPLICATION of PROBLEM-SOLVING**
- ✓ **RECENT ADDITION:**
FINANCIAL LITERACY
- ✓ **Scores: COMBINED & SUB-SCALES**
- ✓ **90th / 95th PERCENTILE Scores**
- ✓ **PROFICIENCY LEVELS 1 – 6**
- ✓ **GENDER Differences**
- ✓ **PISA “Effect”**
- ✓ **Indirect but Influential TOOL of Education POLICY**

14 KARAT **GOLD** NUGGETS

1	TOP PERFORMERS in SCIENCE, MATH, READING	8	EARLY CHILDHOOD (ECE)
2	EXCELLENCE GAP Between TOP PERFORMERS and LOW ACHIEVERS	9	OPPORTUNITY TO LEARN (OTL)
3	GENDER Differences	10	GROUPING
4	CONTENT Sub-Scales	11	IMMIGRANT STUDENTS
5	COGNITIVE Sub-Scales	12	FINANCIAL LITERACY
6	International PROFICIENCY LEVELS as BENCHMARKS	13	PROBLEM-SOLVING
7	SOCIOECONOMIC Factors	14	CHANGE OVER TIME

What Sample Would You Select?

HOME COUNTRY: _____

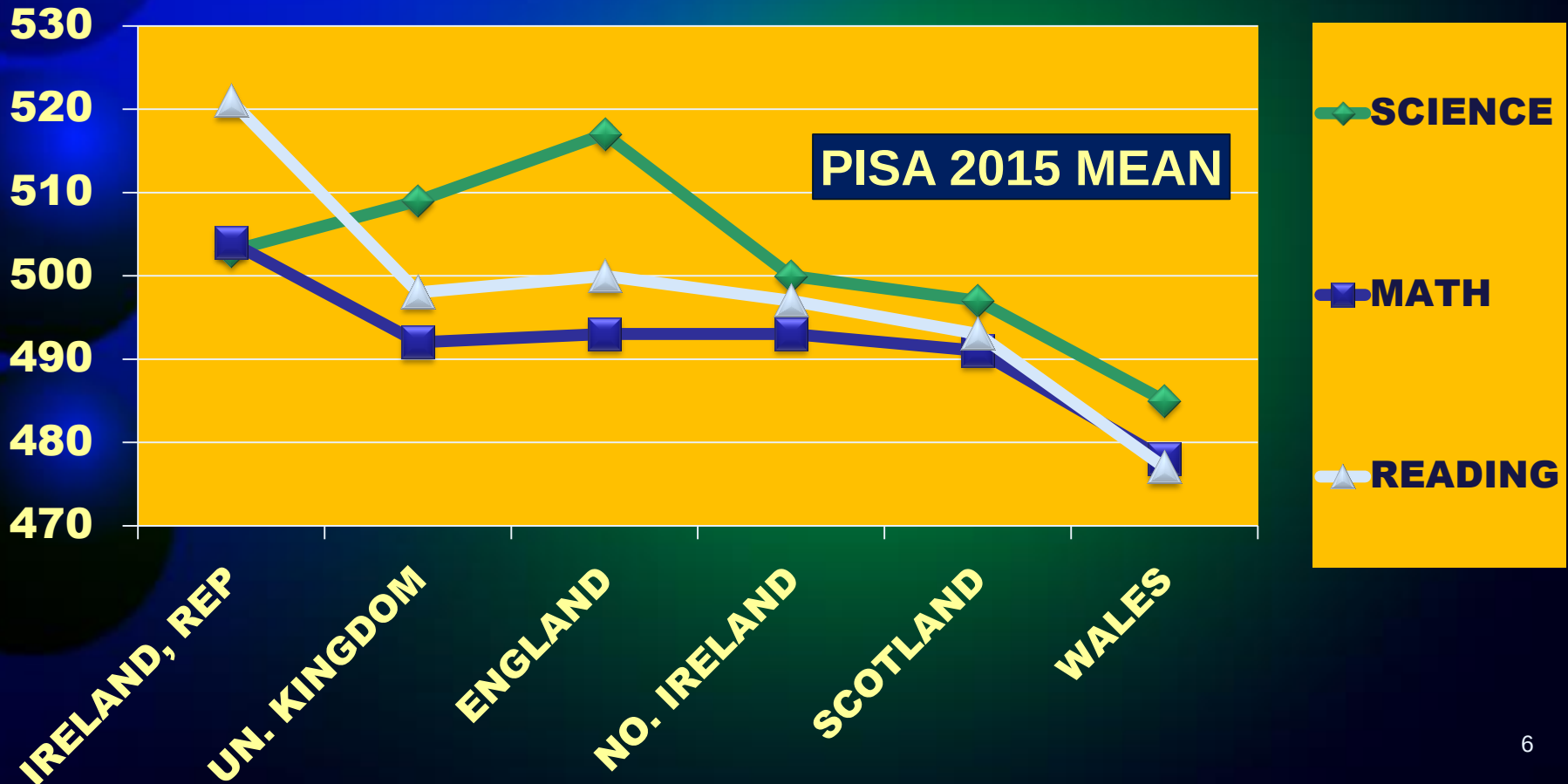
COUNTRY	RATIONALE
1.	
2.	
3.	
4.	
5.	
6.	
7.	

COUNTRY	RATIONALE
8.	
9.	
10.	
11.	
12.	
13.	
14.	

SAMPLE COMPARISON METHOD

MEAN SCORES	TOTAL SCIENCE	TOTAL MATH	TOTAL READING
IRELAND, Rep.	503	504	521
UNITED KINGDOM	509	492	498
England	517	493	500
Northern Ireland	500	493	497
Scotland	497	491	493
Wales	485	478	477

1. EXCEL SPREADSHEET – ENTER DATA
2. HIGHLIGHT EXCEL DATA CHART
3. SELECT INSERT – CHART – LINE GRAPH
4. GRAPH APPEARS – Can move, Copy, Paste
5. USE LAYOUT Choices, DESIGN Choices
6. ADD TITLES, HEADING, COLOR



PISA “GOLD”

PISA 2015

- Research **Gold Mine**
- International Data
- Waiting to Mine in Depth
- Valuable Potential
- Mining Process
- Digging Through
- Huge Amount of Sediment Shake and Sift
- **Nuggets of gold**
- Valuable Research Data

- **Metaphor**
- **Data Mining** process
- **14 Karat Focus**
- Evidence From PISA
- **Gold Mine.**



- **PISA**
- **Advocacy**
- **Policy initiatives**
- **Advanced Achievement**
- **Gifted & Talented Education.**

PISA 2015 GOLD

- ❖ Evidence - **Advocate** for Gifted Education **policy**.
- ❖ U.N. Sustainable Development Goal 4 - Nations achieve **equitable quality** education.
- ❖
- ❖ PISA total **League Table Rankings** less valuable than **secondary analyses**.
- ❖ PISA sub-scores identify “**Top Performers**” highest **Proficiency Levels 5/6** in Science, Math & Reading.
- ❖ PISA’s **sub-group** analyses in **Gender** differences also support goals to reduce barriers to achievement for GIRLS as “**Top Performers**” especially in **STEM**.₈

SAMPLING DECISIONS

- ❑ Plan a comparison of countries.
- ❑ Relate to interests of your country.
- ❑ Which countries would you compare? (Maximum 15)
 - G6 Japan, U.S., Canada, U.K., France, Germany, Italy
 - PIIGS Portugal, Ireland, Italy, Greece, Spain
 - Geographical Area – Continent - Region
 - Neighbors
 - Top Performers
 - High – Mid – Low
 - Personal Interest (e.g. U.S.A. for Gifted)
 - OTHER

The EUROPE Book c. 2010 (Lonely Planet)

BRITISH ISLES	WESTERN MEDITERRANEAN	CENTRAL EUROPE	SCANDINAVIA & BALTIC	E. MEDITERRANEAN, BALKANS
UNITED KINGDOM (G7)	FRANCE (G7)	GERMANY (G7)	DENMARK	BOSNIA & HERCEGOVINA
ENGLAND	ITALY (G7)	SWITZERLAND	FINLAND	CROATIA
IRELAND	SPAIN	LIECHTENSTEIN	NORWAY	BULGARIA
SCOTLAND	MALTA	AUSTRIA	SWEDEN	MONTENEGRO
WALES	PORTUGAL	HUNGARY	ICELAND	ALBANIA
IRELAND, REP	MONACO N/A	CZECH REP.	GREENLAND N/A	MACEDONIA
LOW COUNTRIES	VATICAN CITY N/A	SLOVAKIA	ESTONIA	GREECE
NETHERLANDS	SAN MARINO N/A	POLAND	LATVIA	TURKEY
BELGIUM	ANDORRA N/A	SLOVENIA	LITHUANIA	CYPRUS
LUXEMBOURG				SERBIA N/A
BLACK SEA	ROMANIA	RUSSIA	UKRAINE N/A	ARMENIA N/A
& CAUCASUS	MOLDOVA	GEORGIA	BELARUS N/A	AZERBAIJAN N/A

REGIONAL Sub-Groups 9 Countries

BELGIUM (3)	U. K. (4)	SPAIN (17)	Castile La Mancha
Flemish	England	Andalusia	Catalonia
French	N. Ireland	Aragon	Comunidad Valenciana
German	Scotland	Asturias	Extramadura
ITALY (4)	Wales	Balearic Islands	Galicia
Bolzano	CANADA (10)	Basque Country	La Rioja
Compania	U.S. (3)	Canary Islands	Madrid
Lombardia	Mass.	Cantabria	Murcia
Trento	N. Carolina	Castile & Leon	Navarre
U.A.R. (7)	Puerto Rico	PORTUGAL (1)	COLOMBIA (4)

PISA 2015

Major FOCUS **SCIENCE**

Minor Areas

- **READING**
- **MATH**
- **Collaborative PROBLEM SOLVING**
- **FINANCIAL LITERACY (Optional)**

540,000 Students

Representing 29,000,000
15-Year-Olds

COMPUTER-BASED

57/72 COMPUTER

15/72 PENCIL-PAPER

- **2 Hours Per Student**
- **4 - 30 Minute Clusters**
- **6 Clusters Each – Science, Reading, Math**
- **Science – Addl. 6 Clusters**

RELEVANT SUB-GROUPS

- **Boys and Girls**
- **Different Social & Economic Backgrounds**
- **Trends – Since 2000**

IMPORTANT **SUB-GROUP** ANALYSES

- ❑ **Mean/Rank** Math/Science/Reading
- ❑ **“TOP Performer”** Proficiency Levels 5/6
- ❑ **90th and 95th** Percentiles
- ❑ **Gender** Differences
- ❑ **Science** sub-scales for
Content, Procedural Knowledge,
and Science **Competencies**
- ❑ **SES**/Demographic data.

PISA 2015

QUESTIONNAIRES

QUESTIONNAIRES

- **Students (35 Min.)**
- **Principals (45 Min.)**

STUDENT BACKGROUND

- **Family Backgrounds**
- **Economic, Social Capital**

STUDENTS' LIVES

- **Attitude Towards Learning**
- **Habit/Life in/out of School**
- **Family Environment**

SCHOOLS

- **Human/Material Resources**
- **Public/Private Mgmt., Funding**
- **Decision-Making**
- **Staffing**
- **Extracurricular Activities**
- **Context of Instruction**
- **Types, Class Size**
- **Classroom/School Climate**
- **Science Activities**
- **Aspects of Learning: Interest, Motivation, Engagement**

OPTIONAL QUESTIONNAIRES

- **Computer Familiarity**
- **Educational Career**
- **Parent Perceptions**
- **Teacher – Science Curriculum**

LIMITATIONS in Causality

U. S. National Academy of Education Report (2018)

**“International
Education
Assessments –
Cautions,
Conundrums, and
Common Sense”**

- ❖ Design Issues
- ❖ Sampling
- ❖ Questionnaire Development
- ❖ Computer-based Assessment
- ❖ Analysis
- ❖ Interpretation and Reporting
- ❖ Policy Uses and Limitations

Research Cautions Using ILSA

(International Large-Scale Assessments)

David Rutkowski, Leslie Rutkowski (Indiana University)

Tailored Background Scales

- **SES Socio-Econ. Status**
- Learning Resources
- Economic Wellbeing
- **Threats to Validity: Age**
Language, Culture, Ability

South-North Perspectives

Floor Effects – Low-Performing

Cultural Clusters

PISA For Development

Girls – Collaborative Prob. Solving

Shanghai – School Inequality

Computer Gaps – School Locations

IEA International Association for
Evaluation of Educ. Achievement

- **TIMSS** Math & Science
- **PIRLS** Reading
- ICCS Civics & Citizenship
- SITES, ICILS Computer. Tech.
- **ECES** Early Education
- TEDS-M Teacher Education

Influence Task Design:

Target Knowledge

Content

Proficiency Level

Benchmark



PISA 2015 - VOLUME 1 of 5 Volumes

CHAP	TITLE
I	WHAT IS PISA?
2	<u>SCIENCE</u> PERFORMANCE AMONG 15-YEAR-OLDS
3	STUDENT'S ATTITUDES TOWARDS <u>SCIENCE</u> AND EXPECTATIONS OF SCIENCE-RELATED CAREERS
4	READING PERFORMANCE AMONG 15-YEAR-OLDS
5	MATHEMATICS PERFORMANCE AMONG 15-YEAR-OLDS
6	ATTITUDES TOWARDS <u>SCIENCE</u>
7	IMMIGRANT BACKGROUND, STUDENT PERFORMANCE AND STUDENTS' ATTITUDES TOWARDS <u>SCIENCE</u>
8	WHAT PISA 2015 RESULTS IMPLY FOR POLICY

PISA WORLD	MATH Rank	RDG Rank	SCI Rank
Singapore	1	1	1
Japan	5	8	2
Estonia	9	6	3
Ch. Taipei	4	23	4
Finland	12	4	5
Macao Ch	3	10	6
Canada	10	2	7
Viet Nam	21	30	8
Hong Kong	2	2	9
B-S-J-G Ch	6	27	10
Korea Rep	7	7	11
N. Zealand	21	10	12
Slovenia	14	14	12
Australia	23	15	14
Germany	16	10	15

PISA LEAGUE TABLES

List Based on
SCIENCE
RANK 1 - 15

League Table Rank
by **MEAN**
Less Relevance for
Gifted & Talented

%TOP PERFORMER	MATH Lv. 5-6	RDG Lv. 5-6	SCI Lv. 5-6
Singapore	34.8	18.4	24.2
Japan	20.3	10.8	15.3
Estonia	14.7	11.0	13.5
Ch. Taipei	28.1	6.9	15.4
Finland	11.7	13.7	14.3
Macao Ch	21.9	6.7	9.2
Canada	15.1	14.0	12.4
Viet Nam	9.3	2.7	8.3
Hong Kong	26.5	11.6	7.4
B-S-J-G Ch	25.5	10.9	13.6
Korea Rep	20.9	12.7	10.6
N. Zealand	11.4	13.6	12.8
Slovenia	13.5	8.9	10.6
Australia	11.3	11.0	11.2
Germany	12.9	11.7	10.6

1. PISA

TOP PERFORMERS

Rank 1-15 Science

**PROFICIENCY
LEVELS 5-6**

% PERCENT
More Relevant
for Gifted &
Talented

1. TOP PERFORMERS

Science, Math, Reading

TOP Performers

Proficiency Levels 5 and 6 – **Percent**

LOW Achievers - Below Level 2

PERCENTILE Scores (Highest 800)

90th and 95th Percentiles

Mean (Published LEAGUE TABLE)

10th Percentile

WORLD'S HIGHEST-SCORING STUDENTS

**“The World’s
Highest-Scoring
Students – How
Their National Led
Them to Excellence”**

**By Hani Morgan
Peter Lang Publishing, Inc.
New York c. 2018
Global Studies in Education
Volume 35**

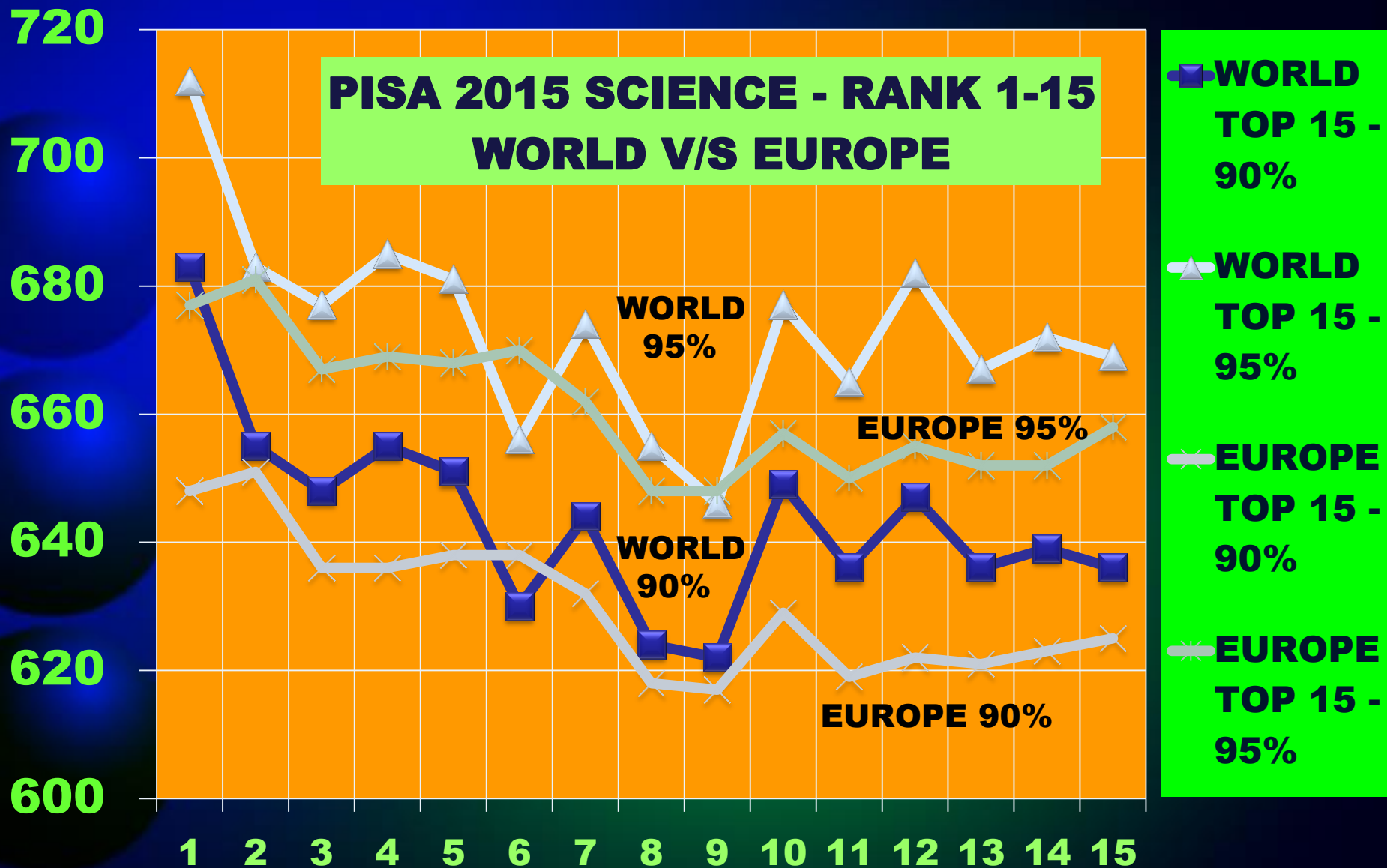
**Finland
Singapore
Japan
South Korea
China
Canada
Estonia**

**From Excellence to Mediocrity:
The Decline of the Education
System in the United States**

WORLD HIGH 10	TOT SCI RANK	PISA SCIENCE WORLD	WORLD TOP 15 - 90%	WORLD TOP 15 - 95%	EUROPE TOP 15 - 90%	EUROPE TOP 15 - 95%	EUROPE	TOT SCI RANK
World	1	Singapore	683	712	648	677	Estonia	3
World	2	Japan	655	683	651	681	Finland	5
World	3	Estonia	648	677	636	667	Slovenia	12
China	4	Ch Taipei	655	685	636	669	Germany	15 T
World	5	Finland	651	681	638	668	Netherland	15 T
China	6	Macao Ch	630	656	638	670	U.K.	15 T
World	7	Canada	644	674	632	662	Switzerland	18
	8	Viet Nam	624	655	618	648	Ireland	19
China	9	Hong Kong Ch	622	646	617	648	Denmark	20 T
World	10	B-S-J-G Ch	649	677	629	657	Belgium	20 T
World	11	Korea Rep.	636	665	619	650	Poland	22
	12	N. Zealand	647	682	622	655	Norway	24
	12	Slovenia	636	667	621	652	Austria	26 T
	14	Australia	639	672	623	652	France	26 T
	15	Germany	636	669	625	658	Sweden	28

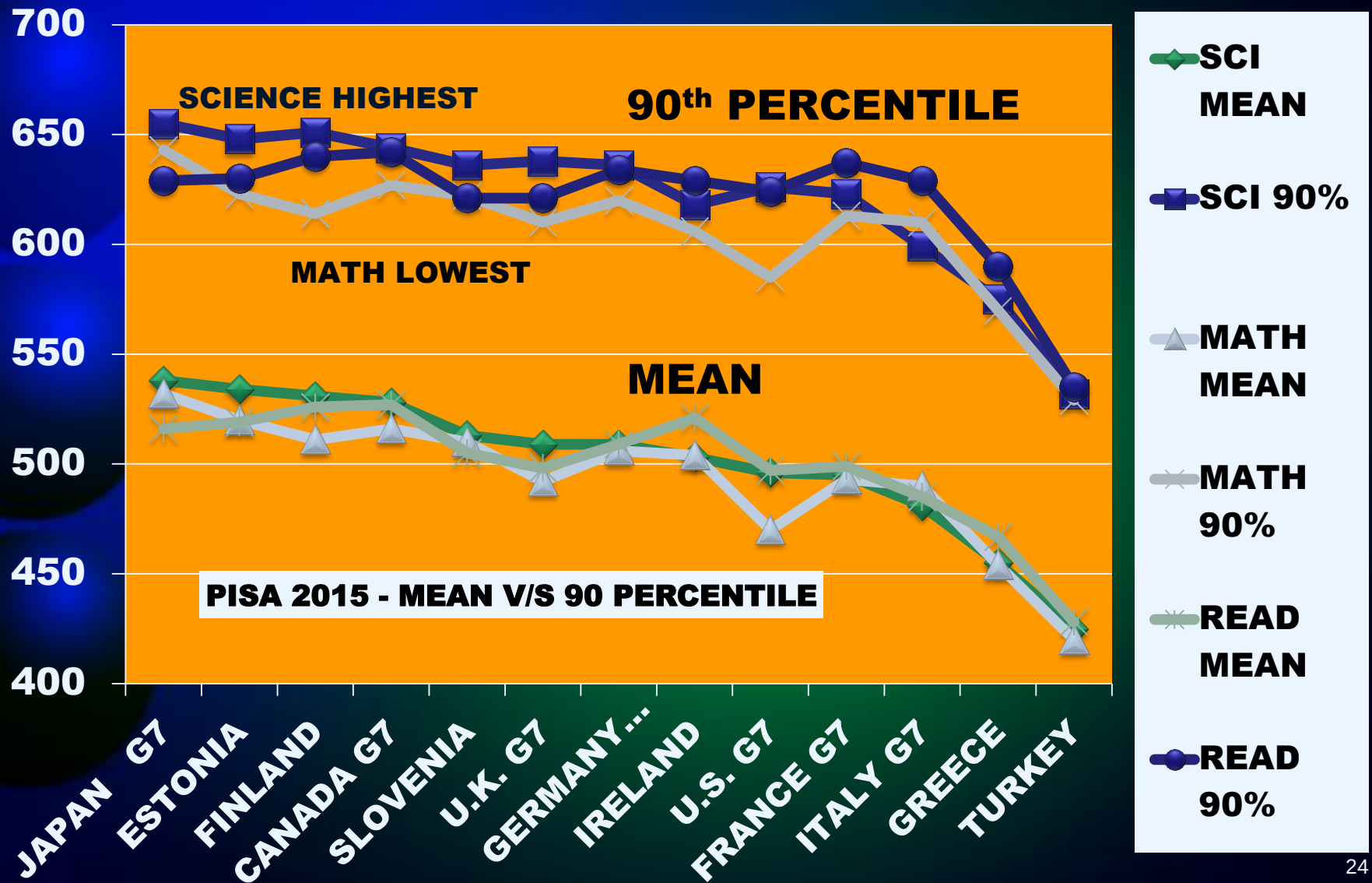
**PISA 2015 – SCIENCE –World / Europe
RANK 1-15 – 90th and 95th PERCENTILES**

NOTE: 30 Score Points equates to about one year of Schooling.



PISA 2015 – SCIENCE – Rank 1-15 – World v/s Europe

PISA 2015 MEAN V/S 90TH PERCENTILE



2. EXCELLENCE GAPS

Between **TOP** Performers – **LOW** Achievers

“EXCELLENCE GAPS IN EDUCATION –

Expanding
Opportunities
For Talented
Students”

By **Jonathan A. Plucker**
Scott J. Peters

c. 2016

Harvard Education Press

- ❑ American Infatuation With Narrowing Achievement GAPS
- ❑ GAPS in student sub-groups exist before formal K-12 Education
- ❑ Socioeconomic Status GAPS
- ❑ ESCS Economic, Social, and Cultural Status - PISA
- ❑ State-Level Excellence GAPS

PISA GAPS

- Top Performers – P/L 5-6
- Low Achievers – P/L 1-2

2. ACHIEVEMENT GAPS – U.S.

Poor, Ethnic, Racial Minority Groups

STATE-LEVEL GAPS

FEDERAL EDUCATION POLICY

- ✓ **ESEA Elementary & Secondary Education Act**
- ✓ **NCLB No Child Left Behind (2002)**
- ✓ **Race to the Top (2009)**
- ✓ **CCSS Common Core State Standards (2012)**
- ✓ **ESSA Every Student Succeeds Act (2015)**

Narrowing the Achievement Gap

Editors: Thomas B. Timar

Julie Maxwell-Jolly

Harvard Education Press (c. 2012)

ECONOMIC ADVANTAGE

- ❖ **Caucasian**
- ❖ **Asian American**

LOW INCOME

- **Afro-American**
- **Latino**
- **Native American**

The Flat World and Education – How America's Commitment to Equity Will Determine Our Future

By: Linda Darling-Hammond

Teacher's College (C. 2010)

2. Addressing the EXCELLENCE GAP (Plucker 2016)

ALTERNATIVE IDENTIFICATION

1. Different Tests
2. Nonverbal Testing
3. Structured Observation Protocols
4. Universal Screening
5. Local Norm Comparisons
6. Group-Specific Comparisons
7. Losing the Arbitrary Classifications
(Observing Need Through Data)

RECENT INITIATIVES

1. Growth-Focused Accountability and Educator Evaluation
2. Out-Of-Level Testing
3. Javits Gifted & Talented Students Education Program
4. Response to Intervention (RTI)
5. **Wider Interest in Advanced Education**

Sample GLOBAL Selection - GAPS **NAGC Publication**

Parenting For High Potential

NAGC Publication

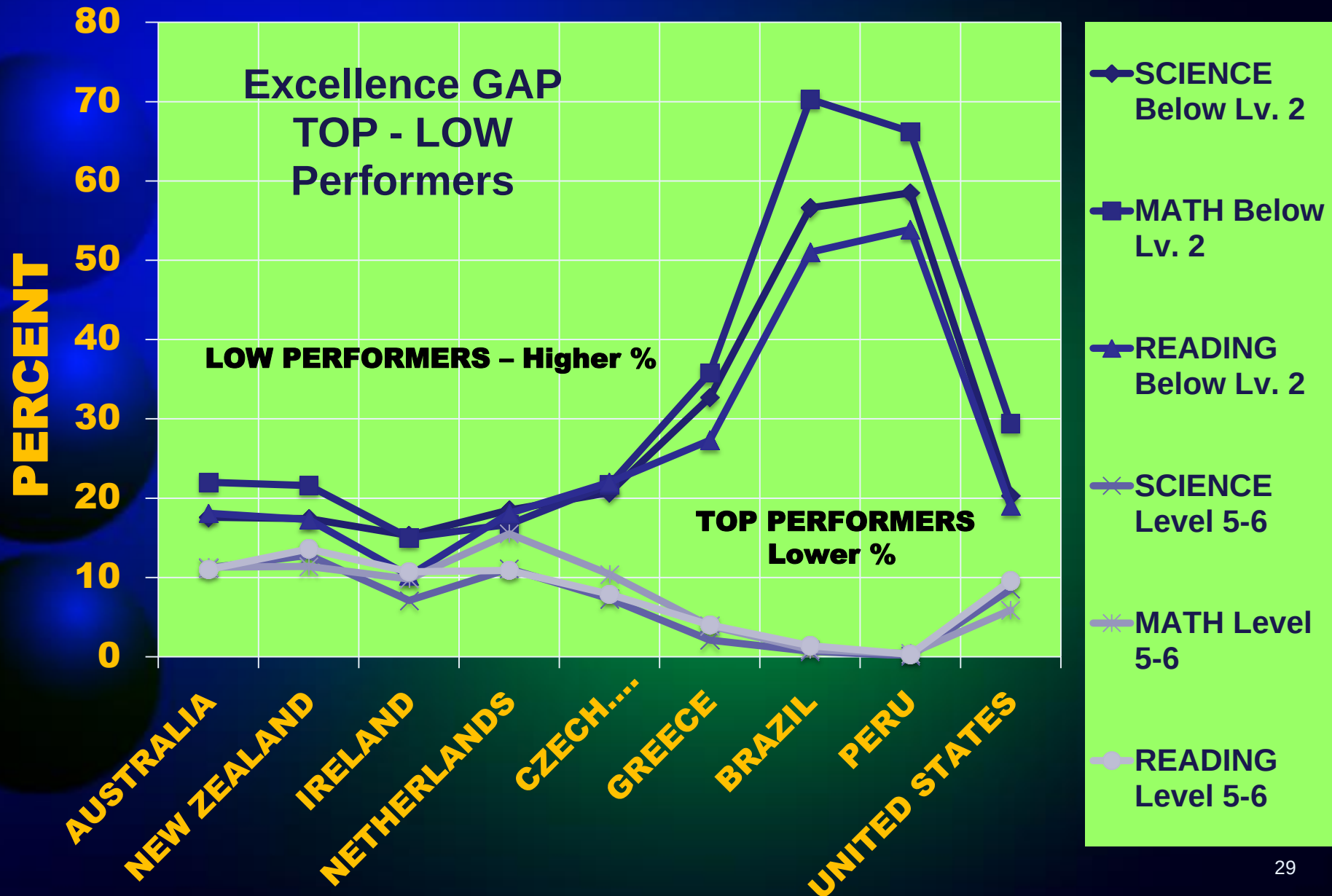
December 2018

Special Issues:
Inside – A Global
Look at Giftedness

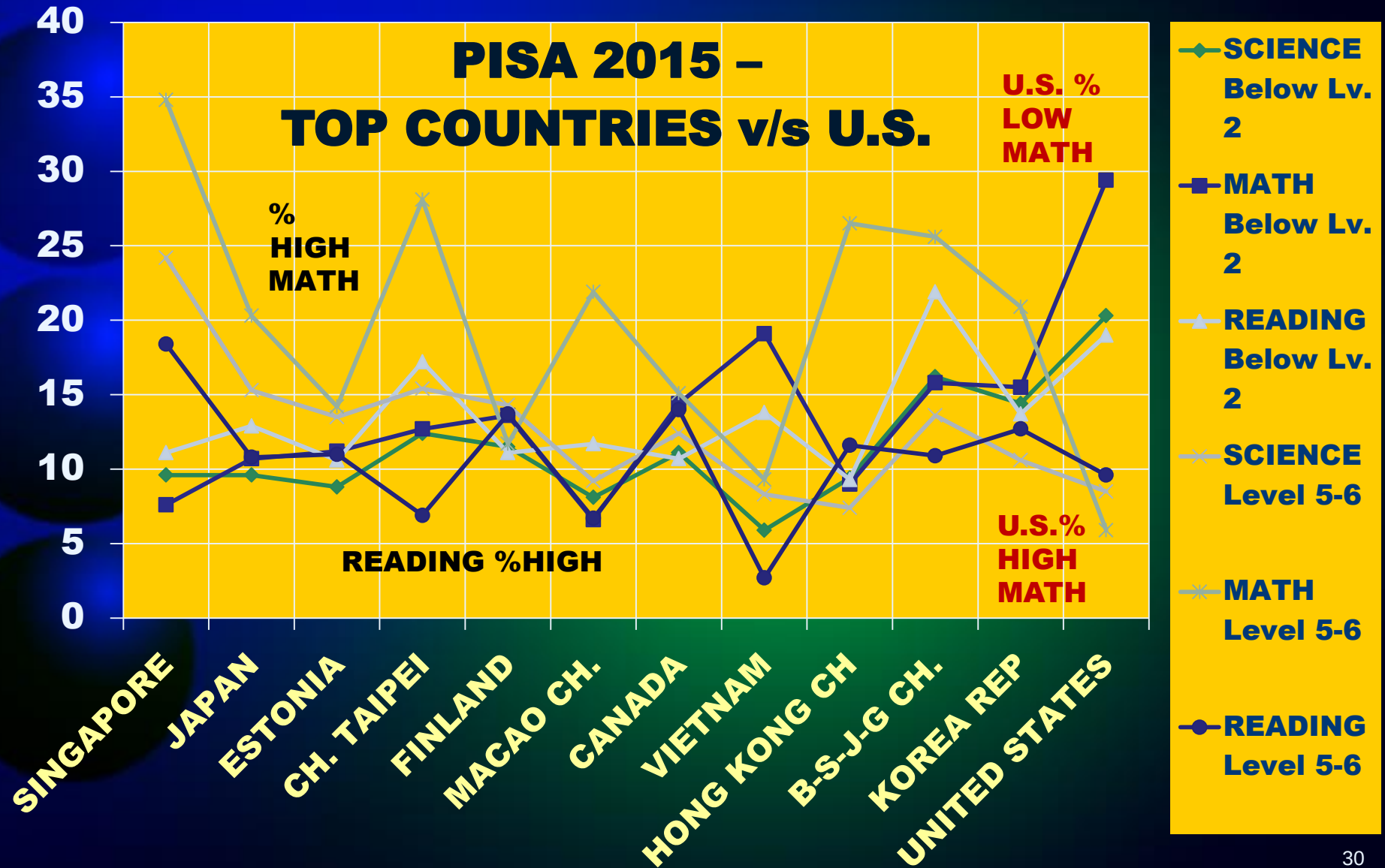
M. Rene Islas
Executive Director

- **Australia**
- **New Zealand**
- **Brazil**
- **Netherlands**
- **Greece**
- **Peru**
- **Czech Republic**
- **Ireland**
- **Kenya** (No PISA)
- **India** (No PISA)

NAGC Sample Excellence GAP



Excellence GAP – Top Performers



3. GENDER Less GIRLS Choose Careers in Science and Engineering

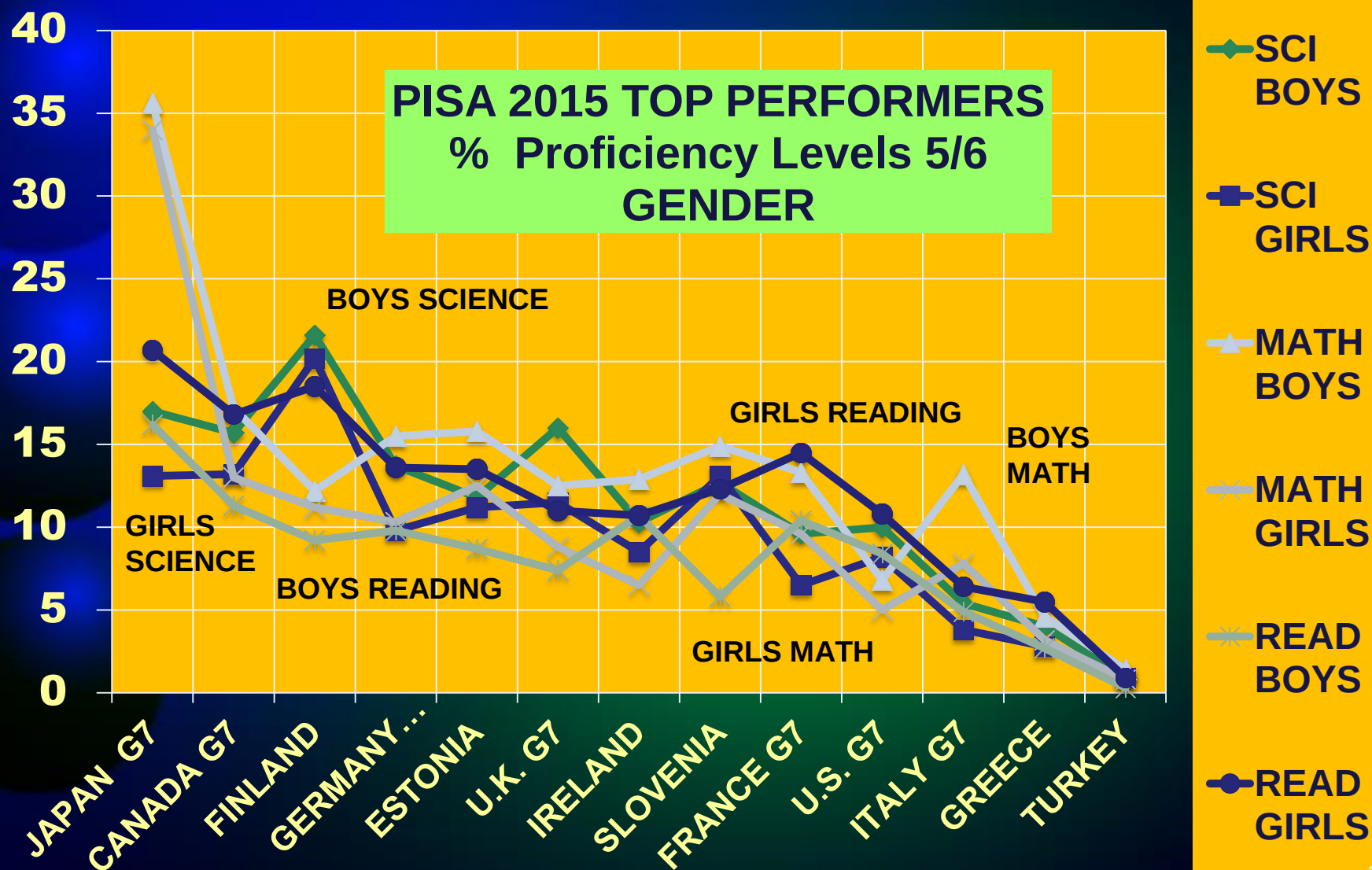
Feb. 26, 2019

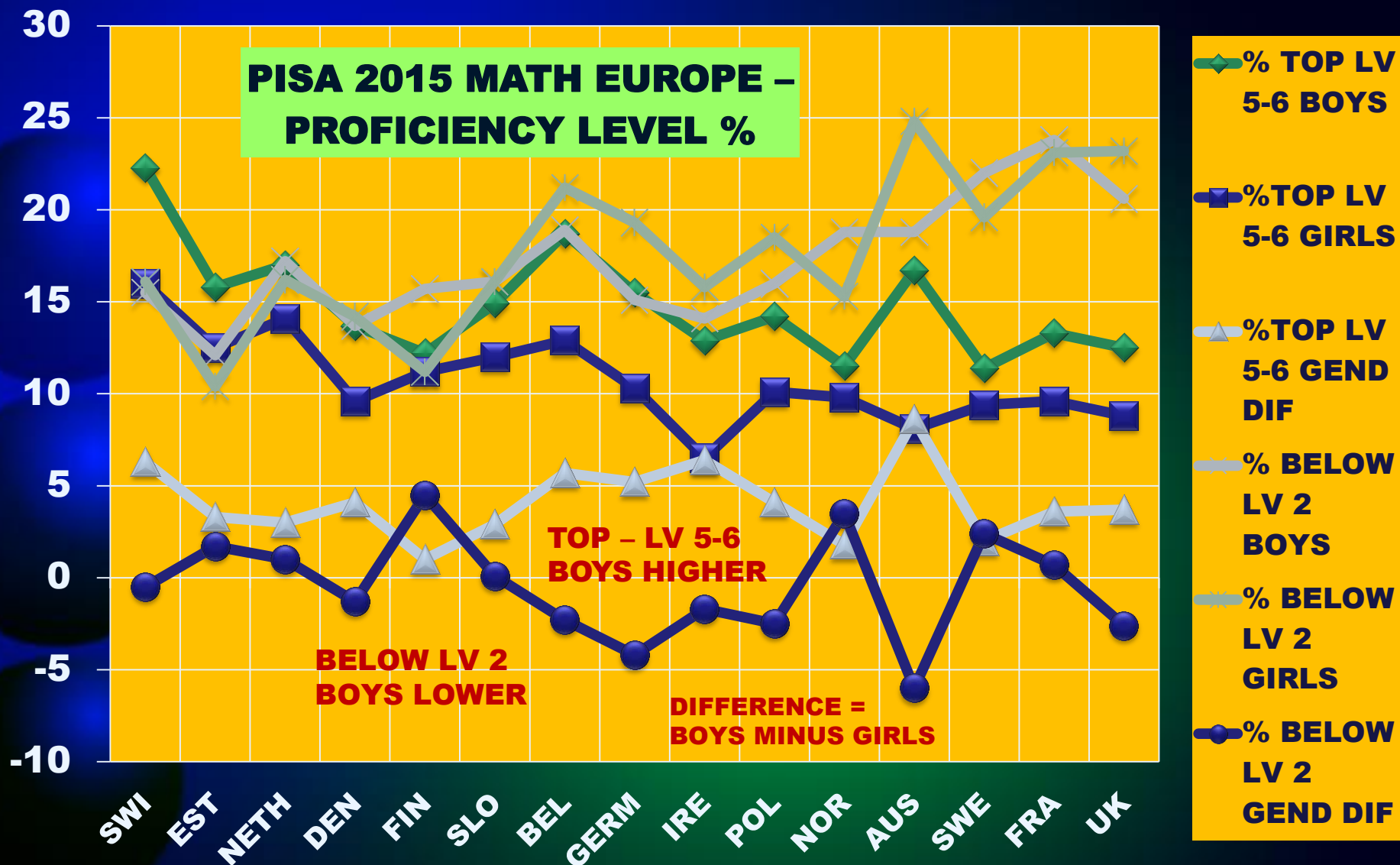
- Women under-represented in most tech companies & Labs.
- More women complete tertiary education across high-income countries.
- **25% of ICT Graduates**
- **24% Engineering Graduates**
- ✓ **GIRLS** outperformed Boys Science **19 of 67** countries
- ✓ **BOYS** outperformed Girls Science **22 of 67** countries
- ✓ Remaining 26 countries not statistically significant

NEW RESEARCH:

- Girls' **confidence** in Science
- Relative Strength **other Subjects.**
- **Interest in Science** accounts for deficit in Women's STEM,
- High-Performing Girls **avoid STEM** . Non-science higher
- ✓ **BOYS** higher Science/Math
- ✓ **GIRLS** higher in **Reading**
- ✓ **BOYS** more likely to choose careers **STEM.**
- ✓ **BOYS** Self-efficacy in Science higher in **39/67**
- ✓ **BOYS** stronger interest in Science **51/67**

PISA 2015 - TOP PERFORMERS - GENDER



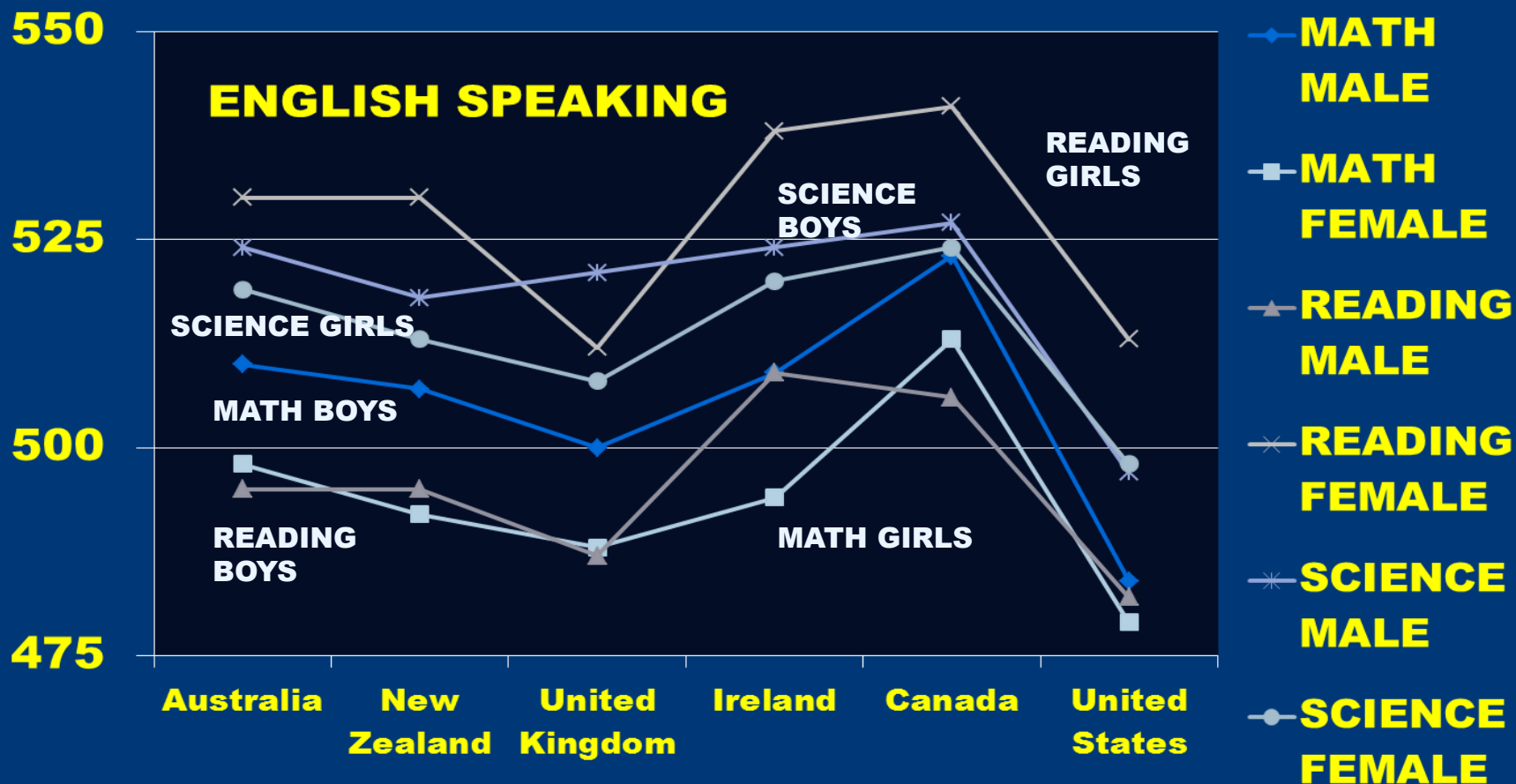


**PISA 2015 MATH EUROPE
High/Low Proficiency Levels – Gender Differences**

PISA – GENDER: MATH – READING - SCIENCE

HIGH: READING/Female

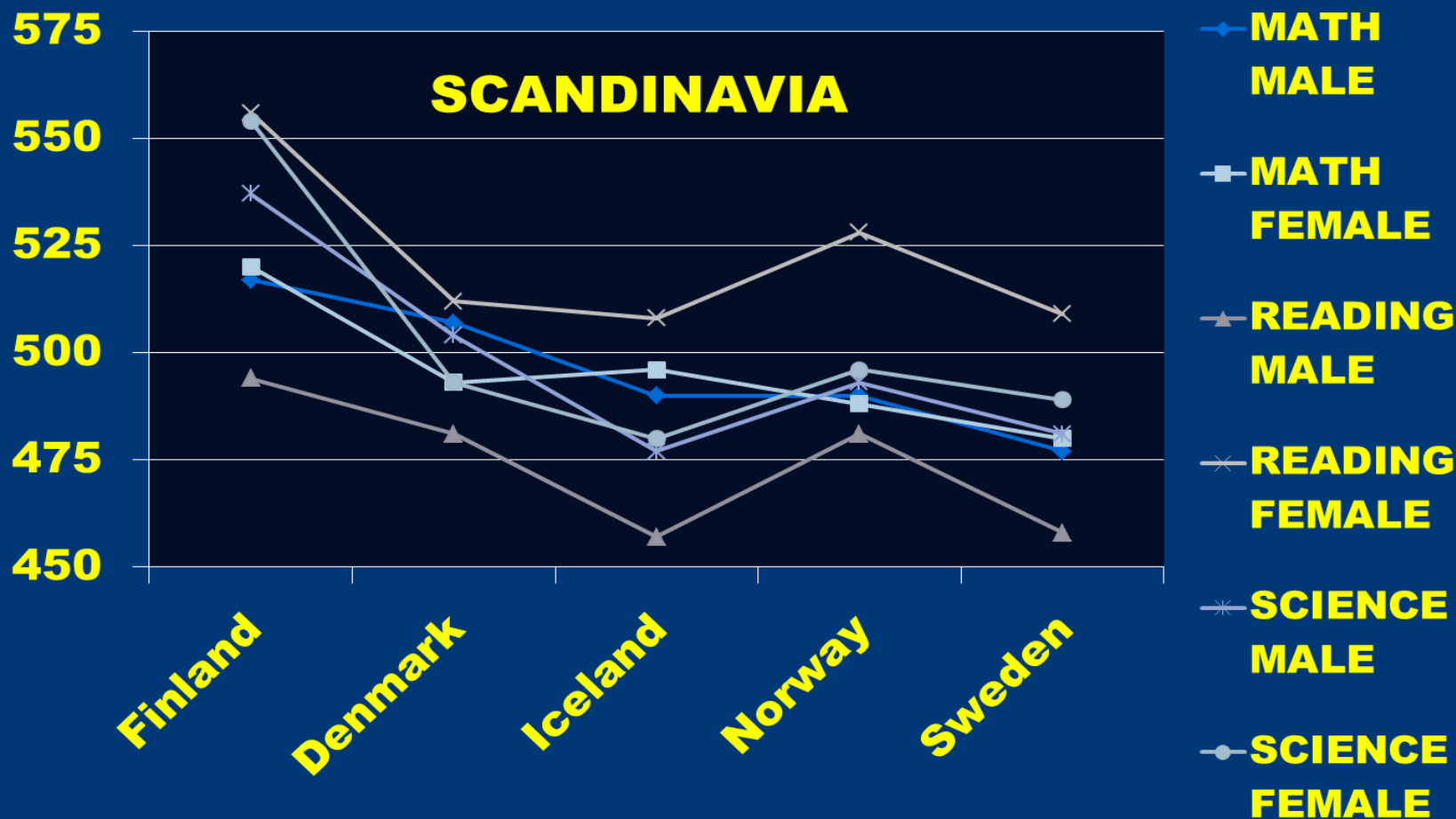
LOW: READING/Male MATH/Female



PISA – GENDER: MATH – READING - SCIENCE

HIGH: READING/Female

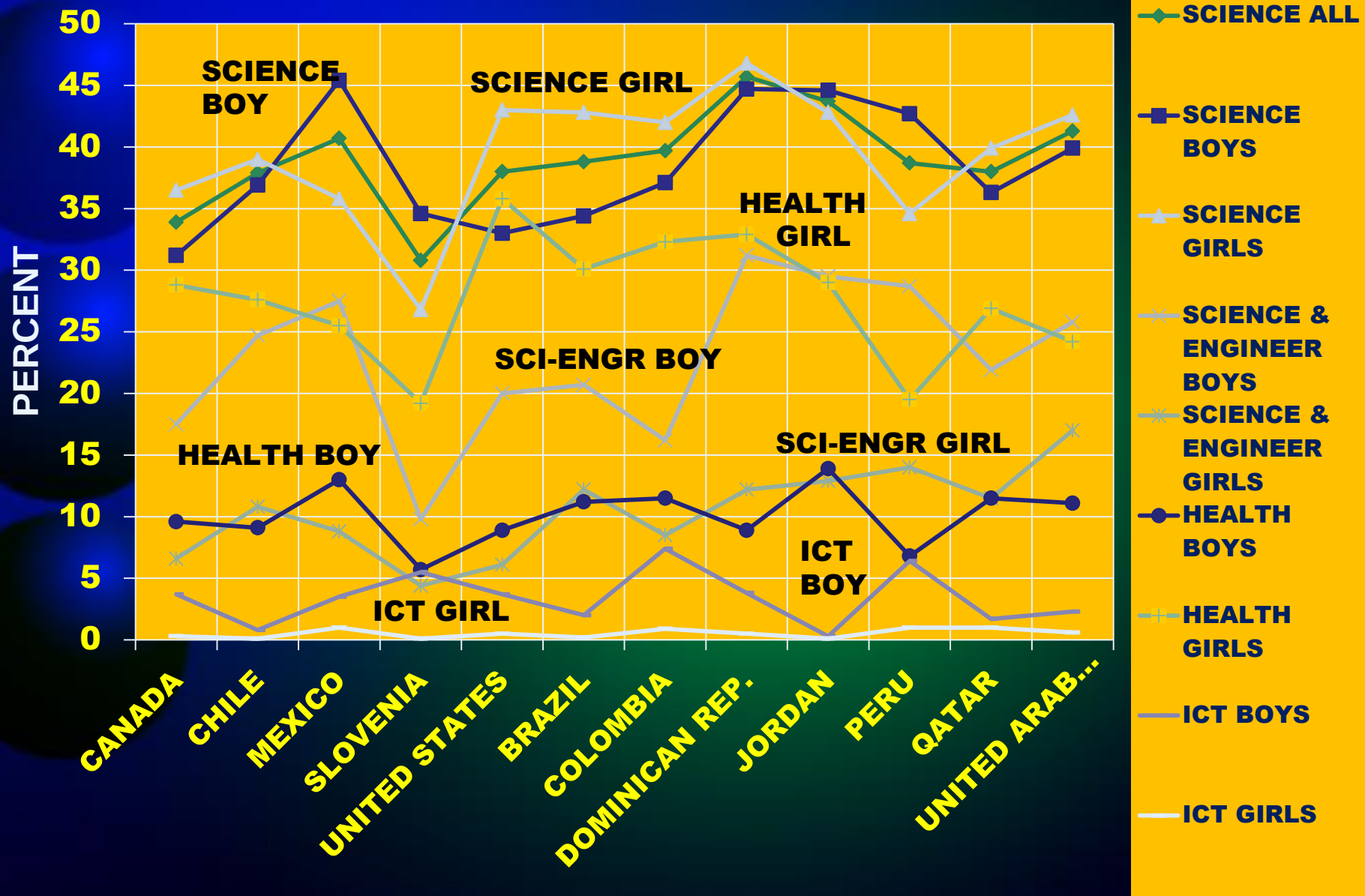
LOW: READING/Male



SCIENCE CAREER CHOICES – NUMBER COUNTRIES N=72	BOYS	GIRLS
Medical Doctors	72	72
Engineers	66	34
Software & Applications Developers & Analysts	61	7
Architects and Designers	55	53
Dentists, Pharmacists, Physiotherapists, Dieticians, Other Health Professionals	35	71
Physical & Engineering Science Technicians	21	0
Electro-technology Engineers	17	0
Physical & Earth Science Professionals (e.g. Chemist)	12	8
Life Science Professionals (e.g. Biologist)	11	17
Veterinarians	5	45
Database and Network Professionals	4	0
Nurses and Midwives	1	45
Medical & Pharmaceutical Technicians	0	7
Paramedical Practitioners	0	1

STUDENTS EXPECTING TO WORK IN SCIENCE-RELATED OCCUPATIONS

GENDER
Difference



4. CONTENT Sub-Scales

2015 SCIENCE



CONTENT KNOWLEDGE

CONTENT Subscales

- PHYSICAL SYSTEMS
- LIVING SYSTEMS
- EARTH & SPACE SYSTEMS

PROCEDURAL & EPISTEMIC KNOWLEDGE

2012 MATH

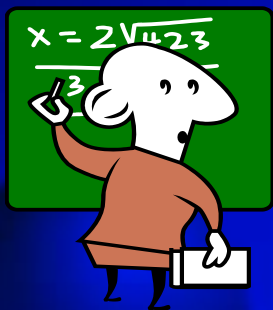
- NUMBERS
- ALGEBRA
- GEOMETRY



2012 READING

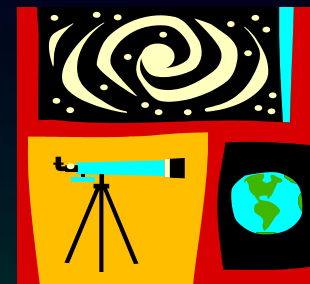
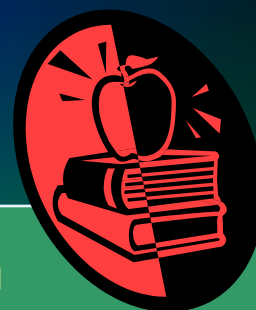
- CONTINUOUS TEXT
- NON-CONTINUOUS TEXT





PISA 2012

CONTENTS



MATHEMATICS

Four Overarching Ideas That Relate to
NUMBERS
ALGEBRA
GEOMETRY

- ☐ **Quantity**
- ☐ **Space and Shape**
- ☐ **Change and Relationships**
- ☐ **Uncertainty and Data**

READING

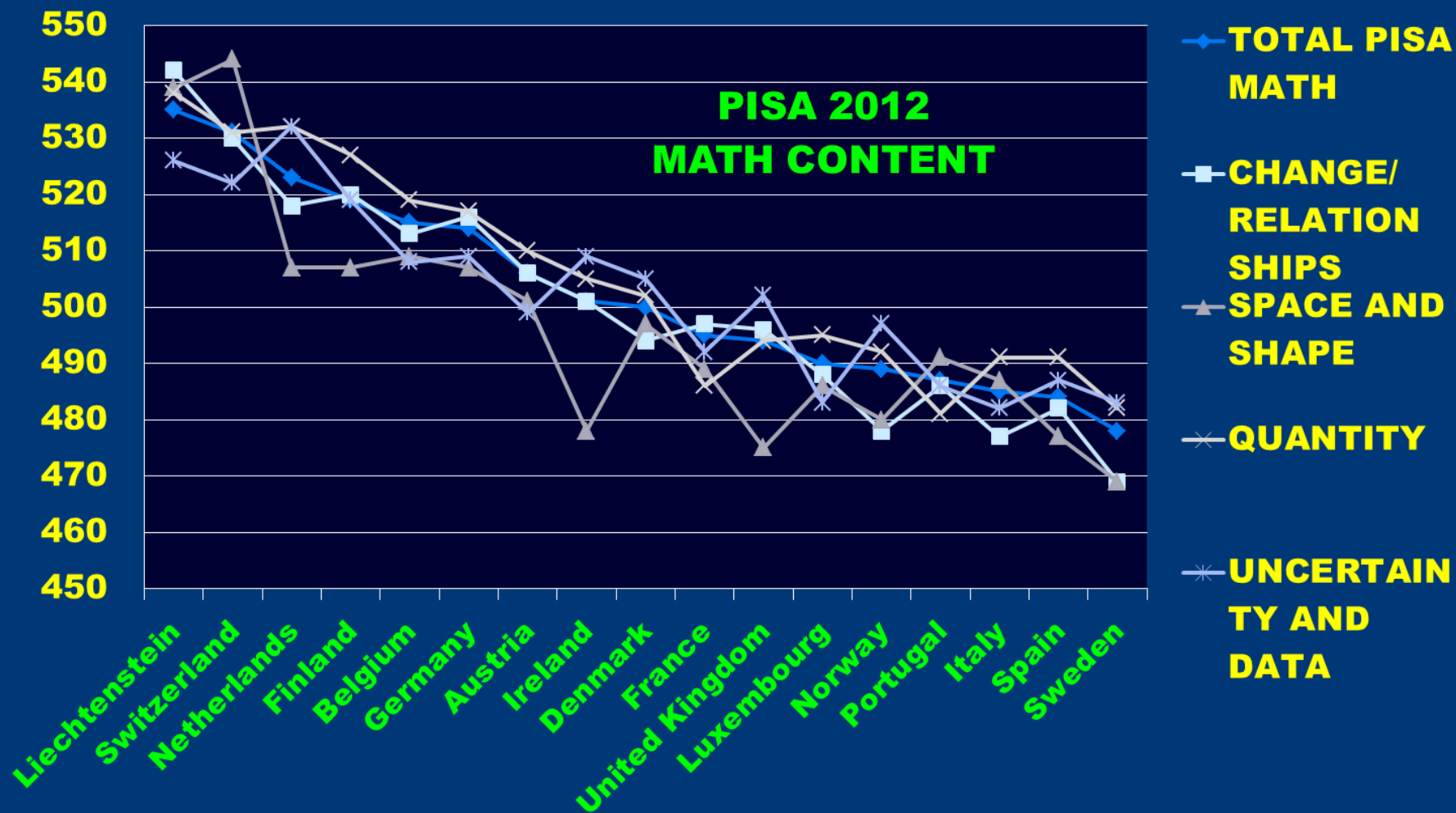
Form of Reading Materials Includes:

- ☐ **CONTINUOUS TEXTS**
or Prose Organized in Sentences and Paragraphs
 - Narration
 - Exposition
 - Argumentation
 - Description
 - Instruction
- ☐ **NON-CONTINUOUS TEXTS**
That Present Information in Other Ways
 - Lists, Forms, Graphs
 - Diagrams

SCIENCE

- ☐ **Scientific KNOWLEDGE or CONCEPTS**
Related to:
 - **Physics**
 - **Chemistry**
 - **Biological Sciences**
 - **Earth Sciences**
 - **Space Sciences**
- ☐ **APPLIED to CONTENT** of the Items and Not Just Recalled.

STRENGTHS AND WEAKNESSES IN DIFFERENT KINDS OF MATH - 2012

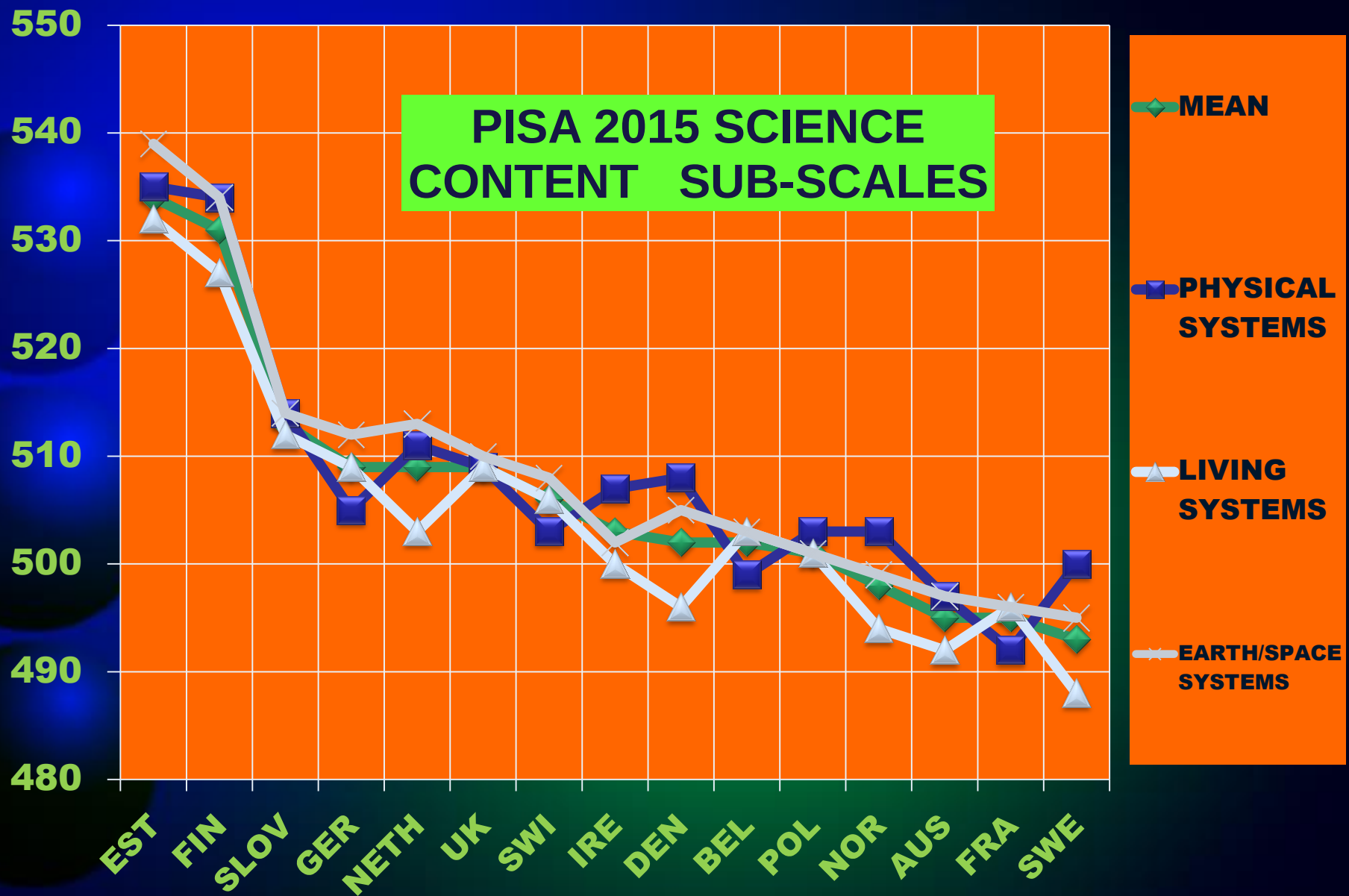


WESTERN EUROPE

SCIENCE CONTENT AREA SUBSCALES

PHYSICAL SYSTEMS	LIVING SYSTEMS	EARTH AND SPACE SYSTEMS
Knowledge of the Structure and Properties of Matter	Knowledge of the Cell and Its Structures	Knowledge about the Structure of Systems
Chemical Properties	The Concept of An Organism	Changes in Earth Systems
Chemical Reactions	Human Biology	The Earth's History
Motion and Forces	Populations	The Solar System
Magnetic Fields	Ecosystems	History and Scale of the Universe
Energy and Its Transformation	Biosphere	
Interactions Between Energy and Matter		

PISA 2015 SCIENCE CONTENT SUB-SCALES



PISA 2015 – EUROPE – SCIENCE

SCIENCE CONTENT & GENDER

BOYS

- More interest in **PHYSICS & CHEMISTRY**
- More interest in Science Topics of **MOTION & FORCES**
 - Velocity
 - Friction
 - Magnetic & Gravitational Forces
- More interest in Topics of **ENERGY & its TRANSFORMATION**
 - Conservation
 - Chemical Reactions

GIRLS

- More interest in **HEALTH-RELATED TOPICS**
- In All Countries & Economies Girls more likely to be interested in **HOW SCIENCE CAN HELP PREVENT DISEASE**



5. COGNITIVE Sub-Scales

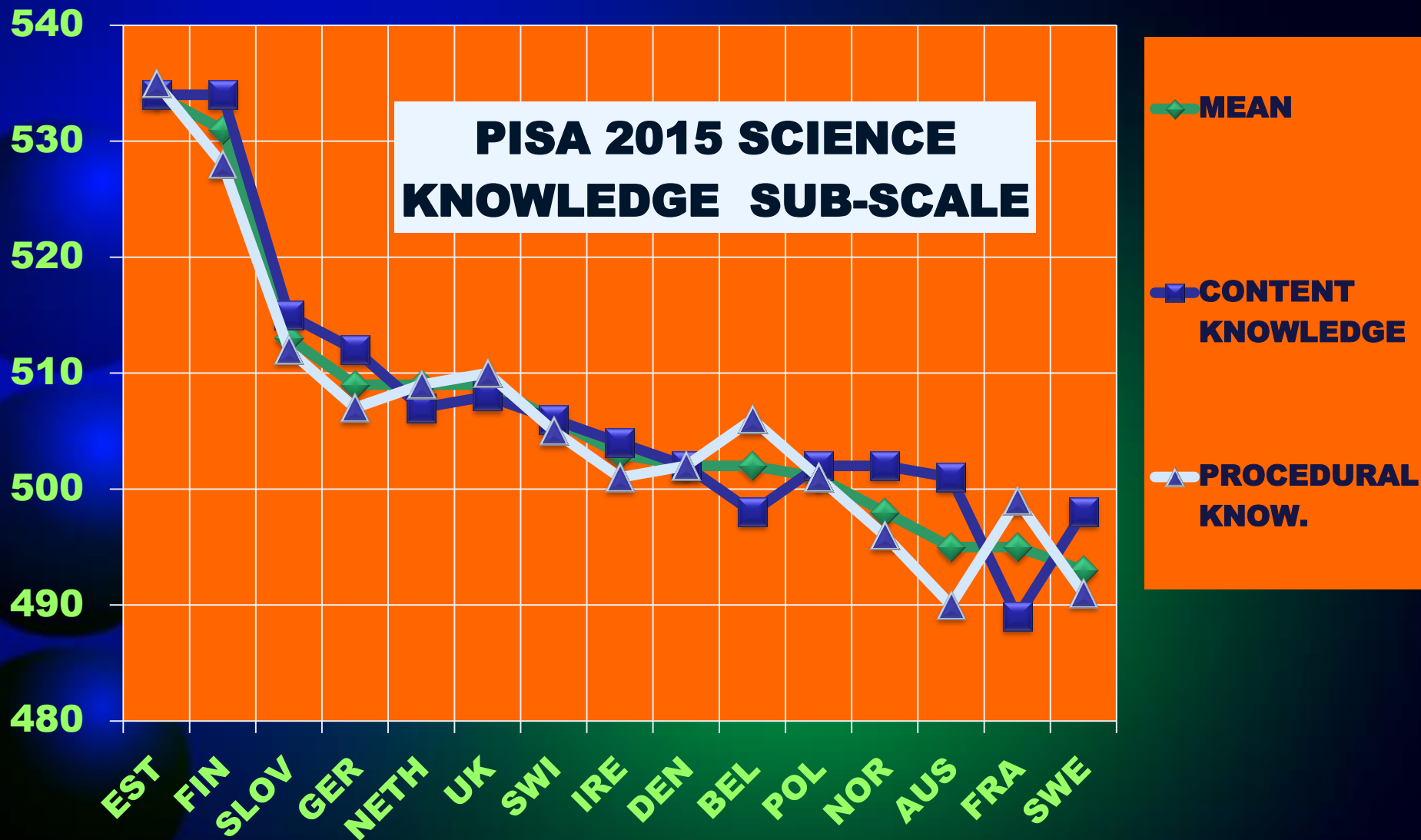
KNOWLEDGE

- CONTENT
- PROCEDURAL

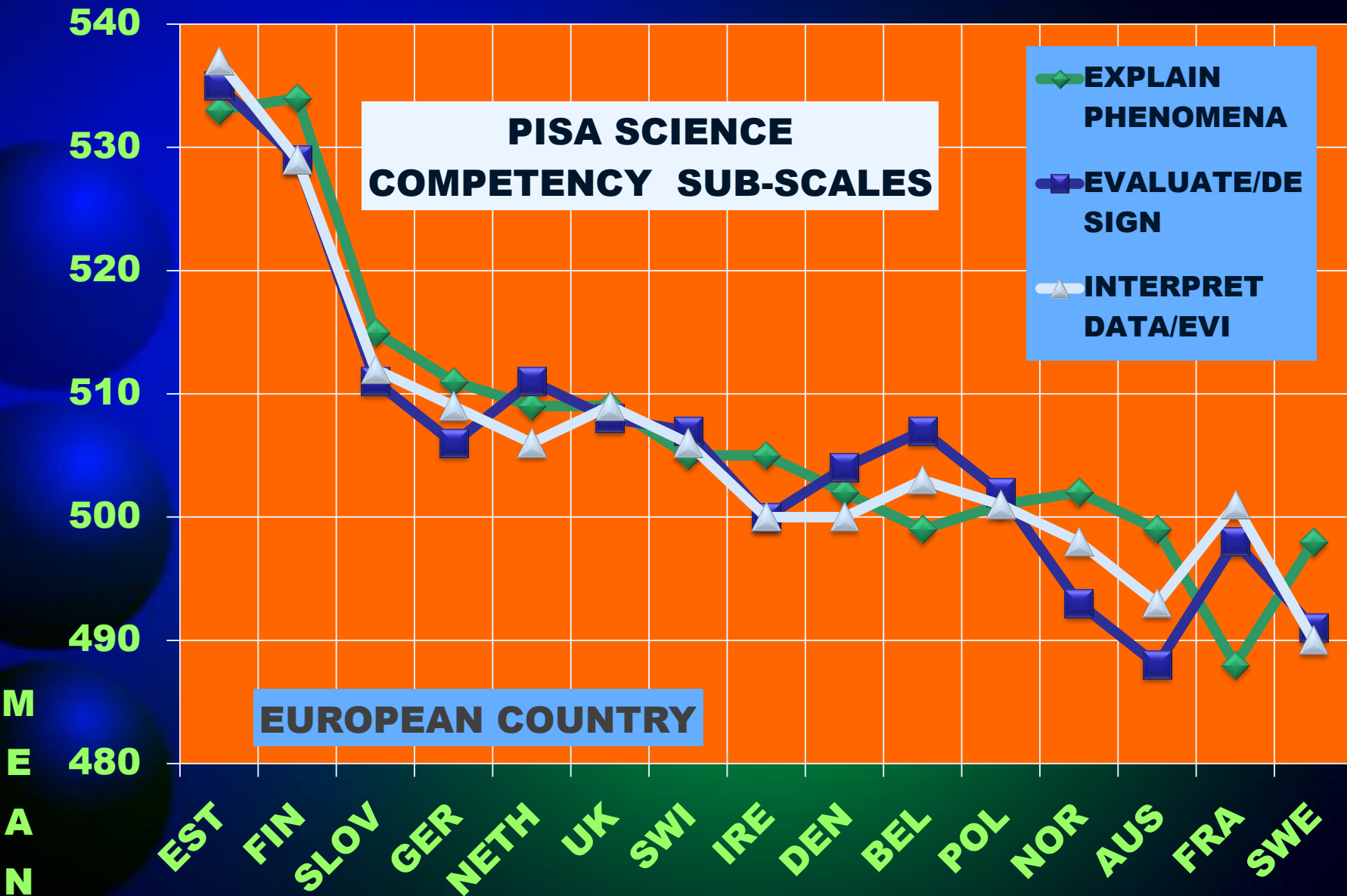
PROCEDURAL

- EXPLAIN PHENOMENA
- EVALUATE DESIGN
- INTERPRET DATA EVIDENCE

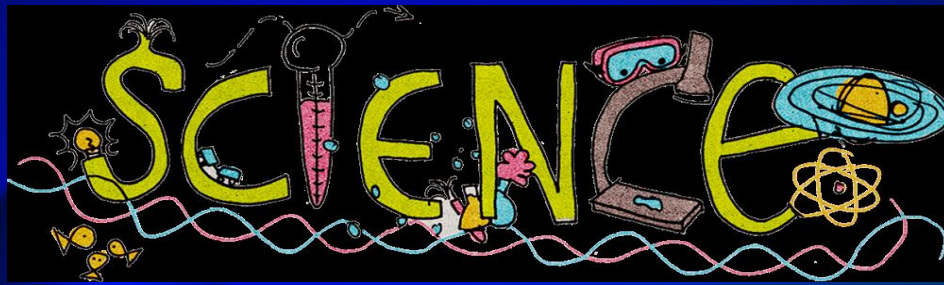




**PISA 2015 – EUROPE
SCIENCE - Knowledge Sub-Scale**



**PISA 2015 – EUROPE
SCIENCE – Competency Sub-Scales**



ENGAGEMENT **MOTIVATION** **SELF-EFFICACY**

SCIENCE **ENGAGEMENT**

**Kind of Job
Expected at 30
Years of Age**

**Science Activities:
Participation in
Range of Science-
Related Activities**

MOTIVATION **FOR LEARNING** **SCIENCE**

**Enjoyment of Doing and
Learning Science**

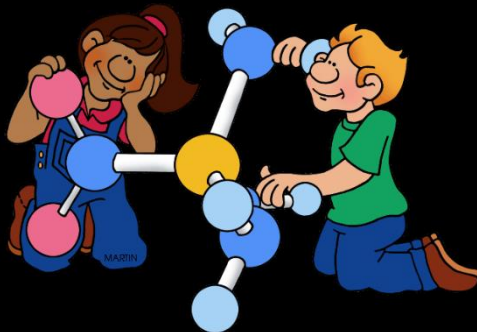
**Interest in Broad
Science Topics**

**Instrumental Motivation
for Learning Science.
Perceptions of How
Useful School Science
is for Their Study and
Career Plans**

SCIENCE **SELF-BELIEFS**

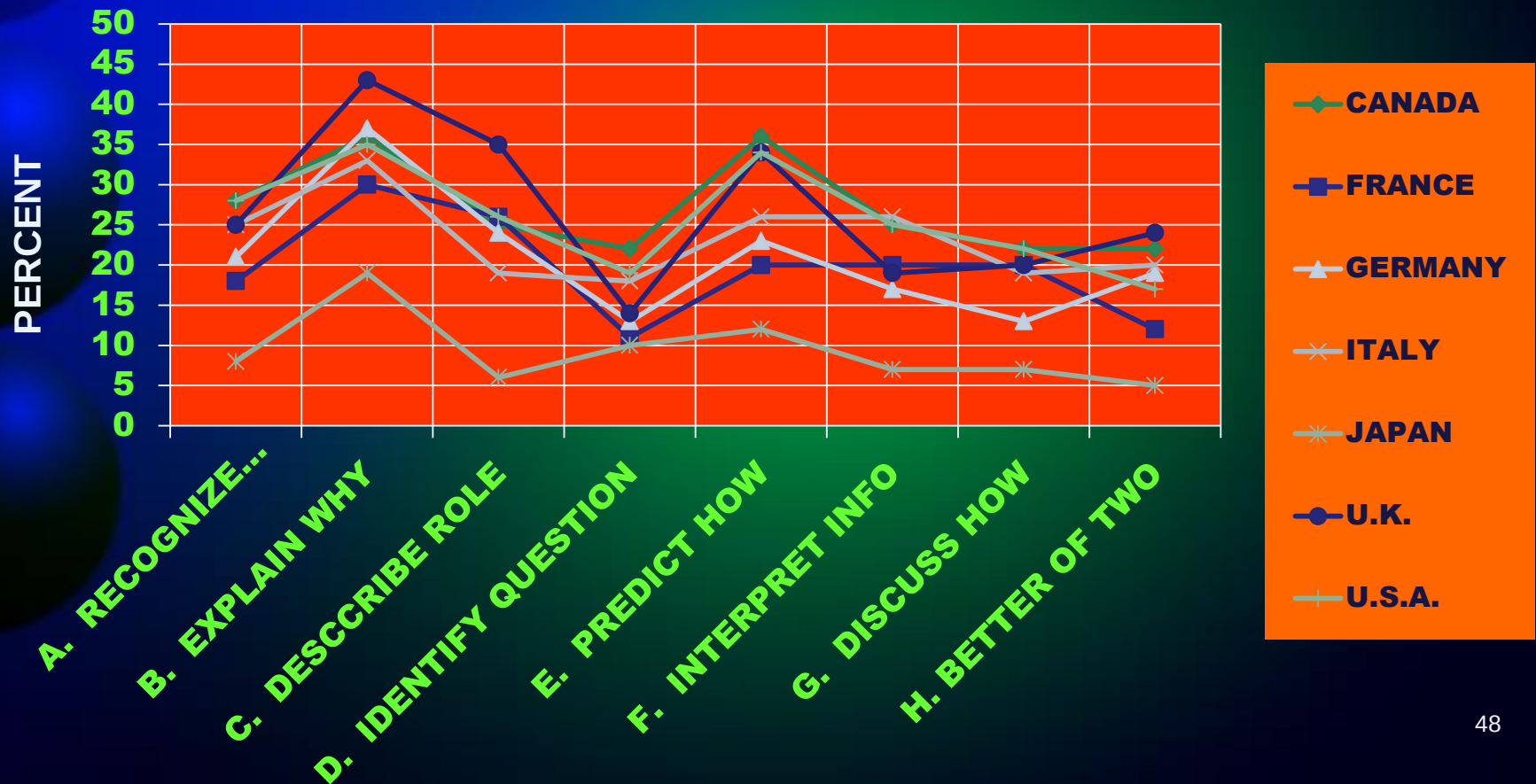
SELF-EFFICACY

**PERCEIVED ABILITY TO USE
THEIR KNOWLEDGE OF
SCIENCE IN REAL-WORLD
SITUATIONS**



STUDENT SELF-EFFICACY IN SCIENCE – Report “They could easily do” Tasks.

- A. **RECOGNIZE** Science **Question** that Underlies a Newspaper Report on Health Issue.
- B. **EXPLAIN** Why Earthquakes Occur more Frequently in Some Areas than in Others.
- C. **DESCRIBE** the **Role** of Antibiotics in Treatment of Disease.
- D. **IDENTIFY** Science **Question** Associated with Disposal of Garbage.
- E. **PREDICT** How Changes to Environment Will Affect Survival of Certain Species.
- F. **INTERPRET** Scientific **Information** Provided on Labelling of Food Items.
- G. **DISCUSS** How New Evidence Can Lead to Change Understanding About Possibility of Life on Mars.
- H. **IDENTIFY** Better of Two Explanations for Formation of Acid Rain.



6. International PROFICIENCY LEVELS As BENCHMARKS

PROFICIENCY LEVEL Benchmarks Align
with Gifted & Talented Education



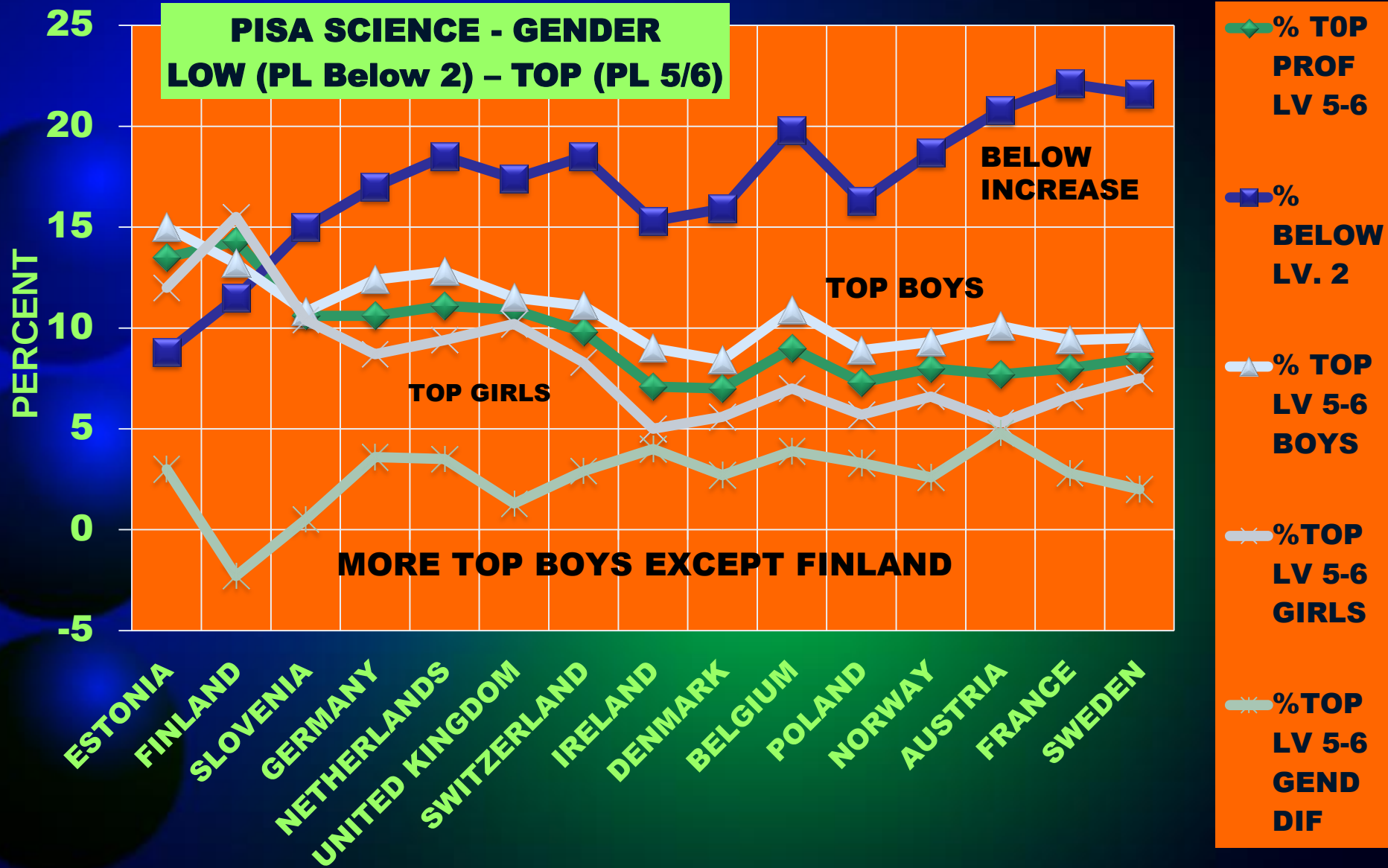
- Boys advantage in MATH is more apparent among best-performing students.
- 10% highest-achieving boys score 15 points higher than the 10% highest girls.

PISA SCIENCE PROFICIENCY LEVELS

NOTE: Proficiency Levels Also Available for Each Content Area

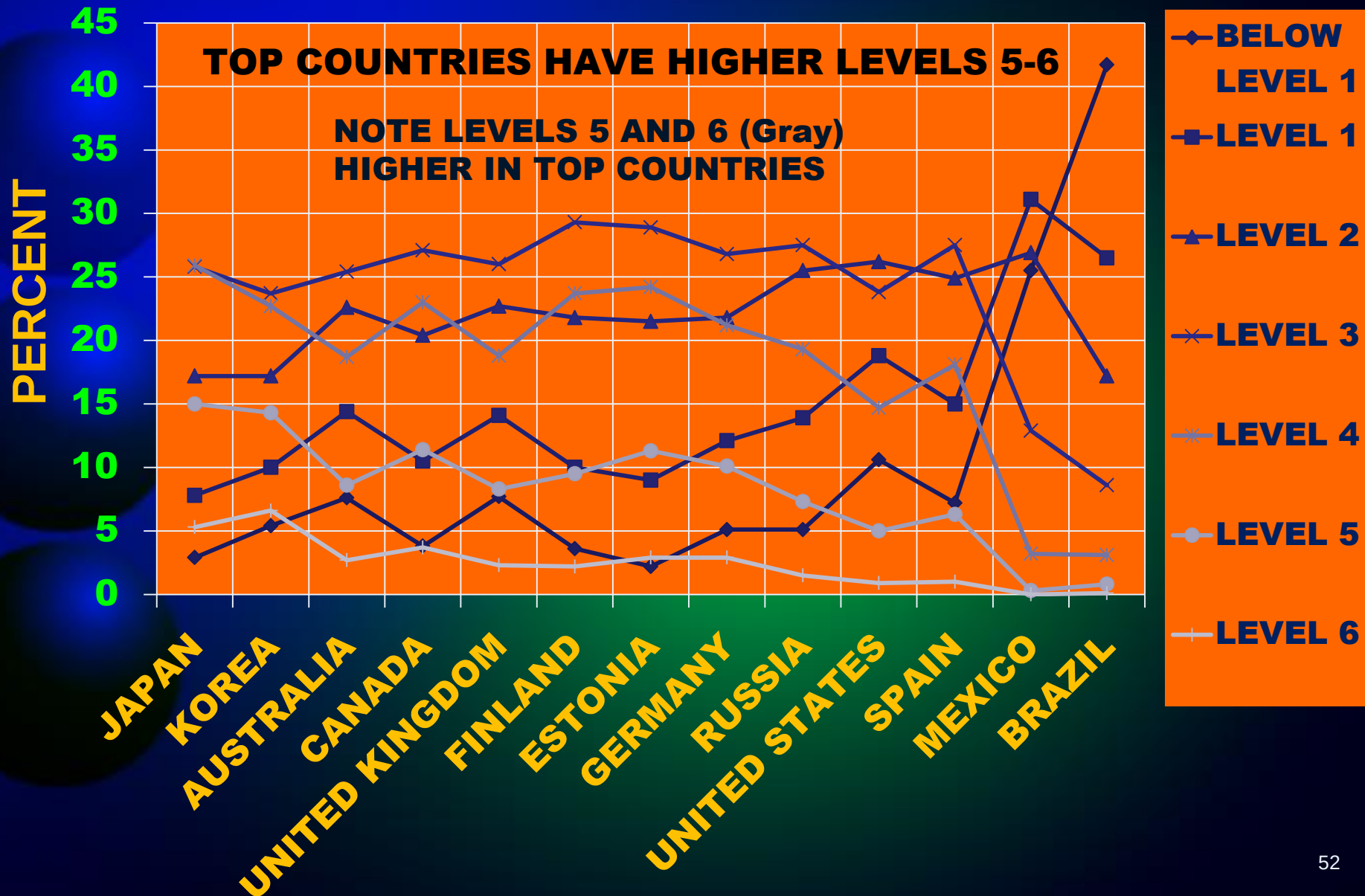
PRO LEV	SCORE RANGE	TASK DESCRIPTIONS
1	261-409	□ 1a. Everyday content knowledge for scientific explanation. Select best explanation. □ 1b. Identify simple patterns in data, basic science terms, and follow explicit instructions.
2	410-483	□ Draw on everyday content knowledge to identify scientific explanation. Identify a valid conclusion from simple data. Identify questions that can be investigated scientifically.
3	484-558	□ Draw upon moderately complex content knowledge to construct explanations. Draw on elements of procedural knowledge for experiment. Distinguish scientific, non-scientific.
4	559-632	□ Use more complex content knowledge to construct explanations. Conduct experiments with 2 or more independent variables. Justify experiment design, interpret data.
5	633-707	□ Use abstract scientific ideas to explain more complex phenomena. Apply more sophisticated epistemic knowledge to evaluate and justify, interpret, make predictions. □ Evaluate ways of exploring question scientifically and identify limitations in interpreting data sets including sources and the effects of uncertainty in scientific data.
6	708+	□ Draw on range of interrelated scientific ideas and concepts from physical life and earth and space sciences. Use content, procedural and epistemic knowledge for hypotheses. □ Interpret data and evidence to discriminate between relevant and irrelevant. Distinguish between arguments based on scientific evidence. Evaluate competing experiment design.

**PISA SCIENCE - GENDER
LOW (PL Below 2) – TOP (PL 5/6)**



**PISA 2015 SCIENCE EUROPE
PROFICIENCY LEVELS - GENDER**

PROFICIENCY LEVELS 1 – 6 – MATH



7. SOCIOECONOMIC Factors

ESCS Index

E Economic
S Social
C Cultural
S Status

Socio-economically disadvantaged almost 3 TIMES MORE LIKELY than more advantaged NOT to attain Baseline Proficiency Level.

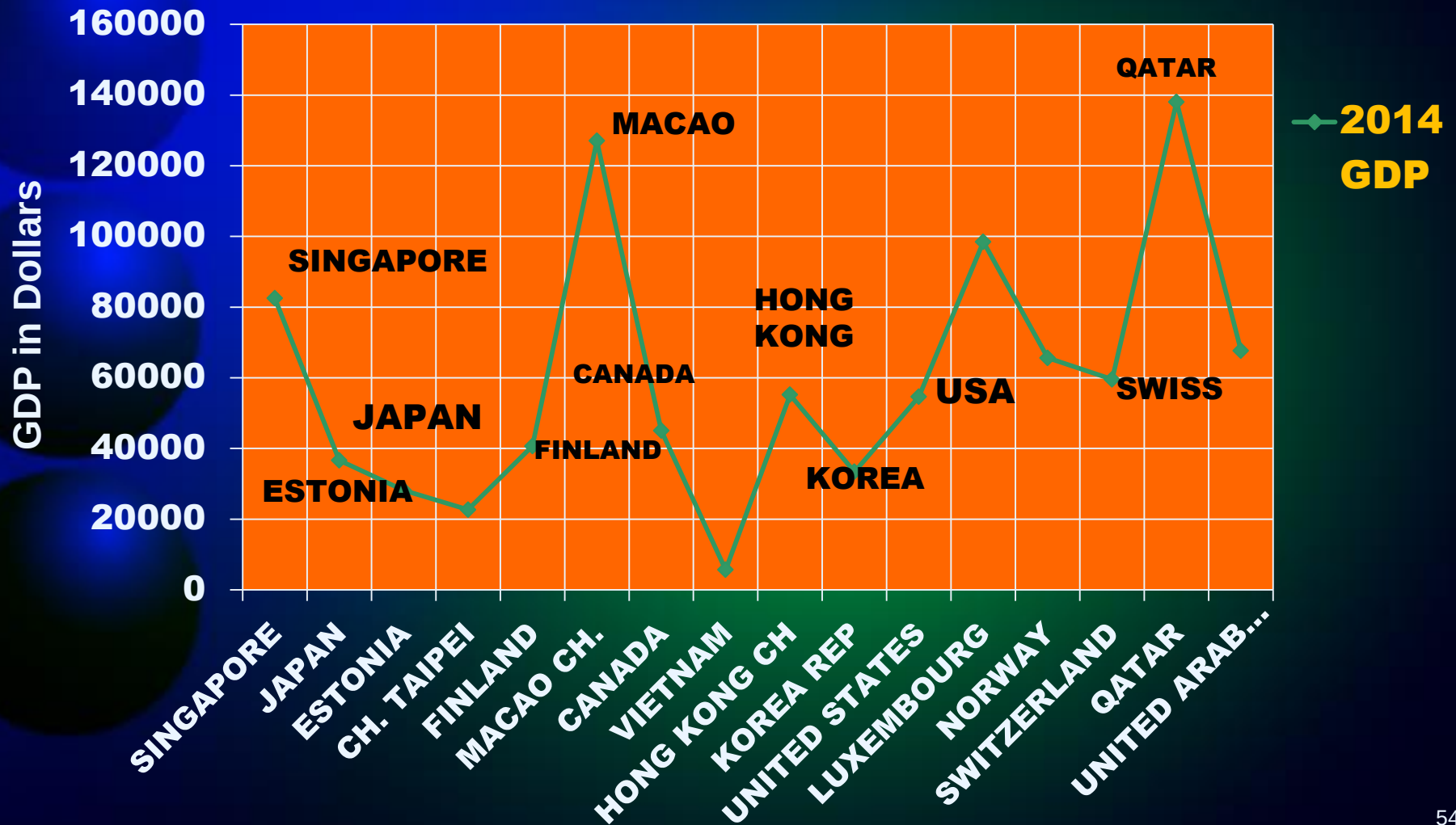
HOWEVER

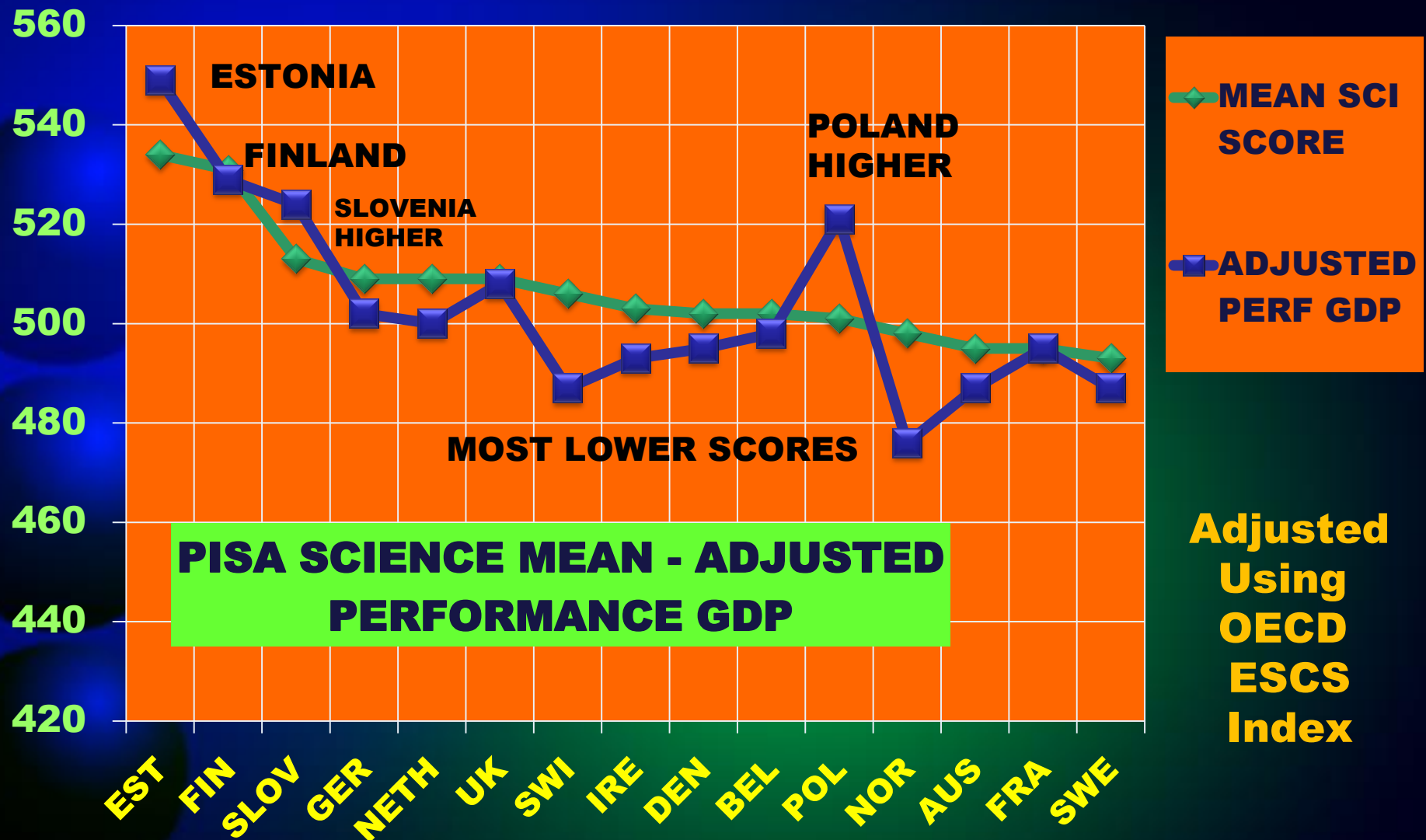
About 29% of disadvantaged are considered **RESILIENT** – They beat the odds and perform among the **TOP QUARTER** of students in all countries.

NOTE: Macao & Viet Nam disadvantaged Outperform advantaged in 20 Countries

PER CAPITA GDP - 2014

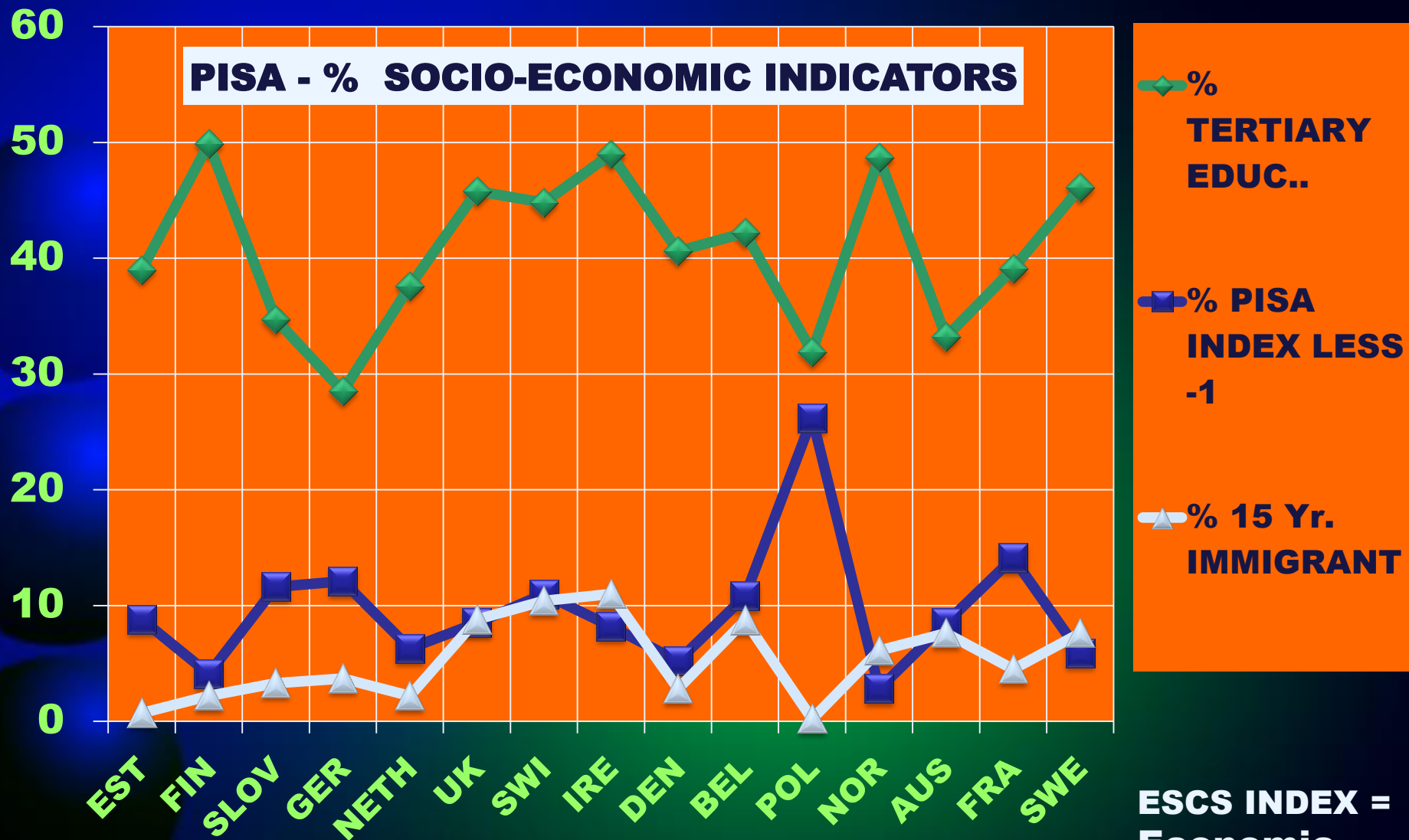
2014 GDP (Gross Domestic Product)





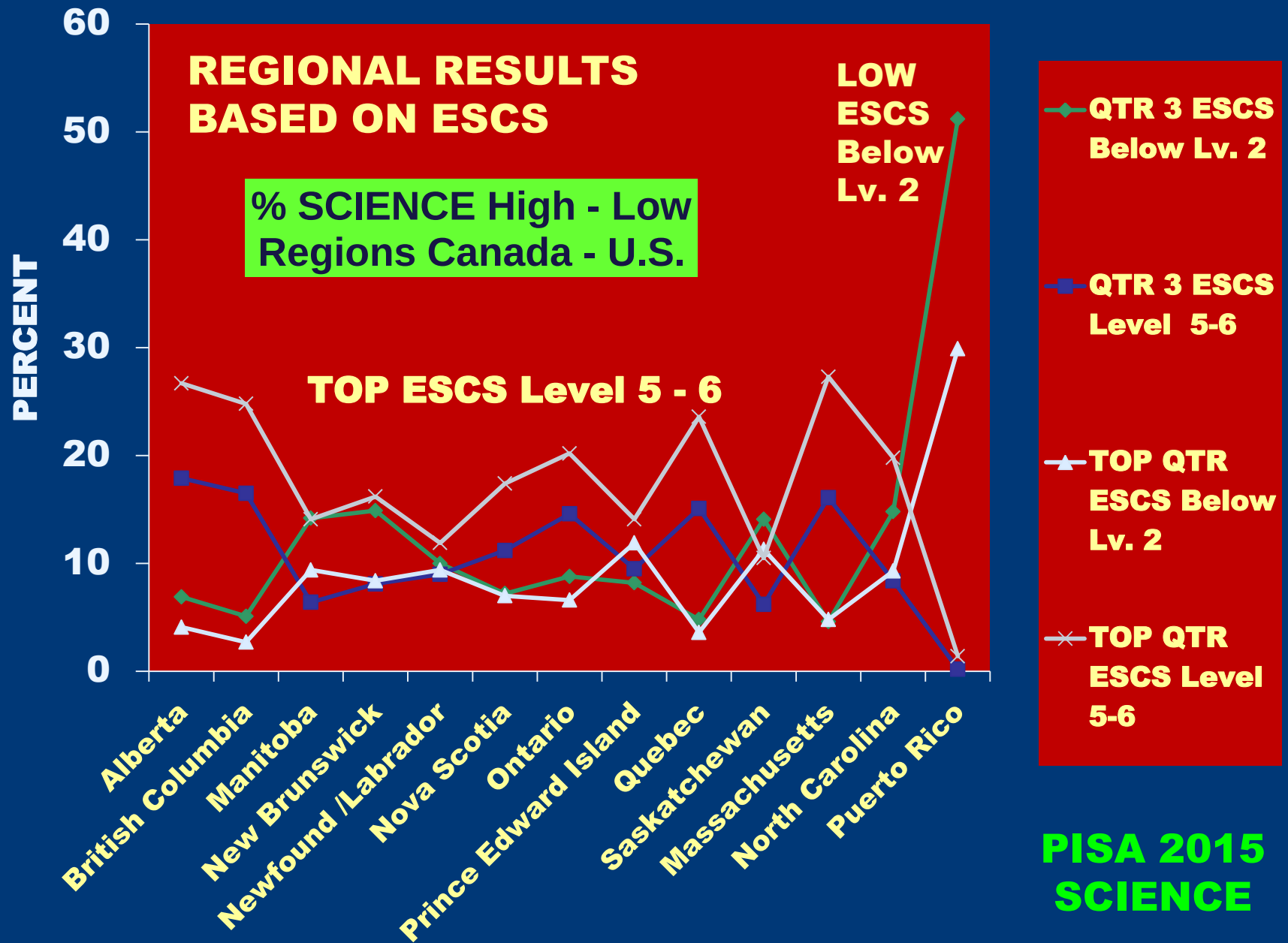
PISA 2015 – Science - EUROPE

Adjusted Performance GDP



PISA 2015 – EUROPE – SCIENCE Socio-Economic Factors

**ESCS INDEX =
Economic
Social
Cultural
Status**

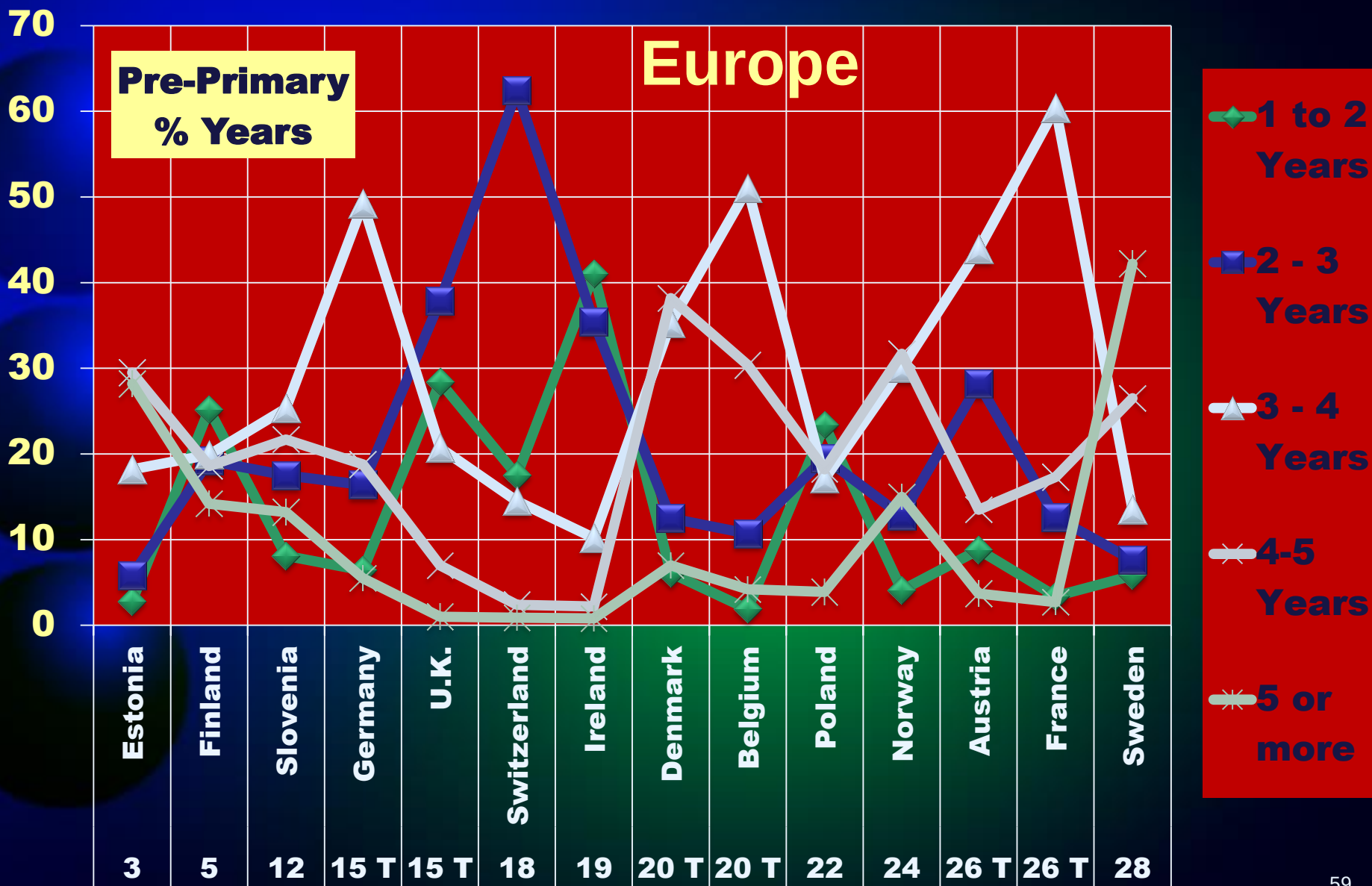


8. EARLY CHILDHOOD

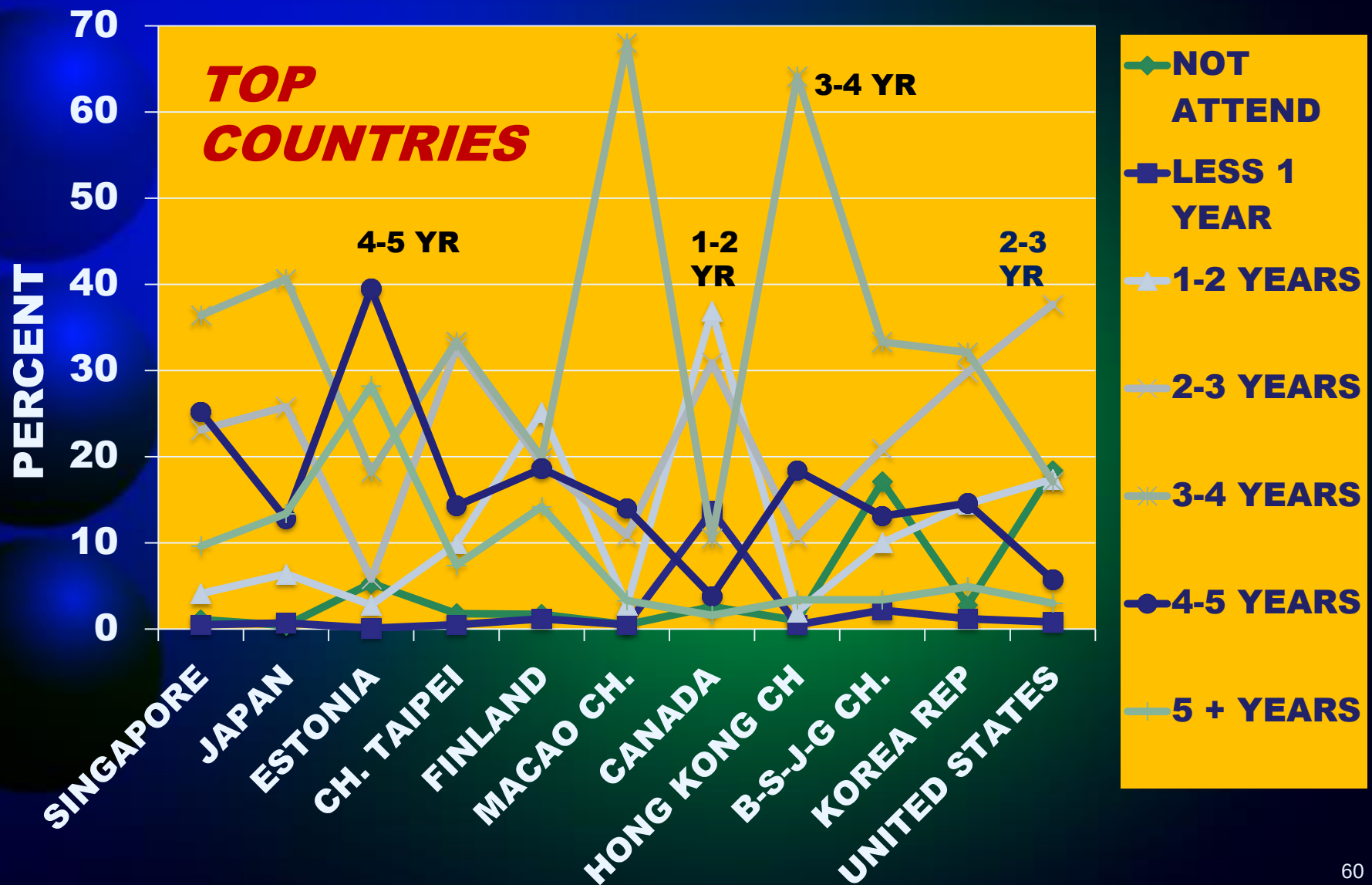


- “Provide Access to
- Quality Early Education for All Children”
- Pre-Primary – Score Better at Age 15
- Less Pre-School – More Likely Disadvantaged
- Pass Legislation
- Free Pre-Primary Education Centers
- Ease Financial Burden for Disadvantaged
- Provides Parent Information and Guidance

ATTENDANCE - PRE-PRIMARY SCHOOL



ATTENDANCE - PRE-PRIMARY SCHOOL

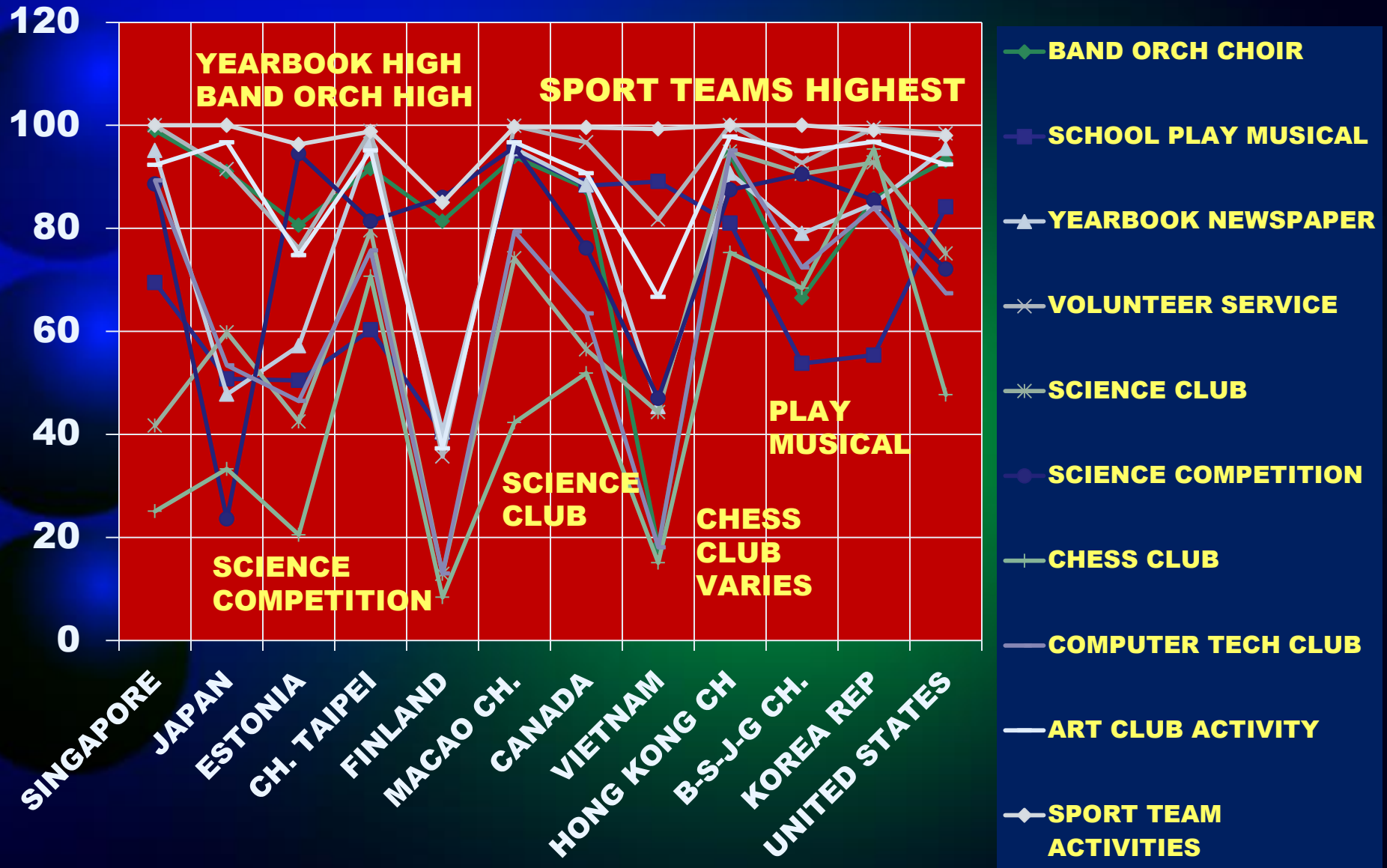


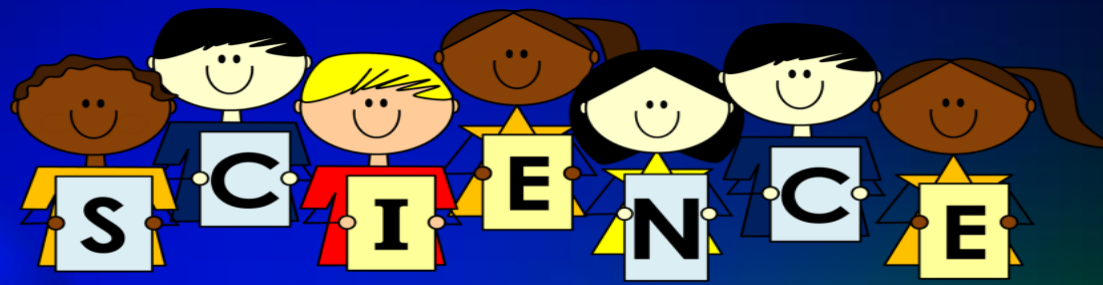
9. OPPORTUNITY to LEARN

- Different Classes
- Grouping Within Classes
- Educational Materials
- Computers at School
- Student-Teacher Ratio
- School SES Profile
- Average Time Per Week
- After-School Study Time

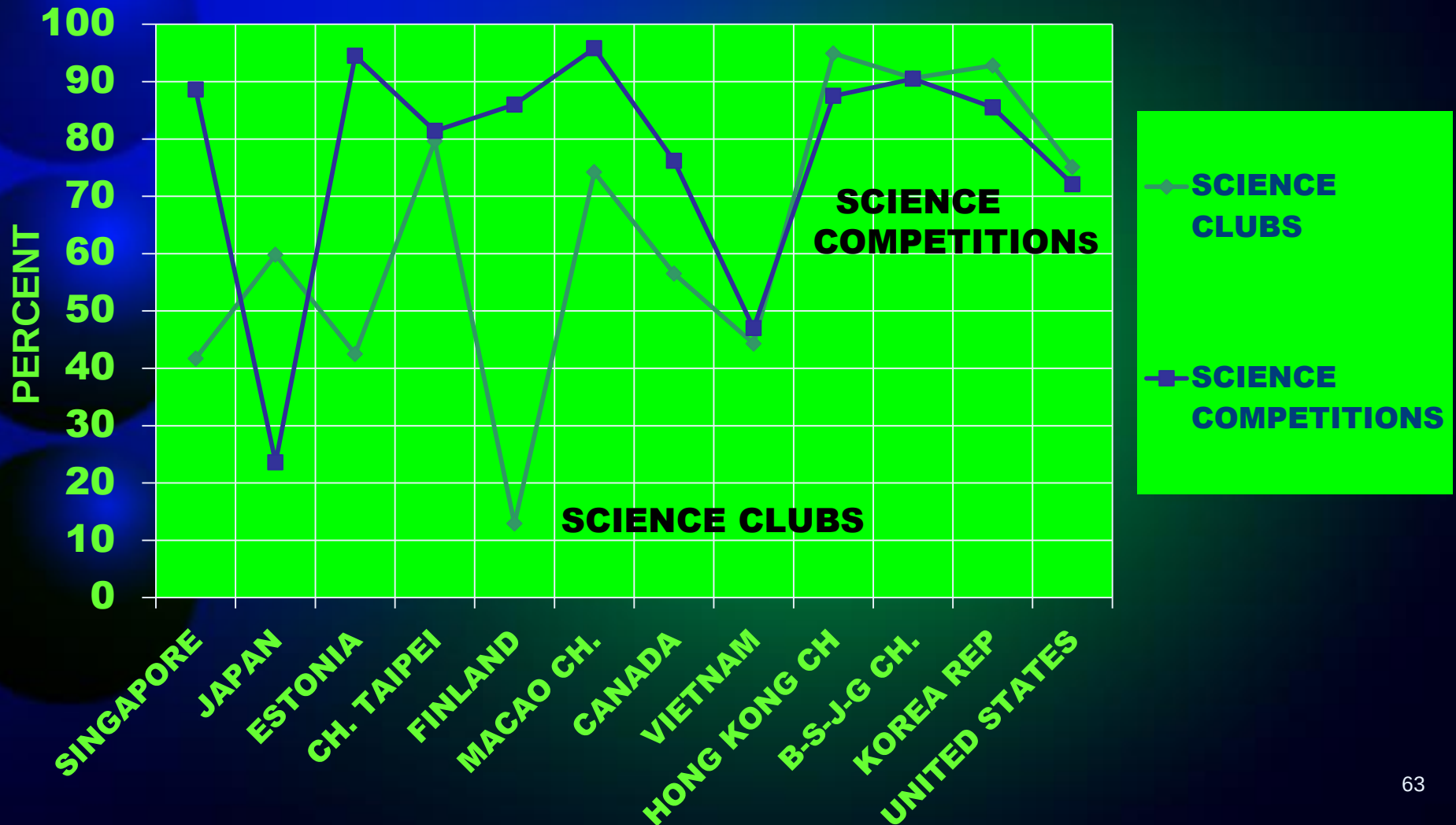


% EXTRACURRICULAR ACTIVITIES OFFERED AT SCHOOL

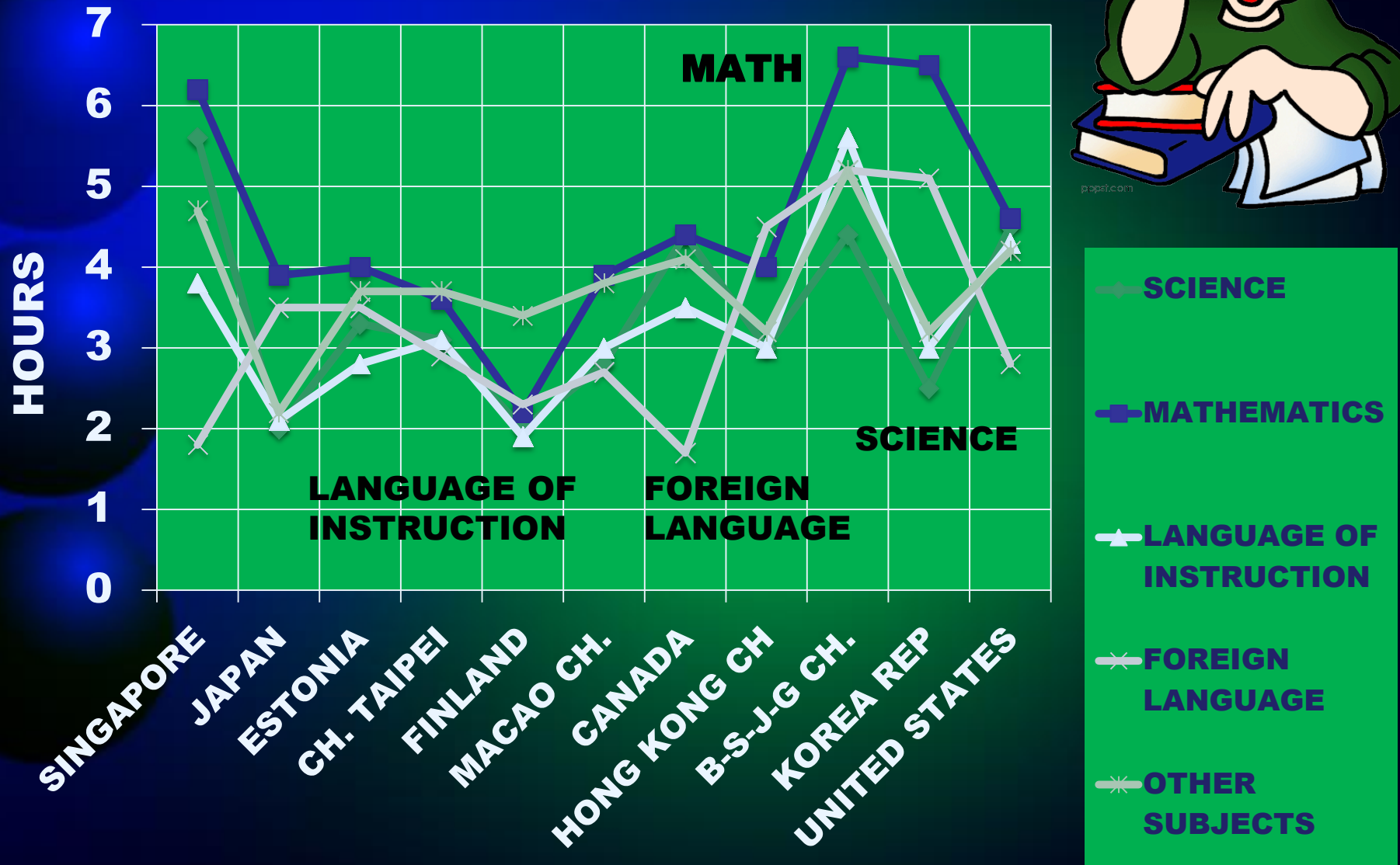
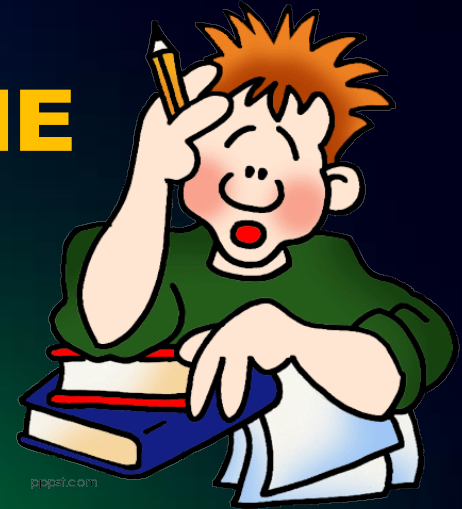


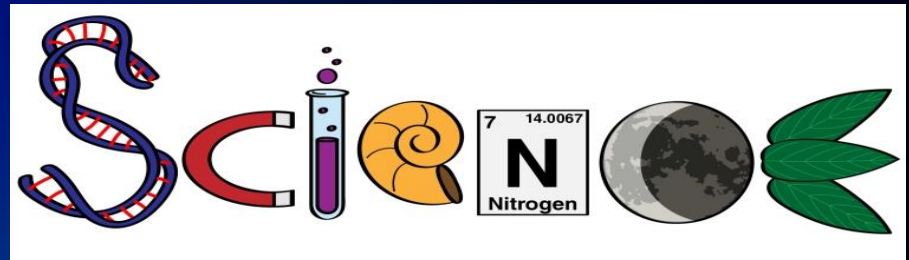


EXTRA-CURRICULAR ACTIVITIES



AFTER-SCHOOL STUDY TIME





- ❑ **SCIENCE** - Student Epistemic Beliefs
- ❑ Average Levels Support in **SCIENCE**
- ❑ Current/Future **SCIENCE** Engagement
- ❑ **SCIENCE** Self-Efficacy
- ❑ Nurturing Future **SCIENTISTS**

PISA 2015 SCIENCE

CHAPTER 3 – Students' Attitudes Towards Science and Expectations of Science-Related Careers (Pisa Questionnaire)

MOTIVATION for Learning SCIENCE

- ❑ **Enjoyment**
- ❑ **Interest**
- ❑ **Instrumental Motivation**

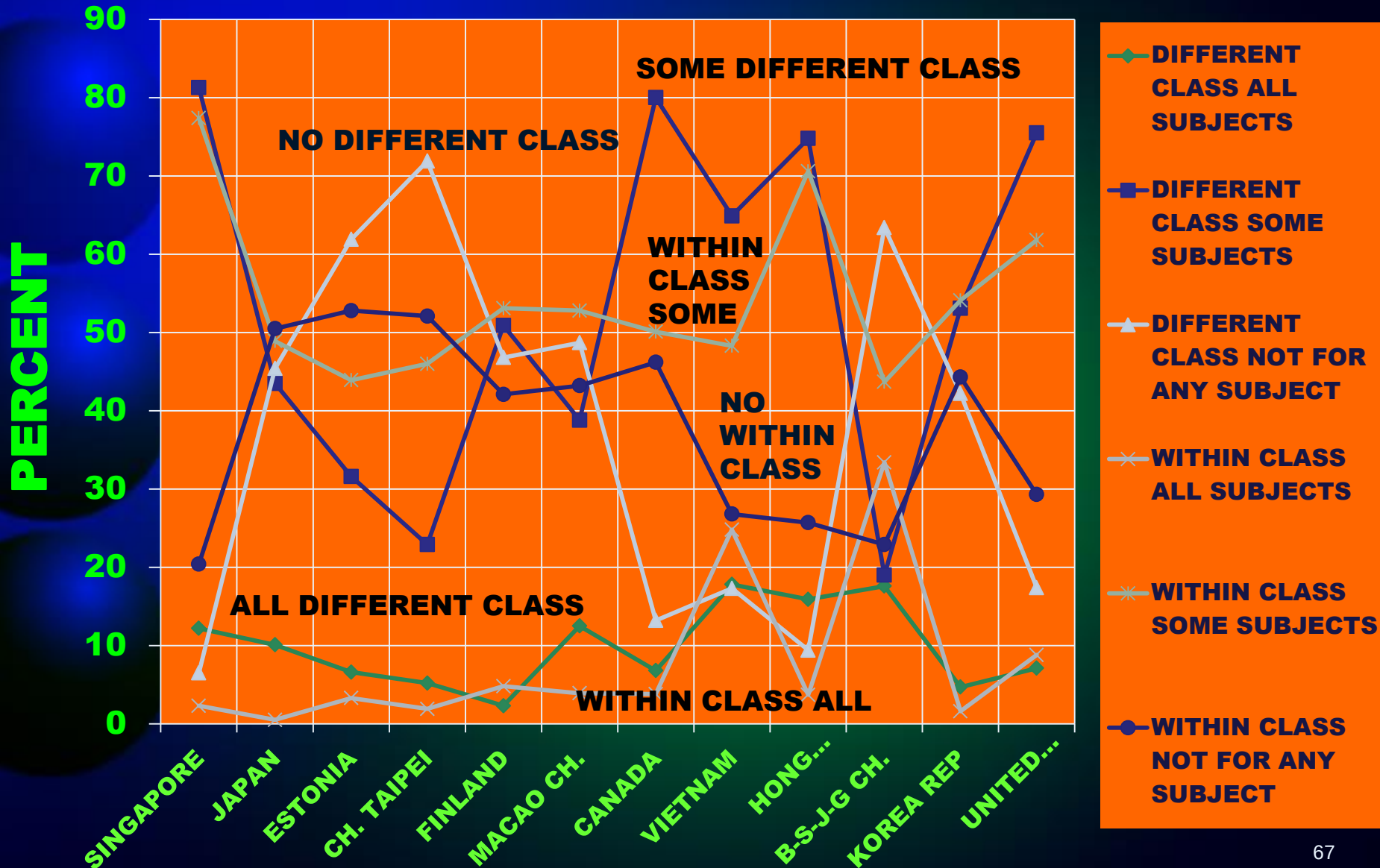
Association of Engagement with Motivation

FACTORS ASSOCIATED WITH SCIENCE PERFORMANCE



- ✓ **Student Socio-Economic Profile**
- ✓ **Index of Adaptive Instruction**
- ✓ **Index Teacher-Directed Instruction**
- ✓ **Student Requirement of At Least
One Science Course**
- ✓ **Disciplinary Climate - Science Lessons**
- ✓ **Student Speaks Test Language at Home**
- ✓ **No Immigrant Background**
- ✓ **Number of Students in Class**
- ✓ **Science-Specific Resources**

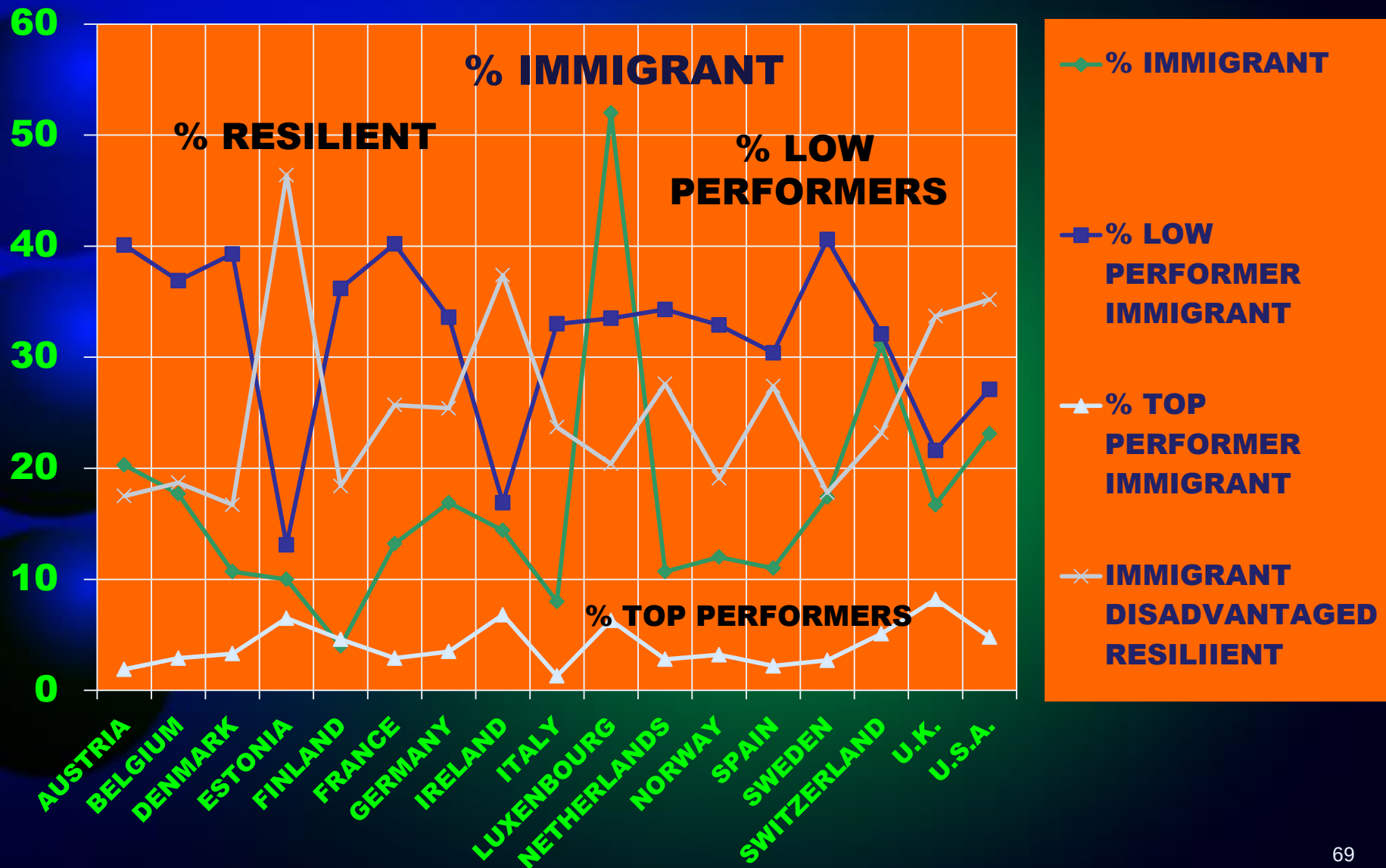
10. ABILITY GROUPING



11. IMMIGRANT STUDENTS

- ❑ **Not PISA Test Language at Home**
2015 - **12.5% Immigrant** v/s 2006 - 9.4%
Generation 1 = **67%** Generation 2 = **45%**
- ❑ **Twice as Likely – Below Level 2 Science**
- ❑ **RESILIENT – 24% Socio-economically disadvantaged**
Score among **top quarter** of all students in PISA
- ❑ **School with large immigrant population – not related to lower performance after accounting for SES.**
- ❑ **Generation 2 - Perform Better than Generation 1**
- ❑ **Sharp Increase in Immigrants, Asylum-Seekers – Europe**
- ❑ **Immigrants Differ: Country, Culture, Language, SES**
- ❑ **Criteria for admitting immigrants varies considerably.**
- ❑ **Growing Migration – Greater Linguistic Diversity**
- ❑ **Immigrants can perform at VERY HIGH LEVELS.**

11. IMMIGRANT Students



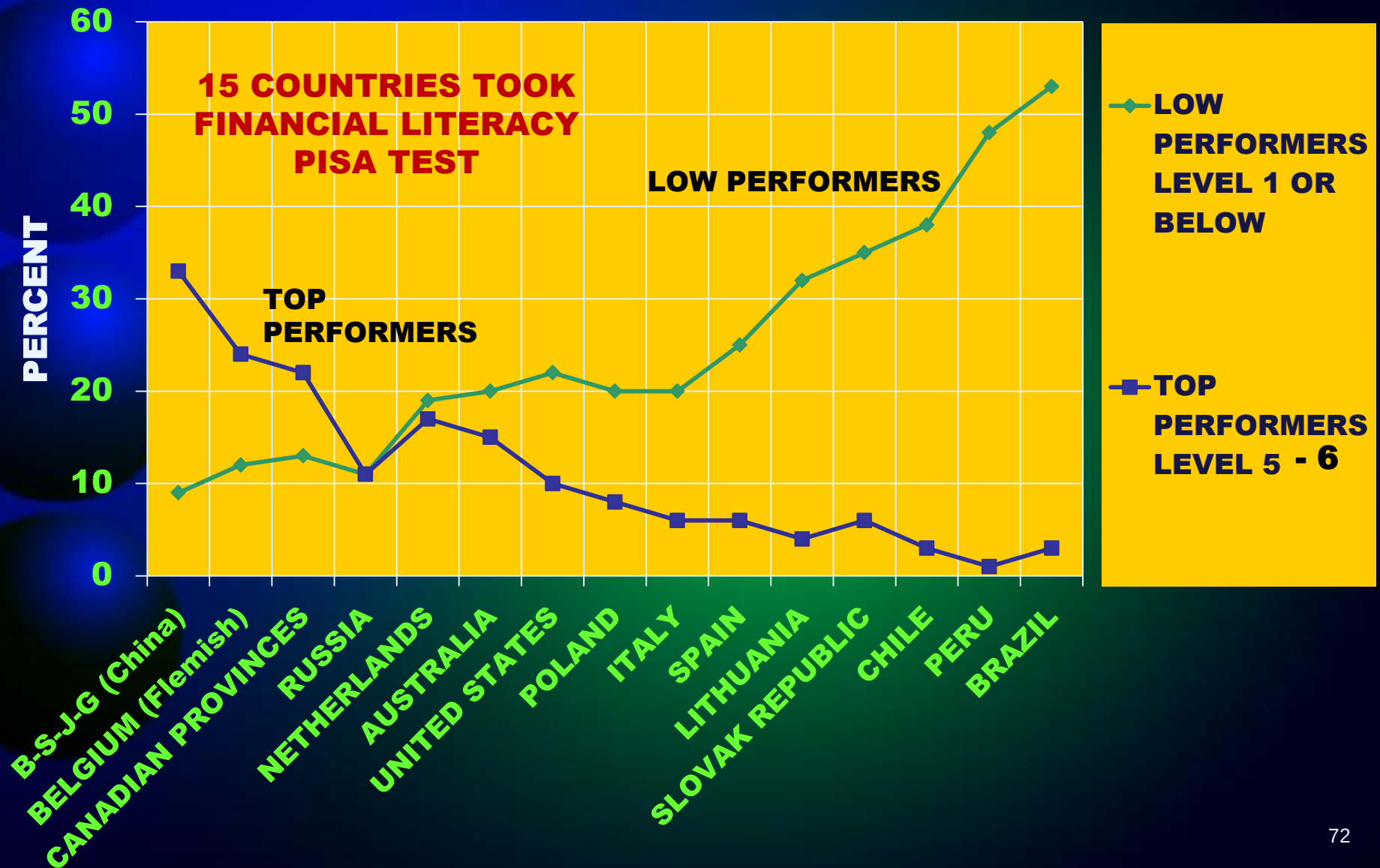
PISA 2015 VOLUMES



VOLUME	TITLE	
I	PISA 2015 RESULTS - EXCELLENCE AND EQUITY IN EDUCATION (2016)	489 Pages
II	POLICIES AND PRACTICES FOR SUCCESSFUL SCHOOLS (2016)	467 Pages
III	STUDENTS' WELL-BEING (2017)	525 Pages
IV	STUDENTS' FINANCIAL LITERACY (2017)	265 Pages
V	COLLABORATIVE PROBLEM SOLVING (2017)	305 Pages

71

12. FINANCIAL Literacy - Vol. IV



13. COLLABORATIVE PROBLEM SOLVING

44 Countries

8% OECD **TOP** Performers

Aware of **Group** Dynamics

Team Member **Roles**

Resolve **Disagreements**

Positively Related Core

Math, Science, Reading

Positive Collaboration

With **Physical Activity**

Video Games – Lower

Internet, Media - Higher

GIRLS perform better than

BOYS in every country.

Performance is positively

related to **SES** Profile

Girls value **Relationships**

Boys value **Teamwork**

Advantaged Students

value Relationships

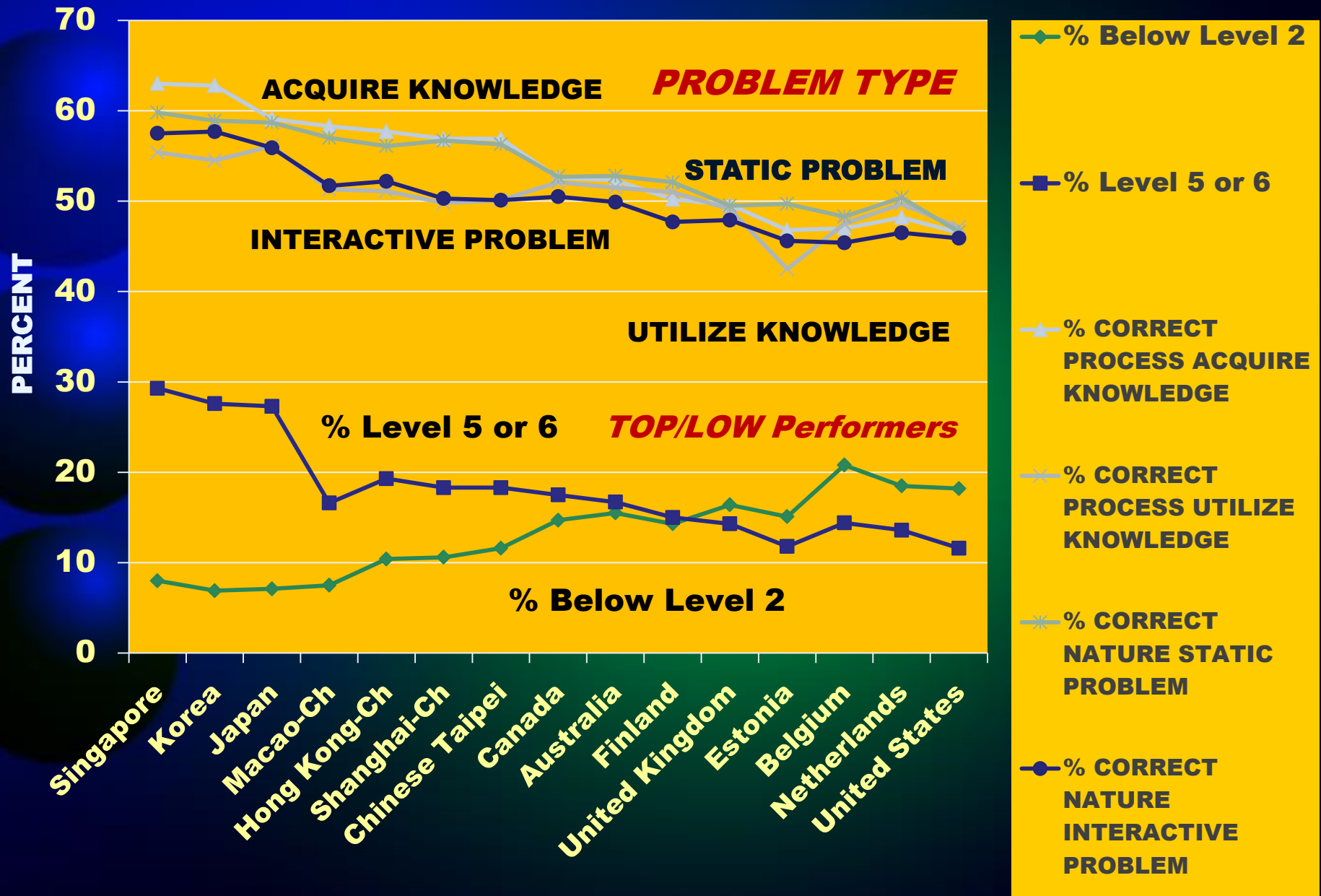
Disadvantaged Students

value Teamwork

Schools Foster

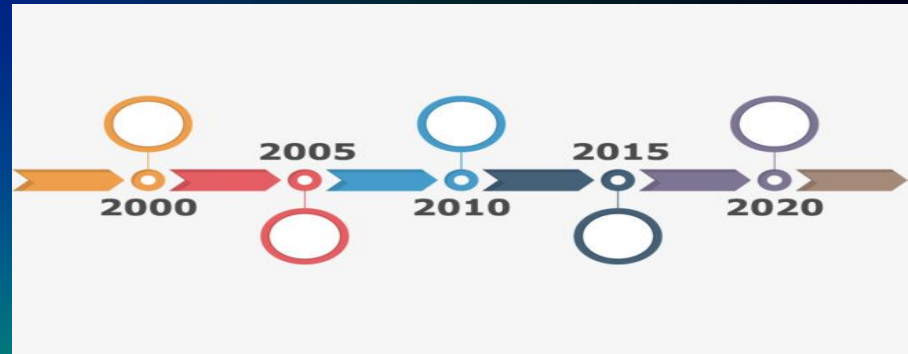
Positive Collaboration

13. COLLABORATIVE PROBLEM-SOLVING



14. CHANGE Over TIME “TRENDS”

- **GENDER Gap in READING** in favor of **GIRLS** narrowed by **12 points** between **2009** and **2015**.
- **BOYS READING** performance improved particularly among highest-achieving **BOYS**.
- **BOYS** perform better than **GIRLS** in **MATH** among the highest-achieving students.

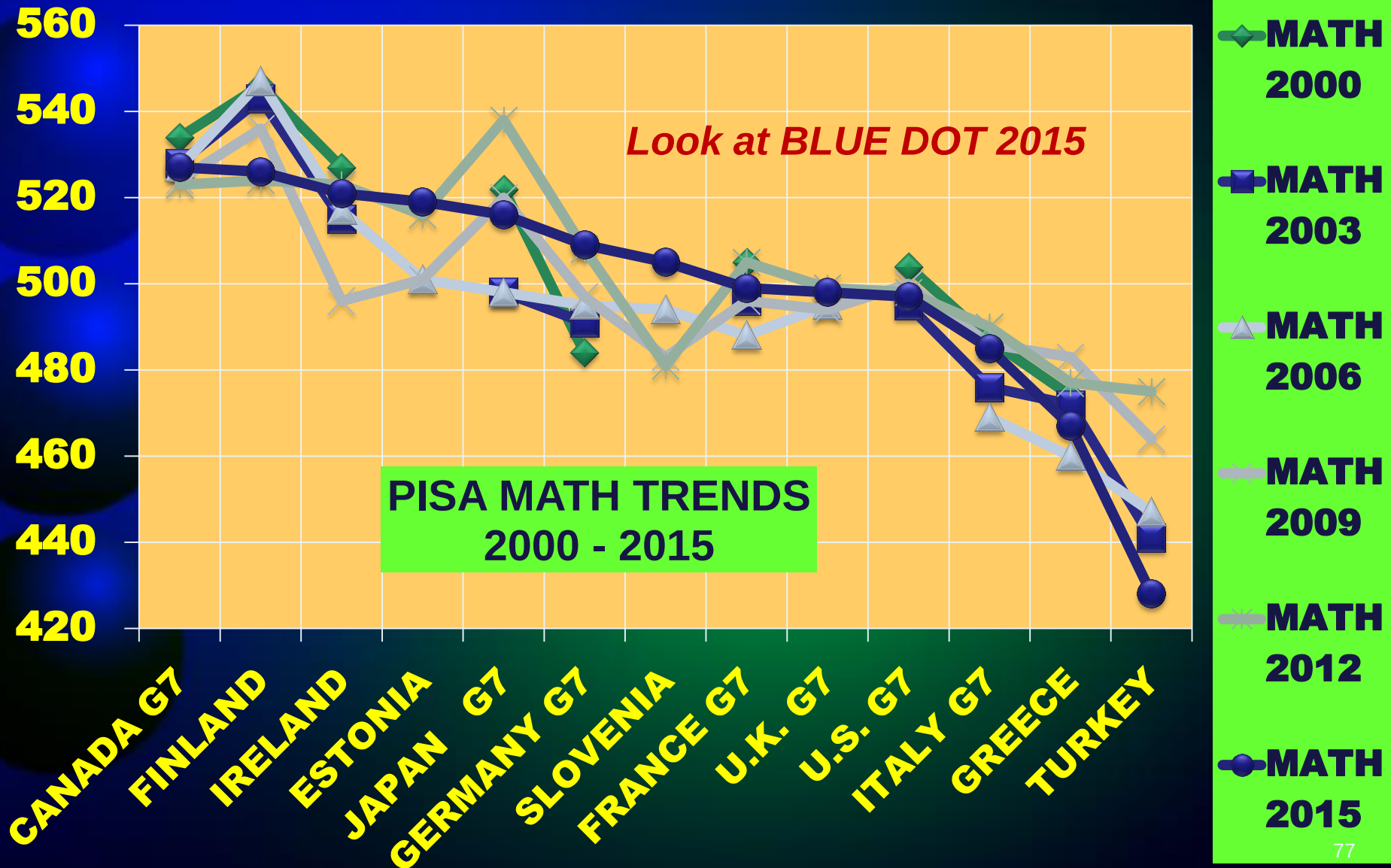


PISA ASSESSMENT	YEAR	MAJOR DOMAIN
1ST	2000	READING
2 ND	2003	MATH
3 RD	2006	SCIENCE
4 TH	2009	READING
5 TH	2012	MATH
6 TH	2015	SCIENCE
7 TH	2018	READING

TRENDS Over TIME – G7 & Others

	MATH 2000	MATH 2003	MATH 2006	MATH 2009	MATH 2012	MATH 2015
JAPAN G7	522	498	498	520	538	516
CANADA G7	534	528	527	524	523	527
U.S. G7	504	495	m	500	498	497
U.K. G7	m	m	495	494	499	498
IRELAND	527	515	517	496	523	521
GERMANY G7	484	491	495	497	508	509
FRANCE G7	505	496	488	496	505	499
ITALY G7	487	476	469	486	490	485
GREECE	474	472	460	483	477	467
TURKEY	m	441	447	464	475	428
ESTONIA	m	m	501	501	516	519
FINLAND	546	543	547	536	524	526
SLOVENIA	m	m	494	483	481	505

PISA 2015 MATH TRENDS



PISA 2015 – POLICY IMPLICATIONS

- ✓ How universal are **basic skills**?
- ✓ Higher **Public Expenditures** not always delivered results.
- ✓ Countries do not have to choose between **nurturing excellence** & reducing underperformance.
- ✓ **Gender** Differences in Performance Persist.

POLICY IMPLICATIONS - SCIENCE

- Support widespread **engagement** with science while meeting demand for scientific **excellence**.
- Improve both **skills** and **attitudes** to encourage lifelong engagement with Science.
- Challenge **stereotypes** about science- related occupations to help all **boys** and **girls** achieve their potential.

POLICY IMPLICATIONS - EQUITY

- Design policies based on how well SES predicts performance and how much **difference** in student **performance overlaps** with **SES disparities**.
- Target **special resources** to schools with high concentration of low-performing and **disadvantaged** students. (Also **IMMIGRANT**)
- Encourage **positive attitudes** towards learning science among students of **all backgrounds**.
- Reduce differences in exposure to science content in school by adopting **rigorous curriculum standards**.

PISA Volume II – Policies and Practices for Successful Schools – POLICY IMPLICATIONS

- ✓ Account for Variations in Student Performance
- ✓ Give everyone **Opportunity to Learn** Science
- ✓ Ambitious Reforms = Changes **Inside Classroom**
- ✓ **Positive** Learning Environment For All
- ✓ Schools Use **Multiple** Types of **Assessments**
- ✓ Build Skilled and Dedicated **Teacher Workforce**
- ✓ **Balance School Autonomy with Accountability**
- ✓ **Excellent Schools in Every Neighborhood**
- ✓ **Adjust School Size if Financial Resources Limited**
- ✓ **Additional Support to Struggling – Not Repetition**
- ✓ **Delay Selection Age to Different Education Programs**
- ✓ **Provide Access to Quality Early Education**
- ✓ Additional Support to **Disadvantaged Schools**

PISA Volume III– STUDENTS' WELL-BEING POLICY IMPLICATIONS

❑ Psychological Health, Motivation & Confidence at School

Train teachers to address schoolwork **anxiety**.

Share good practice to raise **intrinsic motivation**.

Guide well-informed decisions future study, **careers**.

❑ Positive Peer and Teacher-Student Relationships

Train teachers - classroom & **relationship** management.

Prevent **bullying**; Support victims, bullies, bystanders.

❑ Positive Synergies Between School and Home

Encourage & remove barriers to **parental involvement**

Impact of **SES inequalities** on student perceptions.

❑ Opportunities to Learn About Healthy Living Habits

Benefits active. healthy lifestyle thru P.E. & Health Ed.

Promote healthy, productive use of the **Internet**.

PISA - Contributions to Sustainable Development Goal 4

- ❑ Inclusive & equitable quality education.

- ❑ Lifelong learning opportunities for all.

- ❑ Differs from Millennium Development

Goals (MDGs) 2000-2015

- Truly Global
- Establish universal agenda.
- Do not differentiate between rich and poor countries.
- Every single country is challenged to achieve SDGs.

Distinction “Top Performer” v/s “Gifted”

- ❖ **International Communication & Terminology**
- ❖ **Facilitate Value High Achievement**
- ❖ **Context of Less Elitist Label**



POLICIES IN HIGH-PERFORMING COUNTRIES

Linda Darling-Hammond (Feb. 14, 2019 - AASA Supt. Conference)

1. Equitable **RESOURCES** to Schools.
2. Major Investments in **EDUCATOR PREPARATION** & Ongoing Support.
3. **SCHOOL DESIGN** Support s Teacher/Student Learning.
4. Equitable Access to **RICH THINKING CURRICULUM.**
5. Performance Assessments Focused on **HIGHER ORDER SKILLS** that are Used to Guide Learning.

HIGH-PERFORMING COUNTRIES SUCH AS FINLAND & SINGAPORE:

- “They take care of children. Health care is usually universal.”
- Both countries have income security and high-quality preschool.
- Educating the “whole child” requires a safe school climate where children are not fearful of violence or of being bullied or ostracized for their differences.

**TEN MEGA-TRENDS in GIFTED EDUCATION
in and for 21ST CENTURY:
CHALLENGES and OPPORTUNITIES FOR ASIA**
(Dai, 2016 P. 303-315)

TREND NO.	MEGA-TREND
1	Deep Pedagogical Changes
2	Structural Changes in the Social Organization of Learning
3	Change in the Technology of Advanced Learning
4	A More Prominent Role of University
5	Changes in Assessment of Learning and Achievement

TEN MEGA-TRENDS in GIFTED EDUCATION in and for 21ST CENTURY: CHALLENGES and OPPORTUNITIES FOR ASIA

(Dai, 2016 P. 303-315)

TREND NO.	MEGA-TREND
6	Changes in the Nature, Purpose & Means of Identification
7	Increasing Local Initiatives and “Reverse Innovations”
8	Shift from Educating a Handful of the Gifted to Developing Talent in All . Making the Pursuit of Excellence More Equitable
9	Preservation of a Good Form of “Elitism” through Gifted Education
10	Significant Change in Epistemology of Gifted Education

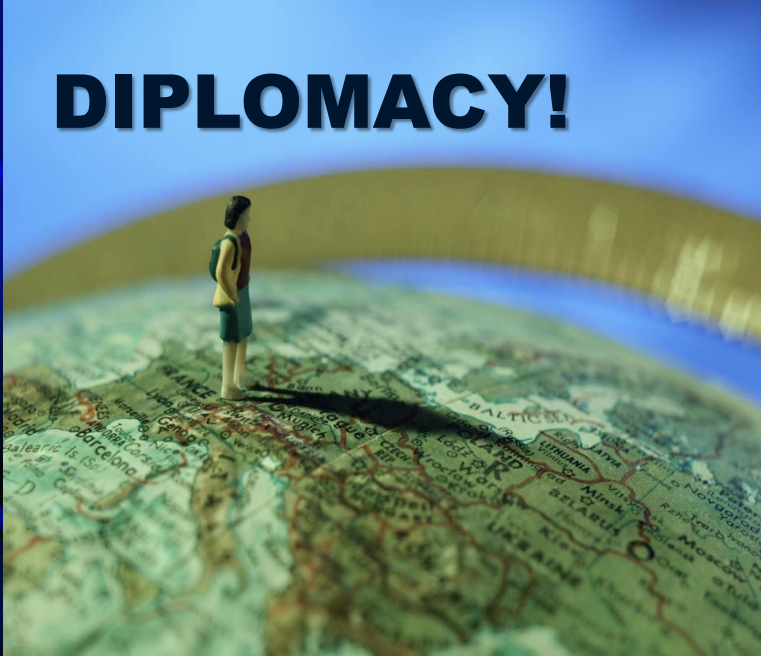
CONCLUSION

- ❑ **PISA - Extensive research Data as Evidence**
- ❑ **Multitude of Sub-group factors**
- ❑ **Achievement, Curriculum, Gender**
- ❑ **Valuable tool - easy access for Policymakers.**
- ❑ **Diplomatically Compare & Advocate for**
- ❑ **“Top Performer” students in overall high achievement.**
- ❑ **Advocacy with Policymakers is Critical**
- ❑ **Support high achievement - Gifted Education**
- ❑ **PISA = uncovered GOLD**
- ❑ **Positively contribute to a country's international educational profile in high achievement.**

DIPLOMACY and Advocacy for Equity in Educational Opportunity For Gifted & Talented Students



DIPLOMACY!



**One Person Can Make a
Difference in Advocacy For
Gifted & Talented Education.**

kstonegift@aol.com

**Entire WCGTC Presentation
Is Available on the
INSTEAD International
Web-site:**

www.insteadinternational.com

- **Personalized Country PISA
Transnational Policy Plan &
Analyses May be Ordered**
- **PISA Data Access Assistance**
- **Charts, Graphs Generated**
- **Analyses in Presentation
Level PowerPoint Format**
- **Report Comments &
Optional Summaries**



I.N.S.T.E.A.D. International

International Network Supporting
Transnational Education And Diplomacy

L Learning
I Integrates
G Genuine
H Harmony
T To
B Build
U Understanding
L Love &
B Belonging

Kathleen Stone, Ph.D.
International Research & Diplomacy

INSTEAD INTERNATIONAL

Burr Ridge, IL 60527 U.S.A.

Tel. 1-630-789-7665

Cell. 1-708-218-4623

E-mail: kstonegift@aol.com

WEB-SITE:

<http://www.insteadinternational.com>

REFERENCES

Page 1

- Abadzi, H., (2006). *Efficient Learning for the Poor: Insights from the Frontier of Cognitive Neuroscience*. Washington, D.C. The World Bank.
- Andrews, P. (2013). Finnish Mathematics Teaching from a Reform Perspective: A Video-Based Case-Study Analysis. *Comparative Educational Review*. Vol. 57, No. 2. P. 189-211.
- Baldi, S., Jin, Y., Skemer, M., Green, P.J., and Hereget, D. (2007). *Highlights from PISA 2006: Performance of U.S. 15-Year-Old Students in Science and Mathematics Literacy and Mathematics Literacy in an International Context* (NCES 2008-016). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC. <http://nces.ed.gov>.
- Carmichael, S., Wilson, W., Finn, C., Winkler, A., Palmieri, S. (2009). *Stars By Which to Navigate? Scanning National and International Education Standards in 2009. An Interim Report on Common Core, NAEP, TIMSS and PISA*. Thomas B. Fordham Institute. P. 1-59.
- Compton, R. (2011). *The Finland Phenomenon: Inside the World's Most Surprising School System*. New School Films. DVD (From Documentary Series on Global Education).
- Crow, B., Lodha, S. K., (2011). *The Atlas of Global Inequalities*. Berkeley: University of California Press.
- Dai, D. Y. (2016). Looking Back to the Future – Toward a New Era of Gifted Education. In D. Y. Dai & C. C. Kuo (Eds.). *Gifted Education in Asia – Problems and Prospects* (pp. 297-315). Charlotte, NC: Information Age Publishing, Inc.

REFERENCES

Page 2

Darling-Hammond, L. (2010). *The Flat World and Education- How America's Commitment to Equity Will Determine Our Future*. New York & London: Teacher's College, Columbia Univ.

Dillon, S. (2010). *Top Test Scores From Shanghai Stun Educators*. New York: The New York Times. Dec. 7, 2010.

Freeman, J. (2016). Cultural Variations in Ideas of Gifts and Talents with Special Regard to the Eastern and Western Worlds. In D. Y. Dai & C. C. Kuo (Eds.). *Gifted Education in Asia – Problems and Prospects* (pp. 232-3, 239). Charlotte, NC: Information Age Publishing, Inc.

Koretz, D. (2009). "How Do American Students Measure UP: Making Sense of International Comparisons." *Future of Children*, V19 n1 Spring 2009. P. 37-51

Loveless, T. (2007). *Lessons Learned – What International Assessments Tell Us About Math Achievement*. Washington, D.C.: Brookings Institution Press.

Martin, M., Mullis, I, Foy, P., Stanco, G., (2012). *TIMSS 2011 International Results in Science*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

Miller, D., Sen, A., Malley L., Burns, S., (2009). "Comparative Indicators of Education in the United States and Other G-8 Countries: 2009." National Center for Education Statistics, NCES 2009-039, P. 4-13.

Mullis, I., Martin, M., Foy, P., Arora, A. (2012). *TIMSS 2011 International Results in Mathematics*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.

- Mullis, I., Martin, M., Foy, P., Drucker, K. (2012). *PIRLS 2011 International Results in Reading*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.
- Mullis, I.V.S., Martin, M.O., Olson, J.F., Berger, D. R., Milne, D., and Stanco, G. M. (Eds.). (2008). *TIMSS 2007 Encyclopedia: A Guide to Mathematics & Science Education Around the World*. Chestnut Hill, MA: Boston College
- OECD (2016), *PISA 2015 Results (Volume I): Excellence and Equity in Education*, PISA OECD Publishing, Paris. <https://dx.doi.org/10.1787/9789264266490-en>
- OECD (2016), *PISA 2015 Results (Volume II): Policies and Practices for Successful Schools*, PISA, OECD Publishing, Paris. <https://dx.doi.org/10.1787/9789264267510-en>
- OECD (2016), *PISA 2015 Results (Volume III): Students' Well Being*, PISA, OECD Publishing, Paris. <https://dx/doi/org/10.1787/9789264273856-en>
- OECD (2016), *PISA 2015 Results (Volume IV): Financial Literacy*, PISA, OECD Publishing, Paris. <http://dx.doi.org/10.1787/9789264270282-en>
- OECD (2016), *PISA 2015 Results (Volume V): Collaborative Problem Solving*, PISA, OECD, Publishing, Paris. <https://doi.org/10.1787/9789264285521-en>
- Pereyra, M., Kotthoff, H., Cowen, R. (Ed.). *PISA Under Examination – Changing Knowledge, Changing Tests, and Changing Schools*. Rotterdam/Boston/Taipei: Sense Publishers.

- Phillipson, S.N., Phillipson, S. (2016). Lessons in Gifted Education From Asia. In D. Y. Dai & C. C. Kuo (Eds.). *Gifted Education in Asia – Problems and Prospects* (pp. 226-227). Charlotte, NC: Information Age Publishing, Inc.
- Rutkowski, D (2017). *Technical Limitation of PISA: Discussion for a Non-Psychometric Audience*. Paper Presented March, 2017 at Comparative International Education Society, Atlanta, GA.
- Rutkowski, L (2017). *The Impact of Floor Effects in PISA for Low-Performing Countries*. Paper Presented March, 2017 at Comparative International Education Society, Atlanta, GA.
- Sahlberg, P. (2010). *Finnish Lessons – What Can the World Learn From Educational Change in Finland?* New York: Teachers College Press.
- Takayama, K. (2010). *Politics of Externatlization in Reflexive Times: Reinventing Japanese Education Reform Discourses through “Finnish PISA Success.”* Comparative Education Review, v54, n1 Feb 2010. P. 51-75.
- Tucker, M. , Ed. (2012). *Surpassing Shanghai – An Agenda for American Education Built on the World’s Leading Systems*. Cambridge, MA: Harvard Education Press.
- Zhao, Y. (2016). The Science and Education of the Individual – Gifted Education for All. In D. Y. Dai & C. C. Kuo (Eds.). *Gifted Education in Asia – Problems and Prospects* (pp. 246-249, 254). Charlotte, NC: Information Age Publishing, Inc.
- Tan, A. (2016). Embracing Education for All Creatively – A Commentary on Gifted Education in East Asia. In D. Y. Dai & C. C. Kuo (Eds.). *Gifted Education in Asia – Problems and Prospects* (pp. 258, 264-266). Charlotte, NC: Information Age Publishing, Inc.
- Vialle, W., Ziegler, A. (2016). Gifted Education in Modern Asia – Analyses from A Systemic Perspective. In D. Y. Dai & C. C. Kuo (Eds.). *Gifted Education in Asia – Problems and Prospects* (p. 288). Charlotte, NC. Information Age Publishing, Inc.