# TIMSS Advanced 2015

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> 53<sup>rd</sup> IEA General Assembly October, 2012, Phuket

TIMSS Advanced 2008



### **TIMSS Advanced 2015** Assesses final-year students with special preparation in

- Advanced mathematics
- Physics

First administered as part of TIMSS in 1995, which included grades 3, 4, 7, 8, and final year

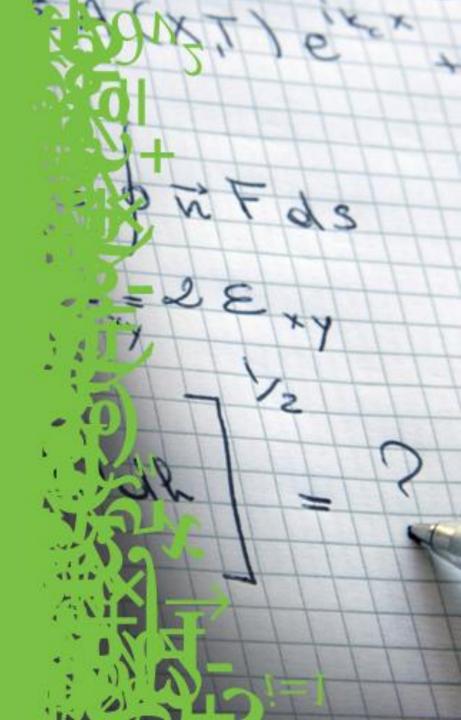
- Trends 1995, 2008, 2015
- 20 years of trends!



## Key Policy Issue – "Yield"

How many can be educated to high level?

- "Mathematics for all"
- Practical considerations
- Strategic planning



## **Students surviving the pipeline**

- Varies across countries
- Remained in school
- Studied at high level all through school careers
- Studied mathematics and science



### Assess carefully defined populations

- Taking advanced courses in mathematics or physics
- Specialists in pre-university programs
- Programs lasting three to five years



### **TIMSS Advanced 2008 Frameworks**

### Advanced mathematics

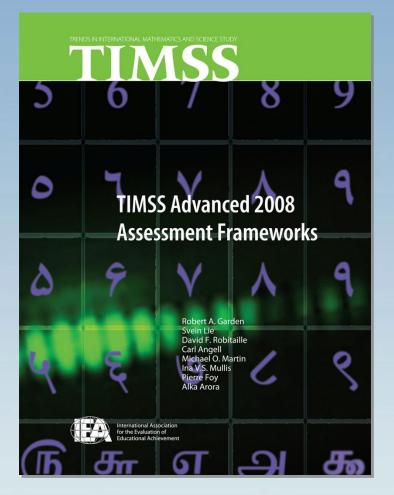
- Algebra
- Calculus
- Geometry

### Physics

**TIMSS** Advanced

2008

- Mechanics
- Electricity and magnetism
- Heat and temperature
- Atomic and nuclear physics





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5

## **Countries Participating in 2008**

- Armenia
- Italy
- Iran
- Lebanon
- Netherlands

- Norway
- Philippines
- Russian Federation
- Slovenia
- Sweden

#### • Also participated in 1995



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### **Target Populations**

- Two separate, but overlapping populations
- Students in the final year of secondary school having taken:
  - Advanced mathematics courses
  - Physics courses





#### EXHIBIT 4.1 – TIMSS Advanced 2008 Advanced Mathematics Populations

Country	Advanced Mathematics Population
Armenia*	Students in the 11th grade in "Physmat" schools
Iran, Islamic Rep. of	Students in the 12th grade in the advanced mathematics and physics track in the pre-university stage
Italy	Students in the 13th grade in an advanced mathematics program or an advanced mathematics and physics program, found in Liceo Scientifico (general schools with scientific focus), Liceo Scientifico Tecnologico (general schools with focus on technology) and Instituti Technici (vocational full time training)
Lebanon	Students in the 12th grade in the general science program
Netherlands	Students in the 12th grade who had taken the advanced mathematics course Math B2 in the pre-university track (VWO)
Norway**	Students in the 13th grade who had taken the 3MX advanced mathematics course in the natural science program of the academic track
Philippines	Students in the 10th grade who had taken advanced mathematics courses and attended either a "science and technology oriented" high school, a regional science high school, a university rural high school and laboratory school, or other public science high school
Russian Federation	Students in the 11th grade who had taken 6 hours or more per week of instruction in mathematics
Slovenia	Students in the 12th grade in general gymnasia programs
Sweden	Students in the 12th grade in the natural science program and the technology program who had taken the mathematics D course and may have taken the mathematics E course

#### Physics Population Country Students in the 11th grade in "Physmat" schools Armenia\* Students in the 12th grade in the advanced mathematics and physics track Iran, Islamic Rep. of in the pre-university stage Italy Students in the 13th grade in an advanced mathematics and physics program, found in Liceo Scientifico (general schools with scientific focus), Liceo Scientifico Tecnologico (general schools with focus on technology) and Instituti Technici (vocational full time training) Lebanon Students in the 12th grade in the general science program Netherlands Students in the 12th grade who had taken the Physics 2 course in the preuniversity track (VWO) Norway\*\* Students in the 13th grade who had taken the 3FY physics course in the natural science program of the academic track Students in the 11th grade who had taken 3 hours or more per week of Russian Federation instruction in physics Slovenia Students in the 12th grade in general gymnasia programs who chose to take an additional physics course in their final year Sweden Students in the 12th grade in the natural science program and the technology program who had taken the physics B course

#### Exhibit 4.2 TIMSS Advanced 2008 Physics Populations

# Sample Design

Basic two-stage sample design, schools (120) at the first stage and one or two intact classes at the second stage

- Completely overlapping populations:
  - One school sample, one or two classes, mathematics and physics booklets rotated within each class
- Partially overlapping populations:
  - Separate school samples for mathematics and physics





ational Study

### **TIMSS Advanced Coverage Index**

### Students Taking Advanced Courses

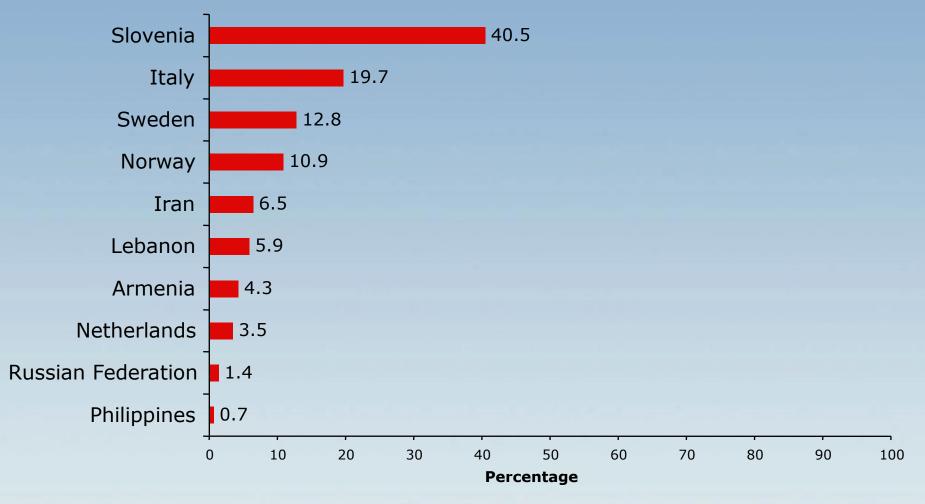


**Entire Age Cohort** 





## **TIMSS Advanced 2008** Mathematics Coverage Index



TIMSS Advanced 2008



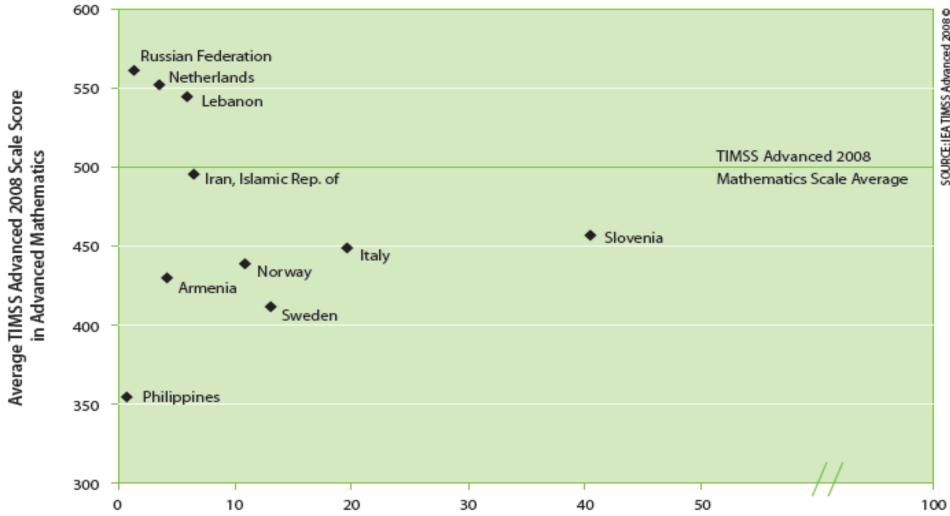
### **Achievement in Advanced Mathematics**

Country	Average Scale Score	Advanced Mathematics Achievement Distribution						
Russian Federation	561 🔿			-			_	
Netherlands	552 🔿				-			
Lebanon	545 🔿				-	-		
TIMSS Adv. Scale Avg.	500							
Iran, Islamic Rep. of	497				•	-	-	
Slovenia	457 💌		-			_		
Italy	449 💌		-			-		
Norway	439 💌		-	-		-		
Armenia	433 🕥		-	• •		-		
Sweden	412 💌		_	-	-	-		
Philippines	355 💌	-			_			
	1	00 200	300	400	500	600	700	800
<ul> <li>Country average significantly higher than TIMSS Advanced scale average</li> <li>Country average significantly lower than TIMSS Advanced scale average</li> </ul>				5th –	$\overline{\top}$	ith 95	ith 2SE)	

TIMSS Advanced 2008



Average Achievement in Advanced Mathematics by TIMSS Advanced 2008 Coverage Index for Advanced Mathematics



TIMSS Advanced 2008 Mathematics Coverage Index (Percent of Students - see Exhibit 1.2)





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TIMSSAdvanced 2008

Advanced Mathematic

#### **Trends in Achievement in Advanced Mathematics**

Countries	Difference in Average Achievement in Advanced Mathematics					TIMSS Advanced Mathematics Coverage Index			
		1995	Higher		200	08 Highe	r	2008	1995
Russian Federation					12			1.4%	2.0%
Slovenia			-20					40.5%	75.4%
Italy			-34					19.7%	20.2%
Sweden	-89							12.8%	16.2%
1	00 8	D	 0 40 2 ifference s	statisti	cally sigr			] 00	

TIMSS Advanced 2008



#### **Advanced Mathematics Results by Gender**

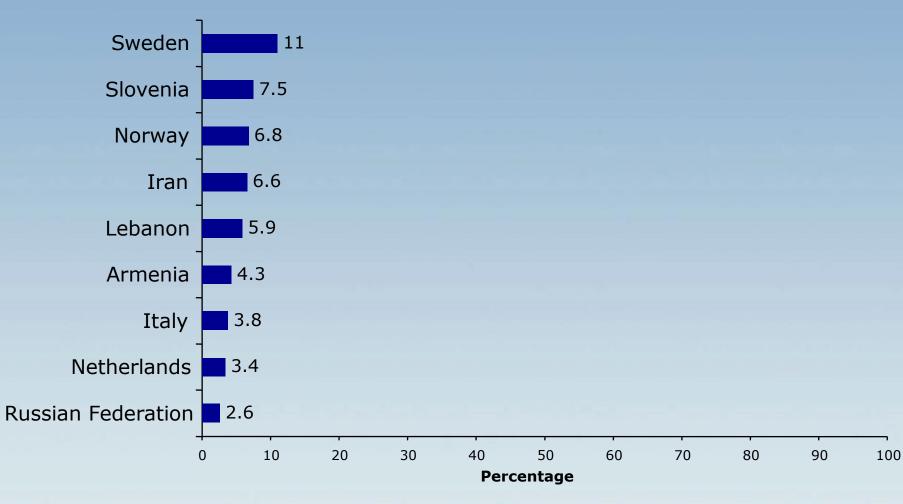
Country	Percent of Students		Average Achievement					
country	Females	Males	Females Scored Higher	Males Scored Higher				
Netherlands	23	77						
Italy	34	66						
Norway	38	62						
Armenia	52	48						
Lebanon	29	71						
Sweden	40	60						
Russian Federation	45	55						
Slovenia	60	40						
Iran, Islamic Rep. of	44	56						
Philippines	63	37						
		10	 00 80 60 40 20 0	0 20 40 60 80 10				
			Difference statistically significant					
			Difference not statistically significant					

Difference not statistically significant





## **TIMSS Advanced 2008 Physics Coverage Index**



TIMSS Advanced 2008

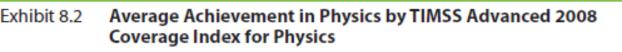


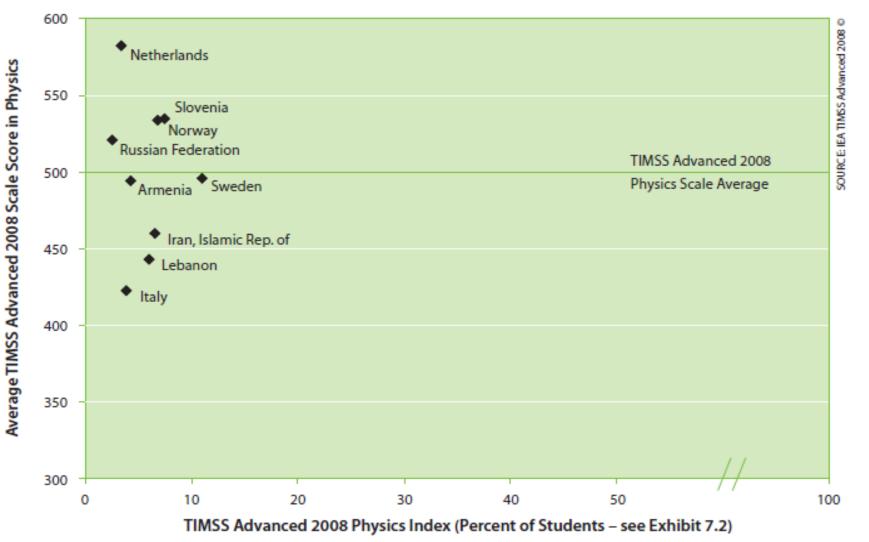
### **Achievement in Physics**

Country	Average Scale Score	Physics Achievement Distribution		
Netherlands	582 🔿			
Slovenia	535 🛆			
Norway	534 🛆			
Russian Federation	521 🔿			
TIMSS Adv. Scale Avg.	500			
Sweden	497			
Armenia	495			
Iran, Islamic Rep. of	460 💌			
Lebanon	444 💌			
Italy	422 🕥			
	1(	00 200 300 400 500 600 700 800		
<ul> <li>Country average significant than TIMSS Advanced scale</li> <li>Country average significant than TIMSS Advanced scale</li> </ul>	e average tly lower	<ul> <li>Percentiles of Performance</li> <li>5th 25th 75th 95th</li> <li>95% Confidence Interval for Average (±2SE)</li> </ul>		

TIMSS Advanced 2008







TIMSS Advanced 2008



TIMSSAdvanced 2008

Physics

#### **Trends in Achievement in Physics**

Countries	Difference in Phy	TIMSS Physics Coverage Index		
	1995 Higher	2008 Higher	2008	1995
Slovenia		3	7.5%	38.6%
Russian Federation	-24		2.6%	1.5%
Norway	-47		6.8%	8.4%
Sweden	-81		11.0%	16.3%
1	00 80 60 40 20	0 20 40 60 80 10	] 00	
	Difference statis	tically significant		
	Difference not st	tatistically significant		





#### **Physics Results by Gender**

**TIMSS** Advanced

2008

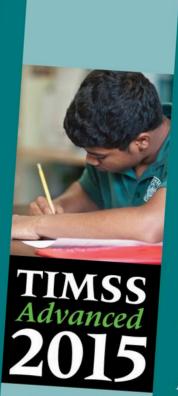
Country	Percent of Students		Average Achievement					
country	Females	Males	Females Scored Higher	Males Scored Higher				
Slovenia	27	73						
Armenia	53	47						
Sweden	35	65						
Lebanon	29	71						
Netherlands	19	81						
Norway	29	71						
Italy	40	60						
Iran, Islamic Rep. of	44	56						
Russian Federation	45	55						
		1	 00 80 60 40 20 0	) 20 40 60 80 10				
			Difference statistically significant					

Difference not statistically significant



### **TIMSS Advanced 2015** *Preparing the next generation of scientists and engineers*

- Quantity and quality of students prepared for university study in STEM fields at the end of secondary school
- Participation options
  - End of secondary school
  - Beginning of first year of tertiary education



Trends in International Mathematics and Science Study

ternational Study Center

timssandpirls.bc.edu

INTERNATIONAL ASSESSMENT of ADVANCED MATHEMATICS and PHYSICS

Innovation in science, technology, and engineering is critical to a country's economic growth.





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