The Significance of IEA Studies for Education in East Asia and Beyond

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Introduction

- East Asian “countries” in IEA: Chinese Taipei, Hong Kong, Japan, Korea, Singapore
- Cultural rather than geographic demarcation: Confucian heritage culture (CHC)
- How do we locate the East Asian countries in terms of development in education?
- Before the mid 1990s, East Asia is not a region well known for its education, and it is not of particular interest to the international education community
- In fact, the literature has indicated that instructional practices in East Asia were rather traditional and backward, failing to keep in pace with the latest development in learning and instructional theories

e.g. Teaching in Hong Kong in the 1980s

"The schools in Hong Kong have a reputation for reliance on teacher dominated instructional strategies. Pressures arise from the external examinations, the complexities of languages, expansion of the school system ….. There has developed a tendency for classes to be taught by lecture-style delivery, with little student participation, apart from note taking and completing assigned work. ... The intense pressure of examinations, the expectations of parents, pupils and colleagues appear to encourage teachers to impart knowledge and instill in students a need to learn for a predominantly recall mode of performance." (Hong Kong SIMS report; Brimer and Griffin, 1985:23)

Mathematics teaching in East Asia

"Curricula … are content oriented and examination driven. Teaching is very traditional and old fashioned. Teachers in these countries seem to be ignorant about the latest methods of teaching, and think that mere competence in mathematics is sufficient for effective teaching of the subject. Classroom teaching is conducted in a whole class setting, and given the large class size involved, there are virtually no group work or activities. Instruction is teacher dominated, and student involvement is minimal. Memorization of mathematical facts is stressed and students learn mainly by rote. There is ample amount of practice of mathematical skills, mostly without thorough understanding. Students and teachers are subjected to excessive pressure from the highly competitive examinations, and the students do not seem to enjoy their study." (Brimer and Griffin, 1985; Biggs, 1994; Leung, 1995, 2000; Wong and Cheung, 1997; Wong, 1998)

Student achievement in East Asian countries

- Most countries monitor the effectiveness of their own education systems
- How well, or how badly, do East Asian countries perform in terms of student achievement?
- In addition to whatever national instruments used, countries need an "objective", accurate, and meaningful measure
- The measure must have international credibility as well as national relevance
- What is needed: an international study with endorsement from a large number of countries

Are IEA studies accurate and objective measures of achievement across countries?

- IEA tradition – ensures reliable measures
- But are IEA studies valid?
- Two validities:
  - International – the latest understanding of the subject matter
  - Nationally – coincides with national understanding of the subject matter
- The use of international experts in the field
- The importance of national participation in IEA matters

IEA studies since the 1990s

How did East Asian students perform in the following IEA studies?

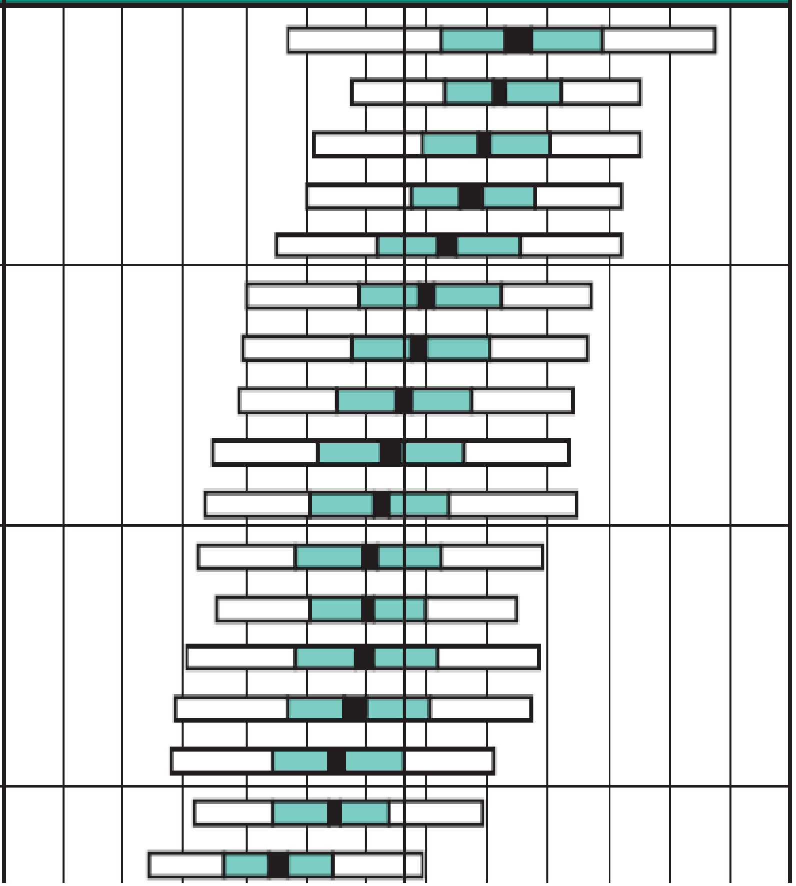
- 1995 TIMSS
- 1999 TIMSS-R
- 1999 TIMSS Video Study
- 2001 PIRLS
- 2003 TIMSS
- 2006 PIRLS

TIMSS 1995

Table 1.1

Distributions of Mathematics Achievement - Upper Grade (Fourth Grade*)

Country	Mean	Years of Formal Schooling	Average Age	Mathematics Achievement Scale Score
Singapore	625 (5.3)	4	10.3	
Korea	611 (2.1)	4	10.3	
Japan	597 (2.1)	4	10.4	
Hong Kong	587 (4.3)	4	10.1	
Czech Republic	567 (3.3)	4	10.4	
Ireland	550 (3.4)	4	10.3	
United States	545 (3.0)	4	10.2	
Canada	532 (3.3)	4	10.0	
† Scotland	520 (3.9)	5	9.7	
†2 England	513 (3.2)	5	10.0	
Cyprus	502 (3.1)	4	9.8	
Norway	502 (3.0)	3	9.9	
New Zealand	499 (4.3)	4.5–5.5	10.0	
Greece	492 (4.4)	4	9.6	
Portugal	475 (3.5)	4	10.4	
Iceland	474 (2.7)	4	9.6	
Iran, Islamic Rep.	429 (4.0)	4	10.5	



TIMSS 1995

Table 1.1

Distributions of Mathematics Achievement - Upper Grade (Eighth Grade*)

Country	Mean	Years of Formal Schooling	Average Age	Mathematics Achievement Scale Score
Singapore	643 (4.9)	8	14.5	
Korea	607 (2.4)	8	14.2	
Japan	605 (1.9)	8	14.4	
Hong Kong	588 (6.5)	8	14.2	
† Belgium (Fl)	565 (5.7)	8	14.1	
Czech Republic	564 (4.9)	8	14.4	
Slovak Republic	547 (3.3)	8	14.3	
[1] Switzerland	545 (2.8)	7 or 8	14.2	
France	538 (2.9)	8	14.3	
Hungary	537 (3.2)	8	14.3	
Russian Federation	535 (5.3)	7 or 8	14.0	
Ireland	527 (5.1)	8	14.4	
Canada	527 (2.4)	8	14.1	
Sweden	519 (3.0)	7	13.9	
New Zealand	508 (4.5)	8.5 - 9.5	14.0	
†[2] England	506 (2.6)	9	14.0	
Norway	503 (2.2)	7	13.9	
† United States	500 (4.6)	8	14.2	
[1] Latvia (LSS)	493 (3.1)	8	14.3	
Spain	487 (2.0)	8	14.3	
Iceland	487 (4.5)	8	13.6	
[1] Lithuania	477 (3.5)	8	14.3	
Cyprus	474 (1.9)	8	13.7	
Portugal	454 (2.5)	8	14.5	
Iran, Islamic Rep.	428 (2.2)	8	14.6	

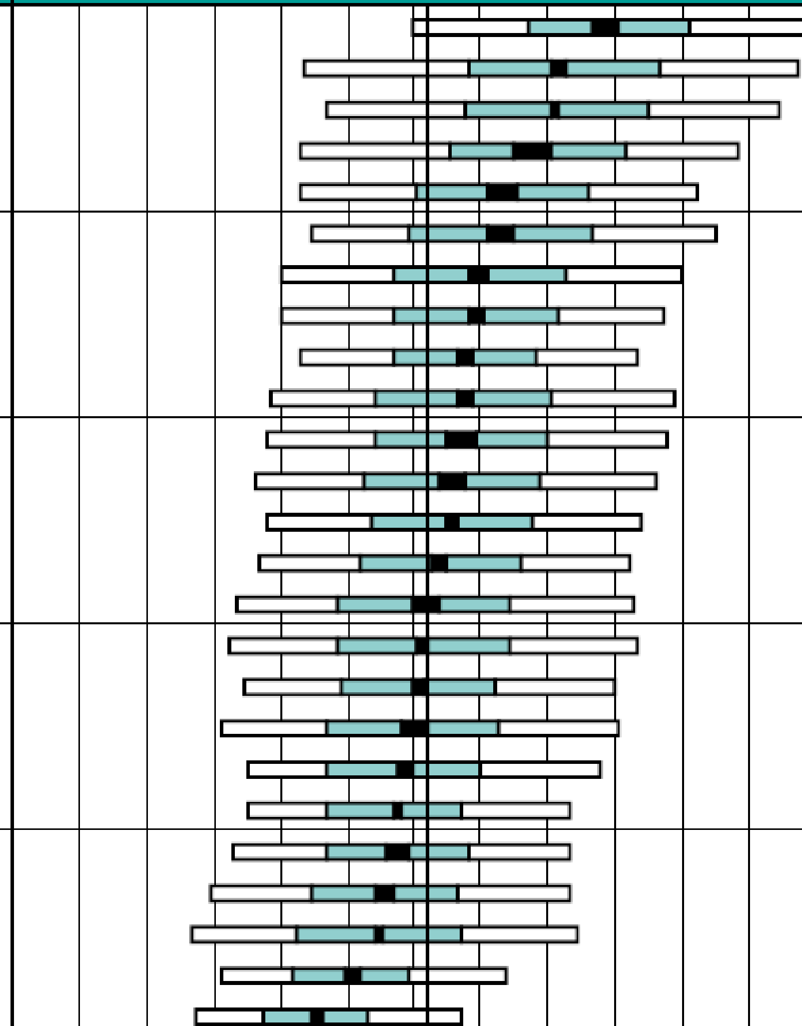
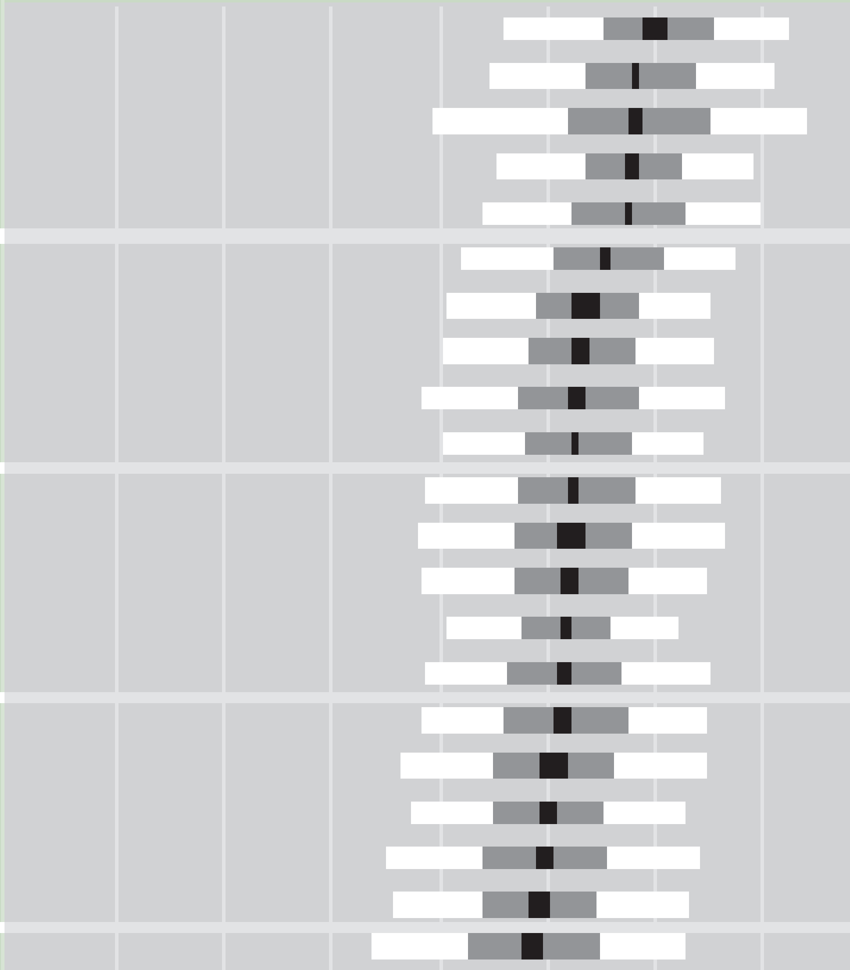


Exhibit 1.1 Distribution of Mathematics Achievement

TIMSS 1999 8th grade Mathematics



Country		Average Scale Score	Years of Formal Schooling	Average Age
Singapore	▲	604 (6.3)	8	14.4
Korea, Rep. of	▲	587 (2.0)	8	14.4
Chinese Taipei	▲	585 (4.0)	8	14.2
Hong Kong, SAR [†]	▲	582 (4.3)	8	14.2
Japan	▲	579 (1.7)	8	14.4
Belgium (Flemish) [†]	▲	558 (3.3)	8	14.1
Netherlands [†]	▲	540 (7.1)	8	14.2
Slovak Republic	▲	534 (4.0)	8	14.3
Hungary	▲	532 (3.7)	8	14.4
Canada	▲	531 (2.5)	8	14.0
Slovenia	▲	530 (2.8)	8	14.8
Russian Federation	▲	526 (5.9)	7 or 8	14.1
Australia	▲	525 (4.8)	8 or 9	14.3
Finland	▲	520 (2.7)	7	13.8
Czech Republic	▲	520 (4.2)	9	14.4
Malaysia	▲	519 (4.4)	8	14.4
Bulgaria	▲	511 (5.8)	8	14.8
Latvia (LSS) [1]	▲	505 (3.4)	8	14.5
United States	▲	502 (4.0)	8	14.2
England [†]	●	496 (4.1)	9	14.2
New Zealand	●	491 (5.2)	8.5 to 9.5	14.0

Exhibit 1.1: Distribution of Mathematics Achievement

MATHEMATICS Grade 4

Countries	Years of Schooling*	Average Age	Mathematics Achievement Distribution	Average Scale Score		Human Development Index**
Singapore	4	10.3		594 (5.6)	▲	0.884
† Hong Kong, SAR	4	10.2		575 (3.2)	▲	0.889
Japan	4	10.4		565 (1.6)	▲	0.932
Chinese Taipei	4	10.2		564 (1.8)	▲	–
Belgium (Flemish)	4	10.0		551 (1.8)	▲	0.937
† Netherlands	4	10.2		540 (2.1)	▲	0.938
Latvia	4	11.1		536 (2.8)	▲	0.811
† Lithuania	4	10.9		534 (2.8)	▲	0.824
Russian Federation	3 or 4	10.6		532 (4.7)	▲	0.779
† England	5	10.3		531 (3.7)	▲	0.930
Hungary	4	10.5		529 (3.1)	▲	0.837
† United States	4	10.2		518 (2.4)	▲	0.937
Cyprus	4	9.9		510 (2.4)	▲	0.891
Moldova, Rep. of	4	11.0		504 (4.9)		0.700
Italy	4	9.8		503 (3.7)	▲	0.916
† Australia	4 or 5	9.9		499 (3.9)		0.939
International Avg.	4	10.3		495 (0.8)		–
New Zealand	4.5 - 5.5	10.0		493 (2.2)		0.917
† Scotland	5	9.7		490 (3.3)		0.930

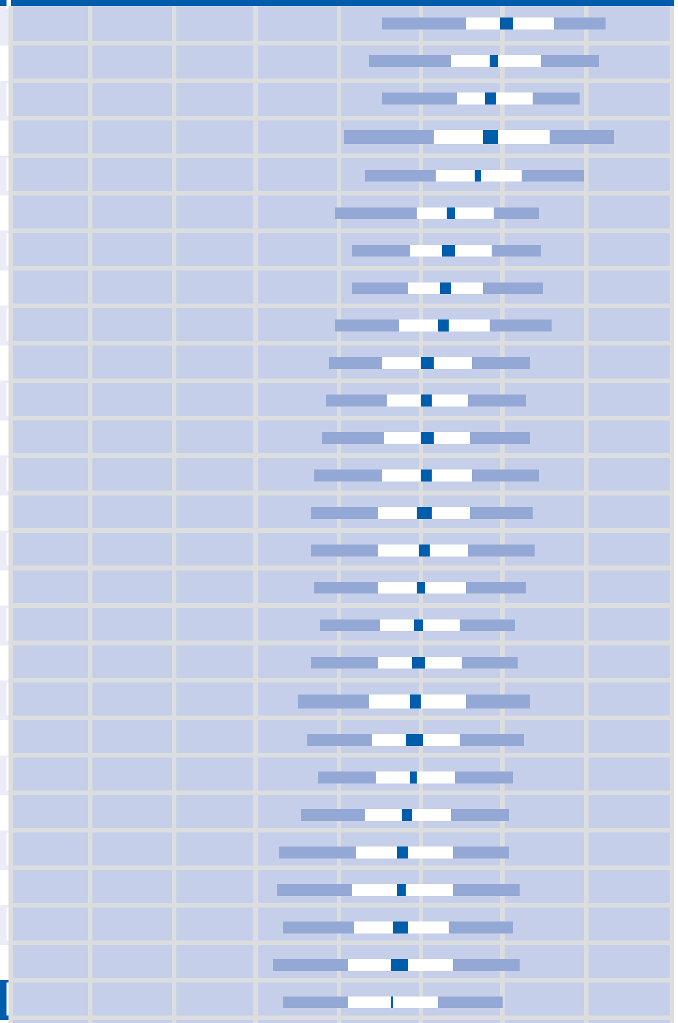
SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 1.1: Distribution of Mathematics Achievement

MATHEMATICS Grade 8

	Countries	Years of Schooling*	Average Age	Average Scale Score		Human Development Index**
	Singapore	8	14.3	605 (3.6)	▲	0.884
‡	Korea, Rep. of	8	14.6	589 (2.2)	▲	0.879
†	Hong Kong, SAR	8	14.4	586 (3.3)	▲	0.889
	Chinese Taipei	8	14.2	585 (4.6)	▲	–
	Japan	8	14.4	570 (2.1)	▲	0.932
	Belgium (Flemish)	8	14.1	537 (2.8)	▲	0.937
†	Netherlands	8	14.3	536 (3.8)	▲	0.938
	Estonia	8	15.2	531 (3.0)	▲	0.833
	Hungary	8	14.5	529 (3.2)	▲	0.837
	Malaysia	8	14.3	508 (4.1)	▲	0.790
	Latvia	8	15.0	508 (3.2)	▲	0.811
	Russian Federation	7 or 8	14.2	508 (3.7)	▲	0.779
	Slovak Republic	8	14.3	508 (3.3)	▲	0.836
	Australia	8 or 9	13.9	505 (4.6)	▲	0.939
‡	United States	8	14.2	504 (3.3)	▲	0.937
1	Lithuania	8	14.9	502 (2.5)	▲	0.824
	Sweden	8	14.9	499 (2.6)	▲	0.941
†	Scotland	9	13.7	498 (3.7)	▲	0.930
2	Israel	8	14.0	496 (3.4)	▲	0.905
	New Zealand	8.5 - 9.5	14.1	494 (5.3)	▲	0.917
	Slovenia	7 or 8	13.8	493 (2.2)	▲	0.881
	Italy	8	13.9	484 (3.2)	▲	0.916
	Armenia	8	14.9	478 (3.0)	▲	0.729
1	Serbia	8	14.9	477 (2.6)	▲	–
	Bulgaria	8	14.9	476 (4.3)	▲	0.795
	Romania	8	15.0	475 (4.8)		0.773
	International Avg.	**8**	**14.5**	**467 (0.5)**		**–**

Mathematics Achievement Distribution



TIMSS 1995

Table 1.1

Distributions of Achievement in the Sciences - Upper Grade (Fourth Grade*)

Country	Mean	Years of Formal Schooling	Average Age
Korea	597 (1.9)	4	10.3
Japan	574 (1.8)	4	10.4
United States	565 (3.1)	4	10.2
Czech Republic	557 (3.1)	4	10.4
†[2] England	551 (3.3)	5	10.0
Canada	549 (3.0)	4	10.0
Singapore	547 (5.0)	4	10.3
Ireland	539 (3.3)	4	10.3
† Scotland	536 (4.2)	5	9.7
Hong Kong	533 (3.7)	4	10.1
New Zealand	531 (4.9)	4.5–5.5	10.0
Norway	530 (3.6)	3	9.9
Iceland	505 (3.3)	4	9.6
Greece	497 (4.1)	4	9.6
Portugal	480 (4.0)	4	10.4
Cyprus	475 (3.3)	4	9.8
Iran, Islamic Rep.	416 (3.9)	4	10.5

Science Achievement Scale Score

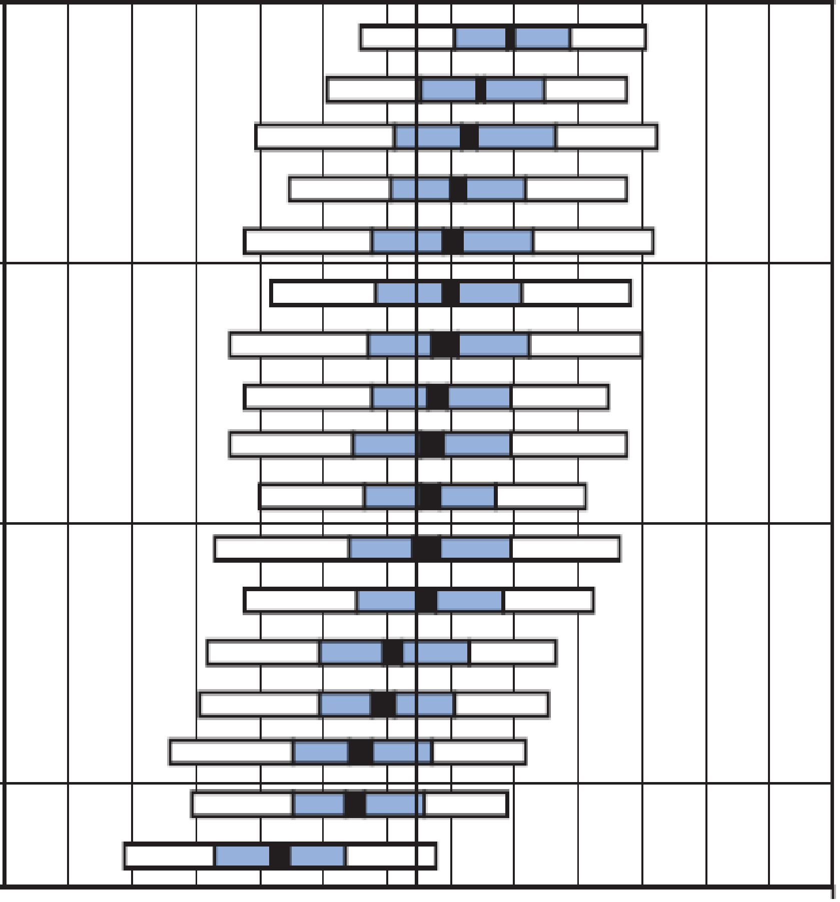


Table 1.1

TIMSS 1995

Distributions of Achievement in the Sciences - Upper Grade (Eighth Grade*)

Country	Mean	Years of Formal Schooling	Average Age	Science Achievement Scale Score
Singapore	607 (5.5)	8	14.5	
Czech Republic	574 (4.3)	8	14.4	
Japan	571 (1.6)	8	14.4	
Korea	565 (1.9)	8	14.2	
Hungary	554 (2.8)	8	14.3	
†[2] England	552 (3.3)	9	14.0	
† Belgium (Fl)	550 (4.2)	8	14.1	
Slovak Republic	544 (3.2)	8	14.3	
Russian Federation	538 (4.0)	7 or 8	14.0	
Ireland	538 (4.5)	8	14.4	
Sweden	535 (3.0)	7	13.9	
† United States	534 (4.7)	8	14.2	
Canada	531 (2.6)	8	14.1	
Norway	527 (1.9)	7	13.9	
New Zealand	525 (4.4)	8.5 - 9.5	14.0	
Hong Kong	522 (4.7)	8	14.2	
† Switzerland	522 (2.5)	7 or 8	14.2	
Spain	517 (1.7)	8	14.3	
France	498 (2.5)	8	14.3	
Iceland	494 (4.0)	8	13.6	
[1] Latvia (LSS)	485 (2.7)	8	14.3	
Portugal	480 (2.3)	8	14.5	
[1] Lithuania	476 (3.4)	8	14.3	
Iran, Islamic Rep.	470 (2.4)	8	14.6	
Cyprus	463 (1.9)	8	13.7	

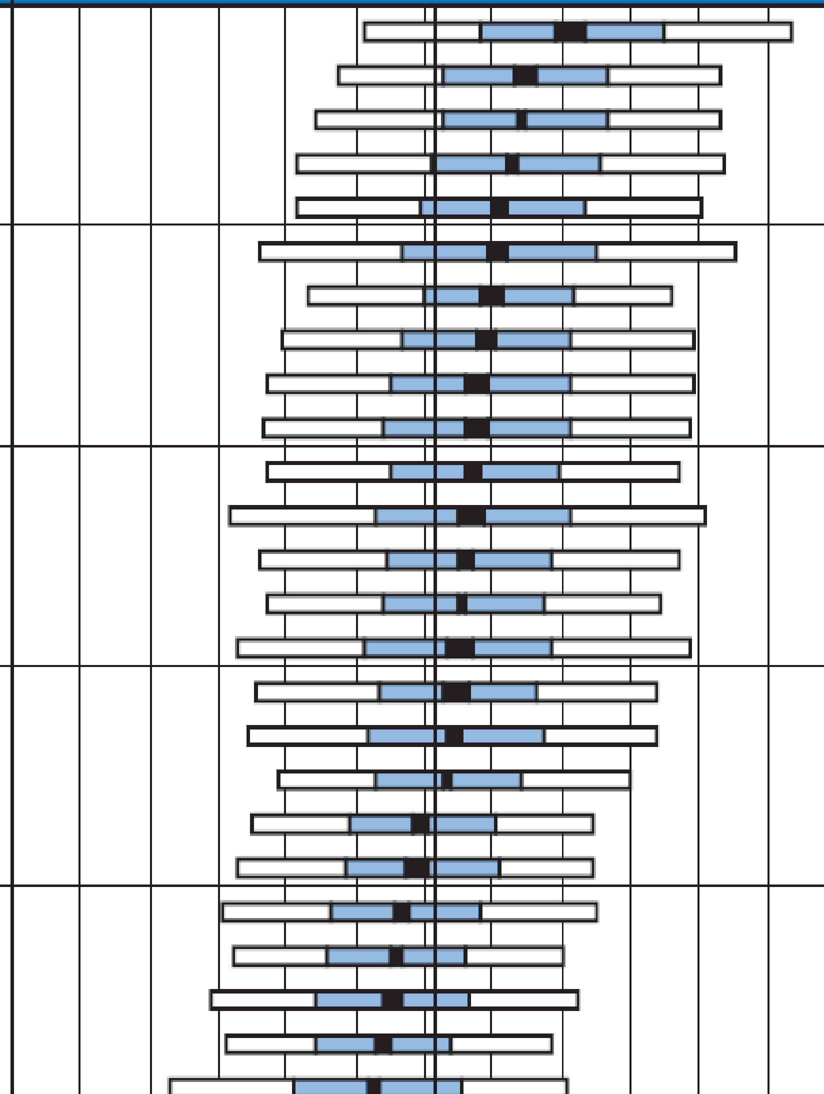
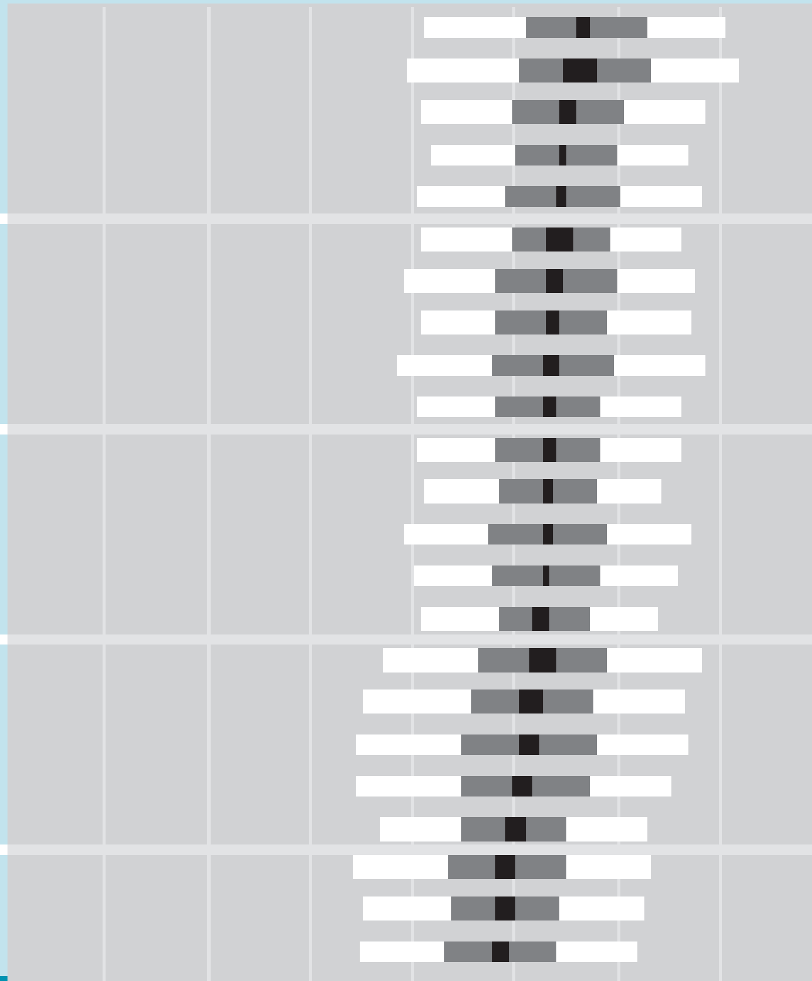


Exhibit 1.1 Distribution of Science Achievement

TIMSS 1999 8th grade Science

Science Achievement Scale Score



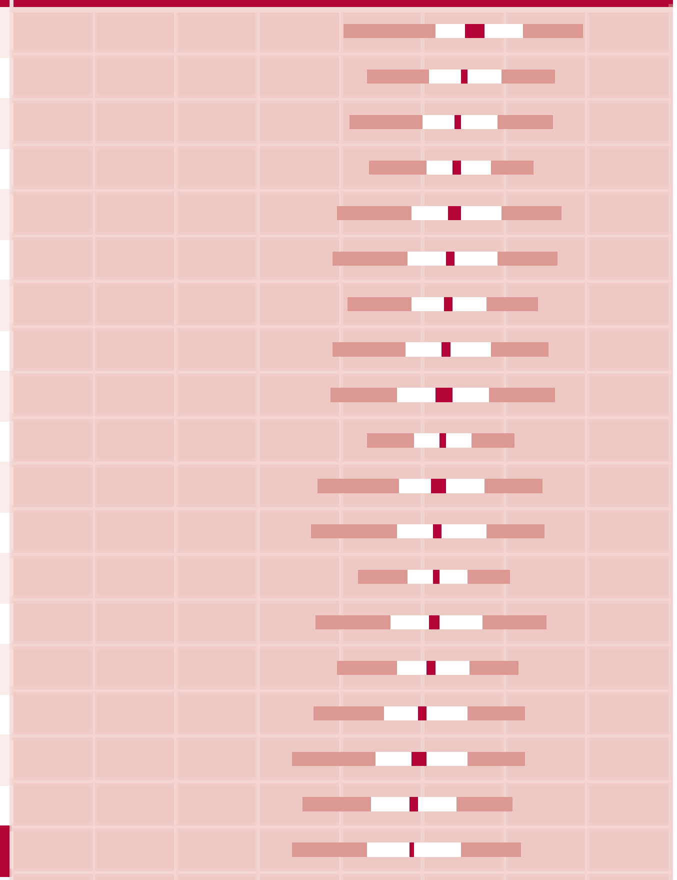
Country		Average Scale Score	Years of Formal Schooling	Average Age
Chinese Taipei	▲	569 (4.4)	8	14.2
Singapore	▲	568 (8.0)	8	14.4
Hungary	▲	552 (3.7)	8	14.4
Japan	▲	550 (2.2)	8	14.4
Korea, Rep. of	▲	549 (2.6)	8	14.4
Netherlands †	▲	545 (6.9)	8	14.2
Australia	▲	540 (4.4)	8 or 9	14.3
Czech Republic	▲	539 (4.2)	9	14.4
England †	▲	538 (4.8)	9	14.2
Finland	▲	535 (3.5)	7	13.8
Slovak Republic	▲	535 (3.3)	8	14.3
Belgium (Flemish) †	▲	535 (3.1)	8	14.1
Slovenia	▲	533 (3.2)	8	14.8
Canada	▲	533 (2.1)	8	14.0
Hong Kong, SAR †	▲	530 (3.7)	8	14.2
Russian Federation	▲	529 (6.4)	7 or 8	14.1
Bulgaria	▲	518 (5.4)	8	14.8
United States	▲	515 (4.6)	8	14.2
New Zealand	▲	510 (4.9)	8.5 to 9.5	14.0
Latvia (LSS) †	●	503 (4.8)	8	14.5
Italy	●	493 (3.9)	8	14.0
Malaysia	●	492 (4.4)	8	14.4
Lithuania ‡	●	488 (4.1)	8.5	15.2

Exhibit 1.1: Distribution of Science Achievement

SCIENCE Grade 4

Countries	Years of Schooling*	Average Age	Average Scale Score		Human Development Index**
Singapore	4	10.3	565 (5.5)	▲	0.884
Chinese Taipei	4	10.2	551 (1.7)	▲	—
Japan	4	10.4	543 (1.5)	▲	0.932
† Hong Kong, SAR	4	10.2	542 (3.1)	▲	0.889
† England	5	10.3	540 (3.6)	▲	0.930
† United States	4	10.2	536 (2.5)	▲	0.937
Latvia	4	11.1	532 (2.5)	▲	0.811
Hungary	4	10.5	530 (3.0)	▲	0.837
Russian Federation	3 or 4	10.6	526 (5.2)	▲	0.779
† Netherlands	4	10.2	525 (2.0)	▲	0.938
† Australia	4 or 5	9.9	521 (4.2)	▲	0.939
New Zealand	4.5 - 5.5	10.0	520 (2.5)	▲	0.917
Belgium (Flemish)	4	10.0	518 (1.8)	▲	0.937
Italy	4	9.8	516 (3.8)	▲	0.916
¹ Lithuania	4	10.9	512 (2.6)	▲	0.824
† Scotland	5	9.7	502 (2.9)	▲	0.930
Moldova, Rep. of	4	11.0	496 (4.6)		0.700
Slovenia	3 or 4	9.8	490 (2.5)		0.881
International Avg.	**4**	**10.3**	**489 (0.9)**		**—**

Science Achievement Distribution

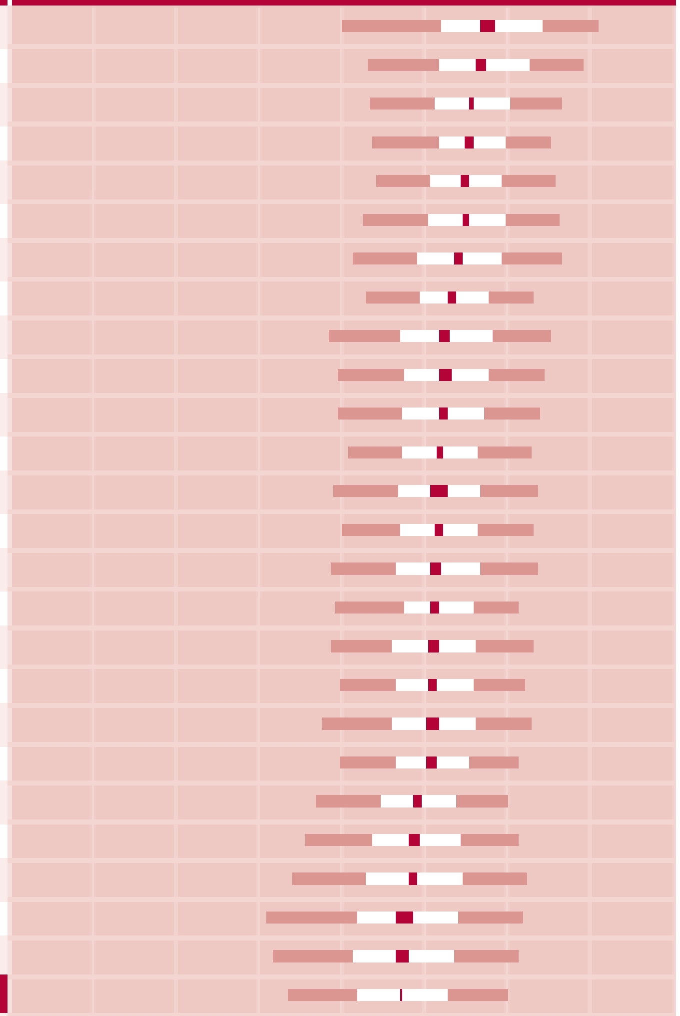


SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 1.1: Distribution of Science Achievement

SCIENCE Grade 8

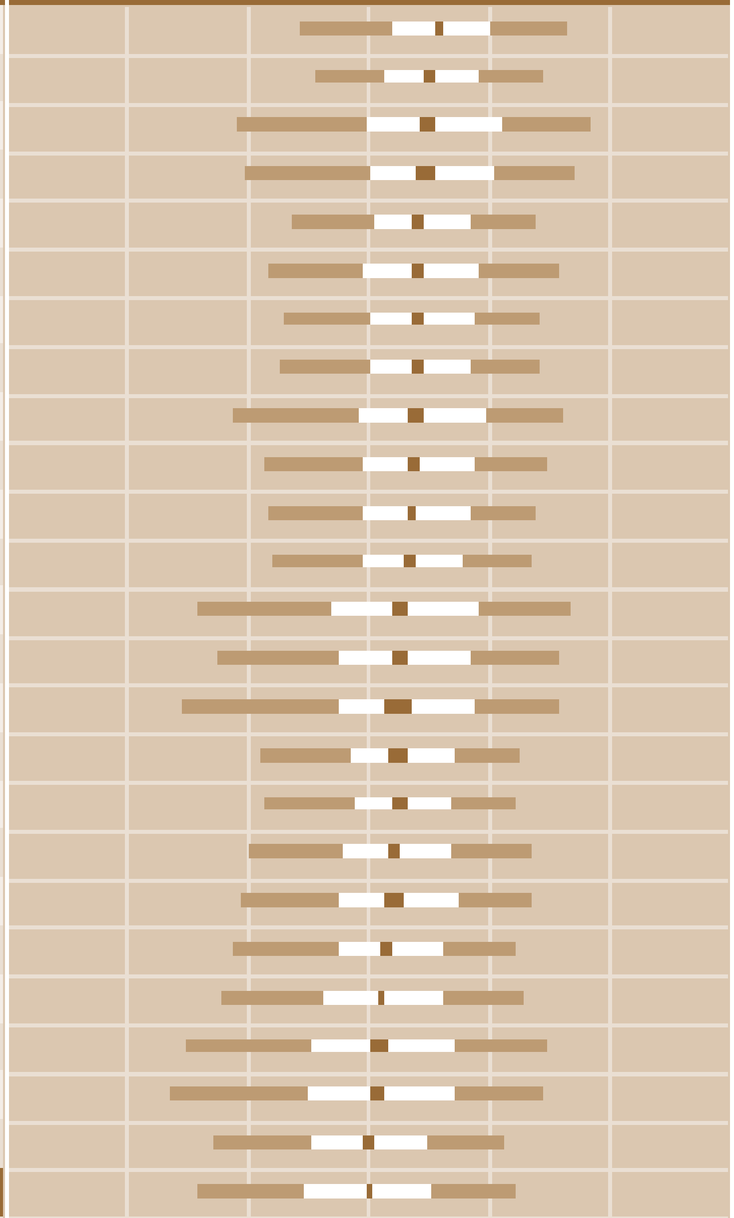
Countries	Years of Schooling*	Average Age	Science Achievement Distribution	Average Scale Score		Human Development Index**
Singapore	8	14.3		578 (4.3)	▲	0.884
Chinese Taipei	8	14.2		571 (3.5)	▲	–
‡ Korea, Rep. of	8	14.6		558 (1.6)	▲	0.879
† Hong Kong, SAR	8	14.4		556 (3.0)	▲	0.889
Estonia	8	15.2		552 (2.5)	▲	0.833
Japan	8	14.4		552 (1.7)	▲	0.932
Hungary	8	14.5		543 (2.8)	▲	0.837
† Netherlands	8	14.3		536 (3.1)	▲	0.938
‡ United States	8	14.2		527 (3.1)	▲	0.937
Australia	8 or 9	13.9		527 (3.8)	▲	0.939
Sweden	8	14.9		524 (2.7)	▲	0.941
Slovenia	7 or 8	13.8		520 (1.8)	▲	0.881
New Zealand	8.5 - 9.5	14.1		520 (5.0)	▲	0.917
1 Lithuania	8	14.9		519 (2.1)	▲	0.824
Slovak Republic	8	14.3		517 (3.2)	▲	0.836
Belgium (Flemish)	8	14.1		516 (2.5)	▲	0.937
Russian Federation	7 or 8	14.2		514 (3.7)	▲	0.779
Latvia	8	15.0		512 (2.6)	▲	0.811
† Scotland	9	13.7		512 (3.4)	▲	0.930
Malaysia	8	14.3		510 (3.7)	▲	0.790
Norway	7	13.8		494 (2.2)	▲	0.944
Italy	8	13.9		491 (3.1)	▲	0.916
2 Israel	8	14.0		488 (3.1)	▲	0.905
Bulgaria	8	14.9		479 (5.2)		0.795
Jordan	8	13.9		475 (3.8)		0.743
International Avg.	8	14.5		474 (0.6)		–



SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Countries	Average Scale Score	Years of Formal Schooling	Average Age
Sweden	▲ 561 (2.2)	4	10.8
[†] Netherlands	▲ 554 (2.5)	4	10.3
[†2a] England	▲ 553 (3.4)	5	10.2
Bulgaria	▲ 550 (3.8)	4	10.9
Latvia	▲ 545 (2.3)	4	11.0
* [1] Canada (O,Q)	▲ 544 (2.4)	4	10.0
[1] Lithuania	▲ 543 (2.6)	4	10.9
Hungary	▲ 543 (2.2)	4	10.7
[†] United States	▲ 542 (3.8)	4	10.2
Italy	▲ 541 (2.4)	4	9.8
Germany	▲ 539 (1.9)	4	10.5
Czech Republic	▲ 537 (2.3)	4	10.5
New Zealand	▲ 529 (3.6)	5	10.1
[†] Scotland	▲ 528 (3.6)	5	9.8
Singapore	▲ 528 (5.2)	4	10.1
[2a] Russian Federation	▲ 528 (4.4)	3 or 4	10.3
Hong Kong, SAR	▲ 528 (3.1)	4	10.2
France	▲ 525 (2.4)	4	10.1
[2a] Greece	▲ 524 (3.5)	4	9.9
Slovak Republic	▲ 518 (2.8)	4	10.3
Iceland	▲ 512 (1.2)	4	9.7
Romania	▲ 512 (4.6)	4	11.1
[2b] Israel	▲ 509 (2.8)	4	10.0
Slovenia	502 (2.0)	3	9.8
International Avg.	500 (0.6)	4	10.3

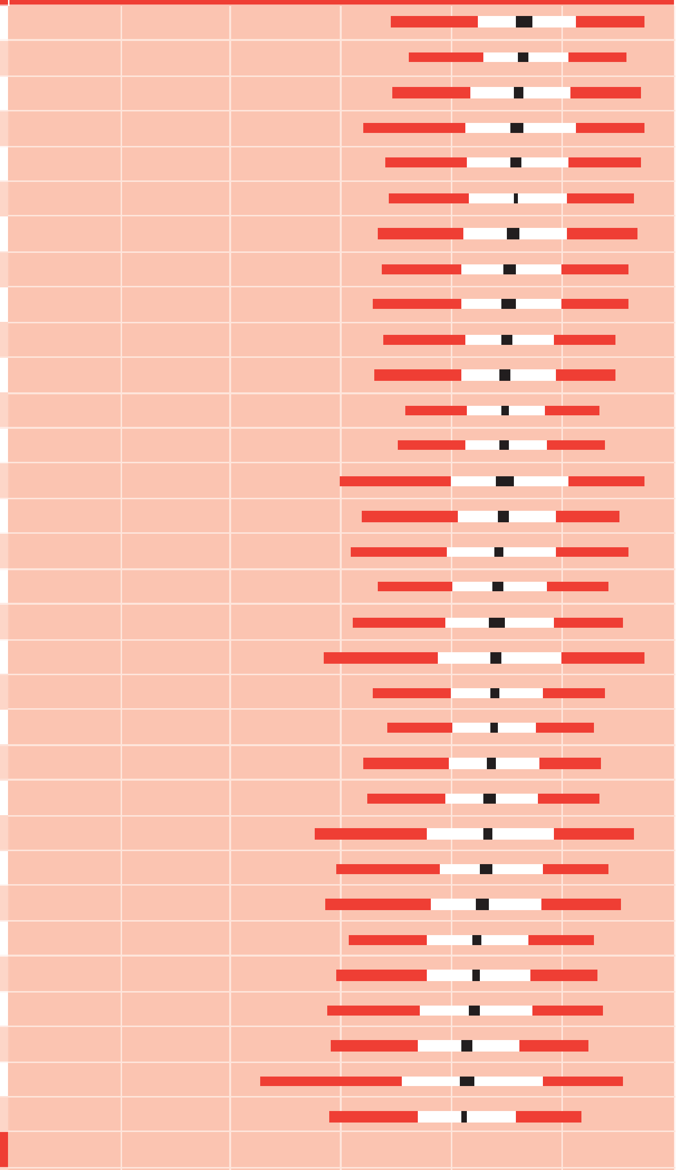
Reading Achievement Scale Score



SOURCE: IEA Progress in International Reading Literacy Study (PIRLS) 2001.

Exhibit 1.1 **Distribution of Reading Achievement**

PIRLS 2006
4th Grade



Countries	Reading Achievement Distribution	Average Scale Score	Years of Formal Schooling*	Average Age	Human Development Index**
2a Russian Federation		▲ 565 (3.4)	4	10.8	0.797
Hong Kong SAR		▲ 564 (2.4)	4	10.0	0.927
2a *Canada, Alberta*		▲ 560 (2.4)	4	9.9	0.950
Singapore		▲ 558 (2.9)	4	10.4	0.916
2a *Canada, British Columbia*		▲ 558 (2.6)	4	9.8	0.950
Luxembourg		▲ 557 (1.1)	5	11.4	0.945
2a *Canada, Ontario*		▲ 555 (2.7)	4	9.8	0.950
Italy		▲ 551 (2.9)	4	9.7	0.940
Hungary		▲ 551 (3.0)	4	10.7	0.869
Sweden		▲ 549 (2.3)	4	10.9	0.951
Germany		▲ 548 (2.2)	4	10.5	0.932
† Netherlands		▲ 547 (1.5)	4	10.3	0.947
†2a Belgium (Flemish)		▲ 547 (2.0)	4	10.0	0.945
2a Bulgaria		▲ 547 (4.4)	4	10.9	0.816
2a Denmark		▲ 546 (2.3)	4	10.9	0.943
Canada, Nova Scotia		▲ 542 (2.2)	4	10.0	0.950
Latvia		▲ 541 (2.3)	4	11.0	0.845
†2a United States		▲ 540 (3.5)	4	10.1	0.948
England		▲ 539 (2.6)	5	10.3	0.940
Austria		▲ 538 (2.2)	4	10.3	0.944
Lithuania		▲ 537 (1.6)	4	10.7	0.857
Chinese Taipei		▲ 535 (2.0)	4	10.1	0.910
Canada, Quebec		▲ 533 (2.8)	4	10.1	0.950
New Zealand		▲ 532 (2.0)	4.5 – 5.5	10.0	0.936
Slovak Republic		▲ 531 (2.8)	4	10.4	0.856
† Scotland		▲ 527 (2.8)	5	9.9	0.940
France		▲ 522 (2.1)	4	10.0	0.942
Slovenia		▲ 522 (2.1)	3 or 4	9.9	0.910
Poland		▲ 519 (2.4)	4	9.9	0.862
Spain		▲ 513 (2.5)	4	9.9	0.938
2b Israel		▲ 512 (3.3)	4	10.1	0.927
Iceland		▲ 511 (1.3)	4	9.8	0.960
PIRLS Scale Avg.		500	–	–	–

SOURCE: IEA Progress in International Reading Literacy Study (PIRLS) 2006

Summary of performance of East Asian students in IEA studies

<u>Mathematics</u>

- 1995/1999/2003 All consistently high

<u>Science</u>

- 1995/1999 High except for Hong Kong
- 2003 All high

<u>Reading</u>

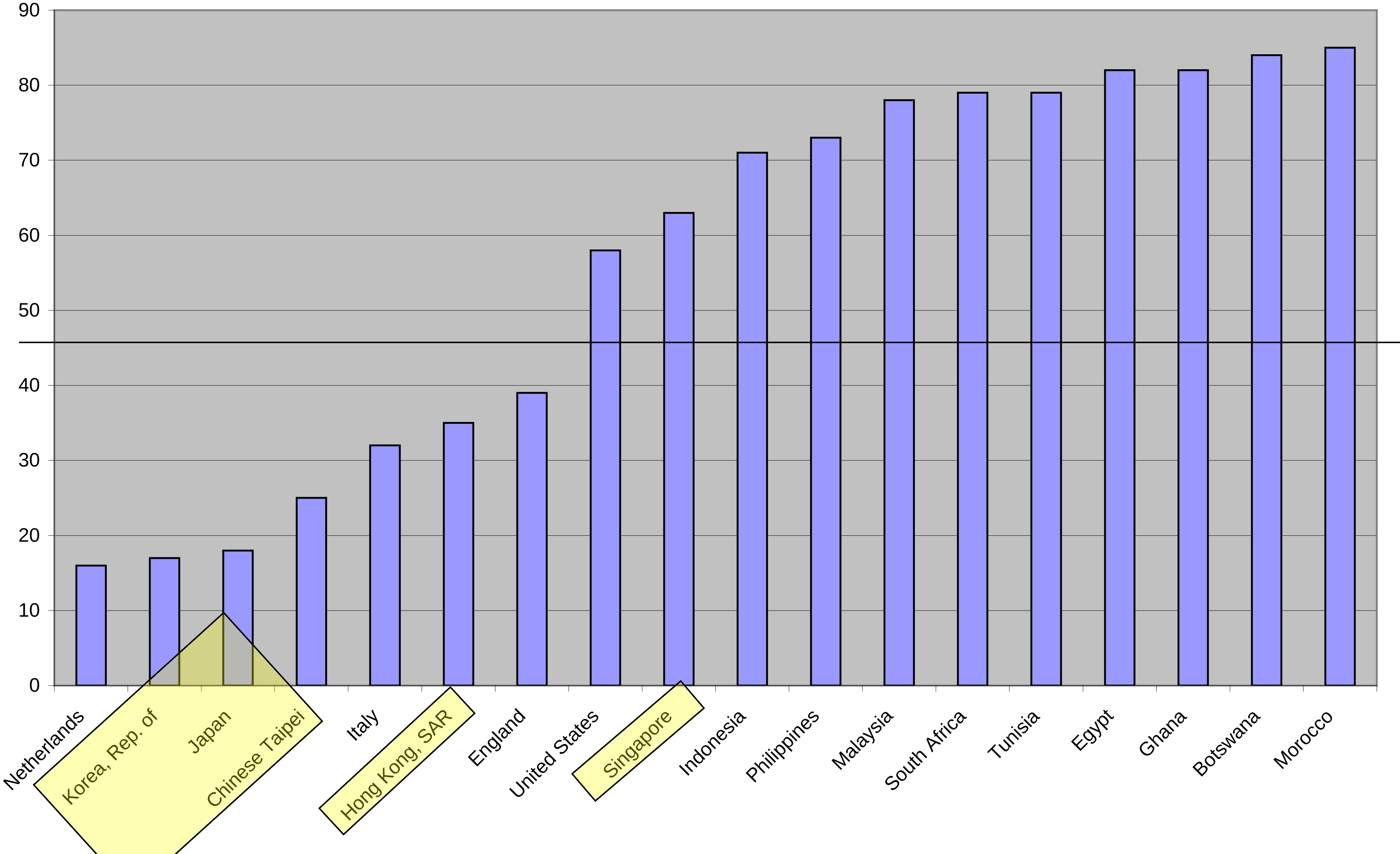
- 2001 Moderate
- 2006 High except for Chinese Taipei

Attitudes of East Asian students

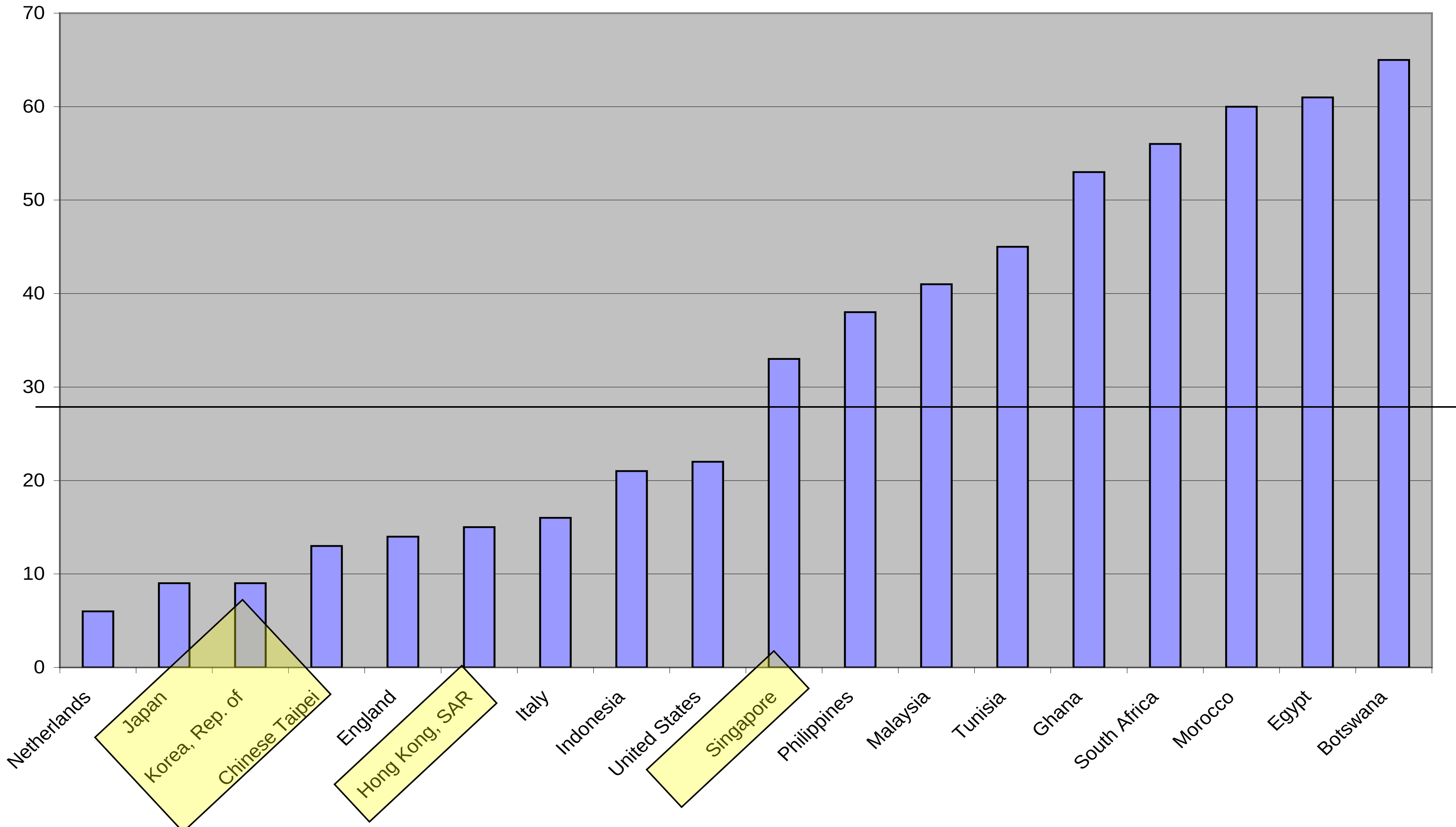
The high achievements do not seem to be accompanied by correspondingly positive attitudes towards study:

- TIMSS 2003: Students (other than Singaporean) did not value mathematics highly, and they did not enjoy studying mathematics; all students (including Singapore) lacked self-confidence in learning mathematics
- PIRLS 2006: Students' attitude towards reading is moderately high; but their self-concept in reading was low

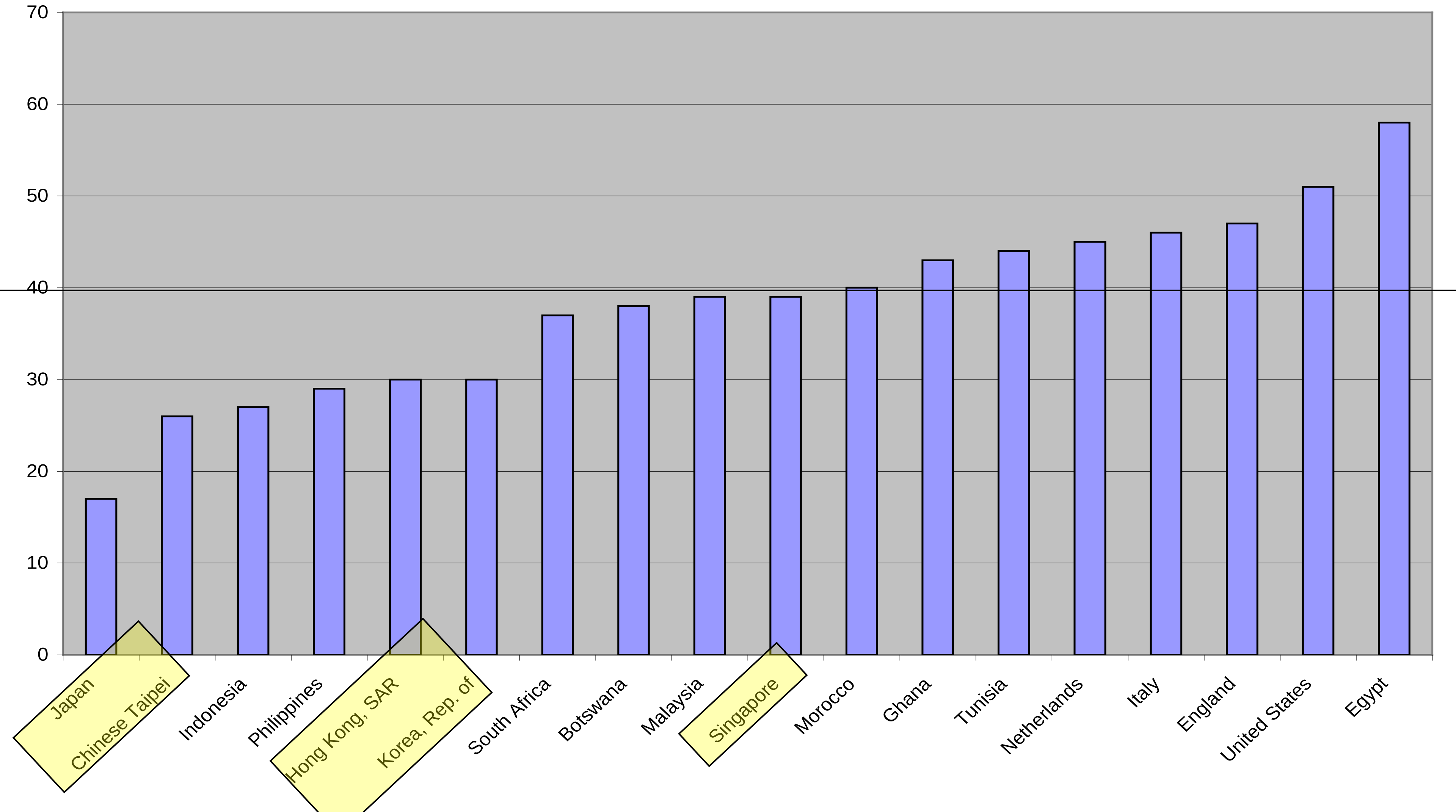
Students' Valuing of Mathematics (TIMSS 2003)
(International Average = 55% of Students)



Students' Enjoyment of Mathematics (TIMSS 2003)
(International Average = 29% of Students)

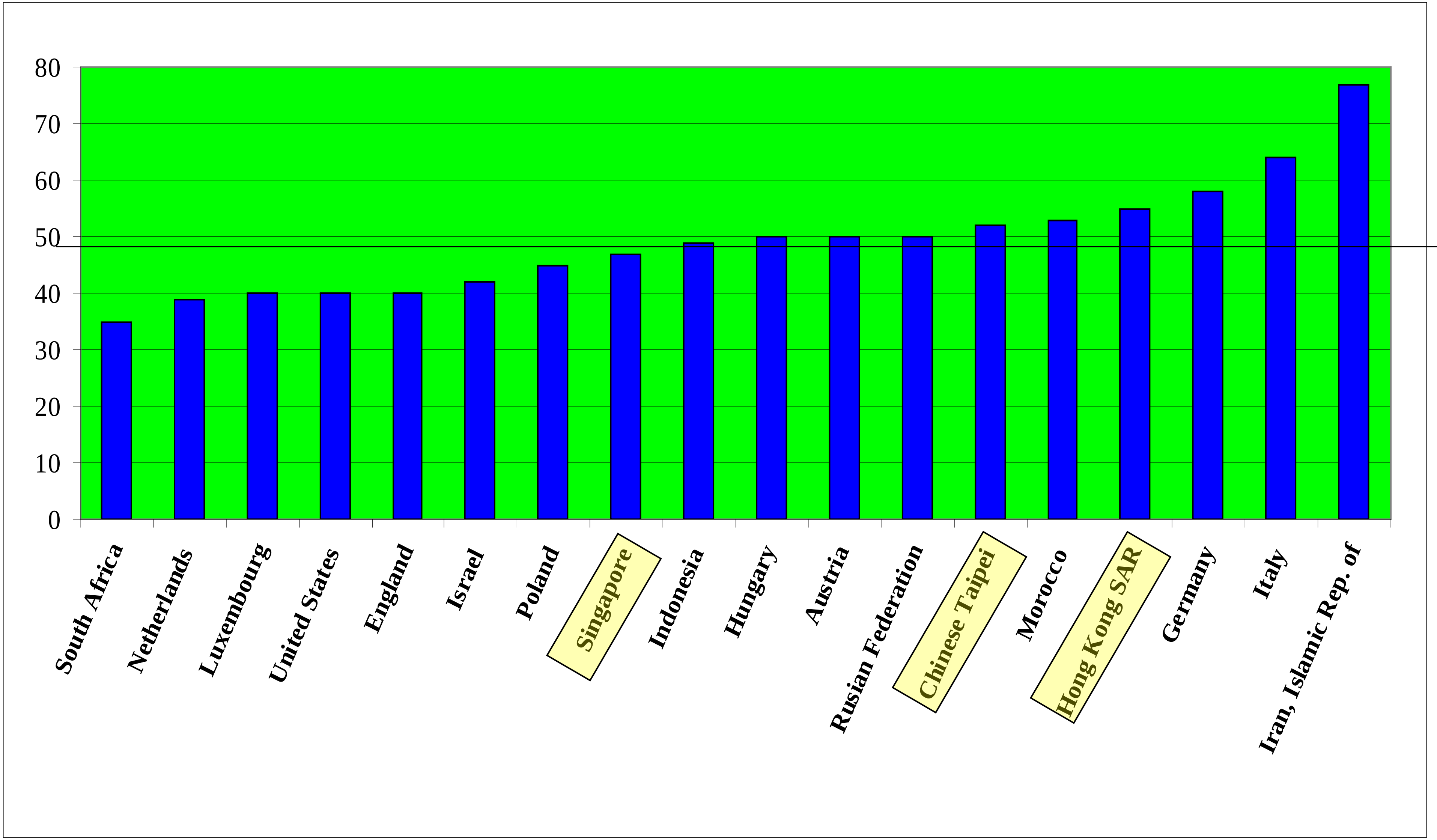


Students' Self-Confidence in Learning Mathematics (TIMSS 2003)
(International Average = 40% of Students)

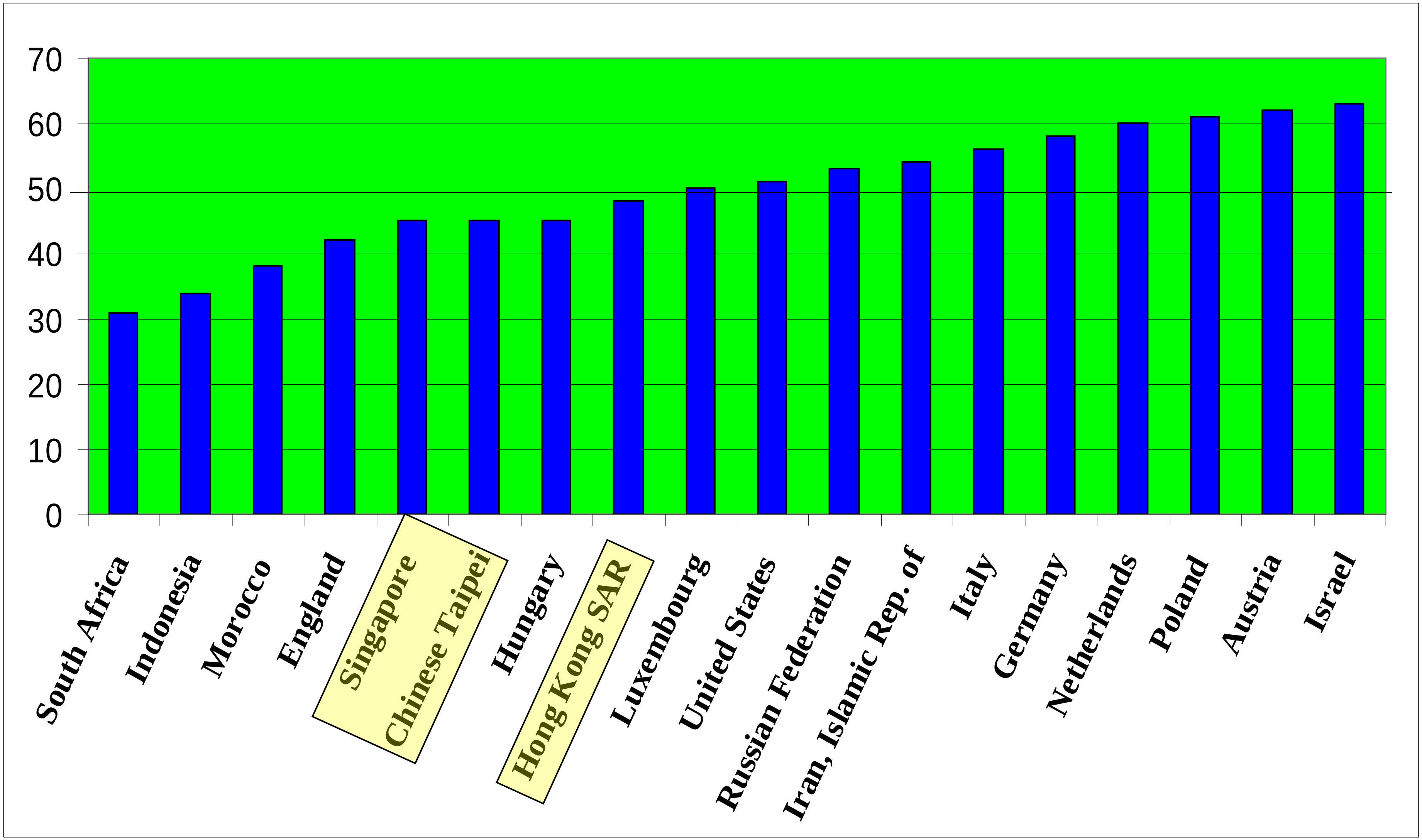


Students' Attitudes towards Reading (PIRLS 2006)

(International Average=49% of Students)



Students' Reading Self-Concept (PIRLS 2006)
(International Average=49% of Students)



Summary: East Asian students' attitudes towards study

TIMSS 2003

- Valuing of Mathematics: ***low***
- Enjoyment of Mathematics: ***low***
- Self-Confidence in Learning Mathematics: ***low***

PIRLS 2006

- Attitudes towards Reading: ***medium***
- Reading Self-Concept: ***low***

Mathematics teaching in East Asian classrooms

- How do we explain the achievement and attitudes of East Asian students?
- TIMSS and PIRLS have system, school, teacher and student questionnaires which explore relation between various factors and student achievements and attitudes.
- Since students learn most of their academic knowledge in the classroom, classroom teaching is one of the most important factors.
- A more thorough study of this factor is the TIMSS Video Study

TIMSS 1999 Video Study (Math)

Goal:

Describe and compare eighth-grade mathematics teaching across seven countries (Australia, Czech Republic, Hong Kong SAR, Japan*, Netherlands, Switzerland, United States)

* The 1995 Japanese data were re-analyzed using the 1999 methodology in some of the analysis

Sampling and data collection

- National probability sample of 8th-grade math lessons: a **Video Survey**
- One lesson per teacher
- Sampled across the school year
- Standardized camera procedures
- 638 lessons, from 50 (Japan) – 140 (Switzerland)

Data coding and analysis

- An international team developed codes to apply to the video data.
- Fluently bilingual coders in the international video coding team applied 45 codes in seven coding passes to each of the videotaped lessons.
- Three marks (i.e., the in-point, out-point, and category) were evaluated and included in the measures of reliability.
- If, after numerous attempts, reliability measures fell below the minimum acceptable standard, the code was dropped from the study.

The Maths Quality Analysis Group

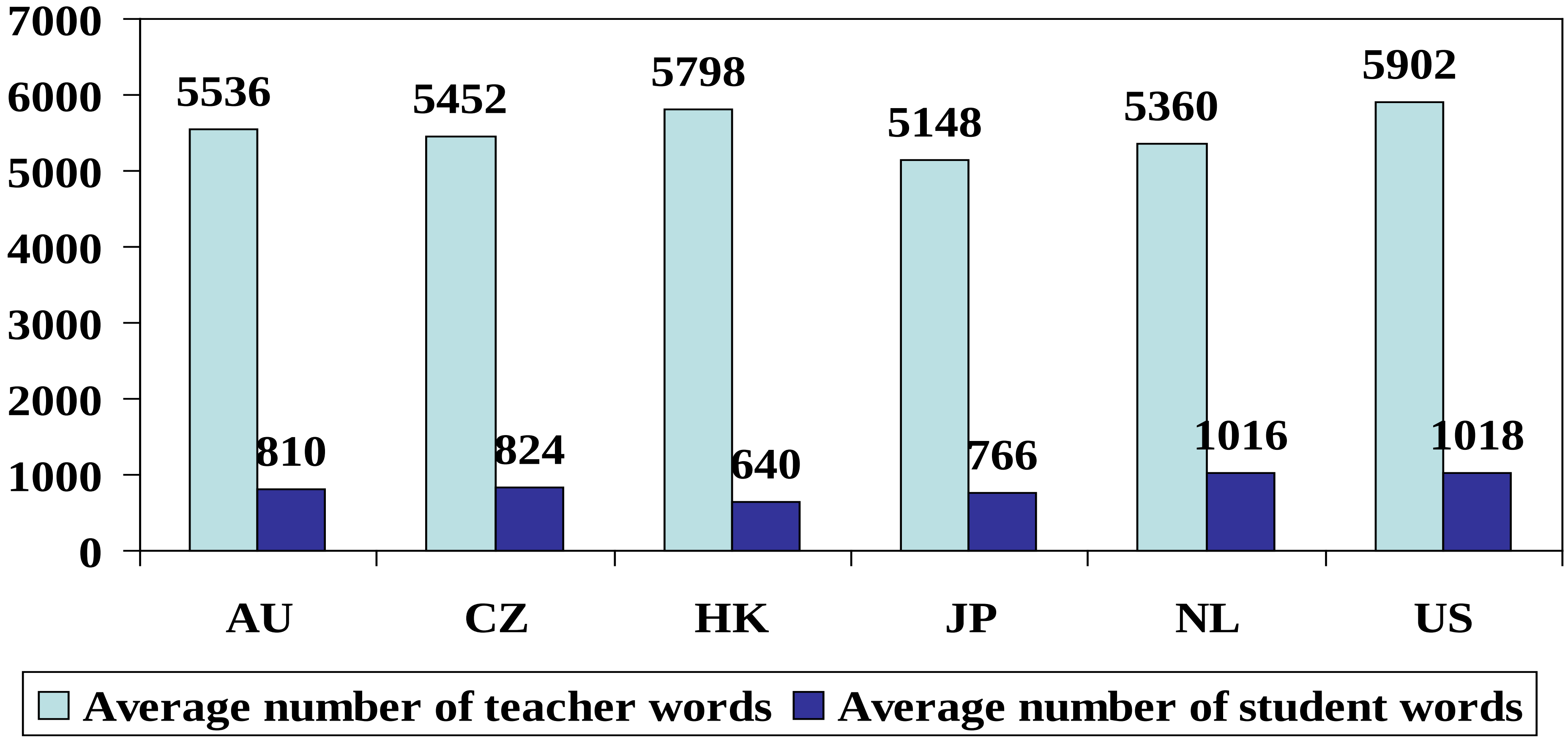
- Specialist group of mathematicians and mathematics educators
- Reviewed randomly selected subset of 120 lessons (20 lessons from each country except Japan)
- International coding team created expanded lesson tables including details about classroom interaction, nature of mathematics problems worked on, mathematical generalizations etc.
- Descriptions “country-blind,” with all indicators that might reveal the country removed

Instructional practices in East Asia as portrayed by the analysis of the codes

1. Dominance of teacher talk

- In all countries in the study, the teachers did a lot of talking, and considerably more than their students
- Hong Kong and Japan differ considerably in the amount of teacher talk

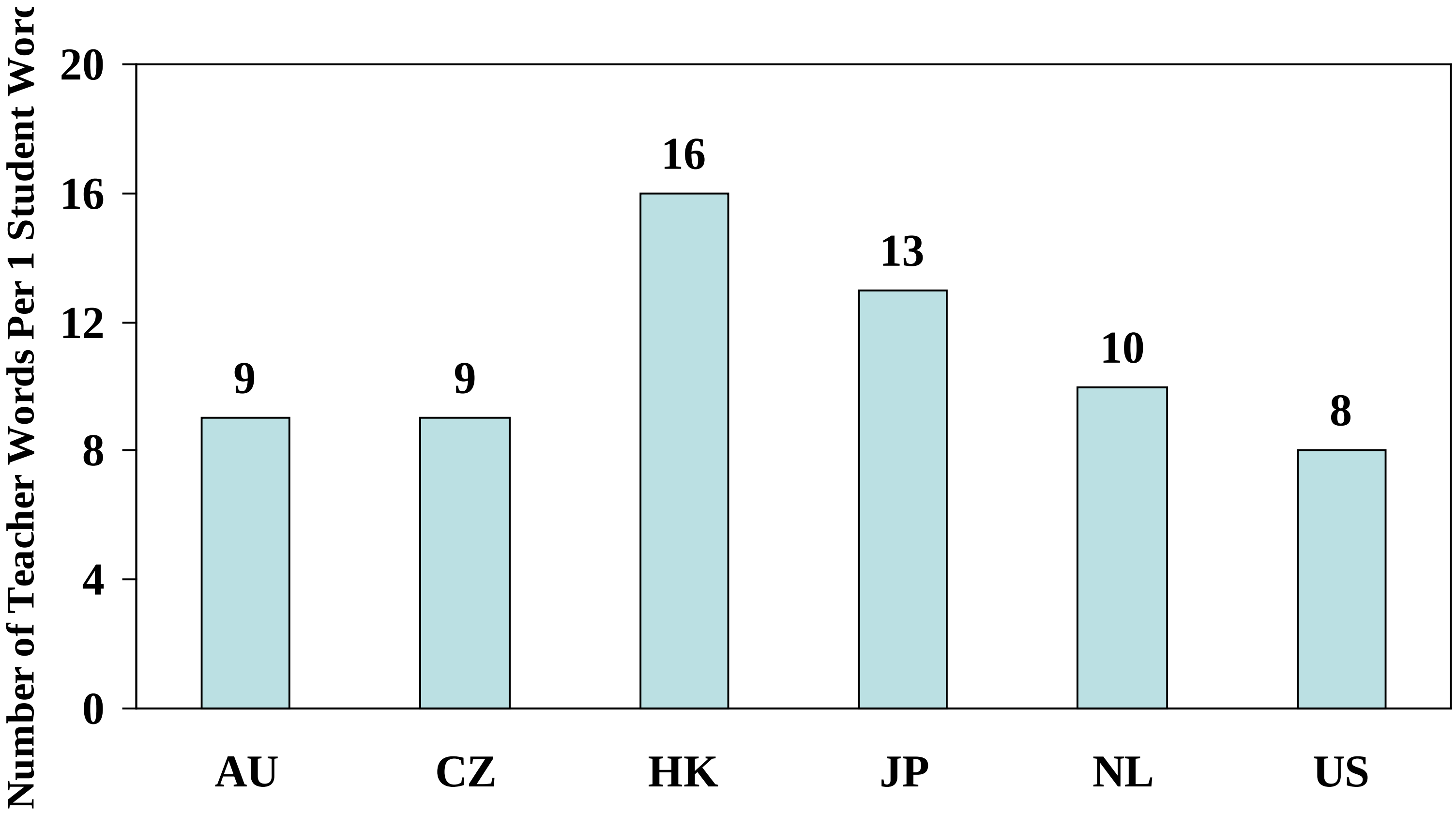
Average Number of Teacher and Student Words Per Lesson



Ratio of teacher and student talk

- Hong Kong and Japanese teachers spoke much more relative to their students
- “Hong Kong SAR eighth-grade mathematics teachers spoke significantly more words relative to their students (16:1) than did teachers in Australia (9:1), the Czech Republic (9:1), and the United States (8:1).” (p. 109, Chapter 5)
- When we factor in the relatively large class size (about 40), the reticence of East Asian students is striking

Average Number of Teacher Words to Every One Student Word Per Lesson



2. More opportunities to learn new content

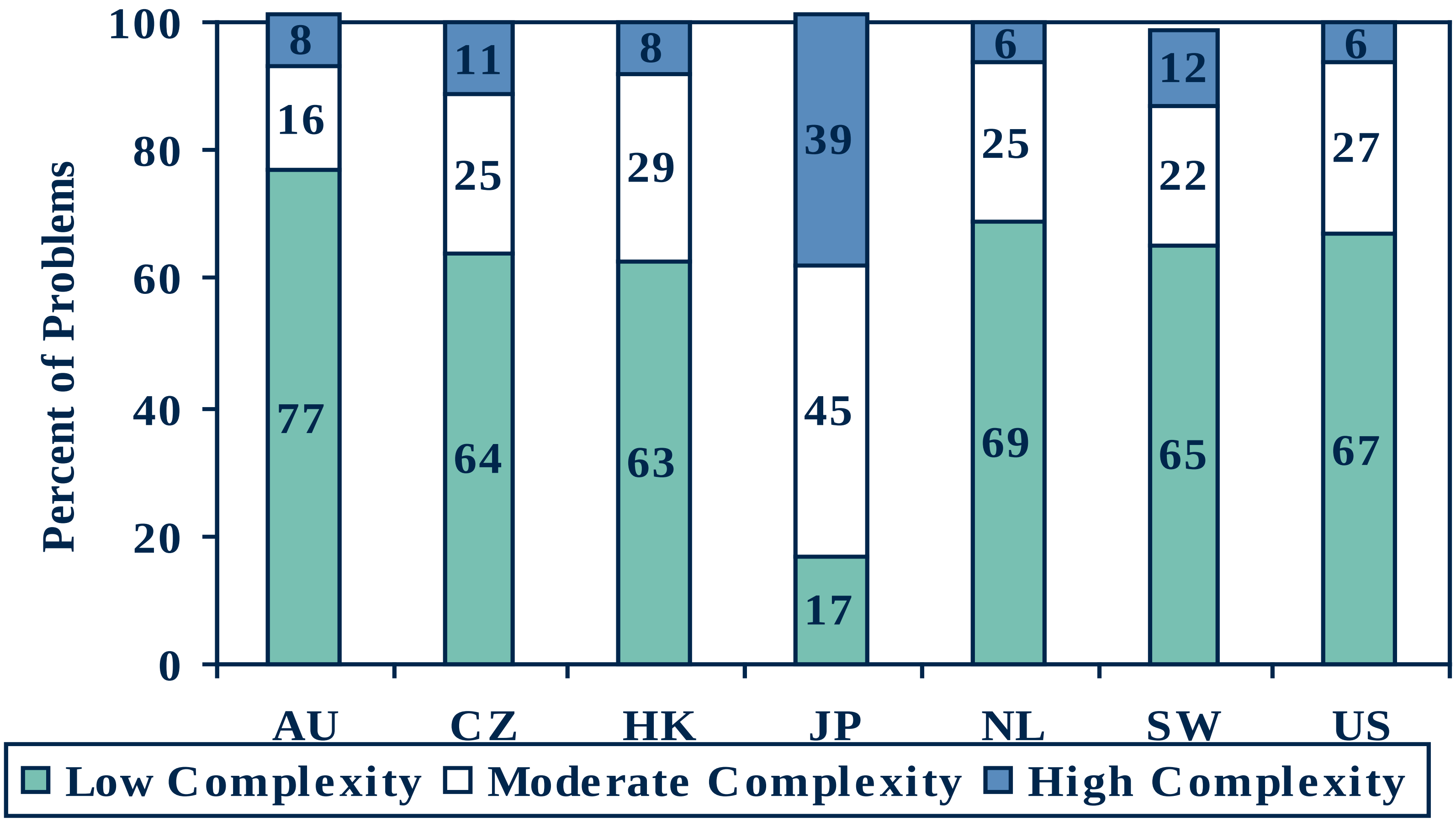
- 75% of lesson time in the East Asian classroom spent on dealing with new content
- Corresponding figures for other countries ranged between 42% (Czech Republic) and 63% (Switzerland)
- Inference: East Asian students learn more mathematics than students in other countries?

Average percentage of lesson time devoted to various purposes

3. Mathematics problems worked on more complex

- Procedural complexity of problems: “the number of steps it takes to solve a problem using a common solution method” (p.70)
- Japanese students worked on procedurally more complex problems
- Problems Hong Kong students worked on not particularly complex, although the percentage (63%) of low complexity problems is relatively small

Average percentage of problems at each level of procedural complexity



Problem complexity (cont'd)

- Another measure of problem complexity: length of time students spent working on the problem (more, or less, than 45 seconds)
- Conclusion: East Asian students have more opportunities to work on procedurally more complex problems which required a longer duration to solve

Average percentage of problems that were worked on longer more than 45 s

4. Problems unrelated to real-life

- Majority of problems in the East Asian classroom were expressed in mathematical language and symbols, and set in contexts unrelated to real life
- Similar to classrooms in Czech Republic, and differ markedly from classrooms in the Netherlands

Average Percentage of Problems Per Lesson Set Up With a Real Life Connection or With Mathematical Language or Symbols Only

5. More proof

- Problems East Asian students worked on involved more proof
- The emphasis is particularly marked in Japan
- The practice in Hong Kong more in line with Switzerland

Percentage of problems that contained at least one proof

Instructional practices as portrayed by the analysis of the codes

- Dominance of teacher talk
- Students have more opportunities to learn new content
- Students solve problems that are more complex and are unrelated to real-life
- More proof

Quality of Content as judged by the Math Quality Analysis Group (based on the same data set)

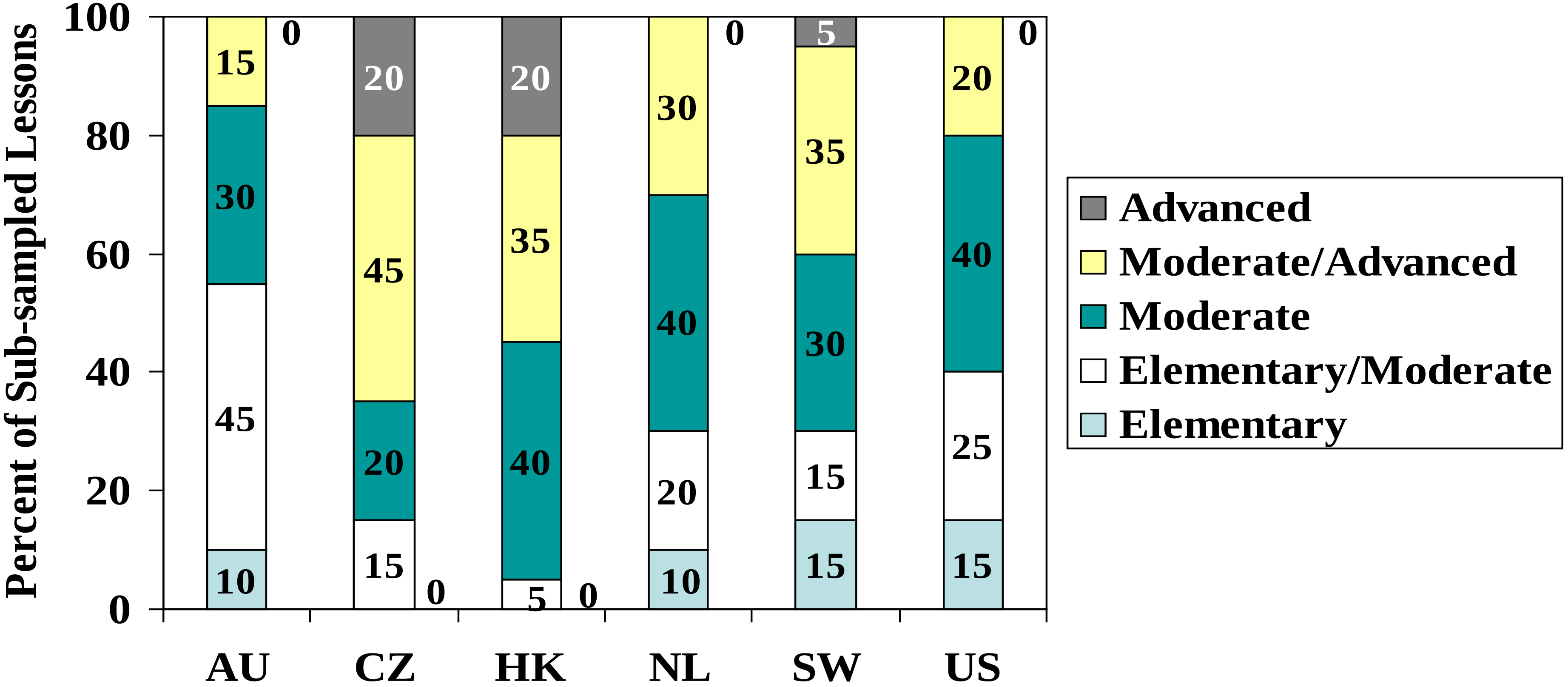
Japan not in the analysis

"Readers are urged to be cautious in their interpretations of these results because the sub-sample, due to its relatively small size, might not be representative of the entire sample or of eighth-grade mathematics lessons in each country." (p. 190, Appendix D)

1. Relatively advanced content

"the ratings for countries with the most advanced (5) to the most elementary (1) content in the sub-sample of lessons, were the Czech Republic and Hong Kong SAR (3.7), Switzerland (3.0), the Netherlands (2.9), the United States (2.7), and Australia (2.5)" (p. 191, Appendix D)

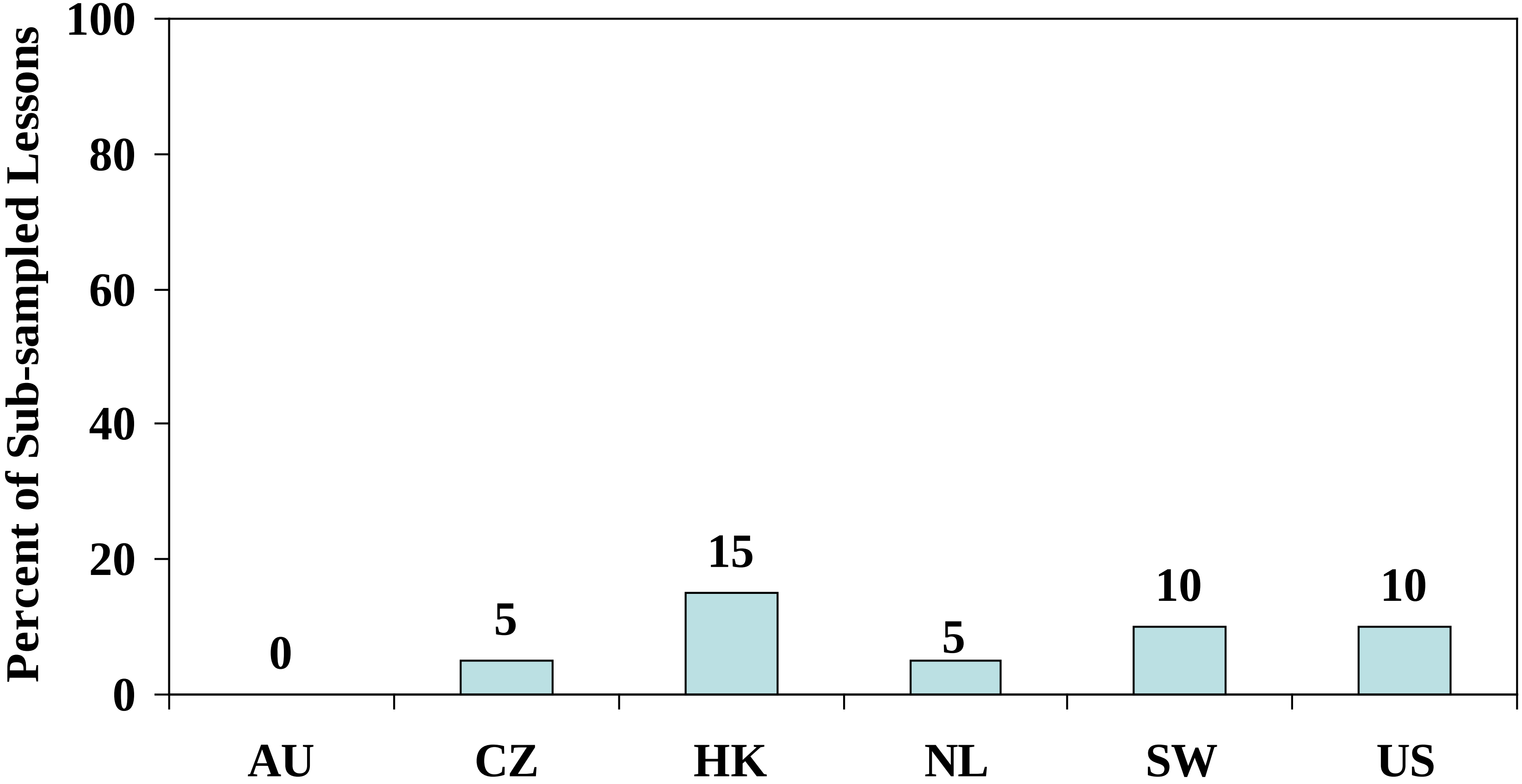
Percentage of Lessons in Sub-sample at each Content Level



2. More deductive reasoning

- Deduction reasoning = "deriving conclusions from stated assumptions using a logical chain of inferences."
- The reasoning did not need to include a formal proof, only a logical chain of inferences with some explanation.

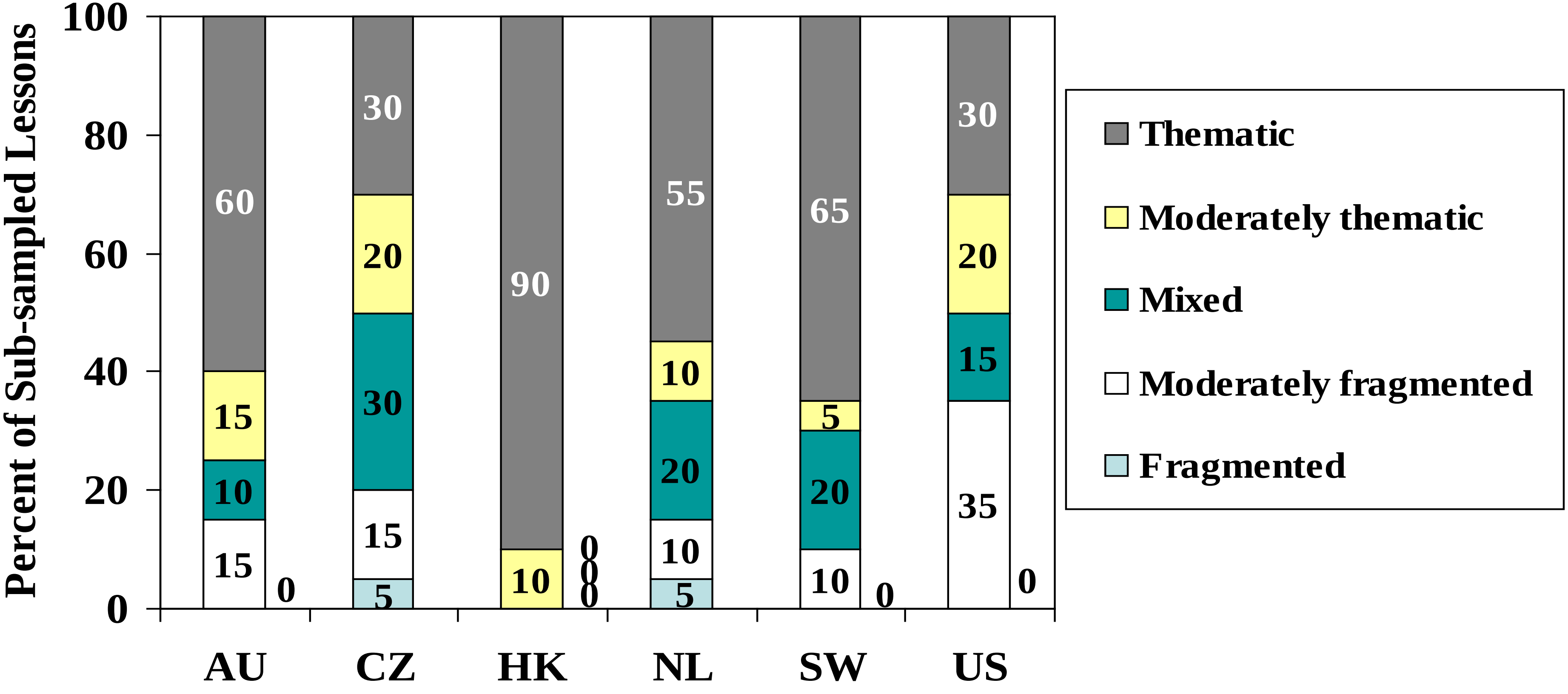
Percentage of Lessons in Sub-sample that Contained Deductive Reasoning



3. More coherent

Coherence was defined by the group as the (implicit and explicit) interrelation of all mathematical components of the lesson.

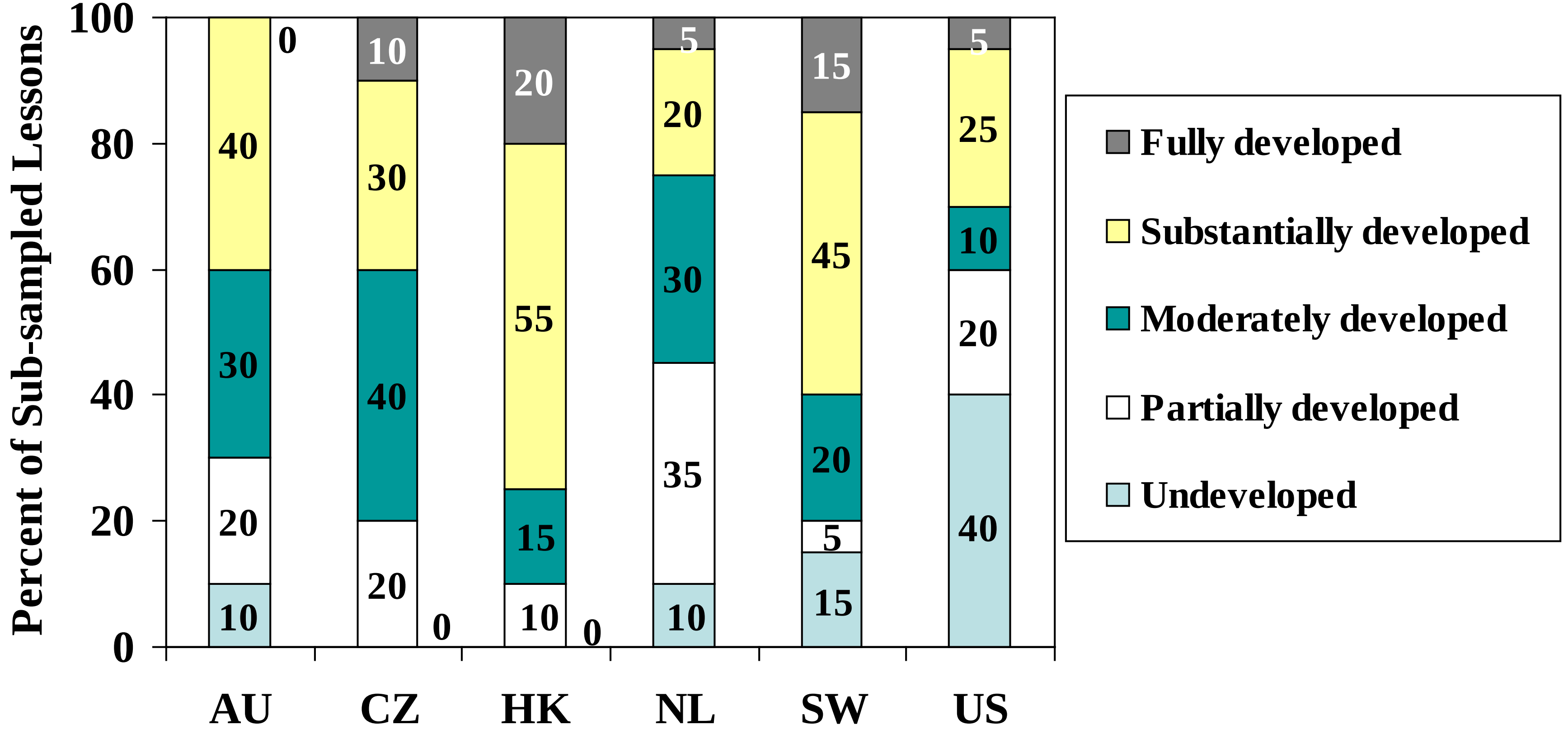
Percentage of Lessons in Sub-sample Rated at Each Level of Coherence



4. More fully developed presentation

- Presentation = “the extent to which the lesson included some development of the mathematical concepts or procedures”.
- Development required that mathematical reasons or justifications were given for the mathematical results presented or used.
- Presentation ratings took into account the quality of mathematical arguments.
- Higher ratings meant that sound mathematical reasons were provided by the teacher (or students) for concepts and procedures.
- Mathematical errors made by the teacher reduced the ratings.

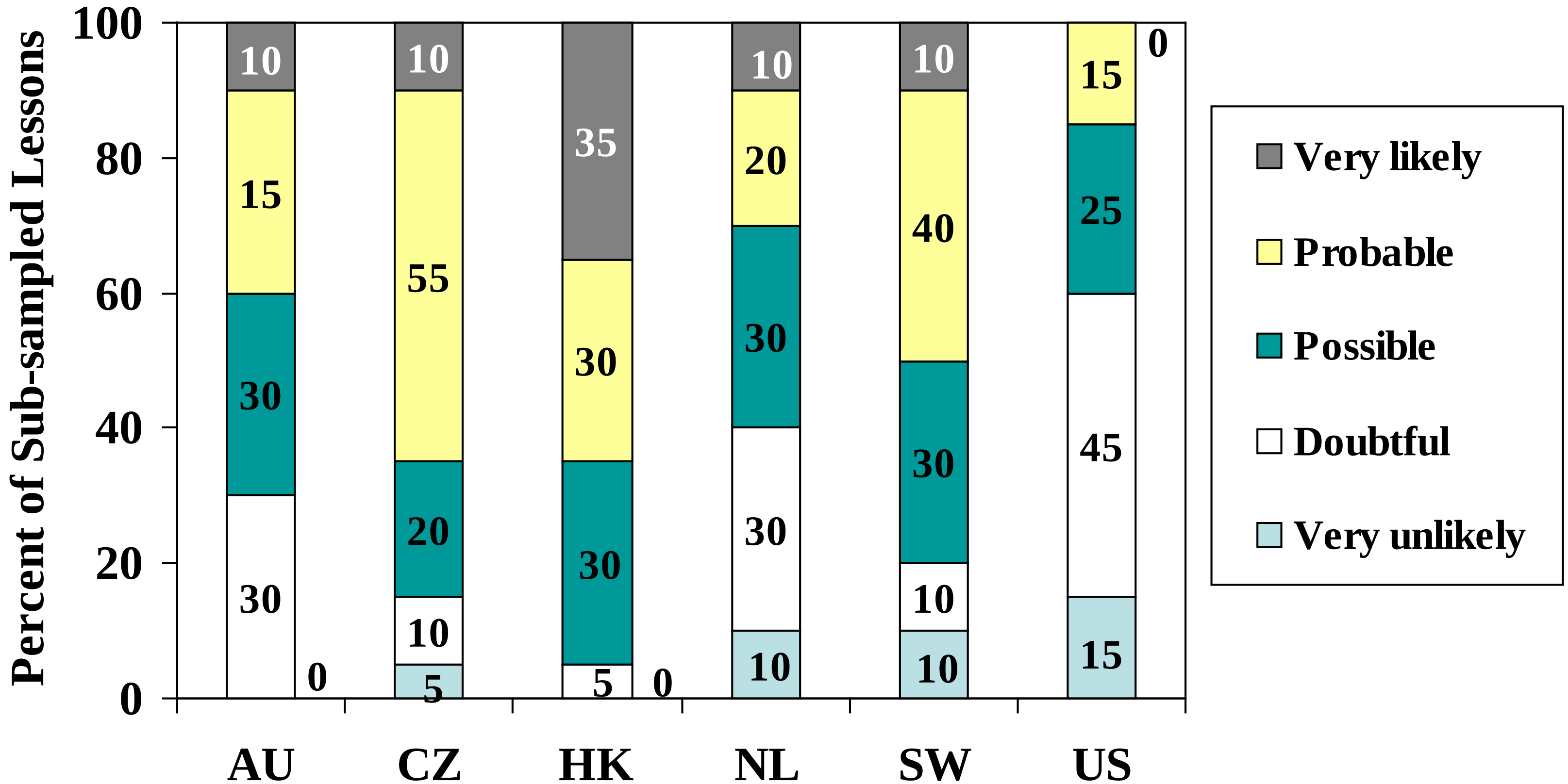
Percentage of Lessons in Sub-sample Rated at Each Level of Presentation



5. Students more likely to be engaged

- Student engagement = “the likelihood that students would be actively engaged in meaningful mathematics during the lesson”.
- A rating of very unlikely (1) indicated a lesson in which students were asked to work on few of the problems and those problems did not appear to stimulate reflection on math concepts or procedures.
- A rating of very likely (5) indicated a lesson in which students were expected to work actively on, and make progress solving, problems that appeared to raise interesting mathematical questions for them and then to discuss their solutions with the class.

Percentage of Lessons in Sub-sample Rated at Each Level of Student Engagement



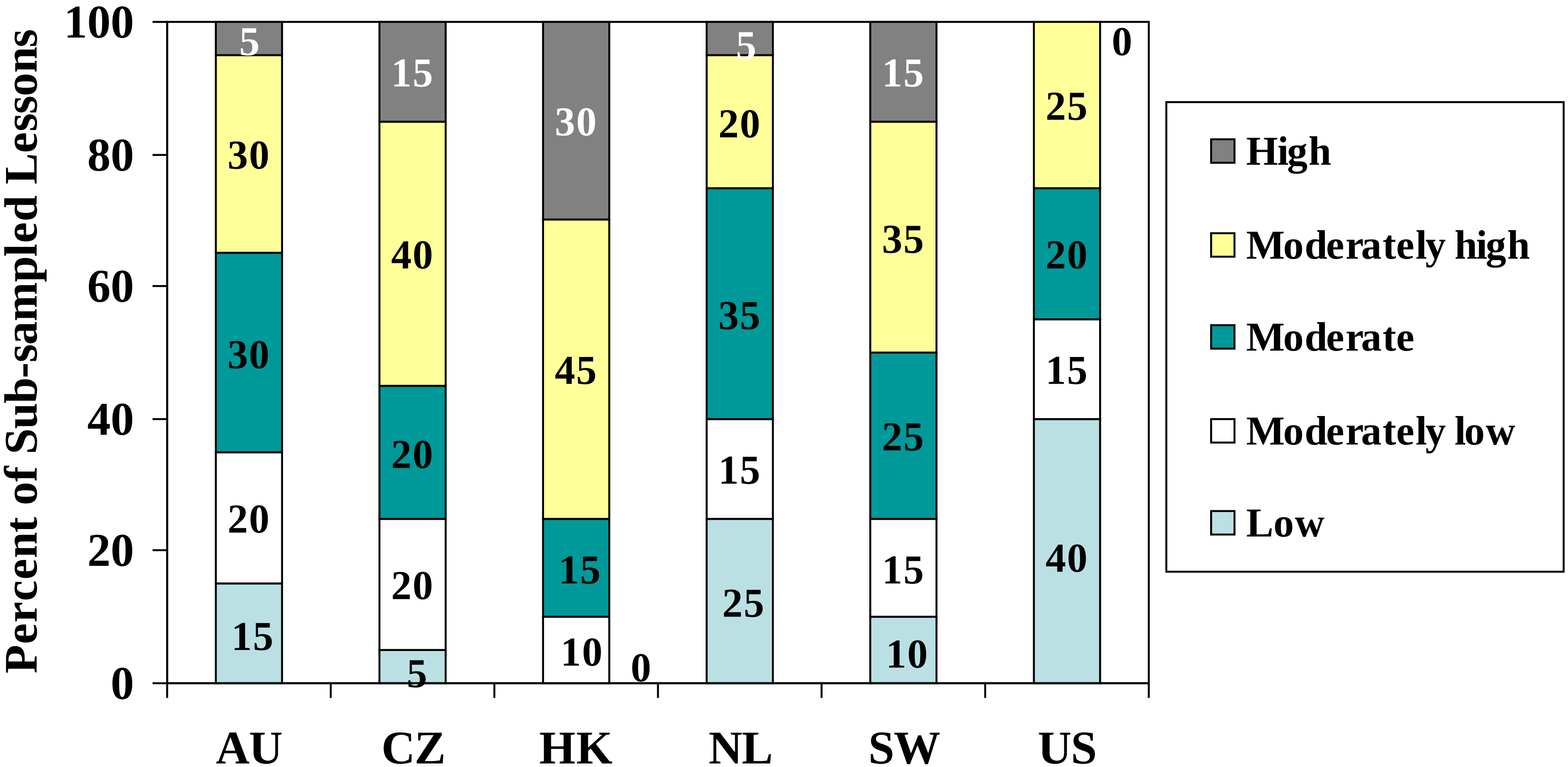
6. Overall quality

Overall quality judgment:

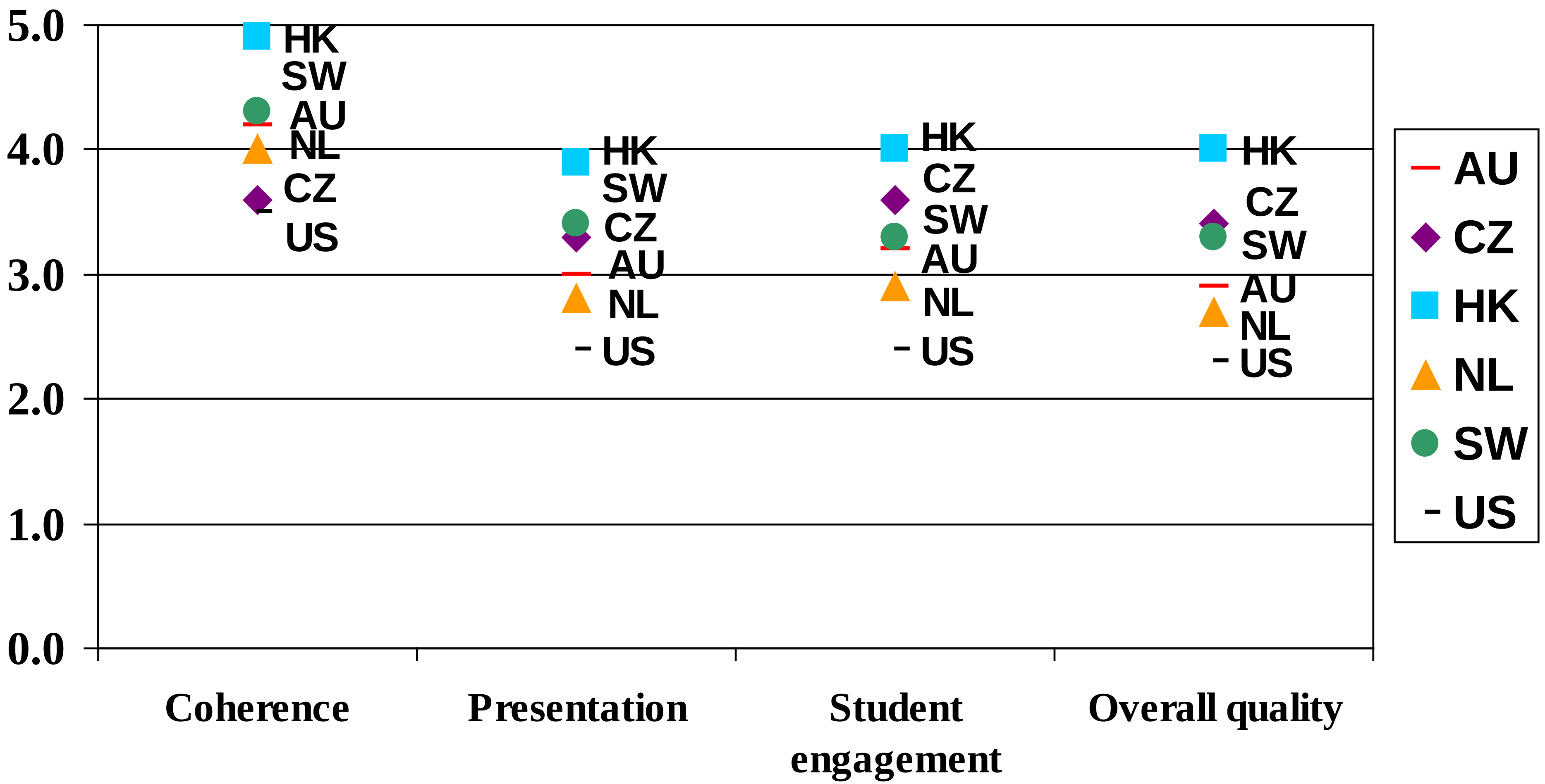
“the opportunities that the lesson provided for students to construct important mathematical understandings” (p. 199, Appendix D)

“the relative standing of Hong Kong SAR was consistently high ….” (p. 200, Appendix D)

Percentage of Lessons in Sub-sample Rated at Each Level of Overall Quality



General Ratings for Each Overall Dimension of Content Quality of Lessons



Quality of the content as judged by the Math Quality Analysis Group

- Relatively advanced content
- More deductive reasoning
- More coherent
- More fully developed presentation
- Students are more engaged, and
- Overall quality is high

Two different pictures?

- How do we reconcile the apparent inconsistency between the instructional practices as reflected by the 2 different analyses of the same video data set?
- Inconsistency due to a quantitative Vs qualitative method of data analysis?
- Methodological issues concerning analysis of video data – inherent trade-off between reliability and validity?
- Classroom teaching a complex phenomenon - a combination of quantitative and qualitative analyses may yield results closer what really happened in the classroom.

Summary: Mathematics teaching in East Asian classrooms

- Traditional, teacher dominated classroom
- More abstract and advanced mathematics content
- More coherent and fully developed presentation
- Quality of lesson (as judged by experts) is high

Discussion

- If classroom teaching in East Asia is indeed backward and traditional, how does this backward teaching produce students who perform so well in IEA studies?
- Why is the superior achievement of East Asian students not accompanied by a correspondingly positive attitude towards study?
- What are the implications of the findings of these IEA studies for countries within and outside East Asia?

The superior performance of East Asian students

- Classroom teaching is an important factor for explaining student achievement, but it is not the only factor – and may not even be the most important factor
- To get the most out of IEA studies, we should explore factors which explain within country differences in achievement as well as factors which contribute to across countries differences
- Many factors (e.g., SES, attitudes towards study) may explain variations in achievement within a country, but may not account for across country differences

Cultural factors for student achievement

- One important factor which is sometimes ignored in the discussion of comparative studies of student achievement is that of the cultural values held by students and teachers

Relevant cultural values in East Asian countries:

- Examination culture
- Practice, memorization, rote learning, and understanding
- Pragmatic philosophy

Examination culture

China is the first country in the world where a national examination system was introduced - as early as the Sui Dynasty (A.D. 587), a national examination was instituted in the imperial court to select scholars to high offices in the government. From then on, “the examinations at different dynasties were invariably the means to select appointees to the officialdom. ... The examination was later developed into a stratified system where scholars competed in local examinations and became qualified for higher level examinations ... Local successful candidates were awarded lifelong titles of *scholars* who became local intellectuals with respectable social status. The champions in the examination held at the central imperial court were granted high positions in the government (as high as the prime minister) and often granted marriage to the royal family.” (Cheng, 1994)

Examination culture and performance in IEA studies

- So East Asian students are good in taking examinations – does that explain their superior performance in IEA studies?
- This has serious consequence for IEA studies, as it touches on the issue of the validity of these studies
- If tests such as those used in IEA studies are not the appropriate instrument for measuring achievement, what are the alternatives?
- IEA represents a common agreement among participating countries on how achievement can be measured
- The importance of country participation in policies of IEA studies

Practice makes perfect?

- How do East Asian students prepare for examination (and IEA studies??)?
- Stress in the East Asian culture on diligence and practice
- Attributes success to effort rather than innate ability
- In East Asia, "repetitive learning" is "continuous practice with increasing variation" (Marton, 1997), and practice and repetition is a "route to understanding" (Hess & Azuma, 1991)
- Equating memorization without full understanding to rote learning is too simplistic
- Practice and memorization are legitimate (and probably effective) means for understanding and learning
- Is constructivism always right? Learning is a complex and multi-faceted phenomenon. Constructivism provides a framework for looking into this process, but it is not the only framework - not that "more constructivistic, the better"

Pragmatic philosophy in East Asia

- East Asians are known to be pragmatic people
- Students take a pragmatic approach in their learning, and teachers take a pragmatic approach in their teaching
- This may explain the "traditional teaching" in East Asian classrooms:

"East Asian teachers are competent in mathematics in general, but they deliberately taught in a procedural manner for pedagogical reasons and for the sake of efficiency. Teachers believe that it would be inefficient or confusing for school children to be exposed to rich concepts instead of clear and simple procedures."

(Leung and Park, 2002)

The negative attitudes of East Asian students

Relevant cultural values in East Asian countries:

- Examination culture
- Extrinsic Vs intrinsic motivation, and high expectation for achievement
- Virtue of modesty

Examination culture

- Examination culture: two-way sword
- The examination culture and the consequent competitive examination system may create “undue pressure upon students, resulting in all sorts of harmful effects such as loss of interest in (study) and behavioral problems”
- Also, learning/studying is considered a serious endeavour, and students expected to put in hard work/perseverance
- This may explain their negative attitude towards study as found in IEA studies

Intrinsic Vs extrinsic motivation

- The examination culture legitimizes performance in examinations as a source of motivation for study
  - this contrasts with the views of some Western educators who value intrinsic motivation to study and consider extrinsic motivations such as those derived from examination pressure as harmful to learning
- Confucian cultural values: emphasize importance of education and high expectation to achieve
  - East Asian parents and teachers may communicate this expectation explicitly or implicitly to their children
  - The high expectations and competitive examinations leave the majority of students classified as failures
  - repeated experiences of a sense of failure reinforced the lack of confidence

The virtue of modesty

- Modesty is a highly valued virtue in East Asia; children are taught from young that one should not be boastful
- Chinese saying: “Contentedness leads to loss; modesty (or humility) leads to gain”
- This may inhibit East Asian Culture students from rating themselves too highly in attitude questionnaires, and the scores may represent less than what students really think about themselves
- But if students are constantly taught to rate themselves low, they may internalize the idea and result in really low confidence
- **According to East Asian value, negative correlation between students’ confidence and achievement is expected: over-confidence lowers incentive to learn**

Implications of IEA studies

For East Asia:

- Results of IEA studies assure us that our education is not that bad after all
- But the purpose of IEA studies should not be just to bring us contentedness in our success
- It should help us identify our strengths and weaknesses
- More importantly, it should help us establish an East Asian identity in education, and not relying solely on Western education theories

e.g., some strengths of East Asian instructional practices

- Lessons taught in a coherent manner
- Content fully developed
- Expectation of students to learn relatively advanced content, with appropriate emphasis on deductive reasoning
- **Results of IEA studies assures us that we may be doing the right thing: repeatedly reducing content difficulty to make it more accessible to students is an endless retreat**

Weaknesses:

- Dominance of teacher talk: not conducive to the total development of the students
- Problems unrelated to real-life: may alienate students from mathematics
- Negative attitudes of students: educators should be alarmed

- High student achievement should not relegate efforts to promote students' interest
- Teachers should make the lessons lively and enjoyable
- **But the purpose is to induce students' interest in the subject matter rather than in the classroom activities per se**

Challenges for educators in East Asia

- We should make use of results of IEA studies and learn humbly from other countries, but without compromising our strengths (e.g., in instructional practices)
- Should evaluate our cultural values, take them as given, and design and improve our educational practices keeping this given in mind
- The most important thing is to identify the underlying factors for our strengths, and establish our own identity in education
- **The final goal is to develop an East Asian pedagogy**

Implications for other countries

- Low achievement in IEA studies should be a cause of concern in this globally competitive world
- But each country should identify and affirm its own strengths.
- E.g., we should reaffirm the importance of the affective aspect of education: enjoy studying is part of the aims of education in all cultures
- But positive attitude and enjoying learning not enough: if the price to pay for enjoyment is low achievement, should consider whether the price is too high

Learning from other countries

- Low achievement does not necessarily imply the need of total revamp of curriculum or instructional practices
- Complicated cultural factors might have affected classroom practices and student achievement
- Drastic changes should not be undertaken until such factors thoroughly examined
- Any changes in educational policy must ensure that the strength in a country not lost in the process
- **Simple transplant of policies and practices from high achieving countries to low achieving ones would not work**

- One cannot transplant the practice without regard to the cultural differences
- Culture by definition evolves slowly and stably with the passage of long periods of time, and there is simply no quick transformation of culture
- Need to identify not only superficial differences in educational practice, but the intricate relationship between practice and the underlying culture
- Through studying these relationships, we understand the interaction between educational practices and culture
- Through identifying commonality and differences of both educational practices and the underlying cultures, we may then determine how much can or cannot be borrowed from another culture

Concluding remarks

- Public interest in IEA studies usually focused on the relative position of countries in the league tables generated, but this should not be the purpose of IEA studies
- Results of IEA studies provide impetus for educational changes, but sometimes, changes are made without careful consideration of the complex context within which achievement and classroom instructions are situated
- Results of IEA studies should serve as mirrors for us to better understand our system
- Education is complex - cannot expect IEA studies to produce answers for all national problems in education
- IEA studies provide rich dataset for individual countries to seek answers for their own issues
- **Need wisdom, not just data!**

Thank you very much for your attention!

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