

TRENDS IN INTERNATIONAL MATHEMATICS AND SCIENCE STUDY

# TIMSS

# HIGHLIGHTS

TIMSS 2019

International Results in  
Mathematics and Science

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## HIGHLIGHTS

### Countries' Achievement in Mathematics and Science



#### COUNTRIES' AVERAGE ACHIEVEMENT IN TIMSS 2019

East Asian countries—Singapore, Chinese Taipei, Korea, Japan, and Hong Kong SAR—were the top performers. In mathematics, led by Singapore, the five East Asian countries outperformed the other TIMSS countries by substantial margins in fourth and eighth grades. In science at both grades, Singapore, Chinese Taipei, Korea, and Japan also performed well and were joined by the Russian Federation and Finland.



MATHEMATICS—EIGHTH GRADE

International Mathematics Achievement  
(Average Scale Scores)



East Asian Countries Top Achievers in  
Mathematics by a Substantial Margin



- Singapore **616** • Chinese Taipei **612** • Korea, Rep. of **607**
- Japan **594**
- Hong Kong SAR **578**
  
- Russian Federation **543** • Ireland **524** • Lithuania **520** • Israel **519**
- Australia **517** • Hungary **517** • United States **515** • England **515**
- Finland **509** • Norway (9) **503** • Sweden **503** • Cyprus **501** • Portugal **500**
- Italy **497** • Turkey **496** • Kazakhstan **488** • France **483** • New Zealand **482**
- Bahrain **481** • Romania **479** • United Arab Emirates **473** • Georgia **461**
- Malaysia **461** • Iran, Islamic Rep. of **446** • Qatar **443** • Chile **441**
- Lebanon **429** • Jordan **420** • Egypt **413** • Oman **411** • Kuwait **403**
- Saudi Arabia **394** • South Africa (9) **389** • Morocco **388**



SOURCE: IEA's TIMSS 2019  
<http://timss2019.org/download>

SCIENCE—FOURTH GRADE

International Science Achievement  
(Average Scale Scores)



**Singapore and Korea  
Top Achievers in Science**

- Singapore **595** • Korea, Rep. of **588**
- Russian Federation **567** • Japan **562**
- Chinese Taipei **558** • Finland **555** • Latvia **542** • Norway (5) **539**
- United States **539** • Lithuania **538** • Sweden **537** • England **537**
- Czech Republic **534** • Australia **533** • Hong Kong SAR **531** • Poland **531**
- Hungary **529** • Ireland **528** • Turkey (5) **526** • Croatia **524** • Canada **523**
- Denmark **522** • Austria **522** • Bulgaria **521** • Slovak Republic **521**
- Northern Ireland **518** • Netherlands **518** • Germany **518** • Serbia **517**
- Cyprus **511** • Spain **511** • Italy **510** • Portugal **504** • New Zealand **503**
- Belgium (Flemish) **501** • Malta **496** • Kazakhstan **494** • Bahrain **493**
- Albania **489** • France **488** • United Arab Emirates **473** • Chile **469** • Armenia **466**
- Bosnia and Herzegovina **459** • Georgia **454** • Montenegro **453** • Qatar **449**
- Iran, Islamic Rep. of **441** • Oman **435** • Azerbaijan **427** • North Macedonia **426**
- Kosovo **413** • Saudi Arabia **402** • Kuwait **392** • Morocco **374**
- South Africa (5) **324** • Pakistan **290** • Philippines **249**



SOURCE: IEA's TIMSS 2019  
<http://timss2019.org/download>

SCIENCE—EIGHTH GRADE

International Science Achievement  
(Average Scale Scores)



**East Asian Countries  
Top Achievers in Science**

- Singapore **608**
- Chinese Taipei **574** • Japan **570** • Korea, Rep. of **561**
- Russian Federation **543** • Finland **543** • Lithuania **534** • Hungary **530**
- Australia **528** • Ireland **523** • United States **522** • Sweden **521** • Portugal **519**
- England **517** • Turkey **515** • Israel **513** • Hong Kong SAR **504** • Italy **500**
- New Zealand **499** • Norway (9) **495** • France **489** • Bahrain **486** • Cyprus **484**
- Kazakhstan **478** • Qatar **475** • United Arab Emirates **473** • Romania **470**
- Chile **462** • Malaysia **460** • Oman **457** • Jordan **452**
- Iran, Islamic Rep. of **449** • Georgia **447** • Kuwait **444** • Saudi Arabia **431**
- Morocco **394** • Egypt **389** • Lebanon **377** • South Africa (9) **370**

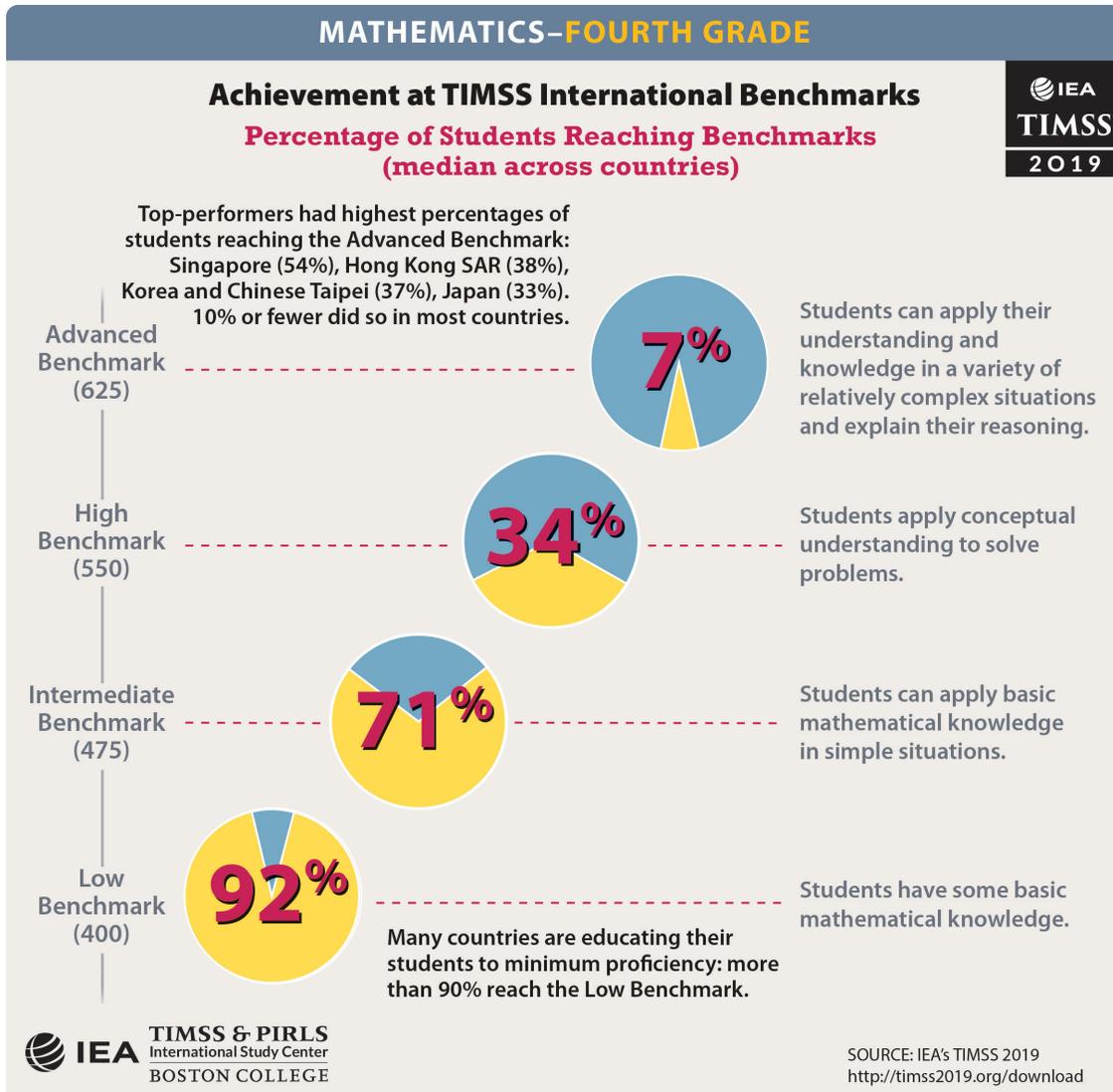


SOURCE: IEA's TIMSS 2019  
<http://timss2019.org/download>



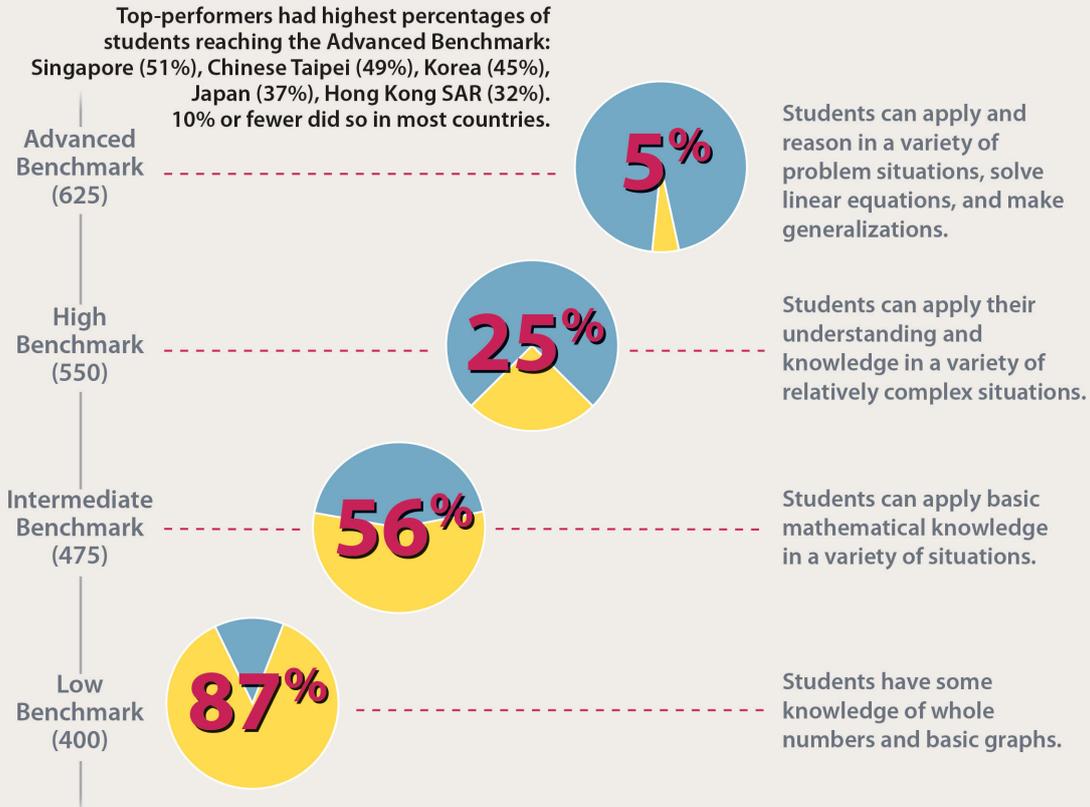
## INTERNATIONAL BENCHMARKS

Across countries, only small percentages of students reached the Advanced International Benchmarks. However, top-performing countries had high percentages reaching the advanced level. On a positive note, most TIMSS countries are educating high percentages of their students to at least the Low International Benchmarks.



MATHEMATICS—EIGHTH GRADE

**Achievement at TIMSS International Benchmarks**  
**Percentage of Students Reaching Benchmarks**  
**(median across countries)**

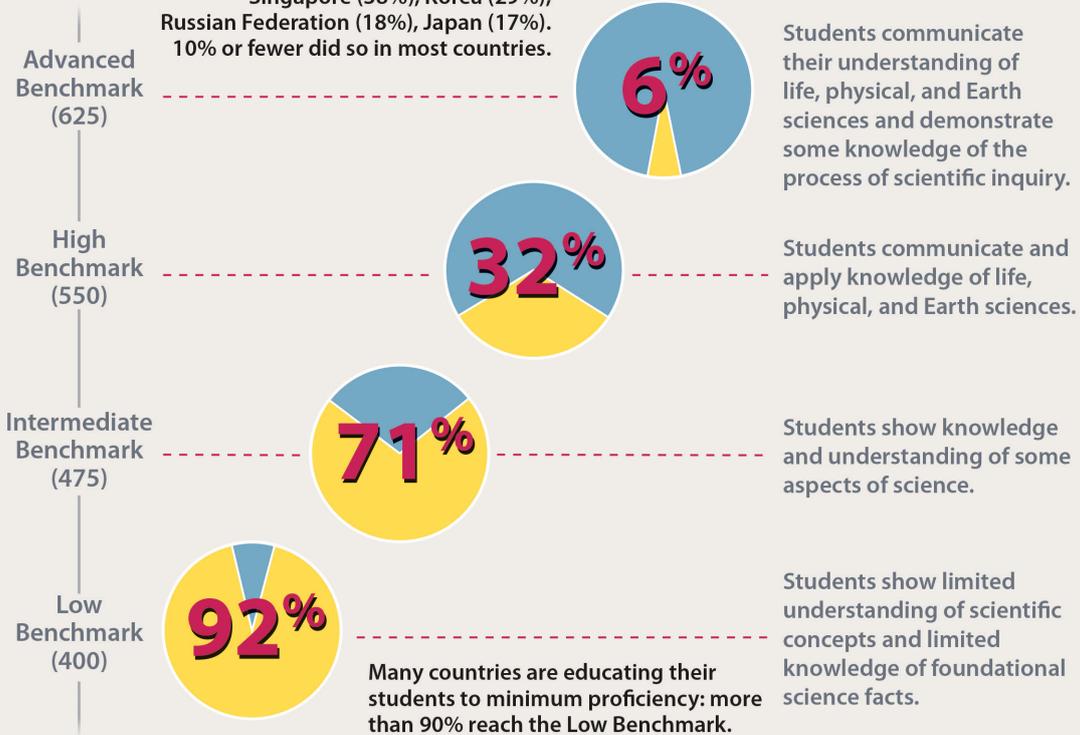


SCIENCE—FOURTH GRADE

**Achievement at TIMSS International Benchmarks**  
**Percentage of Students Reaching Benchmarks**  
**(median across countries)**



Top-performers had highest percentages of students reaching the Advanced Benchmark: Singapore (38%), Korea (29%), Russian Federation (18%), Japan (17%). 10% or fewer did so in most countries.



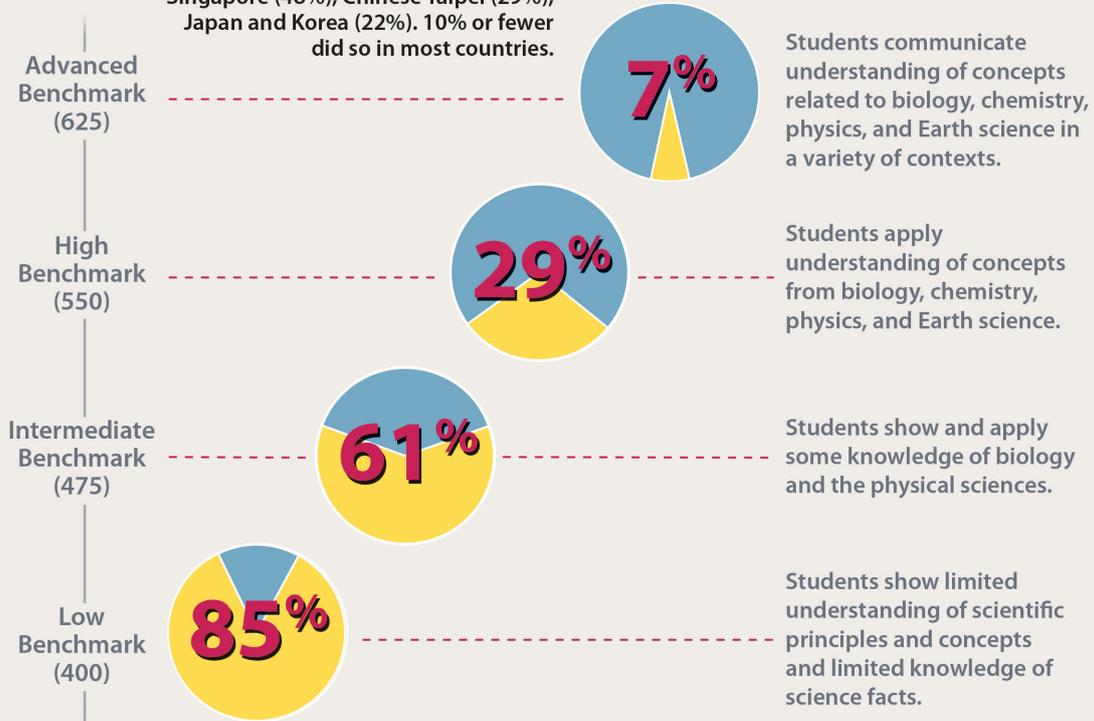
Many countries are educating their students to minimum proficiency: more than 90% reach the Low Benchmark.

SCIENCE—EIGHTH GRADE

**Achievement at TIMSS International Benchmarks**  
**Percentage of Students Reaching Benchmarks**  
**(median across countries)**



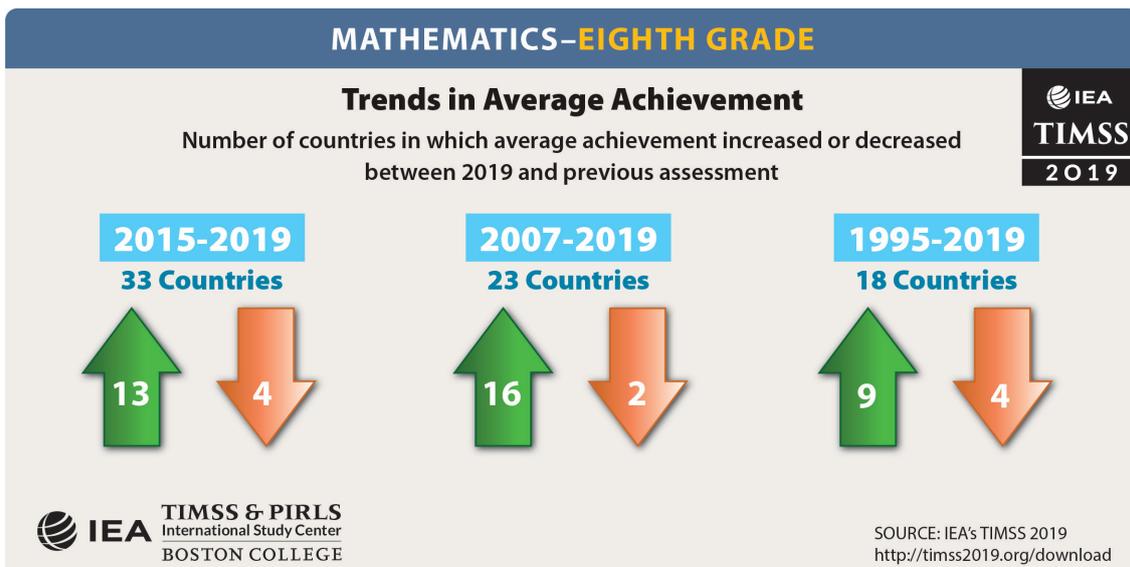
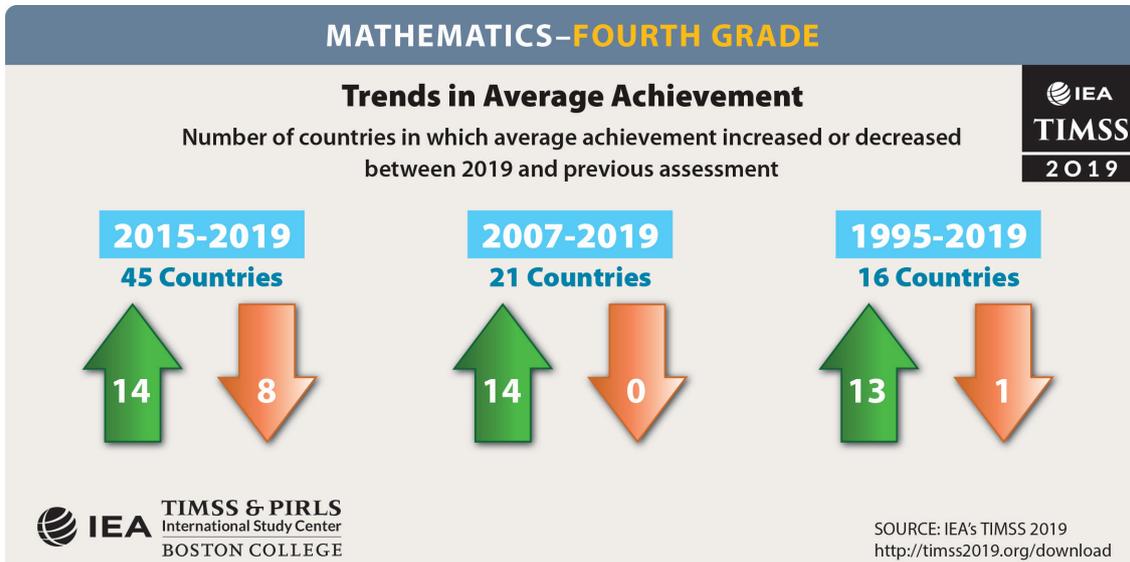
Top-performers had highest percentages of students reaching the Advanced Benchmark: Singapore (48%), Chinese Taipei (29%), Japan and Korea (22%). 10% or fewer did so in most countries.





TRENDS IN ACHIEVEMENT

TIMSS trends show more improvements than declines in average achievement in both the long term—since 1995 and 2007—and the short term—since 2015. The exception was science at the fourth grade where there were as many declines as improvements in the short term.



SCIENCE—FOURTH GRADE

Trends in Average Achievement

Number of countries in which average achievement increased or decreased between 2019 and previous assessment



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SOURCE: IEA's TIMSS 2019 <http://timss2019.org/download>

SCIENCE—EIGHTH GRADE

Trends in Average Achievement

Number of countries in which average achievement increased or decreased between 2019 and previous assessment



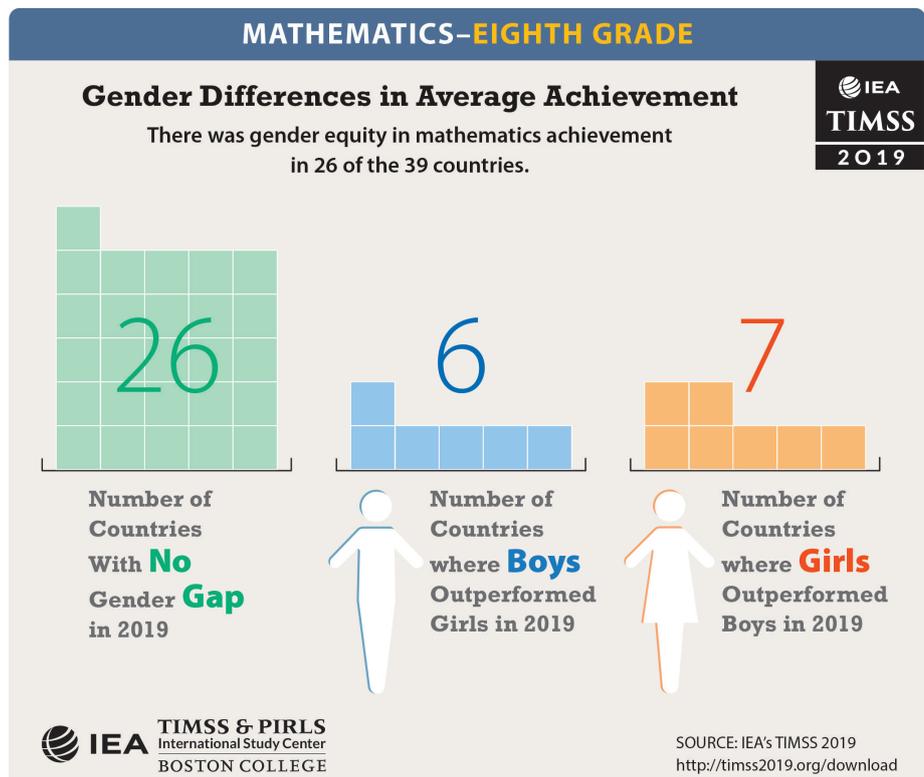
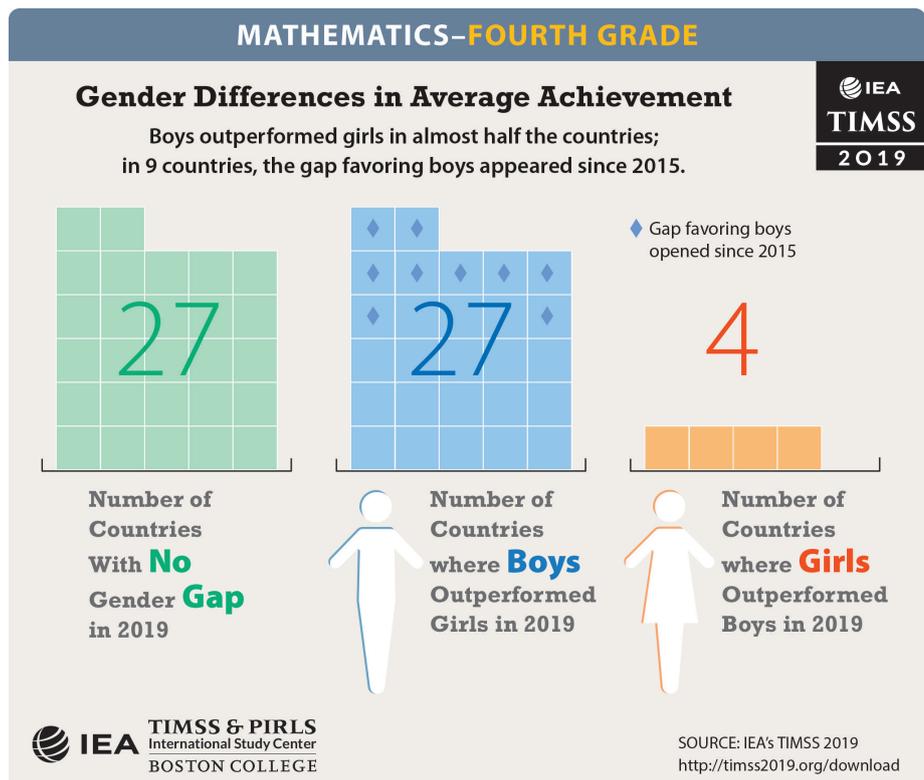
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SOURCE: IEA's TIMSS 2019 <http://timss2019.org/download>



## ACHIEVEMENT BY GENDER

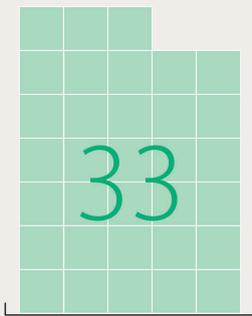
Nearly half the countries had gender equity in average mathematics and science achievement. However, in mathematics, boys outperformed girls in nearly half the countries at the fourth grade. In science, girls outperformed boys in 18 countries at the fourth grade and 15 countries at the eighth grade.



SCIENCE-FOURTH GRADE

Gender Differences in Average Achievement

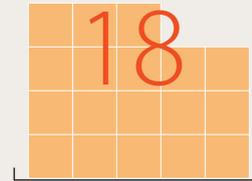
There was gender equity in more than half the countries, but girls outperformed boys in 18 countries.



Number of Countries With **No Gender Gap** in 2019



Number of Countries where **Boys** Outperformed Girls in 2019



Number of Countries where **Girls** Outperformed Boys in 2019

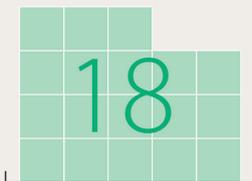


SOURCE: IEA's TIMSS 2019 <http://timss2019.org/download>

SCIENCE-EIGHTH GRADE

Gender Differences in Average Achievement

There was gender equity in 18 countries, but girls outperformed boys in 15 countries.



Number of Countries With **No Gender Gap** in 2019



Number of Countries where **Boys** Outperformed Girls in 2019



Number of Countries where **Girls** Outperformed Boys in 2019



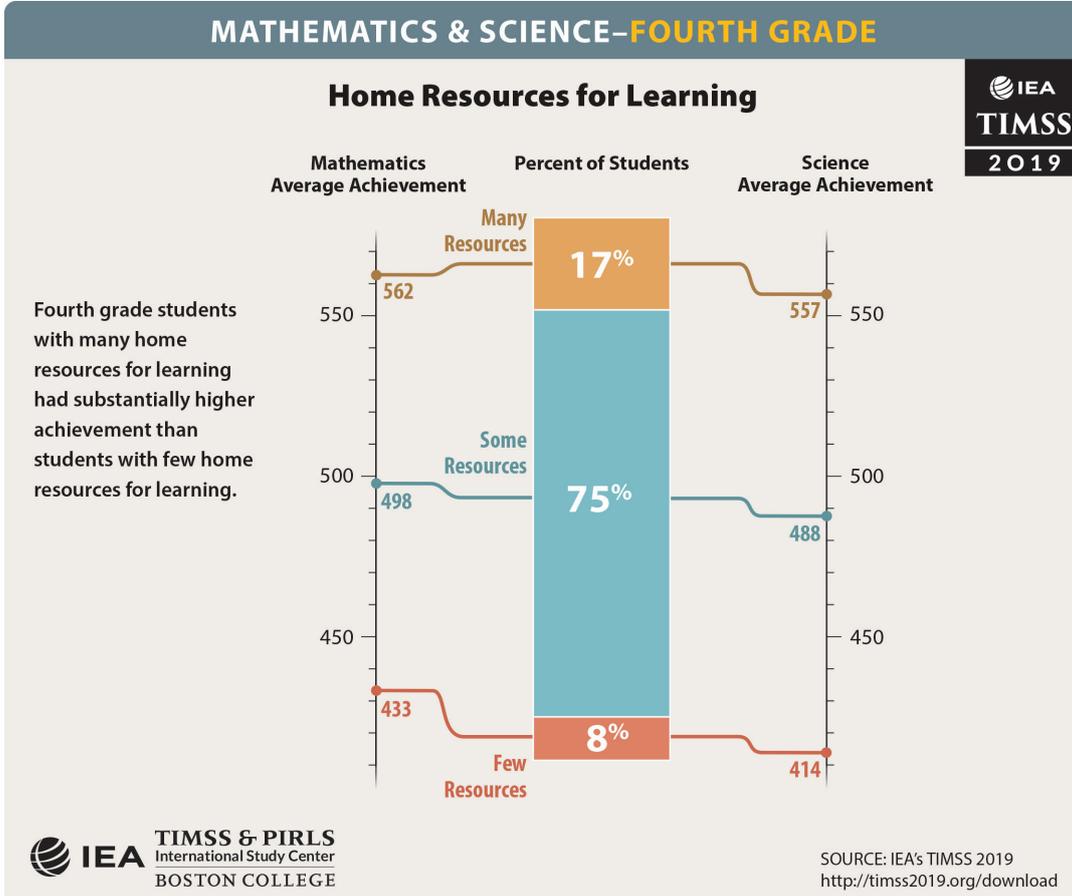
SOURCE: IEA's TIMSS 2019 <http://timss2019.org/download>

# Home and School Contexts



## HOME EDUCATIONAL RESOURCES

Students from homes with more educational resources, such as books, an internet connection, and parents with higher levels of education, had higher average achievement in mathematics and science at both grades.

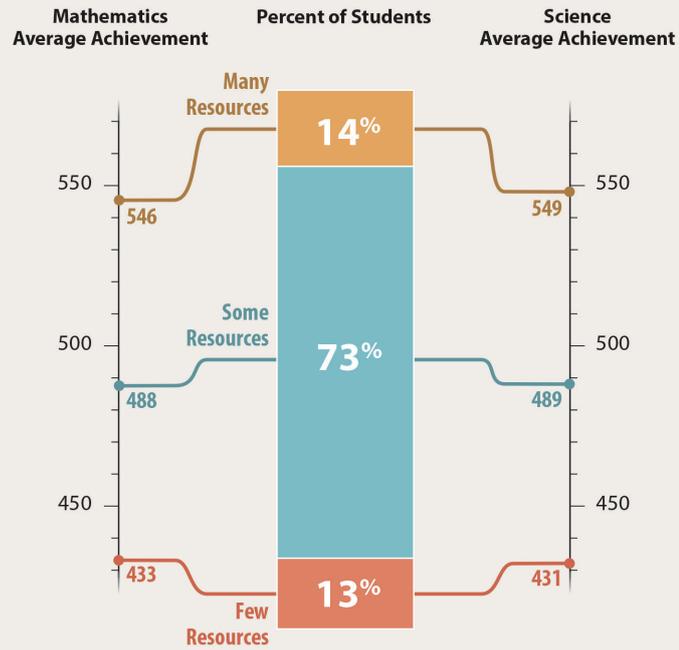


MATHEMATICS & SCIENCE—EIGHTH GRADE



Home Educational Resources

Eighth grade students who had many home educational resources had much higher achievement than students who had few resources.



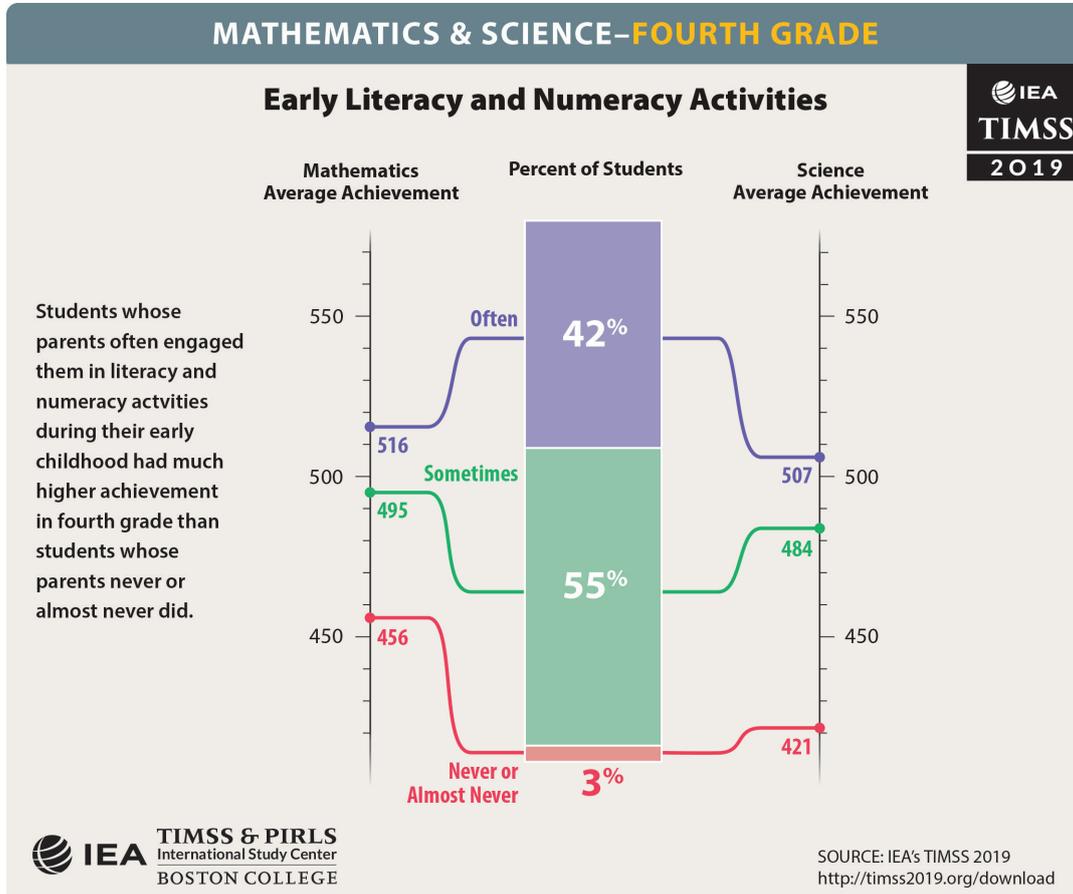
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SOURCE: IEA's TIMSS 2019 <http://timss2019.org/download>



AN EARLY START IN LEARNING

TIMSS shows the importance of early educational activities for later progress in primary school. Fourth grade students had higher achievement, on average, when their parents had engaged them in literacy and numeracy activities at an early age in the home, when the students had attended preprimary education, or when they had literacy and numeracy skills upon entering primary school.

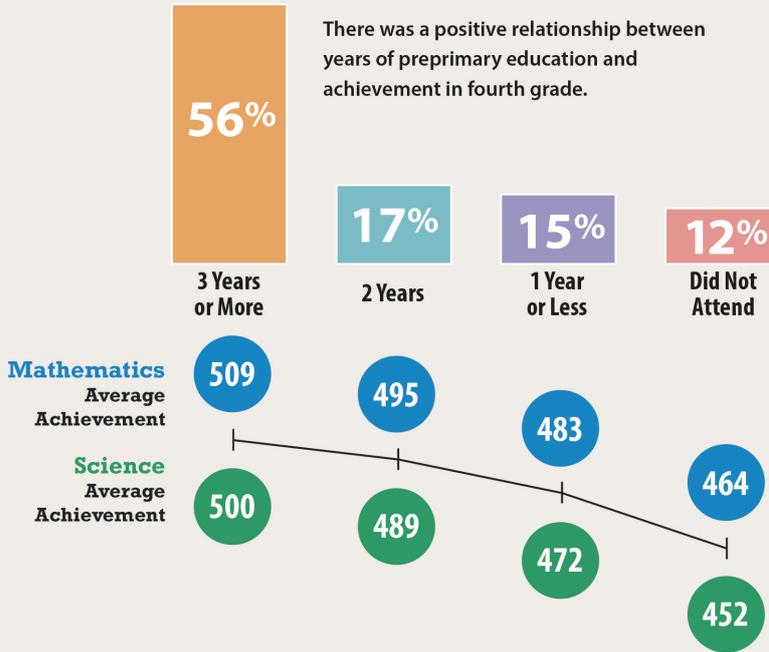


MATHEMATICS & SCIENCE—FOURTH GRADE

Early Start in School: Preprimary Education

IEA  
TIMSS  
2019

There was a positive relationship between years of preprimary education and achievement in fourth grade.



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SOURCE: IEA's TIMSS 2019 <http://timss2019.org/download>

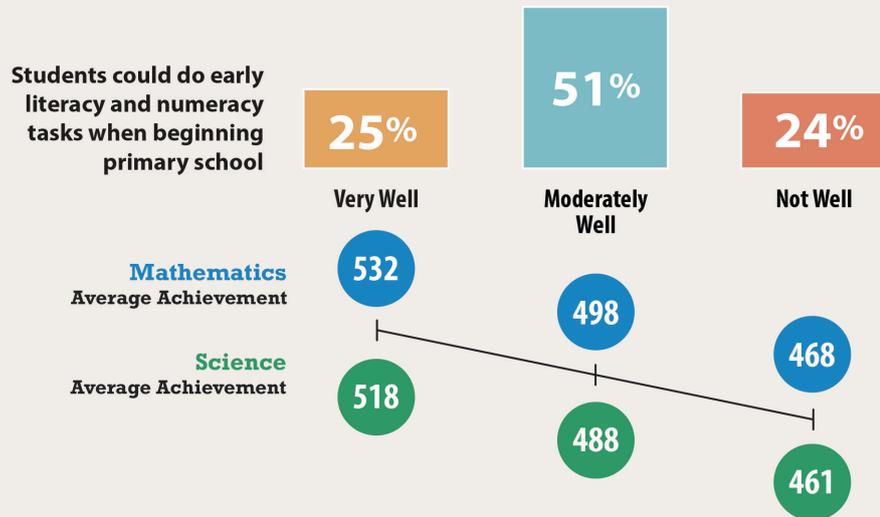
MATHEMATICS & SCIENCE—FOURTH GRADE

Beginning School with Literacy and Numeracy Skills

IEA  
TIMSS  
2019

Students who began primary school with literacy and numeracy skills had higher achievement in fourth grade.

Students could do early literacy and numeracy tasks when beginning primary school



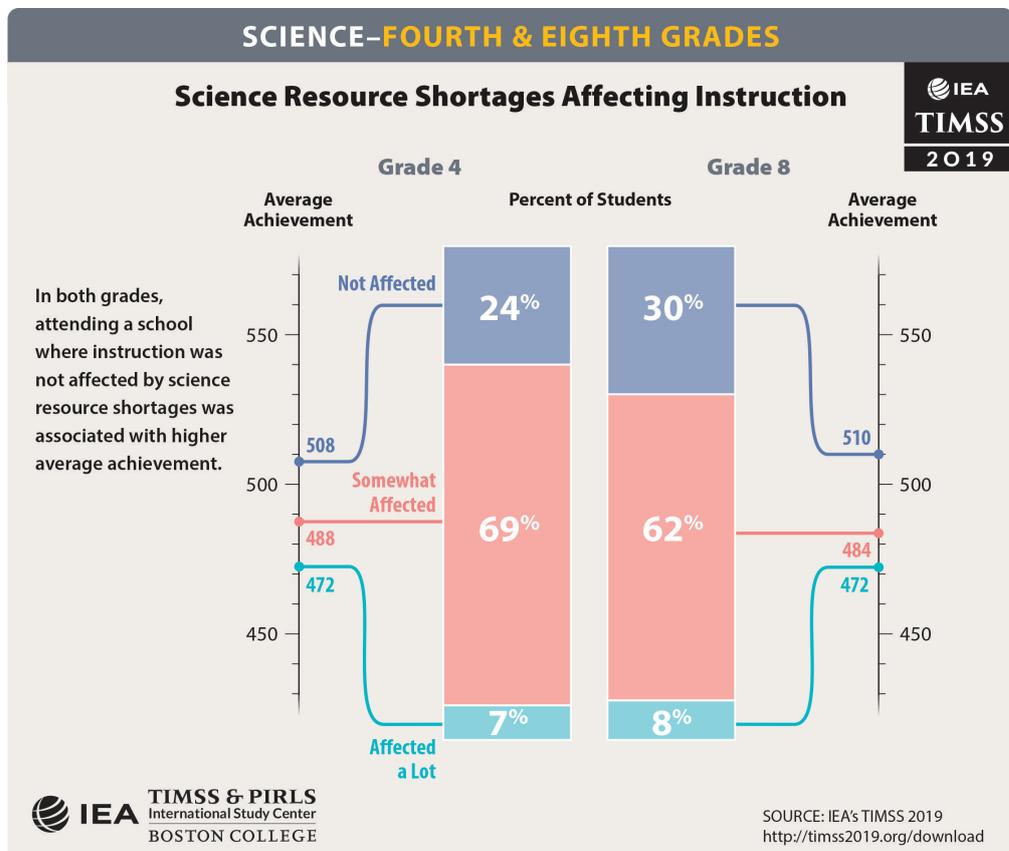
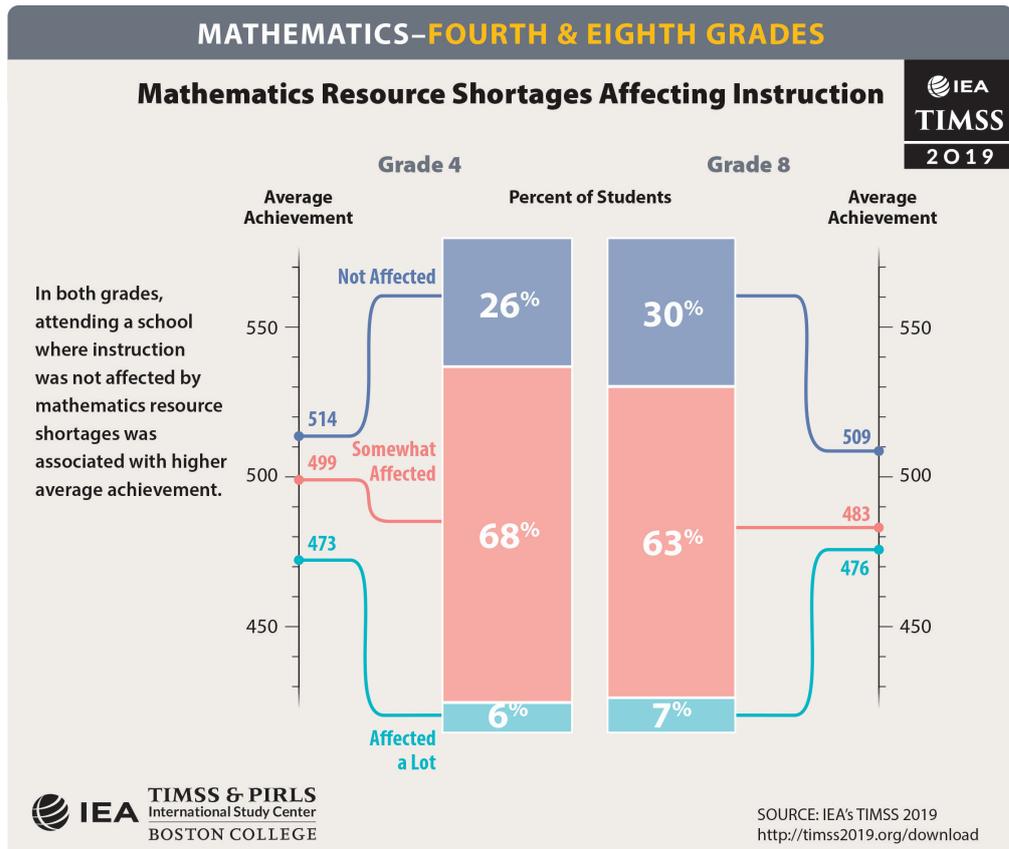
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SOURCE: IEA's TIMSS 2019 <http://timss2019.org/download>



SCHOOL RESOURCES

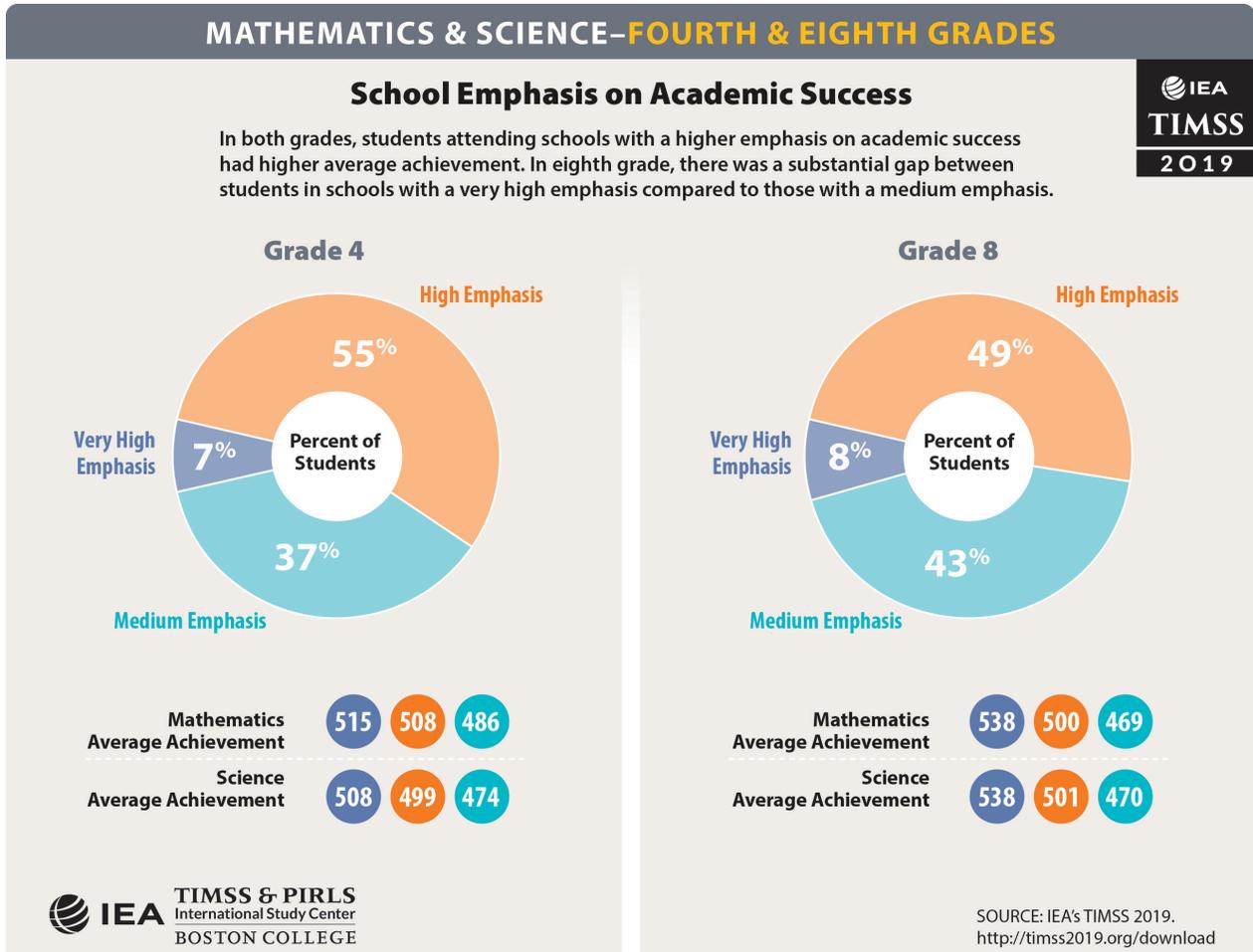
Students attending schools with fewer resource shortages had higher average achievement in mathematics and science at both grades.





## SCHOOL EMPHASIS ON ACADEMIC SUCCESS

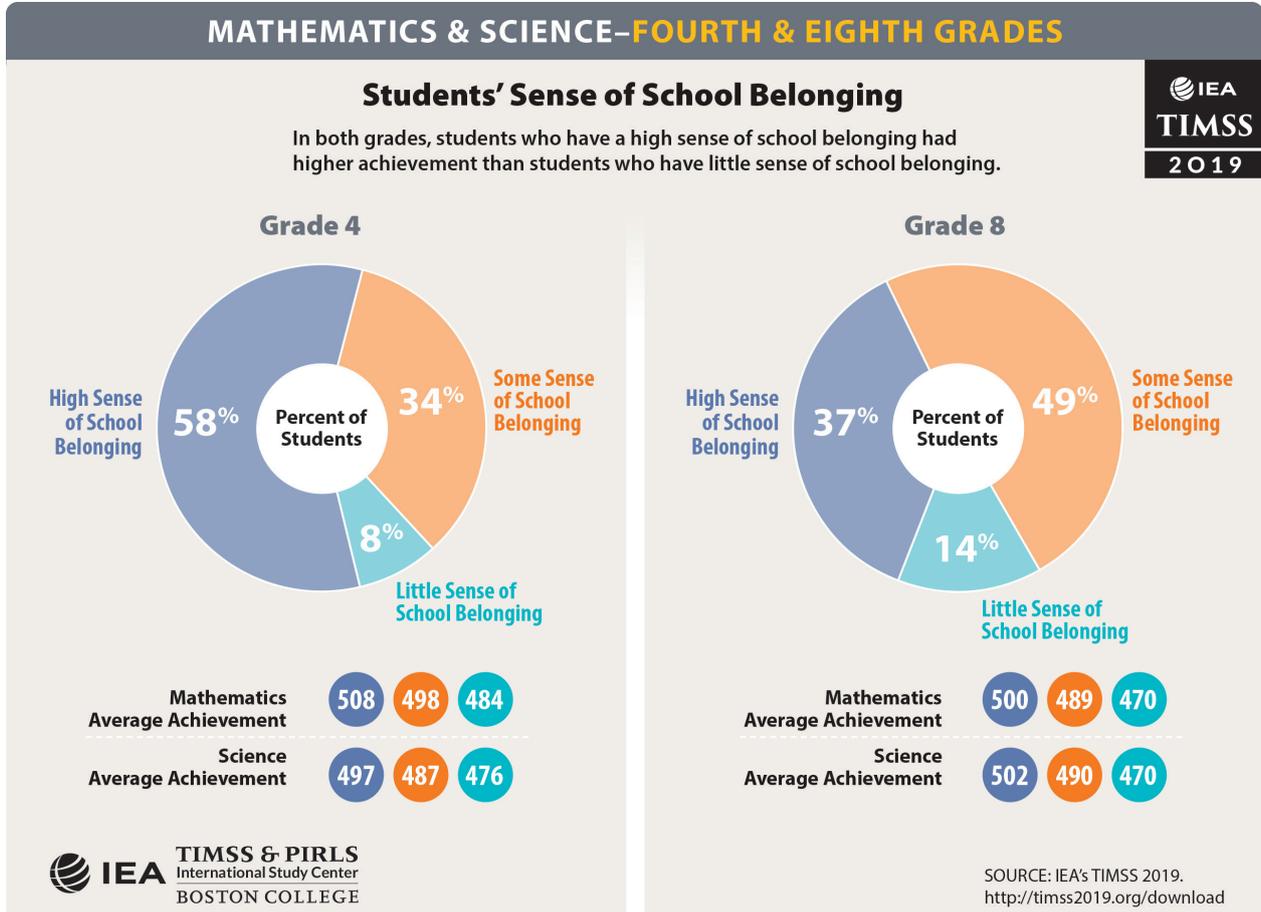
More than half the students at both grades attended schools with a high or very high emphasis on academic success. Especially at the eighth grade, students attending schools with a higher emphasis had higher average achievement in mathematics and science. Schools emphasizing academic success have well prepared and highly skilled teachers, supportive parents with expectations for student success, and students who desire to do well and can meet the schools' academic goals.





## STUDENTS' SENSE OF SCHOOL BELONGING

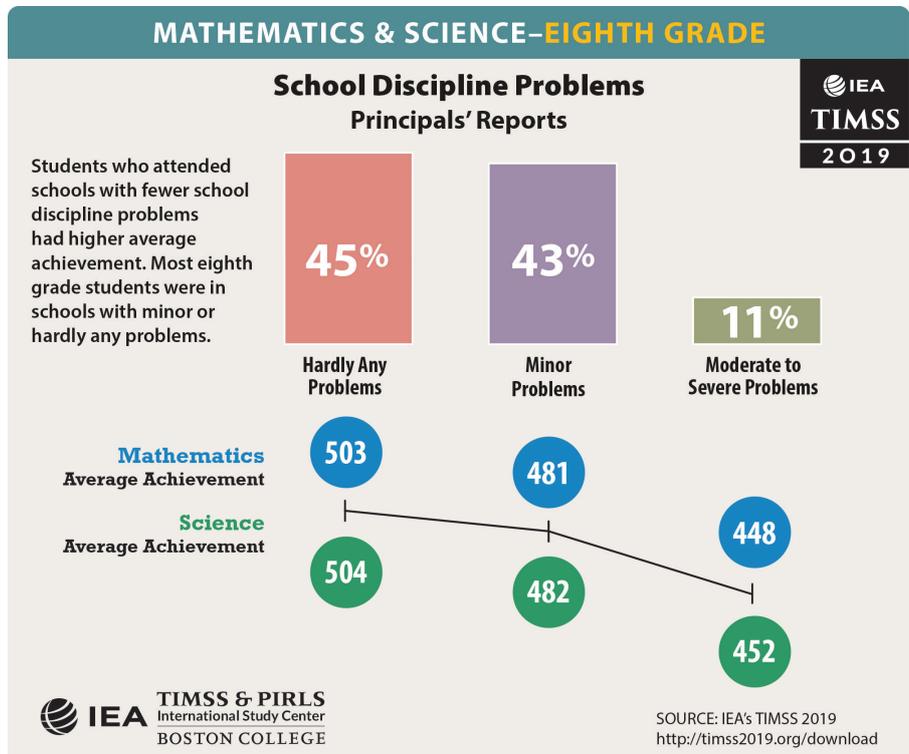
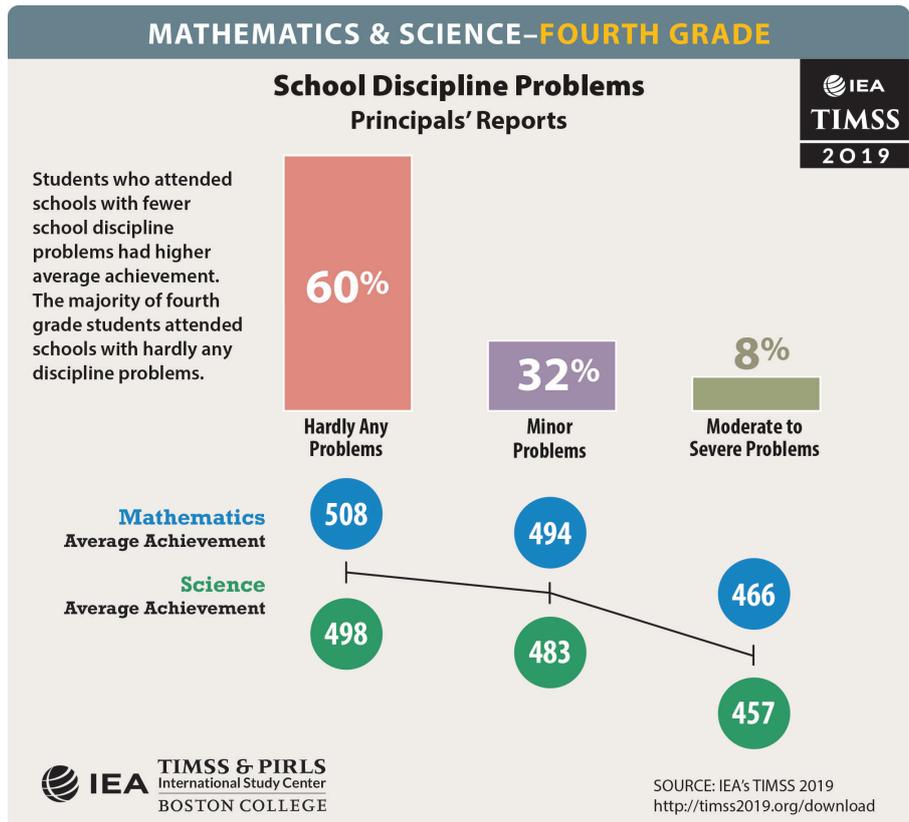
In both grades, students with a higher sense of school belonging had higher average mathematics and science achievement. However, the percentage of students reporting a high sense of school belonging was 58 percent across the 58 countries at fourth grade and only 37 percent across the 39 countries at eighth grade.

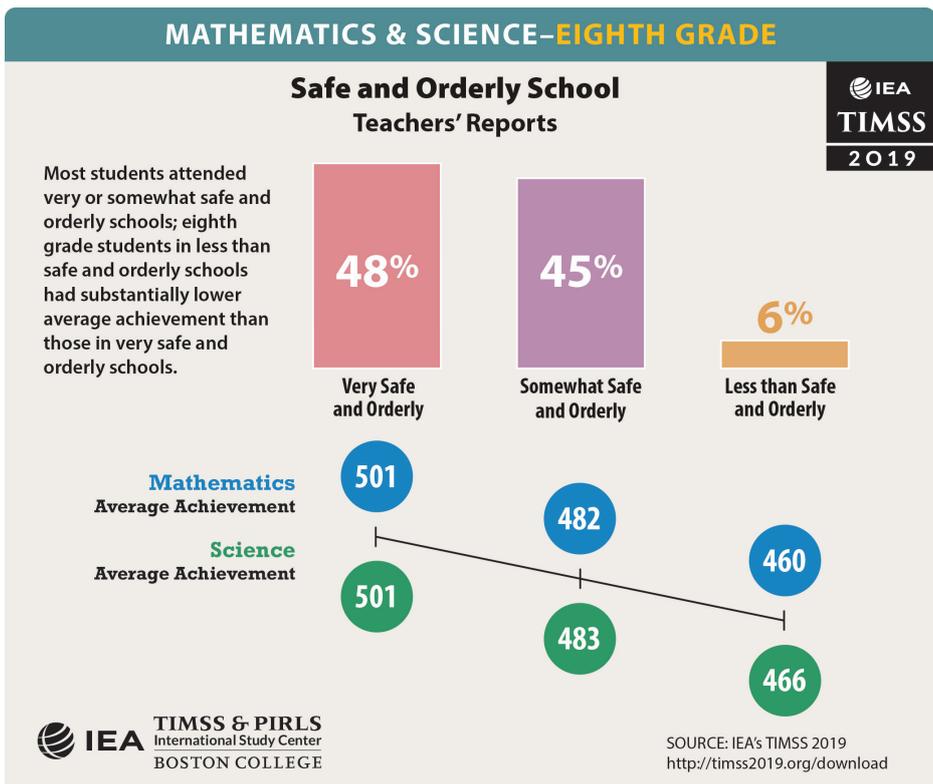
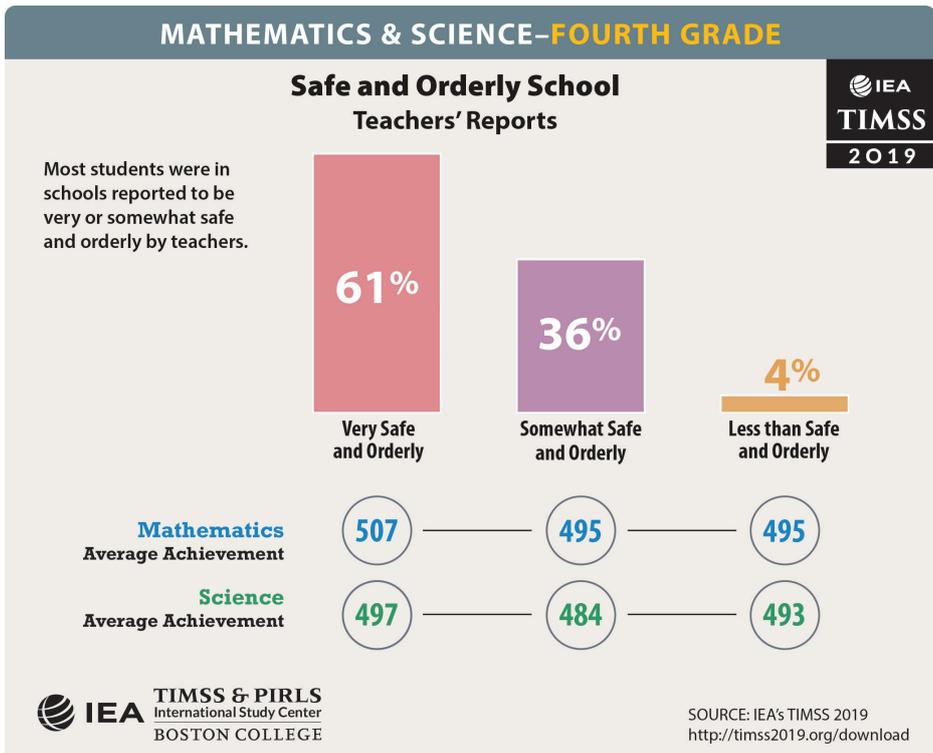




SCHOOL DISCIPLINE AND SAFETY

Most fourth and eighth grade students attended schools with well-disciplined and safe environments. Higher average achievement in mathematics and science was associated with attending schools with fewer school discipline problems and safer and more orderly school environments.

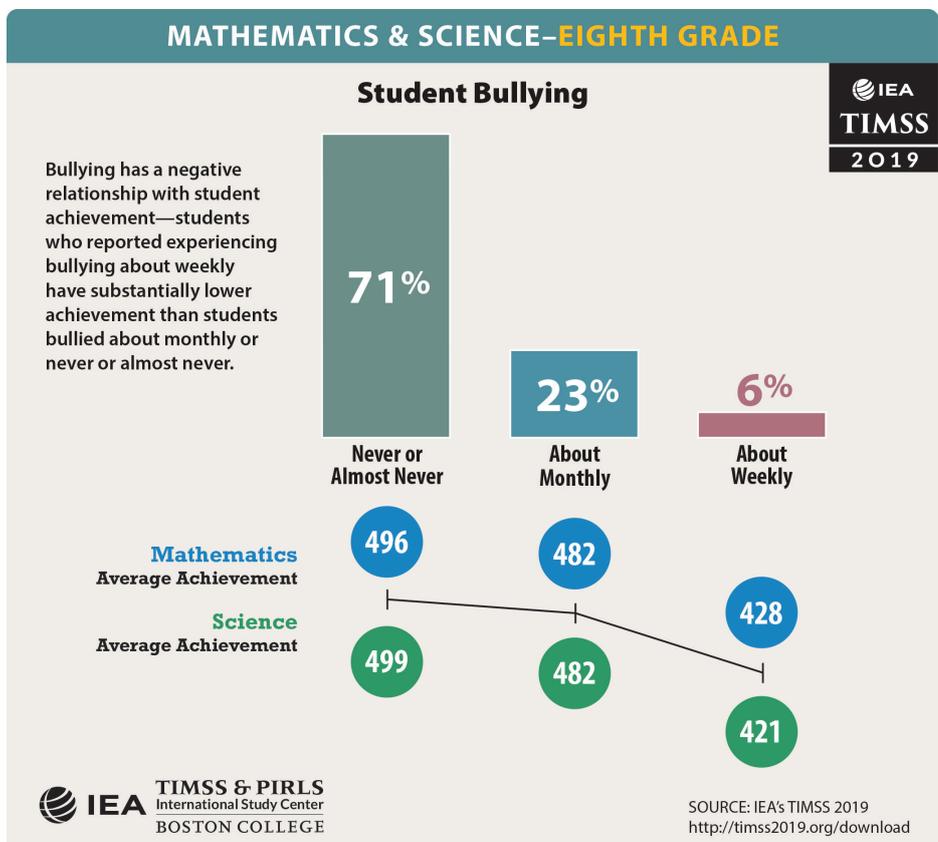
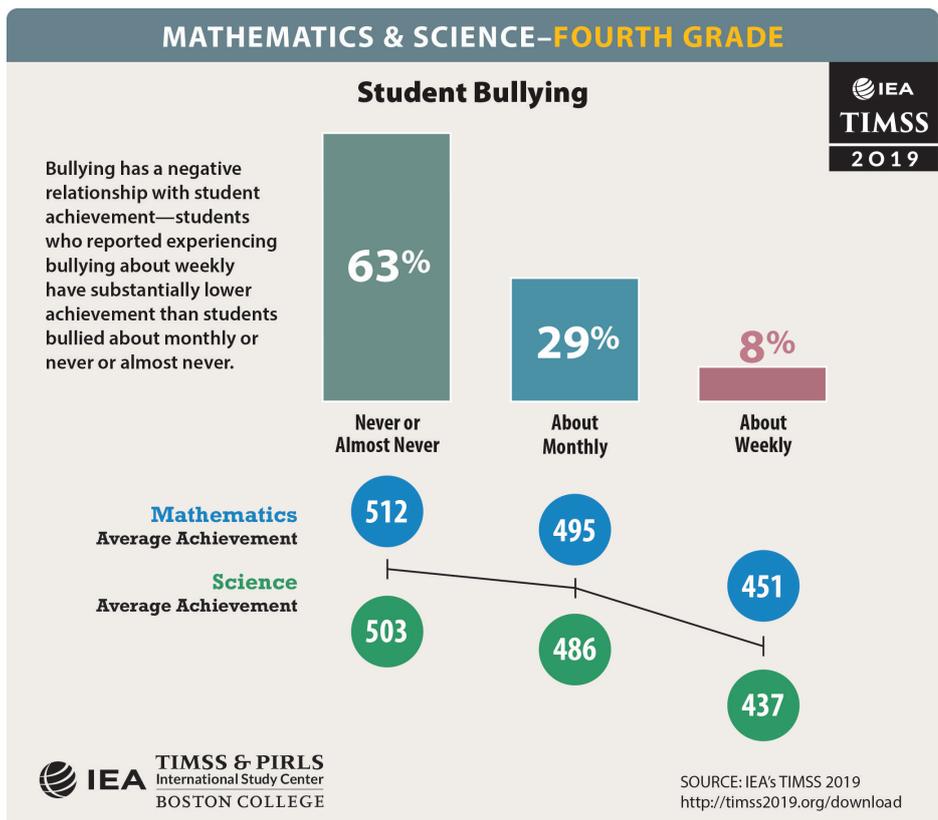






## STUDENT BULLYING

TIMSS asked students about how often they experienced various bullying behaviors by other students, including online cyberbullying, with more extreme behaviors included at the eighth grade. Higher average achievement was associated with students experiencing little or no bullying. At both grades, most students were never or almost never bullied, but the 6-8 percent of students that reported being bullied weekly had considerably lower average achievement.



## Classroom Contexts



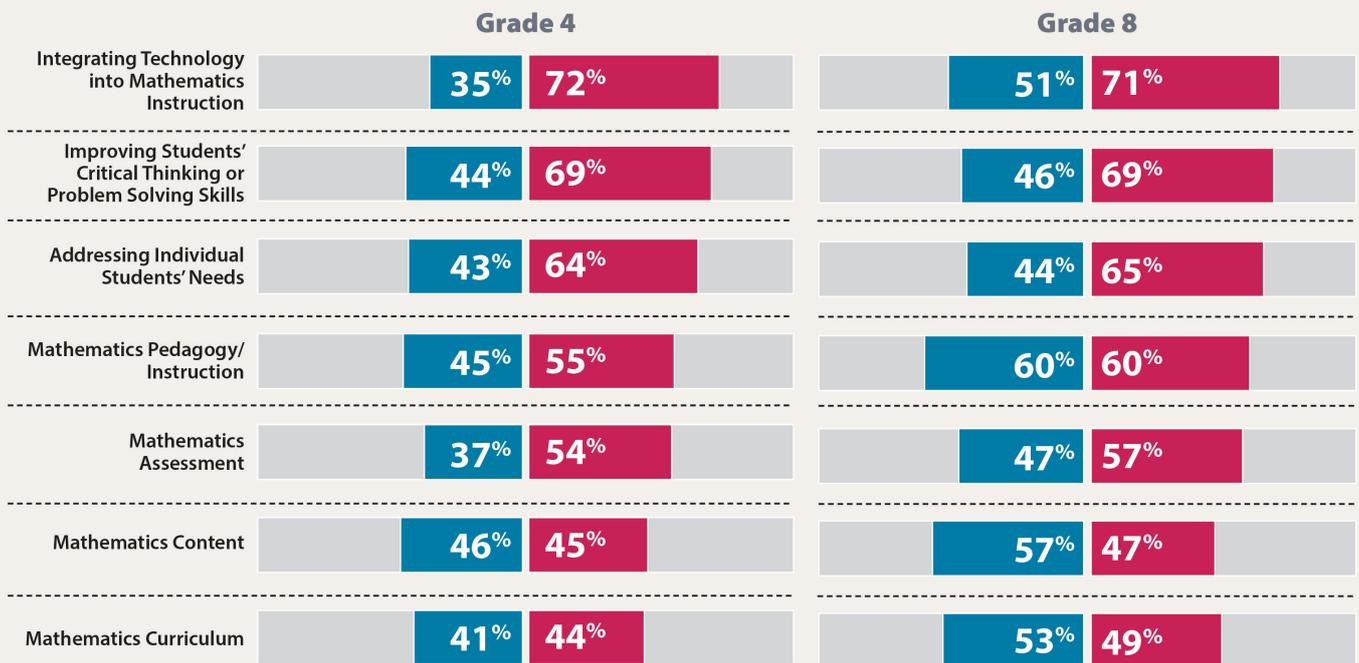
### TEACHERS' PROFESSIONAL DEVELOPMENT NEEDS

Teachers reported a sizable gap between their professional development needs and their recent professional development opportunities when asked about integrating technology into instruction and improving students' critical thinking skills. Although in general less than half the students had teachers who reported participating in such professional development, about 70 percent had teachers who reported needing future professional development in these areas.

#### MATHEMATICS—FOURTH & EIGHTH GRADE

##### Professional Development Participation and Needs

Percent of Students by Teachers' **Participation** in Professional Development in the Past 2 Years ■ Percent of Students by Teachers Indicating a **Need** for Future Professional Development ■

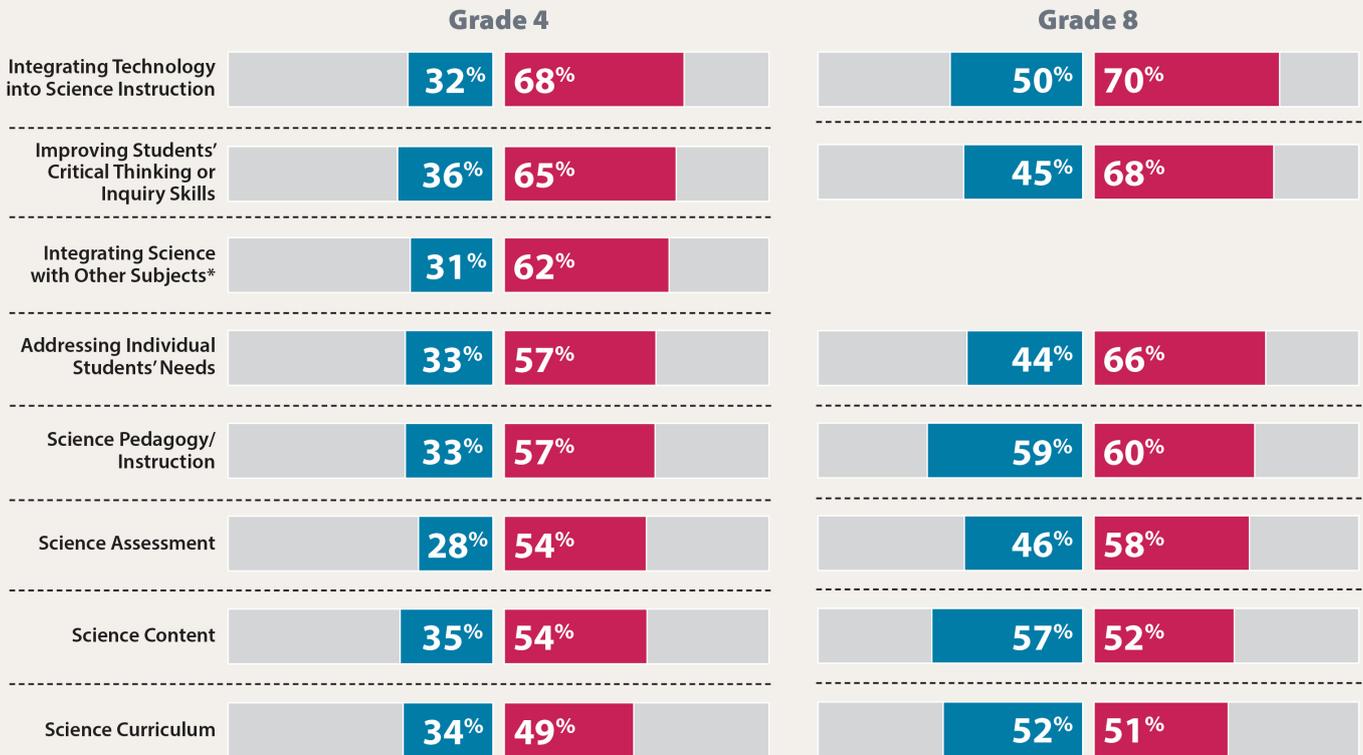


SCIENCE—FOURTH & EIGHTH GRADE

Professional Development Participation and Needs



Percent of Students by Teachers' **Participation** in Professional Development in the Past 2 Years ■ Percent of Students by Teachers Indicating a **Need** for Future Professional Development ■



\*Asked at fourth grade only

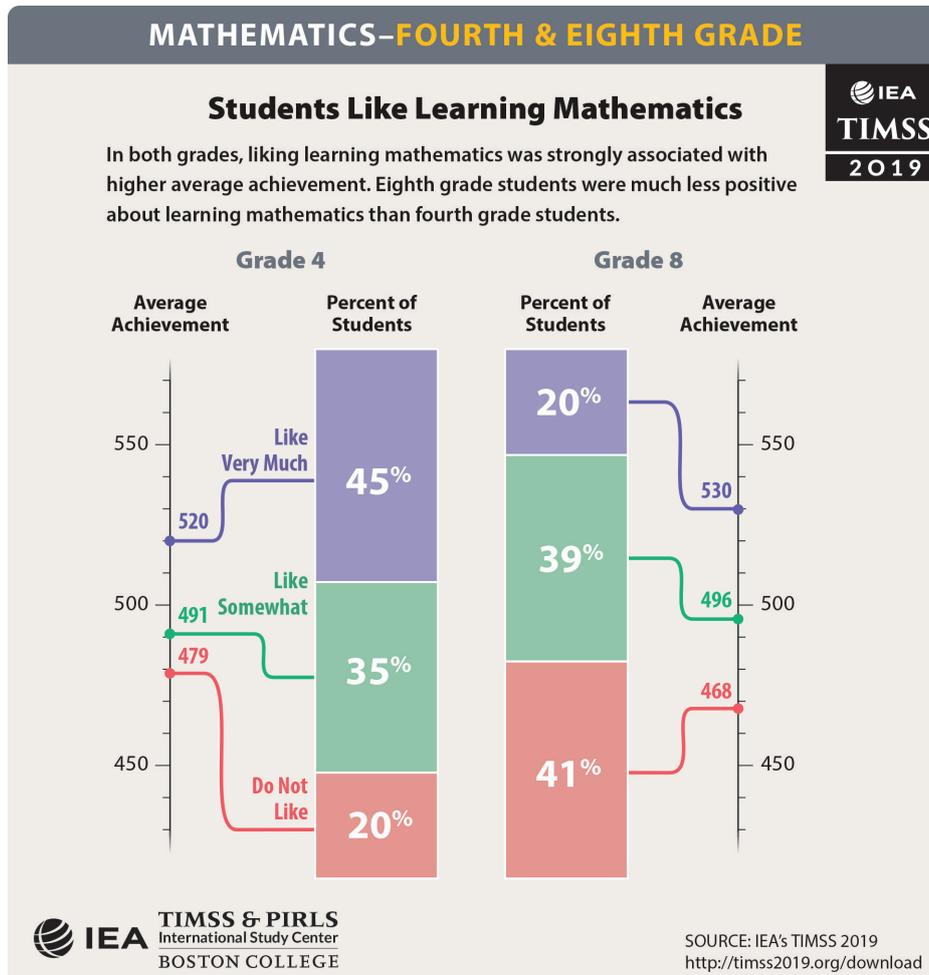
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SOURCE: IEA's TIMSS 2019 <http://timss2019.org/download>



## STUDENTS' ATTITUDES TOWARD MATHEMATICS

In the fourth and eighth grades, liking learning mathematics and feeling confident in mathematics were strongly associated with higher average achievement. Although students generally had positive attitudes, the percentage who do not like learning mathematics was higher in eighth grade than fourth grade (41% compared to 20%). Similarly, students who feel confident in mathematics have higher average achievement than those who do not, but again, the percentage not confident was higher in eighth grade than fourth grade (44% compared to 23%). However, most eighth grade students (84%) reported valuing mathematics at least somewhat.

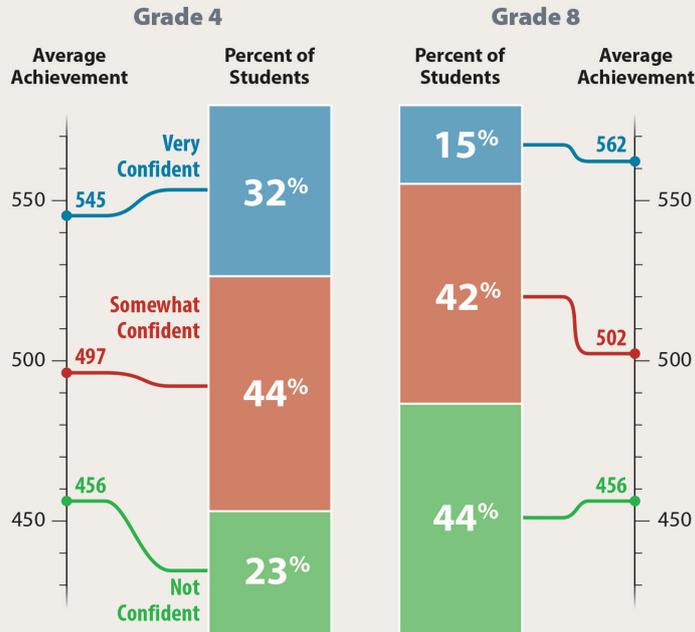


MATHEMATICS—FOURTH & EIGHTH GRADE

Student Confidence in Mathematics

IEA  
TIMSS  
2019

In both grades, being very confident in mathematics was strongly associated with higher average achievement. Eighth grade students were less confident in mathematics than fourth grade students.



IEA TIMSS & PIRLS  
International Study Center  
BOSTON COLLEGE

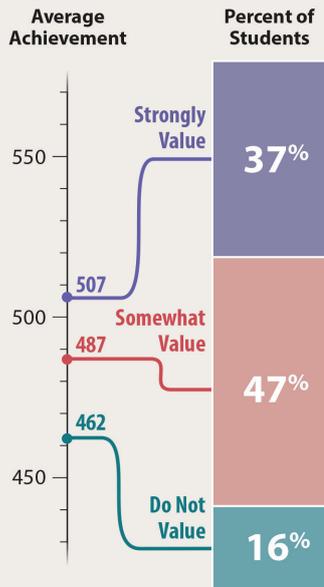
SOURCE: IEA's TIMSS 2019  
<http://timss2019.org/download>

MATHEMATICS—EIGHTH GRADE

Students Value Mathematics

IEA  
TIMSS  
2019

In eighth grade, most students said they value mathematics at least somewhat. Valuing mathematics was associated with higher average achievement.



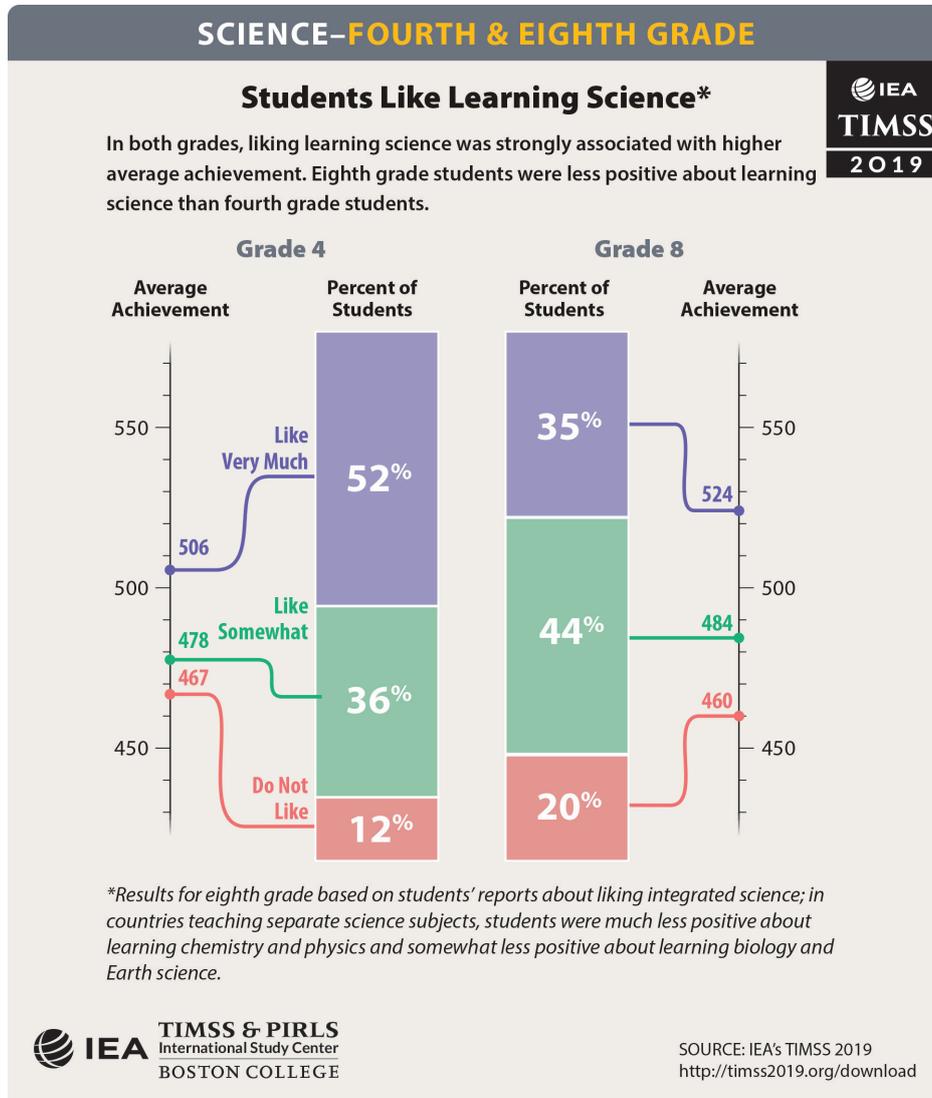
IEA TIMSS & PIRLS  
International Study Center  
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SOURCE: IEA's TIMSS 2019  
<http://timss2019.org/download>



## STUDENTS' ATTITUDES TOWARD SCIENCE

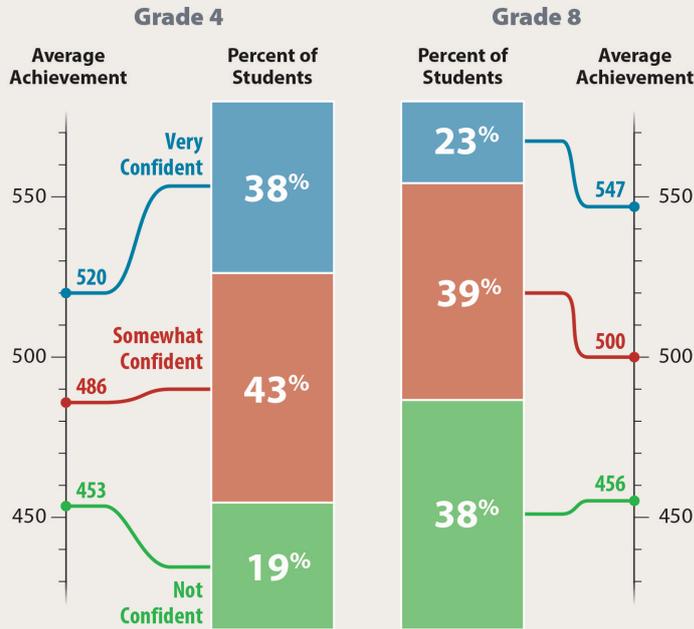
In the fourth and eighth grades, liking learning science and feeling confident in science were strongly associated with higher average achievement. However, there was a higher percentage of students with positive attitudes in the fourth grade (52% very much like science) compared to the eighth grade (35%). The percentage very confident in science also was higher at the fourth grade than the eighth grade (38% compared to 23%). Moreover, 22 percent of eighth grade students reported that they do not value science.



SCIENCE—FOURTH & EIGHTH GRADE

Student Confidence in Science\*

In both grades, being very confident in science was strongly associated with higher average achievement. Eighth grade students were less confident in science than fourth grade students.



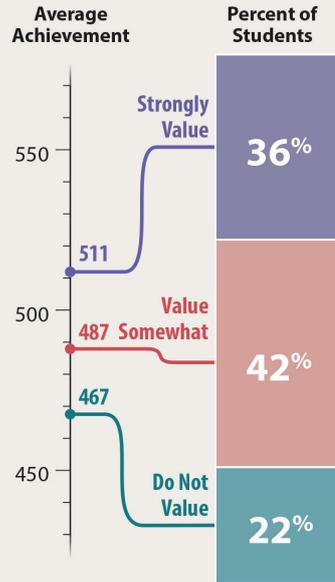
\*Results for eighth grade based on students' reports about their confidence in integrated science; in countries teaching separate science subjects, students were less confident in chemistry and physics and somewhat more confident in biology and Earth science.

SCIENCE—EIGHTH GRADE

Students Value Science



In eighth grade, most students said they value science at least somewhat. Valuing science was associated with higher average achievement.



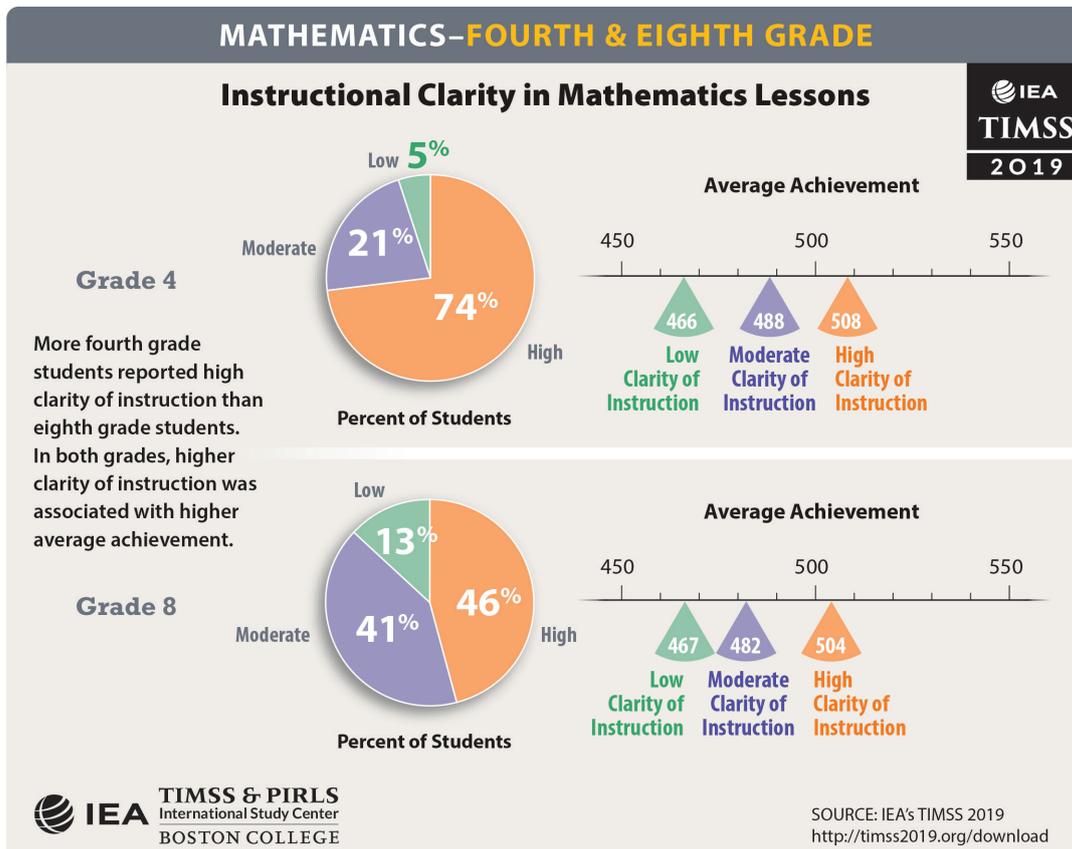
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SOURCE: IEA's TIMSS 2019 <http://timss2019.org/download>



## INSTRUCTIONAL CLARITY

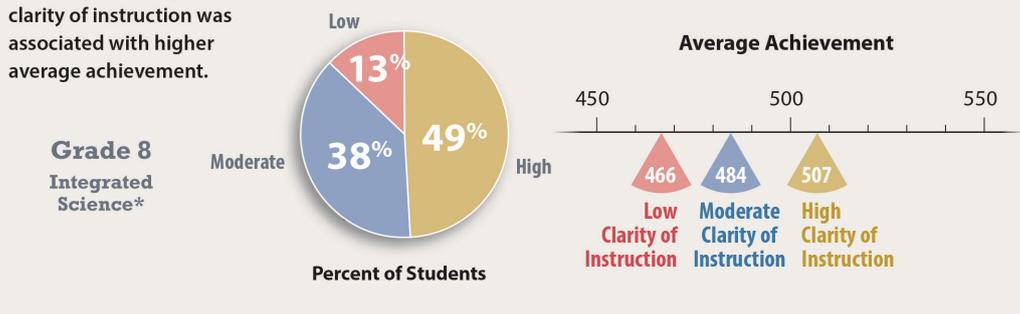
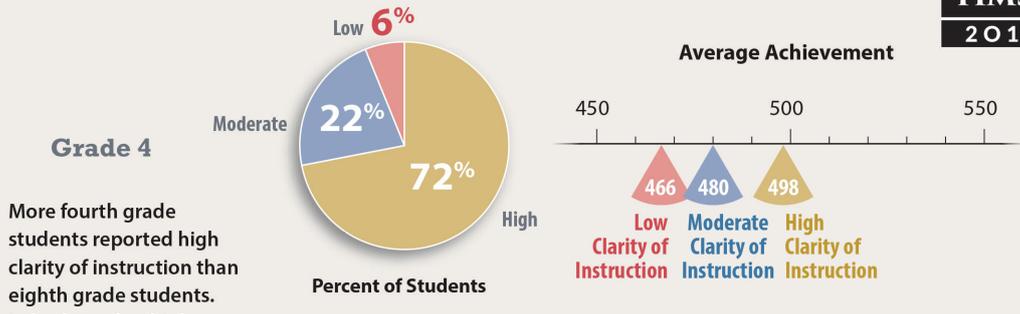
Students were asked about the clarity of their teachers' instruction in mathematics and science. For example, students were asked whether they know what their teacher expects them to do, if their teacher is easy to understand, has clear answers to their questions, is good at explaining mathematics or science, or does a variety of things to help the students learn. As anticipated, higher student achievement was associated with greater clarity of instruction in both subjects and grades. About three-quarters of fourth grade students reported their teachers had high instructional clarity, but less than half the eighth grade students did so.



SCIENCE—FOURTH & EIGHTH GRADE



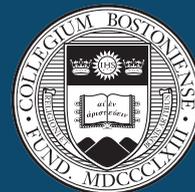
Instructional Clarity in Science Lessons



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\* Separate science subjects showed similar pattern.

SOURCE: IEA's TIMSS 2019 <http://timss2019.org/download>



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