



NFER Education Briefings

Twenty years of TIMSS in England

What is TIMSS?

The Trends in International Mathematics and Science Study (TIMSS) is a worldwide research project run by the IEA¹. It takes place every four years and provides data about trends in maths and science achievement. England has participated in all six cycles of TIMSS since 1995, and so the data allows us to monitor trends in educational achievement and contexts for learning over the past 20 years.

It assesses the knowledge and skills of pupils aged 9–10 (Year 5) and 13–14 (Year 9) and gathers extensive

background information about pupils' home and learning environments and the quantity, quality and content of teaching. This information can provide education policymakers, school leaders, teachers and researchers with powerful insights into how well education systems are functioning, and how to improve teaching and learning in mathematics and science for pupils around the world.

¹The International Association for the Evaluation of Educational Achievement

NFER has a long history of involvement in international large scale assessments dating back over fifty years. We have delivered TIMSS since its inception in 1995.

What can TIMSS tell us about maths and science education across the world?

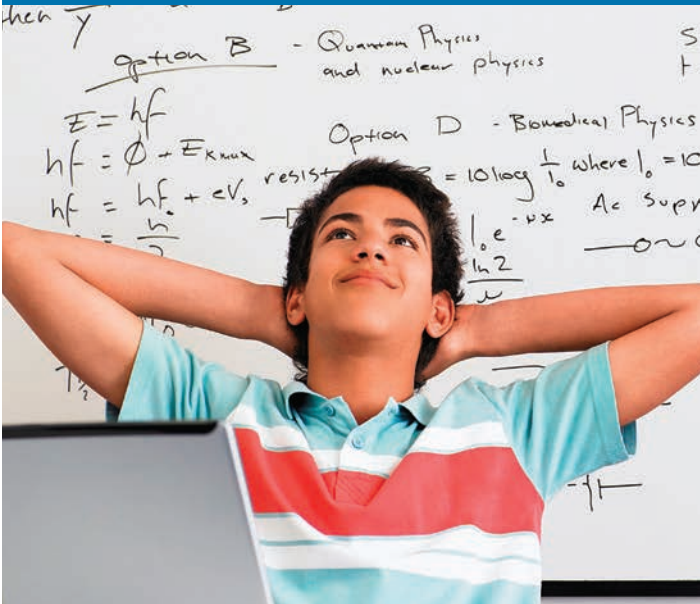
Topic 2
 $V = U + at$
 $S = \frac{u+v}{2} t$
 $S = Ut + \frac{1}{2} at^2$
 $V^2 = U^2 + 2as$

g
G
NA
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7.81 m
6.67 x 10
6.02 x 10
8.31 JK⁻¹
1.38 x 10

Has maths and science achievement changed over time?

Simply looking at whether the score for maths or science is higher or lower than in a previous TIMSS cycle does not tell us accurately whether achievement has improved, is stable or is in decline. It is crucial to consider whether a score is statistically significantly different – in other words, the differences have not arisen solely by chance. In 2015, England's TIMSS Year 5 score for maths was 546 – slightly higher than its 2011 and 2007 scores (542 and 541 respectively). Despite this, the international analysis found that over this period England maintained an equivalent level of performance.



How does achievement compare between countries?

It is tempting to focus on rankings when comparing achievement between countries. However, rankings can be misleading because small differences in scores may not be statistically significant. The TIMSS data allows us to establish whether one score is significantly different from another. England is ranked eleventh for Year 9 maths in 2015, but Slovenia, ranked twelfth, has a score that is not significantly different. Therefore it is better to look at which countries *significantly* outperformed others.

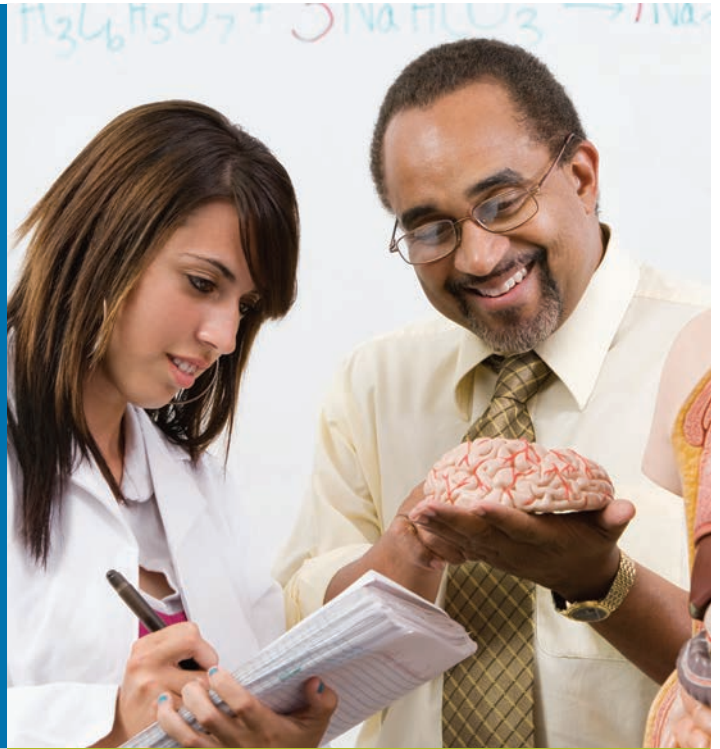
Another reason not to rely on rankings when comparing performance across countries is that rankings can be volatile, varying according to the mix of countries participating in any given cycle. One country's position relative to other countries is not just based on its own performance. It is also influenced by which countries participated and whether their performance has changed since the last round of TIMSS. For example, despite England's Year 5 science score in 2015 not varying significantly from 2011, it was outperformed by three additional countries.



How does achievement vary within countries?

A country's average TIMSS maths or science score doesn't tell us everything we might need to know. In addition to knowing how well pupils in England performed overall, it is also important, for the purposes of teaching and learning, to examine the spread in performance between the highest and lowest achievers.

TIMSS provides data on the 'spread' of achievement in two ways: the proportion of pupils achieving certain 'International Benchmarks'; and the difference between a country's highest and lowest scores. For example, Singapore is the highest achieving country for both maths and science, but has a relatively wide spread of achievement – over 280 scale points in both subjects at Year 5.



What characteristics are associated with achievement?

TIMSS also provides in-depth contextual information about education systems, schools, teachers and pupils; and explores the relationships between these characteristics and achievement. This information can help countries make evidence-based decisions on aspects of their own education policy that they might review and adapt.

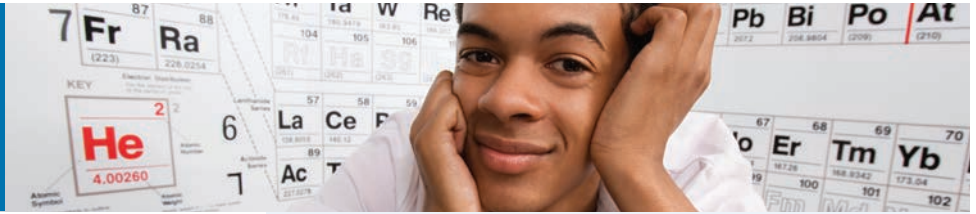
However, it is important to recognise that the data from TIMSS alone does not provide a magic formula for policy changes that will improve achievement. For example, it cannot tell us whether the high performance of countries such as Singapore and Hong Kong is a direct result of the specific teaching practices they adopt or whether it is due to other aspects of the learning (or wider) environment. It is therefore important to consider TIMSS alongside other sources of evidence.



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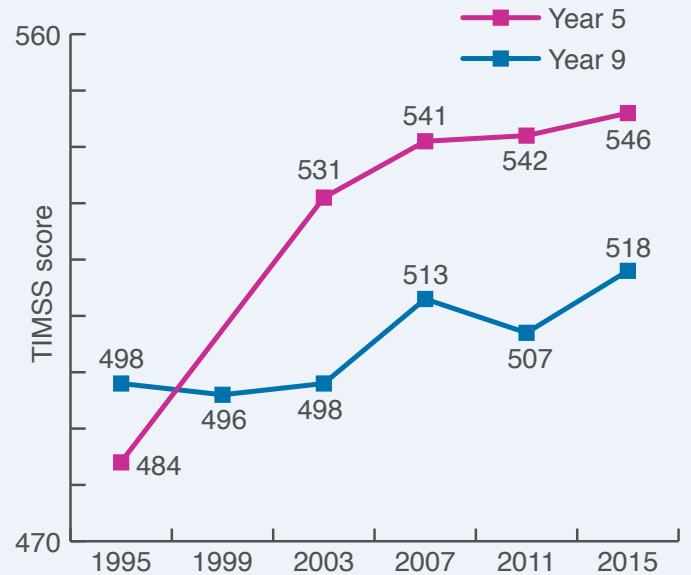
Key findings from TIMSS in England



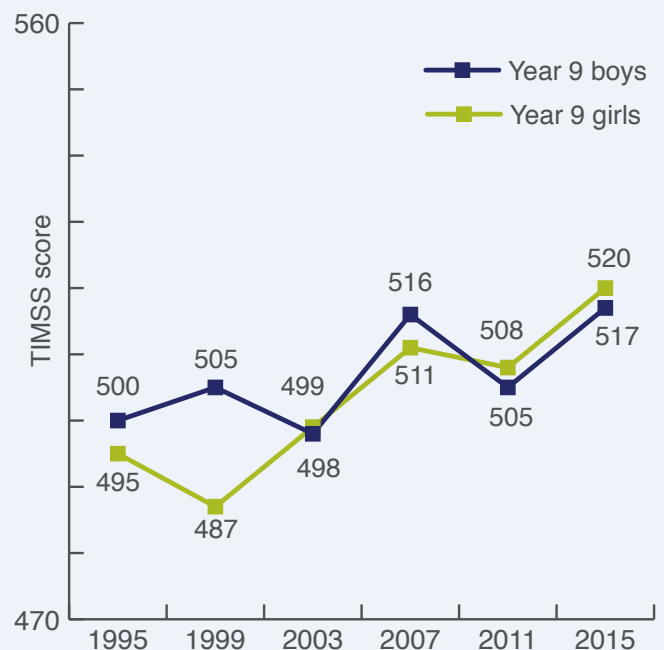
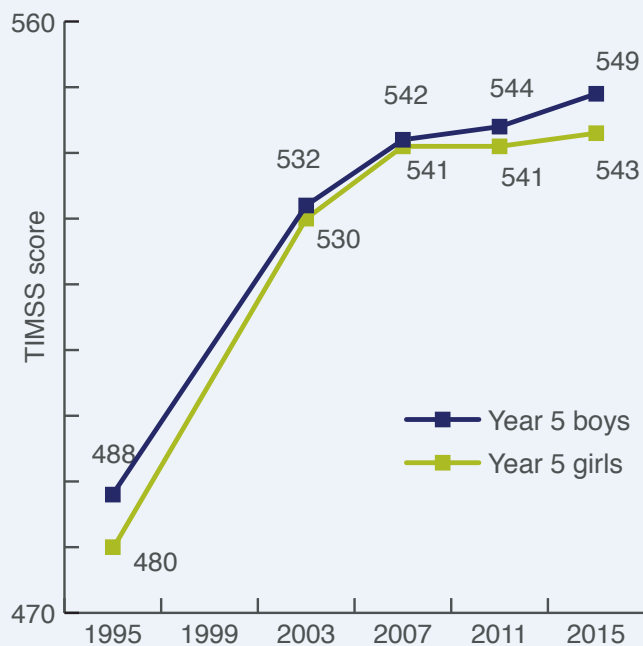
Maths achievement

- Since 2007, England has maintained the same overall level of performance in primary and secondary maths. The proportion of pupils achieving at the highest international benchmark has also been stable since 2007; and since 2003, the proportion of pupils reaching this level has been greater in Year 5 than Year 9.
- In 2015, England was ranked tenth for maths in Year 5 and eleventh in Year 9, but was only significantly outperformed by seven and six countries respectively.
- For most of the last 20 years, the TIMSS surveys have found no gender differences in maths achievement for Year 5 and Year 9 pupils in England. However, there was a significant gender difference favouring Year 5 boys in TIMSS 2015 and Year 9 boys in TIMSS 1999.

England's score in maths has not changed significantly since 2007



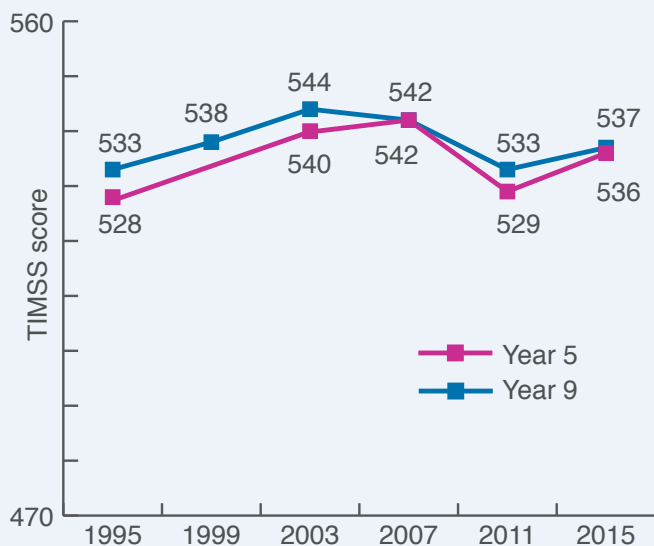
Unusually in 2015 Year 5 boys in England achieved significantly higher maths scores than girls



Science achievement

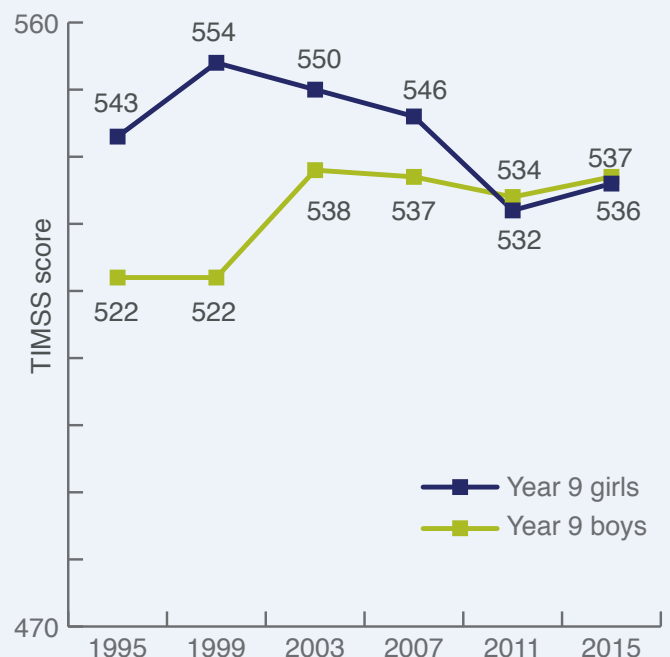
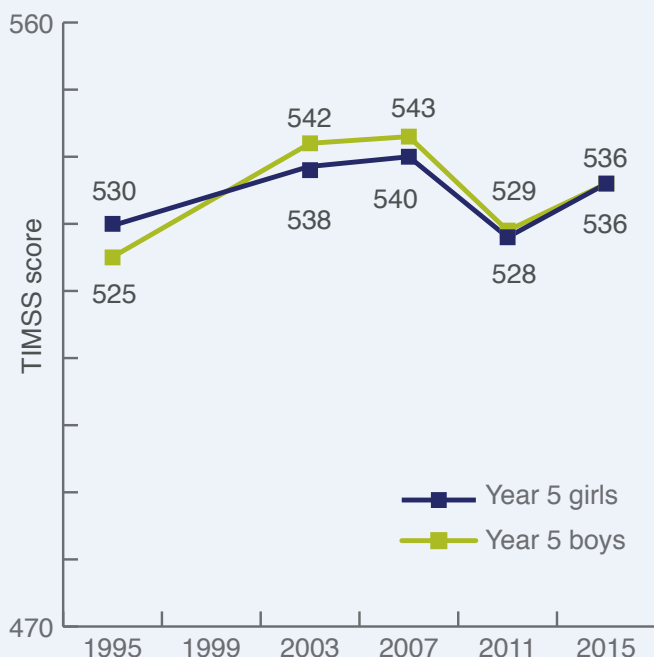
- England's performance in primary science has fluctuated. It improved significantly between 1995 and 2003; declined significantly between 2007 and 2011; and has remained stable since 2011. In contrast, its performance in secondary science has been stable for the last 20 years.
- The proportion of Year 5 pupils achieving the highest international benchmark in 2015 was significantly lower than in 2007, 2003 and 1995, but similar to 2011. For Year 9 pupils this proportion has been stable since 1995, and in contrast to what is seen for maths, since 2007 has been greater than the proportion of Year 5 pupils performing at this level.
- In 2015, England was ranked fifteenth overall for science in Year 5 and eighth in Year 9, but was only significantly outperformed by eleven and five countries respectively.
- No significant differences in gender have been observed in the past 20 years in the performance of Year 5 pupils. Year 9 boys significantly outperformed girls in 1995, 1999 and 2003; however, since 2007, there has been no significant gender difference.

England's primary science score has remained stable, following a decline in 2011



England's performance in secondary science has been stable for the last 20 years

Since 2007 there have been no significant gender differences in England's performance in science





England's maths results show a significant gender difference favouring Year 5 boys in TIMSS 2015



Teachers

- In 2015, the majority of pupils had teachers who reported that they were satisfied with their job, at similar levels seen in TIMSS 2011. A greater proportion of Year 5 pupils were taught by teachers who were very satisfied with their job. However, the proportion of pupils in England taught by 'Very Satisfied' teachers was lower than the international average.
- Levels of participation in professional development activities varied across the subjects and year groups. In maths, it was slightly higher for primary teachers compared to secondary teachers, whereas for science the reverse was true.

School learning environment

- According to headteachers the majority of pupils attended schools with 'Hardly Any' discipline issues (78 per cent for primary schools and 73 per cent for secondary schools). Primary schools in England appeared to be more 'Safe and Orderly' than secondary schools, with three-quarters of Year 5 pupils and around half of Year 9 pupils attending schools that are considered by their teachers to be 'Very Safe and Orderly'. For primary schools this was well above the international average.

- Pupils reported experiencing bullying behaviours less frequently than those in several other participating countries. A greater proportion of Year 9 pupils reported almost never experiencing bullying behaviours compared with Year 5 pupils. This mirrors the findings from 2011.

Pupil attitudes

- In England, Year 5 pupils in 2015 were more likely to be very engaged in their science and maths lessons than their Year 9 counterparts. This proportion was higher than the international average for Year 5, but lower for Year 9. This mirrors the findings from TIMSS 2011.
- Over 80 per cent of Year 5 pupils reported a positive attitude towards maths and science (similar to the international average). However, Year 9 pupils showed less positive attitudes. For mathematics the difference was particularly marked, with just over half of Year 9 pupils liking the subject. Pupil attitudes in 2015 were similar to those seen in 2011.
- Year 5 pupils were more confident about maths than they were about science, whereas for Year 9 pupils there was little difference between subjects. This mirrors the findings from 2011.

How can TIMSS inform national policy?

The TIMSS data enables a range of policy questions to be addressed. For example:

- Can the impact of past policies in England be seen through changes over time in achievement or background data?
- What can be learned from the highest achieving countries, and those which have improved most between TIMSS cycles?
- What reforms to curriculum and resourcing have other countries undertaken, and where these appear successful, what aspects of the approach could be adapted for implementation in England?
- Have there been any unintended consequences resulting in countries changing their curricula, for example have changes in emphasis resulted in certain areas not being taught at all and has there been any impact on achievement?



Who takes part?

Fifty seven countries and seven benchmarking participants² have participated in one or more of the TIMSS assessment cycles since it began in 1995. Fourteen countries and three benchmarking participants have participated in all of the TIMSS assessment cycles with pupils in one or both age groups.

TIMSS participants are varied, ranging from high income countries or regions through to low and middle income ones. Their education systems also vary, differing for example in the age at which children start school. More information about the education system in each participating country and region can be found in the TIMSS encyclopaedias³.



 Countries in **yellow** have participated in all six TIMSS cycles

² Countries participating in TIMSS follow guidelines and strict sampling targets to provide samples that are nationally representative. 'Benchmarking participants' are regional entities which follow the same guidelines and targets to provide samples that are representative at regional level.

³ The TIMSS encyclopedias from 2003 onwards can be found at <http://timssandpirls.bc.edu/>