TIMSS 2023: key messages about year 9 science in England

Jennie Golding shares the key messages from the TIMSS study

TIMSS (Trends in International Mathematics and Science Study) is an international large-scale study run every four years since 1995. TIMSS assesses the mathematics and science performance and learning experiences of students aged 9–10 and 13–14, so in England that is in years 5 and 9. It is widely used to both challenge and develop education policy. Such 'low stakes' assessments can give us a good idea of students' established available knowledge and skills in these areas, as opposed to their exam-polished but maybe short-term learning for, say, GCSEs. In year 9 science, the knowledge and skills assessed, over biology, chemistry, earth science and physics, are a fairly good match to the national curriculum in England, although our young people meet much of the material in 'earth science' in geography, rather than science, lessons.

How TIMSS works

TIMSS assessments use persistent 'trend items' and report successive cycles' scores relative to a persistent 'centrepoint' of 500. They target a very carefully defined sample, representative in a number of key attainment-linked variables. Consequently, performance can reasonably be compared both over time and across participating countries. The same is true of the experience/attitude questionnaire responses from participating students, their teachers and head teachers. In 2023, the year 9 study involved 44 largely middle- or high-income countries, and in England 4239 year 9 students, their teachers and head teachers. The two-part England national report focuses respectively on sample student performance and on student, teacher and head teacher questionnaire responses about related learning experiences (Golding *et al.*, 2024)

For the interested, there are also international and national TIMSS websites that host the 2023 *Encyclopedia*, analysing education systems in each participating country, the *TIMSS 2023 International Report* of international research findings, and a variety of other materials and resources, including some 'released' items at a variety of levels (see *Useful links*).

The value of TIMSS

Comparative and longitudinal data are of interest to policymakers, but key aspects of TIMSS analyses are also of use to teachers and others working close to the classroom. For instance, Figure 1 shows that in England, in the previous cycle of TIMSS in 2019, year 9 students' average score was the lowest ever, despite an apparently robust sample – a finding that perplexed most professionals in science education. However, in 2023 the year 9 average score recovered to near its previous levels, and to the fifth highest average internationally. Given the possible persistence of impact on learning of the pandemic (the students in this cohort were in years 6 and 7 in 2020 and 2021, so significantly affected by school closures), this finding is welcome news indeed, although it should still be treated with caution: this cohort did not complete national key stage 2 assessments, so its representativeness cannot be checked in as much detail as usual. The average performance evidenced in 2023 does suggest, however, that *students' core science curriculum knowledge is, on average, recovering from the pandemic.*

Classroom curriculum balance

Our further analysis compared year 9 performance in each of the component subject domains, as well as each of the targeted cognitive domains (knowing, applying and reasoning in science) with overall performance. We found there were no significant differences – so *on*

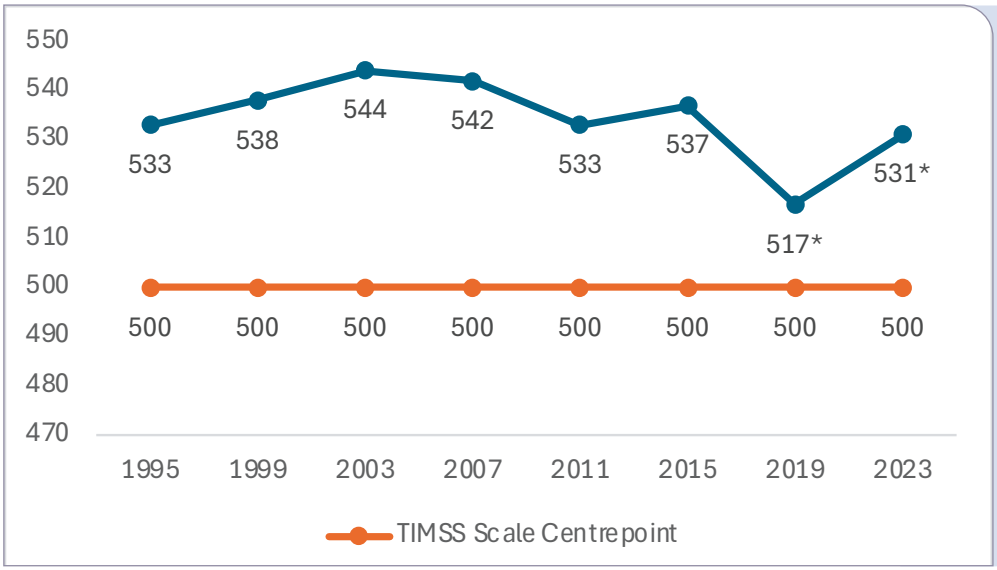

Figure 1 Average TIMSS science scores for year 9 in England 1995–2023
* = significant change from previous cycle

average, our year 9 students are acquiring scientific knowledge, skills and processes that are broad and balanced. Furthermore, England's year 9 students' performance was close to that of the highest performing countries, exceeded only by performance in Singapore, Chinese Taipei, Japan and the Republic of Korea. Of course, students' knowledge in year 9 builds on earlier years; findings for year 5 students in TIMSS 2023 will be discussed in a forthcoming article in *Primary Science*, but broadly show a very encouraging picture.

Particular groups of students

While the average scores have increased significantly since 2019, those at the bottom end of the distribution are fairly static, with the increase being driven by the top end. *Weaker performance remains strongly associated with socio-economic status* – as it does internationally. Further, it was only at the highest levels of performance that our students with English as an additional language performed as well as those for whom English is their first language: language remains an important factor in teenagers' access to science. In terms of equity of access, renewed efforts are needed to ensure students from a range of backgrounds can thrive in science.

Of particular concern, *is a significant gap in average science performance by gender in England in favour of boys*, for the first time since 2003 (Figure 2) – and one of the biggest gaps internationally. In England,

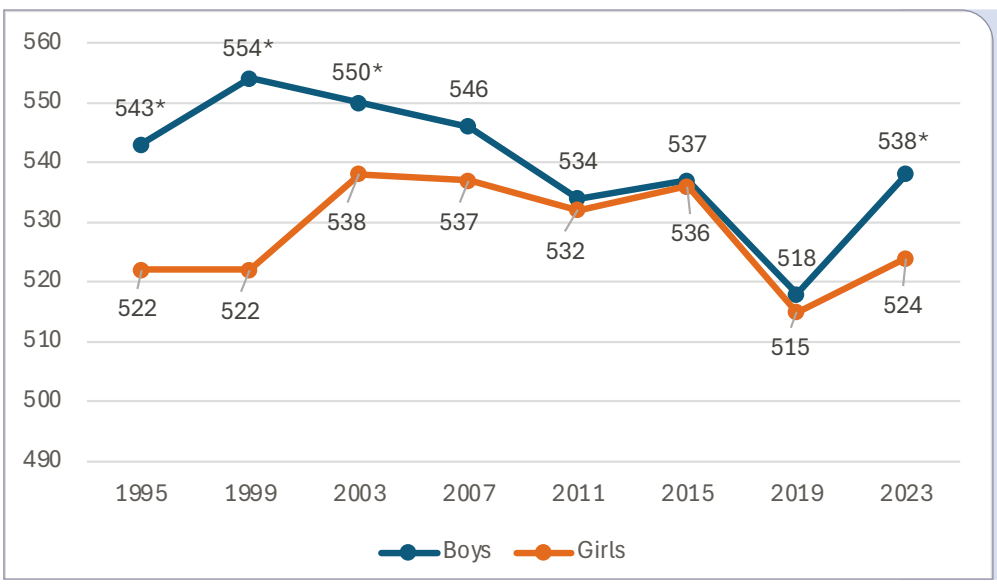

Figure 2 Comparison of year 9 TIMSS scores for boys and girls in England 1995–2023
* indicates a significant gender gap

year 9 boys on average significantly outperformed girls in each of *knowing* and *applying* among the science cognitive domains, and in each of biology, physics and earth science within the content domains. Such trends are not always obvious at class level, but these data are a reminder of the importance of monitoring and addressing such gaps.

Attitudes and experiences

The TIMSS questionnaires use a raft of 'indicator' questions around students' attitudes to, and experiences of, science. Attitudes, and particularly confidence in science, are associated with both performance and future science-related aspirations (Archer and DeWitt, 2016). For England's year 9 science in TIMSS 2023, several of these attitudinal areas were reported less positively than in recent years: for example, the percentage of participating students who either 'very much liked' or 'somewhat liked' learning science was 75% in 2015, 69% in 2019 and just 62% in 2023, which is a concern. Attitudinal responses also commonly revealed a significant gender gap (Table 1).

While we have seen some differential attitudes by gender previously, the extent of gender gaps in 2023 merits further exploration, including at individual classroom level. Teachers might like to use those attitude questionnaires with their own classes, and explore responses by different groups of students.

Table 1 Attitudes to science by gender in England, year 9

	Overall	Boys	Girls
Very confident	12%	14%*	10%
Not confident	52%	44%*	60%
Strongly value	28%	29%*	26%
Do not value	31%	28%*	35%
Very much like	39%	25%*	19%
Do not like	22%	31%*	46%

* indicates a significant gender gap

Conclusion

TIMSS represents a considerable investment for policymakers but also offers teachers and other science education practitioners the opportunity to ask questions about the extent to which national patterns are replicated in their own setting. In Golding 2025, I discuss specific ways in which use of released TIMSS materials can productively enrich classroom teaching and learning, as well as giving an overview of what is known about school-level ways to address the issues emerging.

To read the accompanying article, please follow the QR code or link.
www.ase.org.uk/SSR/394/TIMSS

USEFUL LINKS

TIMSS (International): https://timssandpirls.bc.edu/index.html

TIMSS 2023 England: www.gov.uk/government/publications/trends-in-international-mathematics-and-science-study-2023-england

TIMSS 2023 Encyclopedia: https://timss2023.org/encyclopedia/

TIMSS 2023 international report: www.iea.nl/studies/iea/timss/timss2023#section-1177

Released items, e.g. https://timss2023.org/results/grade-8-science-achievement-benchmarks

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