EVOLVING ATTITUDES OF POLISH 4TH GRADERS TOWARD MATHEMATICS AND SCIENCE IN AN INTERNATIONAL CONTEXT: INSIGHTS FROM TIMSS

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BACKGROUND

Attitudes toward subjects such as mathematics and science are recognized as factors influencing both the educational process and its outcomes, they encompass various dimensions, including enjoyment. Research indicates that, in general, enjoyment and intrinsic motivation toward specific subjects influence students' performance and can shape their subsequent educational and career decisions. However, associations between students' liking of learning mathematics and science and their achievements are not always consistent and vary across cultural contexts and different educational systems.

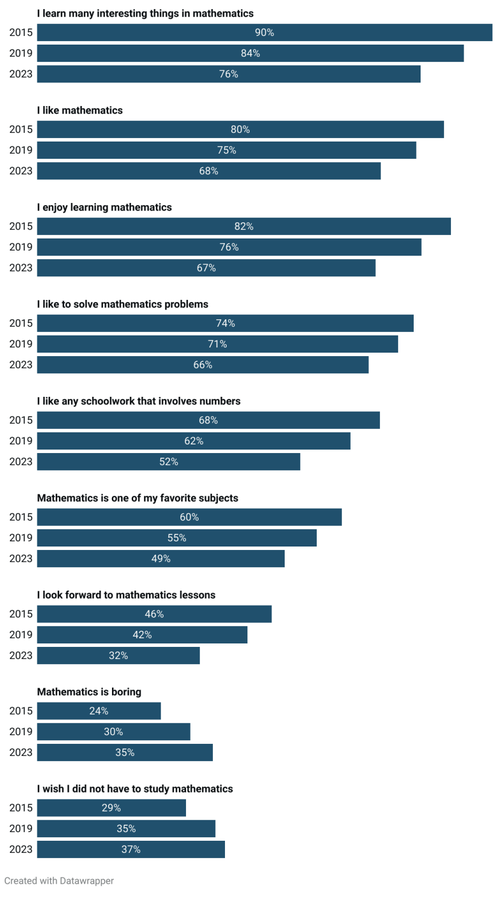
While numerous analyses have explored the relationship between students' enjoyment of mathematics and science and their achievements, as well as shifts in attitudes toward these subjects with age, there are relatively few studies that examine changes in attitudes within the same age groups across different cohorts. The TIMSS provides a unique opportunity to investigate these dynamics across diverse cultural and educational contexts. Data from Poland, with its education system characterized by standardized assessments and curriculum uniformity, offer valuable insights.

AIMS & METHODS

This analysis investigates changes in Polish 4th graders' attitudes toward mathematics and science over three TIMSS cycles (2015, 2019, and 2023). It explores how students' liking of these subjects has evolved and to what extent this is a distinctly Polish phenomenon or part of a broader, more universal trend.

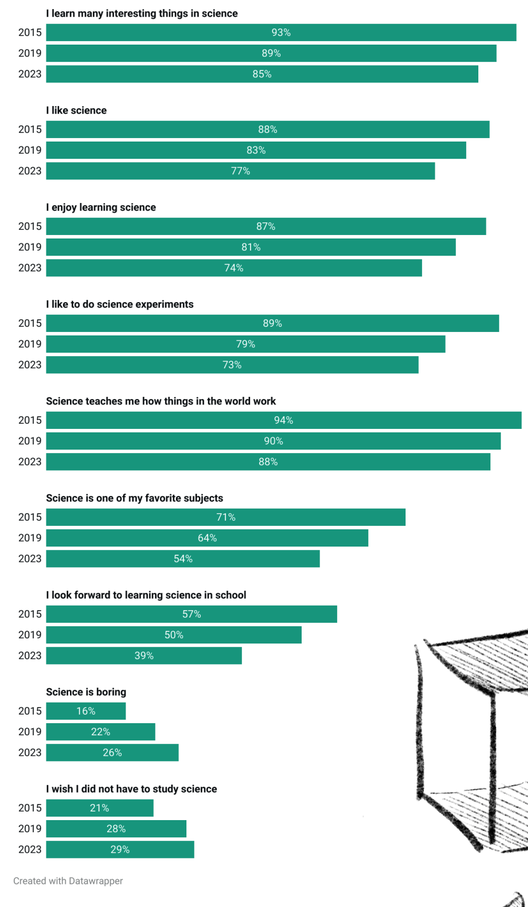
The analysis includes responses from student questionnaires administered in 2015, 2019, and 2023. Percentage distributions of items from the Students Like Learning Mathematics/Science scales are examined. The analysis also explores the correlations between students' enjoyment of mathematics and science (at the scale level) and their achievement levels. Data from Polish students are contextualized using data from other countries.

Figure 1. Trends in Polish students' attitudes towards mathematics based on the TIMSS Students Like Learning Mathematics scale.
Percentage of students who "agree a lot" or "agree a little" with the statements.

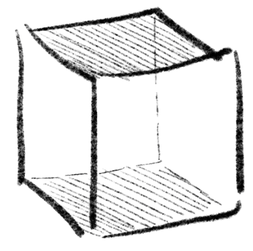


Source: TIMSS 2015, TIMSS 2019, TIMSS 2023 data

Figure 2. Trends in Polish students' attitudes towards science based on the TIMSS Students Like Learning Science scale.
Percentage of students who "agree a lot" or "agree a little" with the statements.



Source: TIMSS 2015, TIMSS 2019, TIMSS 2023 data

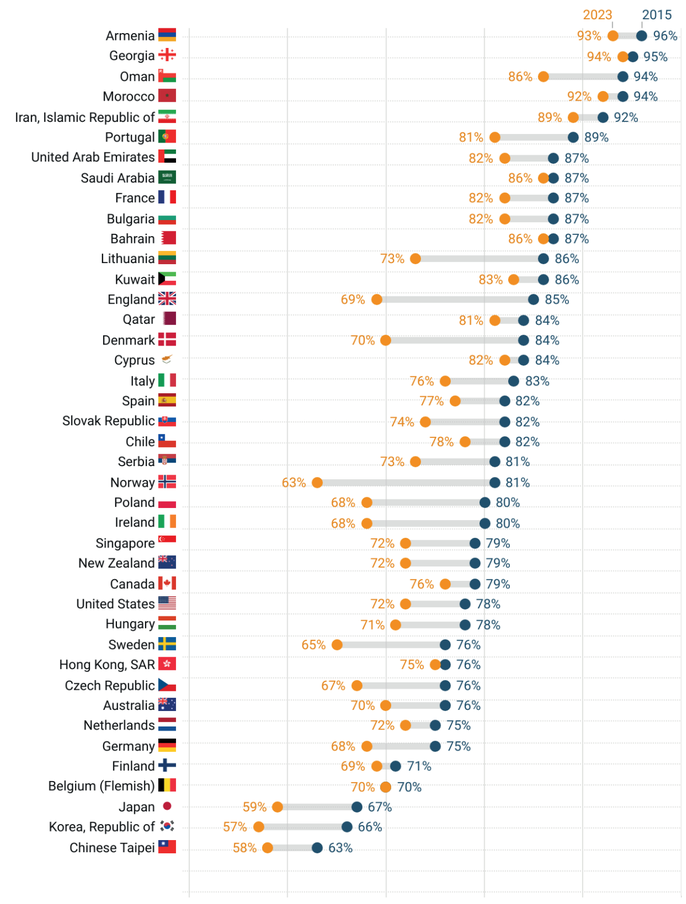


FINDINGS

The analysis reveals a consistent decline in Polish 4th-grade students' liking of mathematics and science over the last three TIMSS cycles with comparable data. For all positive statements related to both subjects, there is a decrease in the percentage of students who agree with them, accompanied by an increase in the percentage of students who agree with negative statements (see Figures 1 and 2). The greater decreases are observed between 2019 and 2023, compared to 2015 and 2019, which could suggest that this trend will continue (see also: Wasilewska, 2024). These trends in attitudes toward the subjects do not align with trends in achievements among Polish students. In mathematics, the average scale scores in 2019 were lower than in 2015; however, the 2023 scores were higher than those in both 2015 and 2019. In science, the average scores in 2023 were higher than in 2019 and roughly the same as in 2015.

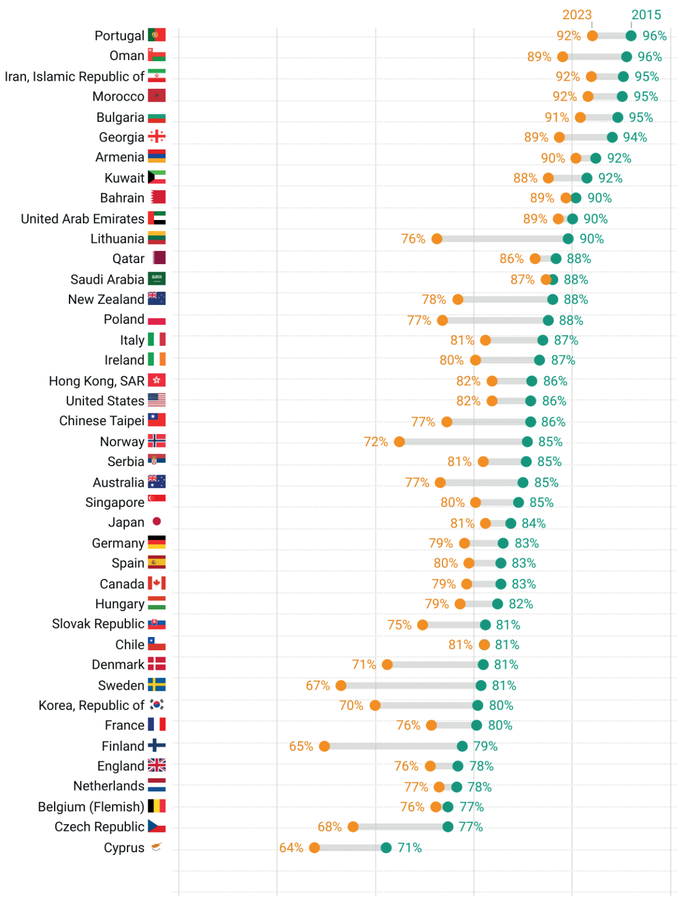
Comparative analysis reveals that similar changes in students' enjoyment of mathematics and science are evident in many other countries (see Figures 3 and 4). Apart from Poland, the largest declines in attitudes (defined as a difference of more than 6 percentage points between 2015 and 2023 across all items from the Students Like Learning Mathematics/Science scales) are observed particularly in European countries. For mathematics, notable declines are seen in Czechia, Denmark, England, Ireland, Lithuania, Norway, Portugal, Serbia, Slovakia, and Sweden; for science, in: Czechia, Denmark, Lithuania, New Zealand, Norway, and Sweden. At the same time, no country showed a substantial increase in the share of students who enjoy learning mathematics or science across all items on the scales.

Figure 3. I like mathematics - changes across TIMSS 2015 and TIMSS 2023
Percentage of students who "agree a lot" or "agree a little" with the statement "I like mathematics"



Source: TIMSS 2015, TIMSS 2023 data

Figure 4. I like science - changes across TIMSS 2015 and TIMSS 2023
Percentage of students who "agree a lot" or "agree a little" with the statement "I like science".

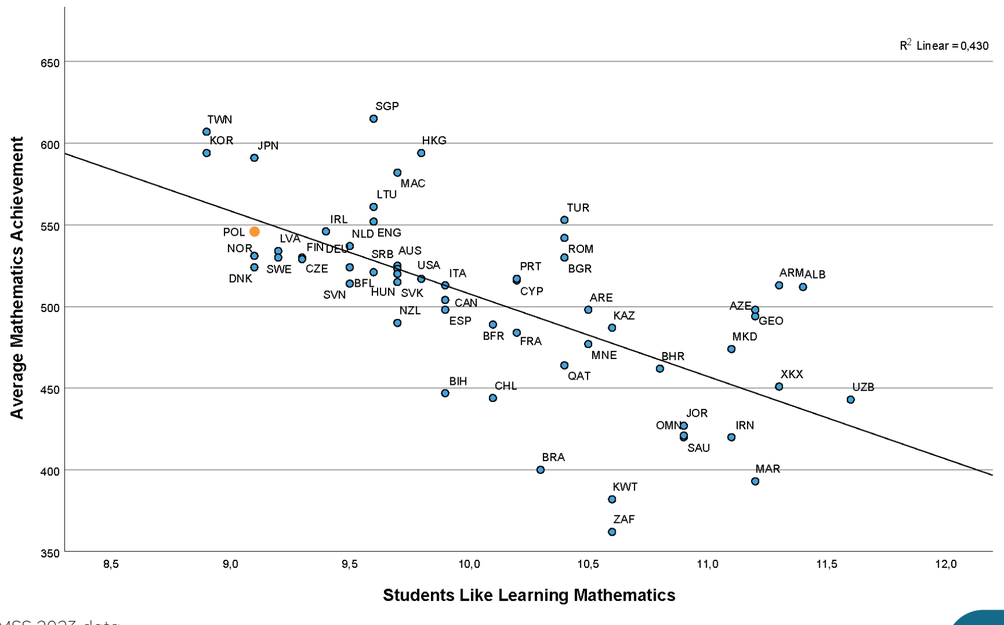


Source: TIMSS 2015, TIMSS 2023 data

Regardless of the decline in attitudes toward the subjects analyzed, the long-observed relationship between the Students Like Learning Mathematics/Science scales and achievement remains stable. At the individual level, students who score higher on the liking scales for mathematics tend to achieve better results. This pattern is consistent over time and across most countries, although the strength of the relationship varies. A similar trend is observed for science, though with more exceptions depending on the educational context. In the case of Poland, TIMSS 2023 data show a significant—though not very strong—association between students' enjoyment of mathematics and their achievement in the subject (Pearson correlation coefficient r = 0.17). For science, no such relationship was observed.

On the other hand, at the country level, higher TIMSS achievement scores are often associated with lower levels of student enjoyment on the corresponding scales. However, when we examine trends in mathematics and science achievements in countries that experienced a decline in student attitudes, no uniform pattern emerges. Some countries saw increases in achievement, others experienced declines, and still others showed no significant change.

Figure 5. Correlation between TIMSS 2023 average mathematics achievement scores and Students Like Learning Mathematics scale.



Source: TIMSS 2023 data

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CONCLUSIONS

An increasingly smaller proportion of students in Poland report that they enjoy mathematics and science and consider these subjects interesting. TIMSS findings suggest that this is part of a broader international trend. Similar patterns are observed in other countries—particularly across Europe—where students' enthusiasm for learning mathematics and science is declining, and attitudes toward these subjects are becoming more negative.

Fostering genuine interest in learning and re-engaging students with science and mathematics is becoming an urgent challenge. It calls for deeper analysis, both within education systems and in the context of broader societal changes (Wasilewska, 2024). This raises a fundamental question: How can school-based education compete with the diverse and often more engaging experiences of the modern world? Overcoming this challenge will require not only innovation in teaching practices but also a broader reconsideration of the role of education in contemporary society.

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