

Short analyses of TIMSS (Trends in International Mathematics and Science Study) results in Bosnia and Herzegovina, Croatia, Slovenia, and Serbia

Bosnia and Herzegovina

The TIMSS survey in Bosnia and Herzegovina is prepared and conducted by the Agency for Preschool, Primary and Secondary Education in cooperation with the education authorities. BiH participated in the TIMSS survey twice, unfortunately not continuously. For the first time, in 2007, the results showed that the achievements of students from BiH are below the international average, i.e., only 10% of surveyed students showed the ability to apply mathematical skills in solving specific problems, and 14% in the field of natural sciences. The second TIMSS survey in BiH was conducted in the spring of 2019 on a sample of about 6,000 fourth-graders in 178 primary schools across the country. The PISA 2018 survey indicated a low level of student achievement and functional literacy of students in BiH. The recommendations of this research have been distributed to all levels of education authorities in the country, and some have taken concrete steps to curricular reform and improve the quality of education. Unfortunately, activities have been slowed or stopped altogether due to the pandemic. The research in Bosnia and Herzegovina was conducted on a sample of 5628 fourth grade primary school students in 178 primary schools and 336 classes. Similar to previous research, this time the results show that the achievements of students from Bosnia and Herzegovina are below average. Fourth grade students in BiH scored 452 points on the math test and 459 points on the science test. The achievement in both tests positions BiH below the average of the TIMSS scale, which is 500 points, and the difference in relation to the average is statistically significant.

Conclusions and recommendations:

- Low achievements of fourth grade students. The achievement, which the fourth-grade students from BiH achieved at the international research TIMSS 2019, in which BiH participated for the first time at this level of education, is not satisfactory. Average scores from both areas are at a low reference level. Among the countries in the region of BiH, it is among the last, the average achievements in natural sciences are slightly better than in mathematics. The average results in BiH are significantly lower than the average results of Asian and European countries that achieve the best results.
- Contribution of attending preschool education. Each year of preschool education contributes to the accomplishments at the end of fourth grade. It is recommended to increase the coverage of pre-school education at an early age, with a special focus on the age of three years. Considering that, qualitatively speaking, the kindergarten program is

different from the nursery program, we can conclude that the length of stay in the kindergarten is a significant factor for achievements in mathematics and natural sciences.

- Quality of teaching and teaching staff. Although the years of work experience of fourth grade primary school teachers are not a significant factor in student achievement, it is noticeable that students of teachers with the least experience, 5 years or less, have the worst achievements. Teachers need much more support than they have. It is important that they leave the teaching faculties much stronger, that the programs of these faculties are modernized, that they follow the changes in the pedagogical and methodological aspect of the work of teachers, etc.
- Contribution of positive belief. A positive belief in mathematics and science contributes to the achievements of fourth grade students in BiH. These beliefs need to continue to be built in the next generations of students so that they are not lost or diminished in higher levels of education.
- Changes in the curriculum towards a curriculum based on learning outcomes. Changes are needed in mathematics and science curricula, and this change should be based on the Common Core Curriculum defined on learning outcomes, developed by the Agency for Preschool, Primary and Secondary Education, with a special focus on mathematics and natural area. It is necessary to gradually introduce examples of tasks used in TIMSS research, and in parallel it is necessary to train teachers on how to prepare such tasks, etc.

Croatia

This was the third cycle of TIMSS research conducted in Croatia. 3785 4th grade pupils participated along with 263 teachers and 153 school principals.

Looking at long-term and short-term trends results showed improvement in average pupil achievement generally. The same applies to Croatian pupils.

Pupils in Croatia scored 509 points (above-average result) in math and placed 34th. It is an improvement to the results from 2011 when pupils scored 409 points (below-average result). In math, boys solve the test with 10 points more than girls on average. In science, pupils scored 534 points which placed them in 20th place. In science, the difference in achievement between boys and girls is almost not visible.

Looking at the overall results, in Croatia, 95% of pupils in math and 98% of pupils in science have basic knowledge, which is more than the average result in TIMSS research. The intermediate level is achieved by 70% of pupils in math and 80% of pupils in science. About 28% of pupils in math and 34% of pupils in science are at a higher level. Only 4% of pupils reach the advanced level in math and science.

The research showed few other correlations, such as the positive influence of the early start of education on academic achievement (through preschool programs). Also, it highlighted that the pupils from families with better social and economic status get statistically better results. Finally, it indicated that a pupil's interest in the subject also has an effect on the final score.

It is also mentioned that the part of the content in TIMSS research is not processed according to the new curriculum which makes some of the results even more significant.

Slovenia

In Slovenia, TIMSS testing was conducted with a sample of 4,800 4th grade pupils and 4,600 8th grade pupils in 2015. Slovenia participated in every TIMSS from 1995 until 2015. However, it did not take part in the 2019 study, which is why mathematics performance of pupils from the 2015 study is presented.

Slovenian 8th-graders were ranked in the 12th place with only 9 countries scoring higher, which placed Slovenia in the top third of participating countries. With this Slovenia achieved its long-term educational goals. The performance of 4th-graders in mathematics has seen a significant improvement since 2011, having reached the 25th place and the TIMSS scale centrepont. One of the main reasons for this improvement is the introduction of the reformed syllabi, which has been one of the major changes in Mathematics and Science education since 2011.

All the achievements have increased significantly since 2011. The trend in Slovenia's primary school mathematics score is one of constant improvement over time without any decline in performance, showing no significant gender differences. Performance in primary school has improved across all the content and cognitive domains, including the reasoning domain. Improvement was seen in both stronger and weaker pupils. Slovenia is one of the few countries, where there has been an increased share of students reaching low, intermediate, high and advanced benchmarks of mathematical achievement.

While pupils' achievement is relatively high, their attitudes towards learning mathematics and science are negative and indicating a consistently downward trend. In 2015 pupils showed less confidence and more negative attitudes when learning mathematics and science compared to 2011. Compared to other countries, headmasters and teachers believe that schools in Slovenia do not put as much emphasis on academic success; parents do not value mathematics and science and, similarly to headmasters, recognize pupils' limited knowledge upon school entry; and students and pupils report weaker sense of belonging to their schools and do not value knowledge as strongly as their peers in other countries.

Adapted from: Educational research institute (Pedagoški inštitut), TIMSS 2015

Serbia

The Institute for Educational Research from Belgrade conducted this research 5 times so far, in 2003, 2007, 2011, 2015 and 2019.

The report on the TIMSS research from 2015 is publicly available on the website of the Ministry of Education of the Republic of Serbia.

In 2015, 4th grade pupils in Serbia achieved 518 points on the math test, and 525 points on the natural science test.

The points obtained on both tests placed them slightly above the average on the TIMSS scale (the average on the scale for mathematics and natural sciences is 500)

Regarding mathematics, Serbia is equal to many countries which are more socio-economically developed than Serbia, such as Canada, Australia, Sweden, Slovenia, Germany and the Czech Republic.

Regarding natural sciences, our students are equal to students from Italy, the Netherlands, Spain, Northern Ireland, Australia, Denmark, Germany and Canada.

Conclusion for 2015 - At the global level, Serbia was ranked average on the TIMSS scale for 2015 for the 4th grade. Although our Ministry is satisfied with the report, it concluded that there is a lot of space for improvement.

Results of the TIMSS survey for 2019 in Serbia, taken from <http://www.timss.org/>.

In 2019, 4th grade pupils from Serbia achieved 508 points on the math test, and 517 points on the science test.

The points obtained on both tests place them slightly above the average of the TIMSS scale (the average of the scale for mathematics and natural sciences is 500).

Conclusion for 2019 - At the global level, Serbia was ranked average on the TIMSS scale for 2019 for the 4th grade. When compared to the 2015 report, Serbia has a downward trend.

References

1. <http://www.timss.org/>
2. Agency for Preschool, Primary and Secondary Education (Bosnia and Herzegovina)
3. Educational research institute (Slovenia)
4. National Centre for External Evaluation of Education (Croatia)
5. Ministry of Education of the Republic of Serbia