

Change in Lithuanian Basic School Students' Mathematics Achievement through 1995-2003

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Abstract

The article deals with Basic School student's mathematics achievement change through 1995-2003 in Lithuania. For the analysis data from TIMSS (Trends in International Mathematics and Science Study) 1995, 1999 and 2003 is used. Lithuania is participating in TIMSS since 1992 and has completed three TIMSS cycles which had their main studies in 1995, 1999 and 2003. Therefore, it is possible to compare Lithuanian students' results not only with the results of other participating countries, but also analyze the trends of changes in mathematics achievements within the Lithuania itself. Some main findings related to the changes in students' mathematics results' are given in the article.

Keywords: *educational reform, mathematics achievements.*

TIMSS (Trends in International Mathematics and Science Study) is an international study of students' mathematics and science achievements and the factors which influence those achievements. Lithuania has been participating in TIMSS since 1992 and has completed three TIMSS cycles which had their main studies in 1995, 1999 and 2003. The research population is Grade 8 students. In Lithuania only students from schools with Lithuanian as the language of instruction were tested. In 1995 2547 Grade 8 students from Lithuania participated in the study, in 1999 – 2361 students, and in 2003 – 5737 students. Students' mathematics achievements were measured using the set of test booklets. The IRT (Item Response Theory) scaling methodology was used to generate students' scores for analysis and reporting. In 1995 TIMSS scale score average across participating countries was set to 500 and the standard deviation to 100. In subsequent studies a part of the items were sustained identical thus using IRT methodology results were calculated in the same scale. This enabled comparison of changes in results from the longer time perspective both on international and country level.

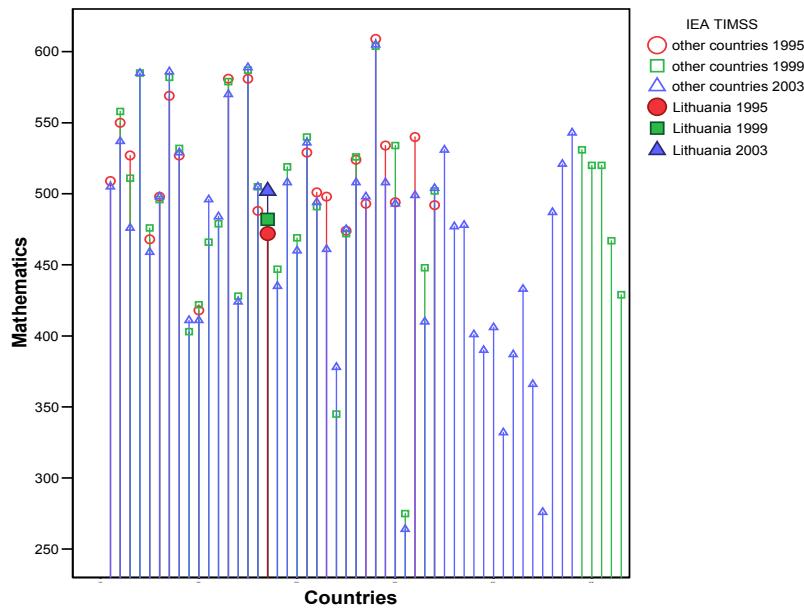
First results of TIMSS 2003 study were presented in Lithuania in the end of 2004 (Dudaitė, Elijo, Urbienė, Zabulionis, 2004). Change in Lithuanian students' mathematics results in the period of 1995-1999 was analyzed by Mackevičiūtė and Zabulionis (2001). In this paper a further analysis of the change in the results of Lithuanian student's achievement in TIMSS assessment will be presented. Main issue of the analysis in this paper is whether Lithuanian Grade 8 students' mathematics results in TIMSS study have changed from 1995 to 2003. For this purpose databases of TIMSS 1995, 1999, 2003 will be used.

Results of study are especially significant because TIMSS study was implemented during educational reform in Lithuania. In 1995 students who

participated in TIMSS were still learning from the old soviet textbooks. In 1999 TIMSS was executed in transitional period when schooling methods and materials were changing. In 2003 students participating in TIMSS were educated in reformed school. Therefore it is possible to observe transformations of school in Lithuania and also to detect whether the results of educational reform are evident in students' mathematics achievement.

Analysis of TIMSS results shows that in every study average mathematics achievement of Lithuanian Grade 8 students is constantly improving (see Exhibit 1).

Exhibit 1. Comparison of Average Mathematics Achievement of 8th Grade Students in 1995, 1999 and 2003



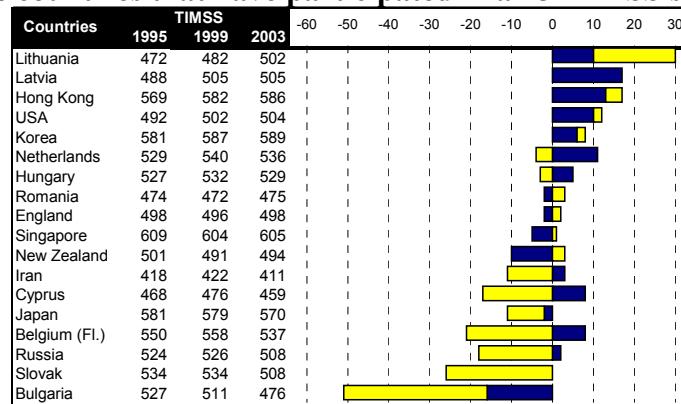
In this diagram comparisons of the average mathematics achievement of different countries are presented in the scale where average is 500 and standard deviation – 100. Every country has its point on X axis. If country has participated in TIMSS study three times, results of all three studies are intercepted on vertical line, rising from the point of that country on X axis. If country has participated in TIMSS study twice then results of two studies will be intercepted on vertical axis, if once – only one result will be marked out.

Diagram shows that in some countries average mathematics achievements are increasing, in some – decreasing. It is also noticeable that average achievements of countries that participated in TIMSS study in 1995 are

considerably higher (upper part of the diagram's left side) than average achievements of the countries that joined TIMSS study in 2003 (lower part of the diagram's right side).

In Lithuania difference between TIMSS 1995 and 1999 mathematics achievement is not very high (10 points of the scale, SE=6.1 – difference is not statistically significant), but between TIMSS 1999 and 2003 – difference is much higher (20 points of the scale, SE=5.0 – difference is statistically significant (Mullis, 2004)). These results indicate that Lithuania had significant increase in average mathematics achievement over eight-year period from 1995 to 2003. By this result Lithuania surpasses all other countries that have participated in TIMSS assessments three times (see Exhibit 2. In this Exhibit average mathematics achievement differences between 1995 and 1999 are marked in dark color and in bright color – achievement differences between 1999 and 2003. Column intercepted on the right side of the exhibit signifies increase in average mathematics achievement, on the left – decrease).

Exhibit 2. Comparison of Average Mathematics Achievement of the countries that have participated in all 3 TIMSS studies.

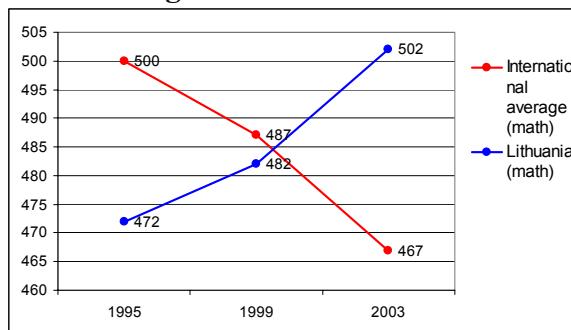


Our neighborhood country Latvia from 1995 to 1999 has made a progress of 17 points in mathematics achievement, but in 2003 Latvian results of TIMSS study was the same as in 1999. Meanwhile results of average mathematics achievement in Russia from 1995 to 1999 decreased. Highest decrease in mathematical achievement from first TIMSS assessment in 1995 to third TIMSS in 2003 was in Bulgaria (51 point).

While stating that Lithuania has made the biggest progress in mathematics achievement over the period from 1995 to 2003, it is also important to evaluate possible reasons for that progress. Maybe the progress was simply determined by the change of countries participating in particular TIMSS study cycles? All countries are free to join or to withdraw from TIMSS study, so the list of participants is always changing. Obviously international

achievement averages are dependant on the countries participating in TIMSS. 37 countries participated in TIMSS 1995, 38 countries (but not all the same as in previous assessment) participated in TIMSS 1999 and 46 countries – in TIMSS 2003. Scotland, Norway and Sweden participated in TIMSS in 1995 and 2003, but missed TIMSS study in 1999. Many West European countries, such as Austria, Ireland, Switzerland, France, that usually demonstrate high results of education achievement, participated in TIMSS only once (in 1995). Afterwards their place was taken by Macedonia, Jordan, Indonesia, Tunisia, Chile, Philippines, Morocco, SAR. Exhibit 3 shows the shift in international and Lithuanian achievement averages.

Exhibit 3. Shift of International Average Achievement and Lithuanian Average Achievement of Grade 8 Students.



This Exhibit shows that during three cycles of TIMSS study international average achievement decreased from 500 to 467 points of the scale and Lithuanian average achievement increased from 472 to 502 points of the scale. In 1995 Lithuanian average achievement were significantly lower than international average – Lithuanian result was in the bottom of the country list. However, in 1999 Lithuanian average achievement was similar to international average. While in 2003 Lithuanian students proved themselves very successfully and outstripped international average with marked difference. By that time international average strongly decreased. International achievement average would remain about the same if only the same countries would participate in all three TIMSS cycles. Comparison between international average of TIMSS 1995 and Lithuanian results of TIMSS 2003 shows, that Lithuanian Grade 8 students in 2003 have reached international average mathematics achievement of 1995. Consequently it could be stated that Lithuania outstripped international benchmark not in 35 points but only about 2 points. It is more expedient to establish measure with the international average achievement of 1995 because in that time in TIMSS participated almost only West European and Asian countries that Lithuania wants to mach as an

example and in 2003 list of countries participating in assessment was very much expanded and included many developing countries.

Generalizing data and information an inference that from 1995 to 2003 average mathematics achievement of Lithuanian Grade 8 students has improved could be drawn. Nevertheless without further analysis it could not be said what specifically and in which sphere have improved and what, possibly, disimproved. Certainly results of TIMSS assessment generally was influenced by societal and educational changes. In particular Lithuanian results in mathematics achievement were affected by newly established *Educational Standards* and mathematics textbooks written in TIMSS “spirit”. After Lithuania has participated in TIMSS assessment for the first time and got very low results, educational reform (including school mathematics) was deflected more towards the style of TIMSS items. This means that it was realized, that one of the main objectives of educational reform should be transformation from the conveyance of knowledge to the education of competence, from academic style mathematics to mathematics literacy. As TIMSS assesses namely students’ mathematic literacy it was a good impulse for this change. Partly, low results of Lithuania in the first TIMSS assessment could be explained referring to the fact that in 1995 in Lithuanian schools mathematic literacy was not emphasized and surely not educated. Lithuanian students were used to a different type of mathematics so they were not able to demonstrate their knowledge in TIMSS 1995. TIMSS 2003 was executed after educational reform was implemented so it assessed students that are educated in contemporary Lithuanian school. That is a solid argument in explanation why in 2003 Lithuanian results jumped up so considerably.

On the other hand, societal factors, such as changes in economics and policy also can not be excluded from the further consideration. Although a proper revelation of their impact on the results of Lithuanian basic school students’ mathematics achievement requires additional information and resources. However this short analysis of TIMSS results can be a base for future analyses and outlines possible ways for further research of the change in Lithuanian students’ achievement during the educational reform.

References

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