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## ***Who Are the Pupils with Low Scores on Achievement Tests in TIMSS Research: Comparative Analysis<sup>2</sup>***

### **Extended summary**

The international TIMSS (Trends in International Mathematics and Science Study<sup>3</sup>) study is a reliable and timely source of data about student achievement. It provides the participating countries with an opportunity to monitor the quality of the education system, reform their national curricula, and improve teaching practice and student achievement. TIMSS provides information on the characteristics of schools, families, and students, as well as on the quality of the primary teachers' work and their professional characteristics. The inspiration for this research was the data from TIMSS 2015, showing that 9% of our pupils cannot solve the tasks measuring the lowest level of TIMSS mathematics competencies, while 7% could not acquire the lowest level of the knowledge and skills related to science. One of the key questions is how to encourage these pupils to develop the basic mathematics and scientific competencies necessary for the life in the modern society. Using this as a starting point, the paper focuses on the pupils who achieved low scores at TIMSS mathematics and science tests (470 points and less). With the aim of examining some characteristics of these pupils, two research questions were formulated: (1) What makes the low-achieving pupils in Serbia different from other

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3 TIMSS research is carried out by the International Association for Evaluation of Educational Achievement (IEA). The Association gathers different educational institutions and government agencies around the world that carry out TIMSS research within the national framework. In addition, it has conducted international research on student achievement since 1959. The first TIMSS research was conducted in 1995, and in Serbia in the year 2003.

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pupils from the same sample in terms of personal and family characteristics? (2) Do the low-achieving pupils from Serbia, Croatia, and Slovenia differ at the level of personal, family, teaching, and school characteristics? The data were analyzed in two subsamples, in line with the defined research questions. One subsample included only the pupils from Serbia (N = 4036), while the other referred to the low-achieving pupils on TIMSS test from three compared countries (N = 1876). Apart from the tests, the researchers also used the data from TIMSS contextual questionnaires for school principals, primary school teachers, pupils, and parents. The contextual reference framework in TIMSS encompasses different school, family, and individual variables related to teaching and learning mathematics and sciences. The obtained data were processed using several different statistical reasoning tests (variance analysis for non-repeated measurement, Pearson's correlation coefficient, the test of differences for category variables: chi-square test), and a series of descriptive indicators involving central tendency measures and dispersion measures. The research results indicate that in Serbia, the low-achieving pupils differ significantly from other pupils (who had higher scores) in terms of some individual and family characteristics: (1) they attended preschool institutions in a smaller number and spent less time in them; (2) they were less prepared in terms of mathematics and language competencies for starting elementary school; (3) they were not particularly interested in learning math and sciences; (4) were not very confident regarding their knowledge of math and sciences; (5) there was more absentism among these pupils; (6) they had fewer learning resources at home; (7) these pupils did not feel safe at school; (8) their parents were less educated and had low-income jobs; and (9) their parents rarely encouraged language and mathematics activities before primary school age. There are also noticeable differences between our low-achieving pupils and their peers from the region who achieved similar results. The pupils from Serbia have: (1) less educated parents and a smaller number of those who had professional occupations; (2) fewer educational resources for learning at home; (3) parents who put a greater emphasis on learning mathematics and sciences; (4) a more pronounced sense of belonging to their school; (5) principals who state that they have the fewest discipline-related problems with fourth-graders; (6) principals who do not focus on their pupils' academic achievement; (7) teachers who think that school is a safe environment in which order and rules are observed. In addition, our pupils claim that: (8) they prefer learning math and sciences; (9) show a greater confidence when it comes to mathematics; and (10) view mathematics and science teaching as more engaging. The research results have several pedagogical implications. First, an action plan must be developed for reducing the number of pupils who did not develop the basic mathematics and science competencies. It is also important to empower parents and raise their awareness about the significance of early mathematical and scientific literacy for learning the content of other school subjects. Furthermore, the number of children in preschool institutions should be increased and they should spend more time in them, while the necessary support should be given to the families that cannot afford the variety of learning resources. Schools have to focus more on the pupils' academic achievement by including more intensely the parents in the life and work of the school, using different motivational strategies in the classroom, fostering pupils' educational aspirations, and creating the school climate which promotes the quality of knowledge.

Keywords: TIMSS test, pupils with low achievement, personal, family, teaching, and school characteristics.

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