

to upgrade the quality of education system and healthcare system, along with other services delivered by the public sector, to incentivize people to pay taxes.

Although these measures produce effects in the long run, their implementation should start immediately. It is the only way to maintain the results that have been achieved so far, and to possibly improve them in the future. Consequently, through further reduction in the shadow economy budget revenues would increase and Serbia would become a more attractive destination for investments and for doing business, because tolerance for the shadow economy implies existence of unfair competition.

### Highlight 3. Connection Between Socio-economic Factors and PISA Test Results Among High School Students in Serbia<sup>1,2</sup>

Mladen Stamenković<sup>3</sup>

*Abstract:* This paper presents an overview of student achievement on PISA tests in Serbia. Determinants of student success were examined, with a special emphasis on the effects of socioeconomic factors. The paper points out the clear differences in student performance depending on different socioeconomic statuses. It confirms the quality of gymnasium-type high schools as the best educational profile. In line with the presented differences in the progress possibilities of students depending on their socioeconomic status and educational profile that the student attends, recommendations for institutional reforms are given toward creating a more equitable educational system.

#### 1. Aims, Importance and Concept of PISA Testing

The importance of education and its effect on economic development has been recognised in many theoretical and empirical papers. In growth models, human capital presents one of the most important factors of economy.

<sup>1</sup> This is the second in a series of papers dedicated to the problems and measures of improving education in Serbia. Previous paper of Professor Branko Urošević, which dealt with measures for improving doctoral studies, was published in Issue no.35 of the Quarterly Monitor.

<sup>2</sup> The author wishes to thank Miloško Arsić and Dragica Pavlović-Babić for their comments and suggestions.

<sup>3</sup> Economic Faculty of the University of Belgrade

#### Literature:

Krstić, G., Schneider, F., Arsić, M., Arandarenko, M., Radulović, B. Randelović, S. i J. Janković, (2013), *Siva ekonomija u Srbiji - novi nalazi i preporuke za reforme*, FREN i USAID, Beograd

Bilten javnih finansija – Novembar 2014, Ministarstvo finansija Republike Srbije, Beograd, 2014.

Zakon o poreskom postupku i poreskoj administraciji ("Službeni glasnik RS", br. 80/02, 84/02, 23/03, 70/03, 55/04, 61/05, 85/05, 62/06, 61/07, 20/09, 72/09, 53/10, 101/11, 2/12, 93/12, 47/13, 108/13, 68/14, 105/14)

Also, the issue of education's effect on equality and distribution of income has an important place in the research, as well as attempts to determine the present value of future income in relation to education. When talking about human capital, Madžar (2011) stresses the following: "In labour force, it is not the mere number or the quantitatively defined head count that matters, but primarily the level and quality of knowledge and skills which are incorporated in labour force. The term that has long been used for labour force is *human capital*, which highlights the fact that it is not a mechanical selection of people, but a mass of knowledge and skills that these people have in themselves and which they have mastered over time. And knowledge and skills are neither god-given nor are they a product of mere demographic processes; these attributes of human capital that are production-relevant are acquired and systematically accumulated through numerous, surprisingly diverse, and in most cases highly complex educational processes. Knowledge and skills are the result of *investment* into education system and activities performed within that system. And the more you invest, the more the results are comprehensive and production-effective. That is why in economic science, supply of human resources is not determined as a property measured by a head count, but rather as possessing the sufficient mass of the human factor that incorporates the equally comprehensive mass of production-relevant knowledge with an adequate differentiation and a quality necessary for efficient earning. *Tout court*, labour force is not demographically determined and naturally given, but a produced natural factor."

The second half of the 20<sup>th</sup> century marked the beginning of the development of international surveys of

## Highlights

educational achievements and student competitions. The expansion of scientific papers, especially empirical ones, occurred thanks to these surveys (Hanushek & Woessmann, 2010). The development of first international testing started in 1958, when a group of eminent professors from different educational fields met at the UNESCO Institute for Education in Hamburg to talk about student evaluation. After that, International Association for the Evaluation of Educational Achievement (IEA) was founded, which today conducts one of the most famous international surveys TIMSS (*Trends in Mathematics and Science Survey*), as well as PIRLS survey (*Progress in International Reading Literacy Study*). In addition to this association, OECD conducts significant international surveys, such as the International Testing and Teaching Survey, and PISA testing.

PISA (*Programme for International Student Assessment*) is certainly the most significant testing in the field of education currently conducted, both in sense of methodology and the impact on creation of education policy. It has been conducted every three years since 1997, and in the last survey conducted in 2012, 64 countries participated, which create almost 90% of the world Gross Domestic Product. PISA survey tests fifteen-year-olds and tries to answer the question of whether or not the students are ready to face challenges of the future. The focus is not on the process of learning, but on testing student ability to reason, analyse and create ideas. Baucal & Pavlović-Babić (2009) agree with this and stress that: “Specificity of PISA study is that it doesn’t test the students’ ability to reproduce what they have learned in school, but how equipped they are to understand and use information (that is provided to them) in solving relevant problems from everyday life.”

Testing is conducted in three areas: mathematics, reading literacy, and natural sciences. In addition to tests, students, schools and even parents fill out detailed surveys, which serve as basis for further research and deeper economic analysis and implementation. Each three-year cycle focuses on one of the three tested fields. For example, the central field of the PISA 2009 study was reading literacy, while in 2012 it was mathematics. The questionnaire that the students fill out contains a large number of questions related to their attitude toward the central field of the study, as well as information about the social and economic status of each student. In addition, detailed analyses are conducted of achievement in the central field on all levels of student competencies that are being tested, which enables a better insight into the quality of the teaching programmes and implementation of relevant changes in line with the results.

PISA 2012 study integrated a new area in the basic testing – solving situational problems. Testing in this field

was done on computers. Students were faced with real problems that have no direct link to any curricula being taught in school. Still, through solving these problems, they demonstrate the ability to reason and reach conclusions, competencies that are increasingly taking over in relation to educational degree when applying for many positions on the labour market, and they certainly make a difference among the candidates with the same level of education and present a clear competitive advantage in the process of finding future employment.

## 2. PISA Test Results of Students from Serbia

PISA study results are given on a scale, which is standardised in the same way in all achievement fields, the mean at the level of the entire tested sample is 500, while standard deviation is 100. Serbia’s position over the last four cycles changed minimally. Government’s indifference toward the issue of education can be shown clearly on the example of PISA testing. Serbia will not be participating in PISA testing this year. This discontinuity cannot be justified, neither from an economic nor any other aspect. Lack of similar tests in our country means that we will not have relevant information about the quality of Serbian education system before 2019 at the earliest, when PISA 2018 test results would be published. Aside from that, international surveys are especially important for the education system in Serbia, which has no national sources of information about the quality of education. The only exception is the final exam at the end of primary education, but it includes a limited number of tasks, which can hardly yield conclusions about the quality of educational outcomes.

When it comes to our achievements, with a moderate improvement on each testing, we are still in the bottom half of European countries, with results that surpass only Montenegro, Albania, Bulgaria and Romania, and are at approximately the same level as Turkey, Cyprus and Greece. The remaining European countries are more or less ahead of us. By comparison, at the last testing in 2012, our students scored 449 points in math on PISA scale, while Croatian students scored 471. How big is this difference? Experts estimate that a little less than 40 points on PISA scale equals one year of studying in school. That means that Croatian students at age 15 have acquired knowledge that Serbian students will acquire after additional six months of school studying. The gap with Slovenia, another former republic of Yugoslavia, is even larger. Its students are somewhere around the OECD average with 501 points scored.

In addition to the results, students are ranked by achievement levels for each tested field. The achievement scale is divided in six levels and each level is described

by competencies required from the student in order to solve the tasks at that level. One achievement level covers around 70 points on the PISA scale, which is a relatively high range, so the students who are at different levels demonstrate qualitatively different skills and knowledge (Pavlović-Babić & Baucal, 2013). Students who are below the second achievement level are considered functionally illiterate. Functionally illiterate means that the person is not able to use its knowledge for the advancement of its community or group, as well as for the personal improvement of its reading, mathematical and other competencies<sup>4</sup>. These persons most often do not continue their education, they enter the work force early, and have problems finding work. On the other hand, the fifth and the sixth achievement levels contain the most complex tasks, which require hypothetical and critical thinking, argumentation and execution of tasks and solutions. Students at the fifth and the sixth level present the most talented children and future leaders of economic development, people who will most certainly obtain college education, and whose stay in this country or return after studying abroad, should be one of our country's main priorities.

The importance of PISA studies is also evident in the fact that the European Union, in developing the 2020 Education Strategy, included PISA test results as a performance benchmark of education systems. One of the goals of the Lisbon Agenda is to reduce the number of functionally illiterate children in EU member states below 15% by year 2020. The significance of PISA testing is acknowledged in Serbia as well, so these study results are used in assessments of the performance of the education system. National Education Council indicated in its report that the reference value that Serbia should reach by 2020 is the 25% threshold. According to the latest results, at the PISA 2012 testing, 38.9% of our students fell into the category of functionally illiterate in the field of mathematics, 33.1% in the field of reading, and 35% in the field of natural sciences. In 2012, a mild improvement was achieved compared to 2009 in mathematics, and a mild decline in other two tested areas, but in all three cases, they are statistically insignificant. This clearly speaks to the inertia of the education system and lack of substantial action toward eradicating functional illiteracy in Serbia. Also, most of our children are at the first or second level of achievement, which indicates that our system is still based on pure repetition. At an age when it is no longer enough to memorise given information, but to be able to adequately use a large number of easily accessible information. Our education system is still based on memorising and

studying facts, i.e. pure repetition, and the results that are repeated from one test to another indicate that the concept of learning throughout our education is wrong. How well do other countries fare? If we only look at the math results, our students are better than Montenegrin (56.1% of functionally illiterate) and Bulgarian (43.8%). Still, Croatia has only 29.9% of students who fall into this category, while countries like Finland and Estonia are far ahead of us with 12.3% and 10.5%, respectively.

What is lacking at the state level year after year, is a deeper analysis of micro data from the PISA studies and their use in further development of educational strategies, and not mere comparison of final PISA results as the only significant measurement. To prove that PISA study micro data speaks volumes, it is enough to state that for almost 5,000 tested students, there are almost 200 pieces of data that can describe in detail the determinants of success and point out the deficiencies of our education system.

### 3. Effects of Socioeconomic Status on Student Achievement

According to all research, confirmed by PISA study as well (OECD, 2013), the socioeconomic status is a factor that affects student educational performance the most. Socioeconomic status also presents the biggest source of inequality in education regarding student possibilities and providing equal opportunity for education to all categories. At the OECD level, students with higher socioeconomic status score 39 points more in mathematics than students with a lower status, which is equal to one year of studying.

We want to examine the socioeconomic effects on student achievement in Serbia. In order to do that, we will divide the students in four groups (quartiles) according to socioeconomic status (SES) index, where each group contains 25% of students. The first quartile includes students with the lowest socioeconomic status, and in the fourth are students with the highest status. The socioeconomic status is assessed through an index, marked in the PISA study as ESCS (Economics, Social and Cultural Status index). This index, measured by OECD as a component of PISA survey, presents a composite index, which includes detailed information about the economic, cultural and education status of students and their families. More precisely, the index consists of three components – highest parental occupational level (HISEI<sup>5</sup>), highest parental educational level measured by years of education, and home property index, which includes a

4 Handbook of Household Surveys, Revised Edition, Studies in Methods, Series F, No. 31, United Nations, New York, 1984, para. 15.63.

5 For more details about the methodology of forming the ESCS composite index and its determinants, as well as other indices created by OECD, please see OECD (2014).

## Highlights

large number of information and questions from the survey filled out by the students, such as the number of books in the house, etc. Percentage of children who fall into the illiterate category (below the second level of achievement) and children from the higher achievement levels (fourth, fifth and sixth level of achievement) are presented in Table 1 for all four SES quartiles.

The effects of socioeconomic status on student achievement in Serbia are undeniable when looking at Table 1. These effects are evident in the number of functionally illiterate students, as well as the number of students at higher achievement levels. Almost four times higher share of capable students who are in the group of 25% of the richest children, compared to the poorest quarter indicates considerable differences in possibilities of further advancement of children from different socioeconomic groups. Reducing this difference should be one more goal of the government's education policy. And how this will be achieved is a question for the creators of public policy in Serbia. How big these differences are can be seen in the second half of Table 1. The difference of 77 points between the poorest and the richest group of students is disconcerting, as it represents two years of school studying. Also, we can see that there are almost no differences in tested fields, so the gap between these two groups of students is evident even when it comes to overall achievement. Such a large difference is not unusual in other countries as well, so for example, Croatia has a similar gap, while in Finland it is 60 points. This does not diminish the importance of the problem and future reforms of education systems in the world will have to deal with the issue of equal educational opportunities.

**Table 1: Student Achievement Levels by SES Quartiles**

	Q1	Q2	Q3	Q4
Functionally illiterate	54.5%	44.3%	36.3%	23.5%
Higher achievement levels	6.8%	9.5%	12.0%	23.7%
Scores – mathematics	408	433	445	485
Scores - reading literacy	413	434	444	478
Scores – natural sciences	414	435	443	481

Table 2 shows, for each educational profile, how the students are distributed by socioeconomic groups. We can see that almost 50% of all students attending gymnasium-type high school (hereinafter: gymnasiums) fall in the group of children with the highest socioeconomic status. Vocational-technical type of school is mostly attended by students with the lowest socioeconomic status (42.9%), while only 8.4% of all students from this type of school belong in the group with the highest socioeconomic status. Similar observation can be made in

Table 3, which shows which schools students apply to for each quartile. We can see that only 7.9% of students with the lowest socioeconomic status apply to gymnasiums. On the other hand, if we look at students with the highest socioeconomic status, 40.6% apply to gymnasiums. It can be said that these students are on a clear path to obtaining higher education, as it is realistic to expect that almost all students who attend gymnasiums will continue their education.

**Table 2: Student distribution by SES within each educational profile, in %**

Educational profile	Lowest SES	Low SES	High SES	High-est SES	Total
Gymnasium	9.4	15.4	26.3	48.9	100.0
Technical high school	28.8	30.4	25.1	15.7	100.0
Vocational-technical high school	42.9	28.1	20.6	8.4	100.0
Medical high school	21.9	29.6	27.8	20.7	100.0
Economic high school	26.2	26.5	25.6	21.7	100.0
Agricultural high school	41.2	24.9	22.5	11.4	100.0
Art high school	10.1	18.5	26.6	44.8	100.0

That is why the Government of Serbia and the Ministry of Education, Science and Technological Development (albeit in previous mandate), within the Education Development Strategy in Serbia, has foreseen an increase in the number of students in gymnasiums as a natural path toward increasing the number of people with higher education in Serbia. Achievement of this goal is possible only through integration of children with lower socioeconomic status into gymnasiums and through motivating them to apply. This is possible only through a clear motivation of successful students, whose socioeconomic status must not affect their further education. This means providing scholarships, which will be targeted to this population. Also, the scholarships that are created with the aim of motivating our best students to study abroad, have to be defined in such a way to give those students incentives to come back to our country, and not to stimulate further outflow of intellectuals, which is perhaps one of the most alarming issues of the Serbian education system.

**Table 3: Student distribution by educational profiles for each SES quartile, in %**

Educational Profile	Lowest SES	Low SES	High SES	Highest SES
Gymnasiums	7.8	12.9	21.8	40.6
Technical high school	27.2	28.6	23.4	14.6
Vocational-technical high school	16.3	10.7	7.7	3.2
Medical high school	9.3	12.5	11.7	8.7
Economic high school	20.0	20.3	19.3	16.4
Agricultural high school	16.6	10.0	8.9	4.4
Art high school	2.8	5.0	7.2	12.1
Total	100.0	100.0	100.0	100.0

PISA data can also help us answer the question of whether the students who attend gymnasiums are really so much better than their peers in other educational profiles. That result would justify this kind of strategy and the attempt to integrate a large number of students into this educational profile, due to the expected positive peer influence that this environment would provide. Naturally, a better quality and more comprehensive curriculum should not be neglected.

Stamenković et al. (2015) conducted this type of analysis relying on the results from Table 4 and 5, as well as equivalent results from other tested areas in PISA 2009 study. The tables show the percentage of students below the second achievement level in mathematical literacy for each educational profile and each socioeconomic quartile (Table 4), as well as the percentage of students from higher achievement levels (Table 5) also in math.

**Table 4: Functionally illiterate students in mathematics by educational profiles and SES, in %**

	Lowest SES	Low SES	High SES	Highest SES
Gymnasiums	24.5	16.7	14.8	9.8
Technical high school	54.4	47.7	47.0	40.7
Vocational-technical high school	76.3	71.3	59.0	62.8
Medical high school	27.2	27.2	23.3	22.9
Economic high school	49.8	40.7	39.9	28.7
Agricultural high school	70.9	74.8	56.6	54.8
Art high school	40.5	35.3	28.6	20.0

We can see a drastic difference between the educational profiles, which was the expected result. Gymnasiums are certainly the highest quality of educational profiles, as can be seen in each SES quartile. Also, only 9.8% of students who attend gymnasiums and belong to the highest socioeconomic quartile fall into the cate-

gory of mathematically illiterate. The lowest percentage of functionally illiterate children in all quartiles is in gymnasiums, which further proves the quality of this profile. It is important to note the quality of medical high schools. Achievement of students in medical high schools is almost unaffected by the changes in socioeconomic status, as can be seen in both tables. This suggests that equality and equity in educational outcomes are best realised in this educational profile and further analysis could indicate the reasons behind this result. The quality of gymnasiums is also evident in Table 5, where almost one quarter of students with the lowest SES are among the better students. This result completely justifies integration of students from this level into gymnasiums in large numbers. On the other hand, percentage of students who attend vocational-technical high schools and agricultural high schools and fall into the group of better students can be considered a statistical error.

**Table 5: Students at higher achievement levels in mathematics by educational profiles and SES, in %**

	Lowest SES	Low SES	High SES	Highest SES
Gymnasiums	22.6	27.6	24.2	38.7
Technical high school	6.3	6.2	7.5	10.1
Vocational-technical high school	1.4	0.7	1.9	0.0
Medical high school	18.4	13	13.2	21.2
Economic high school	5.2	10.6	10.3	13.9
Agricultural high school	0.4	0.0	2.5	1.6
Art high school	10.8	5.9	14.3	19.4

## Conclusion

Education is one of the basic mechanisms of creating human capital and is one of the main determinants of economic growth. Therefore, advancement of education at all levels presents a necessary condition for economic and social progress of Serbia that is sustainable in the long term. The reforms, which would improve the quality and accessibility of education to all social strata, present a long-term process which far exceeds the duration of a government's mandate. That is why education reforms can only be implemented by governments who care about the long-term interests of the society, and not only short-term political interests. From the perspective of economy, low quality education is a form of unproductive waste of resources. Improvement of the quality of education, which encourages argumentative and cri-

## Highlights

tical thinking, is not only important for productivity, but for successful functioning of a democratic society as well.

When it comes to primary and secondary education, a fairer education system in which all students have equal opportunities for further advancement will be one of the biggest challenges of educational reforms in the 21<sup>st</sup> century. Serbia has pronounced differences in student achievement depending on their socioeconomic status. The difference between the 25% of the richest and 25% of the poorest children is 77 points on the PISA scale. This gap presents the difference in knowledge acquired over two years in school. If we take into account that the students are tested in their ninth year of education, we can conclude that this difference is a considerable one.

Instruments that can affect the reduction of this gap have to be directed toward creating equal opportunities for further education. Gymnasiums are the best educational profile in Serbia, which we have shown in this paper. Education Development Strategy foresees increasing the number of students applying for this type of school as the best way to increase the number of highly educated people. In addition, it is necessary to provide the students from the lower socioeconomic groups with an access to this educational profile, probably with scholarship-type stimulation and by reducing the need for private tutoring, which is not available to poorer students, so that lower socioeconomic status would not affect their further education<sup>6</sup>. Properly formulated government intervention, with the expected positive peer influence, could lead to high achievement of our students and to a much better quality and equitable education system – a goal which will in near future take increasing priority in creating education policy.

The state's attitude toward education is also reflected in the fact that Serbia will not be participating this year in PISA 2015 testing. This way, after the results received from the 2012 testing, the first results about the state of Serbian education system will not be received before December 2019, when the PISA 2018 testing results will be published. Applications for the PISA 2018 cycle are open until September this year, and this will be a good test for the current Government as to where on its priority list is education and the reform of this important sector.

## References:

- Aleksandar Baucal, Dragica Pavlović-Babić. *Kvalitet i pravednost obrazovanja u Srbiji: obrazovne šanse siromašnih*. Ministarstvo prosvete Republike Srbije i Institut za psihologiju, Beograd, 2009.
- Eric Hanushek, Ludger Woessmann. *The economics of international differences in educational achievement*. Technical report, National Bureau of Economics Research, 2010.
- Ljubomir Madžar. *Iskušenja ekonomske politike u Srbiji*. Službeni glasnik, Beograd, 2011.
- OECD. *PISA 2012 Technical Report*. OECD Publishing, 2014.
- OECD. *PISA 2012 Results: What students know and can do. Student performance in mathematics, reading and science (Volume I)*. OECD Publishing, 2013.
- Dragica Pavlović-Babić, Aleksandar Baucal. *Podrži me, inspiriši me - PISA 2012 u Srbiji: prvi rezultati*. Centar za primenjenu psihologiju, 2013.
- Mladen Stamenković, Ivan Anić, Marijana Petrović, Nataša Bojković. *An ELECTRE approach for evaluating secondary education profiles: evidence from PISA survey in Serbia*. Annals of Operations Research, Springer. in print.

<sup>6</sup> More about the tutoring market in one of the following issues of the Quarterly Monitor.