Unlocking educational paths: Influential factors of Bosnia and Herzegovina's students performance

Hatidža Jahić [1,*], Nejra Hadžiahmetović–Milišić [1] and Taida Čingić [1]

[1] University of Sarajevo, School of Economics and Business, Bosnia and Herzegovina ✉

SUMMARY

This paper explores the influence of socio–economic status on the education performance of male and female students in Bosnia and Herzegovina, utilizing data from the 2018 Programme for International Student Assessment (PISA). The study defines key terms such as education, socio–economic status, and international student assessments, emphasizing the significance of a quality educational system for societal development. By employing three models for science literacy, mathematics, and reading, the results indicate that parents' education and possession of cultural goods significantly impact student achievements. Students with higher–educated parents and who possess more books at home perform better in PISA tests. The gender variable however is found not to be statistically significant. The study emphasizes the significance of a "quiet study space", suggesting that students with such an environment achieve higher science test scores. While causality is not established, the analysis provides insights into the initial impact of socio–economic status on student achievements. The paper advocates for continued participation in international assessments project like PISA to monitor educational achievements and inform evidence–based policy making. The findings underscore practical implications for educational policymakers, and recommendations to enhance Bosnia and Herzegovina's educational system.

KEYWORDS

BiH, education, international assessment, PISA, socio–economic status

1. Introduction

Quality preschool, primary, secondary education, lifelong learning, and competitive education are crucial for creating the qualification framework of young people, ultimately leading to competitive human capital. Access to education is recognized as one of the fundamental human rights, acknowledged in earlier Millennium Development Goals (MDG) and now in the Sustainable Development Goals (SDG). Education today aims to raise awareness, open

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*Corresponding author

paths and opportunities for self–development, reduce intergenerational poverty, and is considered a precondition for continuous development, serving as an incubator for future generations of leaders and innovators.

The complexity of human capital coverage has resulted in various indicators for measuring the quality of education today, e.g. Pilav–Velić et al. (2019). However, international student testing is increasingly present both in contemporary scientific literature and in reports and analyses published by relevant international organizations. The Organisation for Economic Cooperation and Development (OECD) has gained significant influence in the domain of global education primarily through its comprehensive collection of educational indicators (Rutkowski and Rutkowski, 2021). The OECD has developed and maintains an intricate assessment system, gathering educational data spanning from early childhood to individuals aged 65, encompassing both member and non-member nations (OECD, 2020). Among the OECD's renowned educational assessments, the Programme for International Student Assessment (PISA) stands out. It offers policymakers insights into enhancing student learning, improving teaching methods, and optimizing school system operations, while simultaneously building the participating countries' capacity to conduct extensive learning assessments and utilize the results that can be used as inputs for national policies and evidence–based decision–making (Neumann et al., 2010). In addition, by establishing standards derived from the practices and policies of high–performing countries in PISA, the OECD subtly guides, without imposing binding decisions (Niemann and Martens, 2018), lower–performing nations to seek inspiration and insights from the more successful ones (Santos and Centeno, 2023). This approach encourages the adoption of processes from education systems recognized as effective, turning high–performing countries into sources of empirical knowledge that can either validate or challenge reforms aimed at enhancing other school systems (Takayama et al., 2013).

International testing in the field of education, particularly related to examining students' knowledge and achievements, reveals the success/failure of the education policy of a particular country, its educational system, as well as societal attitudes towards the values of upbringing and education, however it also enables better understanding of its usefulness and significance in the overall education system and policy context. Therefore, this research will focus on the impact of socio–economic status on the achievements of students in the international PISA testing in Bosnia and Herzegovina (BiH). The primary focus of this research is the analysis of the impact of socio–economic status on the educational achievements of male and female students in the international PISA testing in Bosnia and Herzegovina. Socio–economic status can be measured by various indicators; however, this research utilizes parents' educational attainment, an index of educational resources, and an index of cultural goods. The achieved results of students from BiH in the PISA 2018 testing are used in the empirical part of the study as an indicator of educational achievements.

The research objectives include presenting a theoretical framework, introducing PISA international testing, reviewing empirical literature on the socio–economic status and educational achievements of students, analyzing the impact of socio–economic status on male and female students in BiH using PISA data, and providing recommendations for educational policymakers based on empirical findings. The research questions in this paper are defined as follows:

RQ 1. *Does socio–economic status significantly affect the PISA international testing results?*

RQ 2. *Is there a significant association between the region of residence and results achieved in*

the PISA international testing?

RQ 3. *Is there a significant difference in the PISA international testing results with respect to gender?*

The structure of the paper is as follows. After the introduction, literature review is presented through the analysis off the impact of socio–economic status on student's achievement. A brief overview of PISA in Bosnia and Herzegovina is also provided prior to the section on data and methodology employed. Results and discussion are provided before the conclusion which, besides the concluding remarks also provided recommendations for policy makers and presents limitations of the research.

2. Literature review

The discourse on measuring human capital has seen significant contributions from various researchers and international organizations. The debate involves whether education quality is exclusively tied to standardized test success. The focus on international testing of students has gained prominence, revealing the efficacy of a country's educational policies, system, and societal attitudes. International tests, including the International Adult Literacy Survey (IALS), Trends in Maths and Science Study (TIMSS), Progress in International Reading Literacy Study (PIRLS), and Programme for International Student Assessment (PISA), play a crucial role in evaluating students' knowledge and application of knowledge. PISA, for instance, assesses key competencies such as reading, scientific, and mathematical literacy. These competencies, identified as crucial by Baucal (2012), are considered essential for young people in personal, professional, social, cultural, economic, and political aspects after completing mandatory education.

The discussion on educational inequalities, reignited by PISA testing results over the past two decades, is important for countries worldwide to identify and address disparities through adequate policies (Arikan, 2017; Morsy et al., 2018; Mazurek and Mielcova, 2019). PISA not only measures literacy but also aims to highlight educational inequalities impacting different aspects of sustainable development (OECD, 2019). The importance of international standardized testing and PISE per se is visible today in the ability to comprehensively analyse education systems, policies, and different economic and social inequalities (Gregurević and Kuti, 2012; Sulis et al., 2020). In terms of the PISA testing and the data available, the influence of the socio–economic status (SES) on the education achievement is a key question in PISA analyses (Baucal, 2012; Sulis et al., 2020; Avvisati, 2020; Pulkkinen and Rautopuro, 2022). International testing, such as PISA, enables the assessment of the impact of SES on educational achievements globally and importunely, since it is standardized, various comparative studies are possible. SES's impact varies between developing and developed countries (Arikan, 2017), with developed countries having healthier school climates that can mitigate SES influences (Gustafsson et al., 2018) or even the possibility of social capital mitigating SES impact on educational success, contributing to social mobility and the position within the society (Pavić and Vukelić, 2009; Rogošić and Baranović, 2018).

Previous research also emphasizes the role of parental education and financial capital, with more educated parents providing higher cognitive stimulation (Salmela–Aro and Tynkkynen, 2012; Milas Vidović, 2019). Parents and teachers significantly shape students' educational processes, with parental support being a primary driver of successful education

(Salmela–Aro and Tynkkynen, 2012; Devlin and McKay, 2014). The quality of relationships within families and educational institutions positively correlates with educational achievements (Babarović et al., 2009; Rogošić and Baranović, 2018).

When it comes to difference among countries, the PISA 2015 study identified inequalities in countries like France, Luxembourg, Sweden, and Denmark (Sulis et al., 2020). SES explains 14% of the variance in student achievements on reading literacy tests in OECD countries (Baucal, 2012). The analysis in Serbia showed that SES explains 10% of the variance, somewhat weaker than in OECD and European countries. Another possible sources of inequalities could be ethnic background, and Behr and Fugger (2020) have found that socio–economic backgrounds of immigrants and natives significantly explain differences in educational achievements. Additionally, PISA results provide a possibility for the analysis considering gender differences. Female students consistently outperform male students in reading, with some variations in mathematics performance (OECD, 2019). In the context of education achievement SES plays a significant role and international (standardized) testing provide valuable data for the analysis of these gaps.

3. PISA in Bosnia and Herzegovina

PISA testing has been conducted in eight cycles to date. Bosnia and Herzegovina took part of the testing for the first time in 2018. Speaking about countries in the region, Slovenia and Croatia recorded their initial participation in the PISA program in 2006, Montenegro in 2009, while Serbia, North Macedonia, and Kosovo participated for the first time in 2018, along with BiH. In the testing in Bosnia and Herzegovina, 6.480 students from 213 schools, aged 15, participated. Given that students in Bosnia and Herzegovina who are 15 years old have mostly completed their primary education, the participant structure was as follows: 82% comprised students in the first grade of high school, 17% were students in the ninth grade of elementary school, and 1% were students in the eighth grade of elementary school (Džumhur, 2019).

Results for all countries were published in December 2019, and Bosnia and Herzegovina was ranked 62nd out of the 79 participating countries. Among the countries in the region, according to Dragnić et al. (2020), only students from North Macedonia (67th place) and Kosovo (75th place) achieved poorer results. Slovenia ranked 21st, Croatia 29th, Serbia 45th, and Montenegro 52nd, achieving better success. The position on the ranking list is determined based on the average scores in all three testing areas. According to OECD results in 2019 the average number of points is determined in relation to OECD countries. For reading literacy, it was 487, for mathematics 489, and for science literacy 489 points. Students from Bosnia and Herzegovina scored 403 points in the reading test, which is 17% below the OECD average, 406 in mathematics (17% below the OECD average), and 398 points in science (19% below the average).

Table 1. *Descriptive statistics of PISA testing results in BiH*

Variable	Observations	Mean	St.dev.	Min.	Max.
Readings	6107	405.42	78.76	161.27	657.62
Mathematics	6107	408.50	80.88	149.58	719.74
Natural sciences	6107	400.15	76.94	161.47	676.09

Source: authors creation based on the OECD data

Table 1 shows the results of testing in Bosnia and Herzegovina, by tested areas, in comparison with OECD countries, where the OECD average is used as a reference value (Table 2).

Table 2. *Results in BiH and OECD countries*

Country	Readings	Mathematics	Natural sciences	Mean
BiH	403	406	398	402
OECD	487	489	489	488
BiH vs OECD	−17%	−17%	−19%	−18%

Source: authors creation based on the OECD data

Students in Bosnia and Herzegovina achieved, on average, 18% lower results in comparison to students from OECD countries on the PISA test. Regarding regional countries, specifically in the case of Serbia, the achieved results of students are below the OECD average, with scores of 439 in reading, 448 in mathematics, and 440 in science. As for Croatia in PISA 2018, the obtained result is much closer to the OECD average than in the previous two examples but still below the OECD average, with scores of 479 in reading, 464 in mathematics, and 472 in science.

A very convincing indicator that the education system in Bosnia and Herzegovina significantly lags behind international standards is the dominance of level **1a** in knowledge, which represents the highest achievement level for 33% of students (Džumhur, 2019). To provide additional clarification, it is worth noting that the PISA scoring scale consists of 6 levels, with Level 1, being the lowest, further categorized into 3 sub–levels for reading and natural sciences: **1a**, **1b**, and **1c**. According to the test results, more than 50% of the tested students in Bosnia and Herzegovina do not reach Level 2, as indicated in the tables above. From this, we can conclude that the education system in Bosnia and Herzegovina is at a low level compared to education in OECD countries, where almost 60% of students achieve results at Level 3 and above (Džumhur, 2019). The success of students in Bosnia and Herzegovina is below the OECD average, meaning that students in Bosnia and Herzegovina, in all three areas covered by the testing, are, on average, three years behind their peers in OECD countries (Džumhur, 2018). Due to the complexity of the administrative–political structure of Bosnia and Herzegovina, PISA testing was conducted in the cantons of the Federation of Bosnia and Herzegovina (10 cantons) and the regions of Republika Srpska (7 regions), with the Brčko District considered as a separate entity.

4. Data and methodology

The empirical part of the research is focused on analyzing the relationship between socio–economic status and achieved results in international testing by male and female students conducted in Bosnia and Herzegovina. Analysis is based on the data available in OECD database from the latest PISA testing, in which Bosnia and Herzegovina participated as well as the Agency for Pre–Primary, Primary, and Secondary Education of Bosnia and Herzegovina. Testing is conducted at the regional level, as categorized by the OECD, including following regions: Bosnian–Podrinje Canton Goražde, Brčko District, Herzegovina–Neretva Canton, Herzegovina–Neretva Canton, Sarajevo Canton, Banja Luka Region, Bijeljina Region, Bihać Region, Doboj Region, Herzegovina Region, Prijedor Region, Sarajevo–Romanija Re-

gion, Central Bosnia Canton, Tuzla Canton, Una–Sana Canton, Zenica–Doboj Canton, Posavina Region, West Herzegovina Region.

For the purpose of the analysis method of the multiple linear regression analysis was employed (Cohen et al., 2002). Three regression models were developed to with student results in individual areas as the criterion variable and SES indicators as predictor variables. For the indices and variables of socio–economic status approach applied by Gregurević and Kuti (2012) in the case of Croatia will be followed. One of the most commonly used SES indices is the International Socio–Economic Index of Occupation (ISEI), which is not applicable to this study due to data unavailability. Instead, it has been replaced with the Parents' Education level index (PARED), as utilized in the study by Vázquez–Cano, et al. (2020). The other two indices are the Educational Resources Index and the Possessions related to Classical Culture at Home Index (Gregurević and Kuti, 2012). Furthermore, two additional variables, gender and residential region, have been included in the model. Data were analyzed using the STATA 18 software package.

PISA, the OECD's international student assessment program, occurs every three years. Due to differences in early education nature, school starting age, educational system structures, and grade repetition policies among participating countries, grades are often an inadequate indicator of students' cognitive development. To ensure better international comparability, PISA assesses the achievements of students at a specific age. The chosen age group is fifteen, as students at this age are typically at the end of compulsory basic education in most countries, preparing for entry into the adult world, further education, and workforce integration.

The Bosnian and Herzegovinian sample included 6480 students from 213 schools nationwide, comprising 3148 females and 3332 males. The sample included both public and private schools of all types across the entire country, covering all cantons in the Federation of Bosnia and Herzegovina (FBiH), Republika Srpska (RS), and Brčko District (BD). Each school had 46 participants, unless the school had fewer than 46 students, in which case all eligible students meeting PISA criteria were selected. When choosing a relevant sample for PISA testing, Džumhur (2019) mentions the coverage of the 15–year–old population in Bosnia and Herzegovina, known as Index 3 Coverage. This is calculated by dividing the number of students represented in the PISA sample by the total number of 15–year–olds, estimated using demographic projections. Bosnia and Herzegovina's coverage of 82% can be compared to the OECD average of 88% and reference countries, including Austria (89%), Montenegro (95%), Croatia (89%), Slovenia (98%), North Macedonia (95%), and Serbia (88%). Although a small percentage of students in the seventh grade and above may be excluded from PISA due to certain disabilities, living in inaccessible areas, or having limited language knowledge, the largest share of uncovered 15–year–olds comprises of children who are not in school or have been retained in lower grades of primary school (Džumhur, 2019). In Bosnia and Herzegovina, students with more significant developmental difficulties and those following classes in a foreign language were excluded. Students with milder developmental difficulties took a one–hour test, as per PISA standards, followed by a shortened version of the student questionnaire. This study utilized the database of all students in Bosnia and Herzegovina who participated in the 2018 PISA testing.

To compare a country's relative success, student results are summarized using the average achievement in each testing area. PISA also describes student results in proficiency levels, particularly for each tested area. Level 2 is considered the minimum proficiency level in read-

ing, mathematics, and natural sciences expected at the end of basic education, corresponding to the first year of high school in Bosnia and Herzegovina (according to PISA standards). The basic level is where students can tackle tasks requiring at least minimal independent thinking. In the highest proficiency level (level 6), students demonstrate advanced comprehension abilities for lengthy and abstract texts. They can formulate, generalize, and apply information derived from their research and models to address complex problems. These students are adept at utilizing their knowledge in unconventional contexts and integrating a diverse set of interconnected scientific ideas and concepts across various domains, including natural science, earth science, and astronomy. For this research, achievement data were sourced from the official OECD website in their original format (Džumhur, 2019).

For PISA testing purposes, SES indicators are created for international comparability. PISA generates students' socio–economic status based on their own index of economic, social, and cultural status derived from various variables related to students' family backgrounds, including parental education and occupation, the number of material possessions, books, and other resources available in the household. Students provide responses to these questions. (Džumhur, 2018) indicates significant differences in the achievements of students with unfavorable SES, whose SES index is in the country's lower quartile, and students with favorable SES, whose SES index is in the upper quartile. The average achievement difference in mathematics is 63 points in favor of students with favorable SES, while in reading, the difference is slightly less at 58 points. In the case of natural sciences, there is a difference of 55 points in favor of students with a more favorable socio–economic status. These score differences represent a two–year schooling gap.

The dependent variable includes achieved results in international tests with respect to three areas covered by the PISA testing, expressed in number of points on interval scale. The independent variable is socio–economic status. Gregurević and Kuti (2012) in the analysis of the impact of socio–economic status on the educational achievements of students, among other factors, use the socio–economic index of occupations, index of educational resources, and index of possession of cultural goods. Based on previous research, the following socio–economic indicators will be considered in the current study: parents' highest level of education (PARED), home possessions index (HOMEPOS) – created based on the availability of items such as a personal working desk, a quiet corner, computers that students can use for school tasks, educational computer programs, a personal calculator, textbooks, or dictionaries, and possessions related to "classical" culture at home index (CULTPOSS) – ownership of classical literature works, poetry collections, and artistic works. Since these are categorical variables, the following are the representations of variables to be used in the regression analysis:

$PARED_{ME}$ – *highest level of mother's education – elementary school*

$PARED_{MH}$ – *highest level of mother's education – high school*

$PARED_{MG}$ – *highest level of mother's education – gymnasium*

$PARED_{FE}$ – *highest level of father's education – elementary school*

$PARED_{FH}$ – *highest level of father's education – high school*

$PARED_{FG}$ – *highest level of father's education – gymnasium*

$HOMEPOS_{D}$ – *possession of a work desk*

$HOMEPOS_{R}$ – *possession of a separate room*

$HOMEPOS_S$ – *possession of a learning space*

$CULTPOS_{25}$ – *number of books in the household – up to 25*

$CULTPOS_{100}$ – *number of books in the household – up to 100*

$CULTPOS_{200}$ – *number of books in the household – up to 200*

$CULTPOS_{500}$ – *number of books in the household – up to 500*

$CULTPOS_{25}$ – *number of books in the household – up to 25*

GENDER – *if student is male or female*

REG – *region of residence*

5. Results and discussion

The model assumes that parental education level, possession of cultural and educational goods, gender, and residential region significantly influence the achieved results in the PISA testing areas of reading, mathematics, and natural sciences. Testing for the control variable *region of residence* (REG) does not indicate statistical and socio–cultural significance. Therefore, due to very high *p*–values suggesting the insignificance of the regional factor, the subject variables are not included in the models estimated in the analysis. The following subsection outline the results of three regression models, with previously described dependent and independent variables.

Results of the regression analysis in the first model are presented in Table 3. In this model the dependent variable is the achievement of students in the field of natural sciences. Parental education has proven to be a significant factor influencing results in natural sciences. Students whose mothers completed high school, on average, score about 20 points higher in natural sciences compared to those whose mothers have no education (four grades or less of elementary school). Similarly, students whose fathers completed high school score, on average, 38 points higher in natural sciences than those whose fathers have no education.

However, possession of the quite place for learning is not statistically significant. Specifically, students with a "Quiet Place for Learning" achieve, on average, 15 points higher in natural sciences compared to all other conditions, indicating the importance of "students' and families' willingness to learn," not limited solely to the physical learning space. In addition, Gender differences were not statistically significant concerning achievements in natural sciences. Of particular interest is the statistical significance of book ownership and the magnitude of its impact on average achievements in natural sciences. The highest magnitude (whether "A Quiet Place for Learning" is included in the model or not) is for students living in households with 200 to 500 books, where they achieve, on average, 61 points higher than students with fewer than 25 books at home. This is in line with findings presented by Gregurević and Kuti (2012) noting that more educated parents appreciate and understand the educational system, providing encouragement and motivating their children to achieve better results. In the case of Croatia, Gregurević and Kuti (2012) note that students from families with more than 11 books achieve better results in natural sciences. Similarly, in Croatia, a noticeable difference in achievement is observed when owning more than 100 books in the household. Morsy et al. (2018) study in Australia aligns with the results obtained for Bosnia and Herzegovina, where $CULTPOS_S$ is a statistically significant variable. The greater the number of books at home, students achieve better results on PISA testing in Australia

(Veiga, 2012). Arikan (2017) states that educational resources are positive predictors of student achievement in Turkey and negative in Korea. Papanastasiou (2020) confirms that students with a certain number of technological resources at home achieved better results than those who did not (in the case of South Africa). Vázquez–Cano, et al. (2020) demonstrated in the cases of Canada, Finland, and Singapore that the influence of socioeconomic status as a predictor of success in reading is moderate in all three countries.

Table 3. *Regression results with respect to achievements in natural sciences, mathematics and reading*

Variable	Model 1	Model 2	Model 3
Constant	350.753***	342.194***	347.731***
	(9.553)	(9.954)	(9.639)
$HOMEPOS_R$	−24.413***	−22.000***	−16.130***
	(4.308)	(4.489)	(4.347)
$HOMEPOS_D$	6.073	7.599	10.252*
	(5.943)	(6.193)	(5.997)
$HOMEPOS_S$	18.959***	10.158***	16.116***
	(3.496)	(3.643)	(3.527)
$PARED_{ME}$	−8.863	4.471	2.036
	(5.397)	(5.624)	(5.446)
$PARED_{MH}$	9.991*	24.958***	20.160***
	(5.162)	(5.379)	(5.209)
$PARED_{MG}$	20.712***	39.040***	31.841***
	(5.723)	(5.963)	(5.775)
$PARED_{FG}$	38.825***	36.542***	42.962***
	(5.360)	(7.551)	(7.312)
$PARED_{FH}$	22.297***	26.389***	25.759***
	(6.535)	(6.809)	(6.594)
$PARED_{FE}$	−6.160	−9.369	1.012
	(7.040)	(7.336)	(7.104)
$CULTPOS_{25}$	21.765***	21.760***	20.466***
	(2.423)	(2.525)	(2.445)
$CULTPOS_{100}$	36.341***	43.890***	36.897***
	(2.507)	(2.613)	(2.530)
$CULTPOS_{200}$	38.545***	40.840***	43.244***
	(3.654)	(3.807)	(3.687)
$CULTPOS_{500}$	60.481***	54.831***	51.038***
	(4.691)	(4.888)	(4.733)
$CULTPOS_{500+}$	17.941***	31.903***	17.592***
	(5.560)	(5.793)	(5.610)
GENDER	−0.321	2.553	−29.043***
	(1.852)	(1.930)	(1.869)
Observations	6107	6107	6107

Note: ***, **, * denote significance level at 0.01, 0.05 and 0.1; standard errors in parenthesis

Results of the regression analysis for the mathematics scores of students in Bosnia and Herzegovina are consistent in line with statistical significance with the previously presented findings in the natural sciences model. Additionally, when considering the the additional validation with focus on the variable "learning space" both the statistical significance and

the magnitude (size of individual coefficients) of certain coefficients, such as $CULTPOS_{500}$, $PARED_{MG}$, $PARED_{FG}$, are confirmed. The $GENDER$ variable in the mathematics results model (in both variants, including "learning space"), indicates that there is no statistically significant difference in the achieved results between male and female students in mathematics. These results are interesting in the context of current debates about the inclusion of girls in STEM education (Science, Technology, Engineering and Mathematics) and narrowing the gender gap in this specific educational area.

Similar non–significant gender impact findings have been reported in Austria (OECD, 2019) and Vietnam (Nguyen et al., 2021). Slovenia also shows no statistically significant gender differences in mathematics performance, although slight differences are noticeable (Štemberger and Kiswarday, 2018). Conversely, research in Serbia (Lazarević and Orlić, 2018) identified a significant gender impact on mathematics achievements. Spain's case (González de San Román and de la Rica, 2012) demonstrated that boys outperformed girls in mathematics, while the reverse was observed in other PISA domains. Examining Latin American countries (Avles and Candido, 2020), it was found that girls achieve better results than boys, with the largest difference observed in mathematics scores. This emphasizes the variability of gender gaps in educational performance across different regions and subjects.

When observing the results of the third model with reading scores as the dependent variable, the results regarding the statistical significance of individual variables, as well as the magnitude of coefficients for these variables, are consistent. Once again, the education of both parents and book ownership are significant, showing a positive difference in reading scores for students whose parents have completed gymnasium or secondary education compared to those whose parents lack education.

Interestingly, there is no statistically significant difference (across all three models) between students whose both parents have completed primary school and those without parental education. The significant difference arises when both parents have completed secondary education or gymnasium, across all three domains (models), compared to parents without education. In the case of including the additional variable "learning space" in Model 3, it remains statistically significant, providing an average of 14 additional points in reading scores compared to students under all other conditions. Furthermore, what distinguishes this model from the models with results from the other two PISA testing areas and the included "learning space" variable is the statistical significance and very high coefficient for the gender variable. This emphasizes significant and statistically relevant variations in reading results between male and female students according to PISA's reading areas. In neighboring countries, the possession of cultural assets plays a significant role in PISA test results. In Croatia, students with over 100 books at home achieve significantly better results than those with fewer books (Gregurević and Kuti, 2012). Similarly, in Serbia, students with over 200 books at home perform significantly better (Lazarević and Orlić, 2018).

The brief comparison of the results for BiH with those of neighbouring countries, i.e. Serbia and Croatia, is given. In Bosnia and Herzegovina, students whose parents' completed gymnasium achieved, on average, 30 points higher than the baseline category of primary school, similar to Croatia. In Serbia, students whose parents completed high school education scored 60 points higher in all three domains compared to those with lower education.

In Bosnia and Herzegovina, the most significant factor explaining the impact of SES on scores is possession of cultural assets. Students with 200 to 500 books at home achieve 50% better results compared to the baseline category (25 books). In Croatia, students in house-

holds with over 100 books achieve better results, while in Serbia, statistical significance is observed when students have over 200 books, resulting in better performance. HOMEPOSS: In Croatia, students with more educational resources, such as a private room and a quiet space for learning, achieve higher scores, an average of 20 points more than those without. It's important to note that in Bosnia and Herzegovina, although a large number of students have their own room, the influence of physical space did not show statistical significance in the estimated models in this study. In Serbia, the research showed that male students perform better than female students in mathematics, while in Bosnia and Herzegovina, there were no statistically significant differences in results between male and female students except in the reading domain. In the Croatian study, students from more urban regions achieved better results in PISA testing. The conducted research in Bosnia and Herzegovina did not show that the region is a statistically significant determinant when it comes to PISA test results. The analysis of SES impact on students' educational achievements in Serbia revealed that SES explains 10% of the variance, which is consistent with the analyses conducted for Bosnia and Herzegovina in this study.

6. Conclusion

International standardized testing, such as PISA, TIMSS, PIRLS, and IALS, is increasingly used for educational analyses globally. The 2018 PISA results indicated that Bosnia and Herzegovina performed below the OECD average, both globally and regionally. This paper's central focus is on analysing the influence of socio-economic status on students' achievements in Bosnia and Herzegovina during PISA testing. The empirical part involves a regression analysis of selected socio-economic factors in the 2018 PISA testing across three areas: sciences, mathematics, and reading. The regression analysis suggests that socio-economic status, measured by parents' education and possession of educational and cultural goods, significantly impacts students' results in all three PISA areas. However, the region of residence did not show statistical significance in correlation with the results, according to the OECD database. In conclusion, gender did not significantly affect PISA results, except for male students outperforming female students in the PISA reading area. In summary, international standardized testing provides valuable insights into educational systems, and the analysis of socio-economic factors reveals their substantial impact on students' achievements in Bosnia and Herzegovina, emphasizing the need for strategic investments in education to improve outcomes. The results of the regression analysis of the three previously discussed models, including those incorporating the newly created variable "Quiet Space for Learning," lead to several crucial conclusions. The obtained results align with expectations regarding the significant influence of both parents' education and possession of educational resources as significant factors affecting students' achievements in all three PISA testing areas (natural sciences, mathematics, and reading). Based on PISA findings regarding students' results in Bosnia and Herzegovina, which show performance below the OECD average, it is desirable to identify priorities for improving the educational system. However, it is essential to acknowledge that enhancing quality cannot be easily achieved and requires strategic investment of all resources. A strategic approach to education is necessary. The economic condition, standard of living, and school facilities in Bosnia and Herzegovina are not at a level that enables better results. It is evident that more investment is needed in securing a higher standard of living and better working conditions for education (APOSO, 2020). The recom-

mendations for decision-makers include enhancing the funding system to increase access to books and boost school library funds, particularly in households lacking books. Support from municipalities/counties is crucial to ensure equal opportunities for students across the country, with additional government funds directed to schools for students in disadvantaged positions. Efforts to promote a culture of reading are emphasized, along with attention to equal opportunities and gender considerations in teaching. Additionally, the development of early literacy through increased enrolment in preschool education is recommended, targeting parents who cannot afford enrolment fees. This approach could mitigate the impact of lower parental education on students' results, enhancing functional literacy and contributing to improved educational achievements. Lastly, the study underscores the importance of Bosnia and Herzegovina's continuous participation in PISA testing for informed policy-making and educational system improvements. The study's limitations involve the sample and database used, with regression models estimating the initial impact of socio-economic status on students' PISA results without considering other potentially explanatory factors. When mentioning database it is important to add that lack of data after 2018 for Bosnia and Herzegovina certainly creates an additional issues, as results might be slightly different from above presented. Diagnostic tests for normality and heteroskedasticity further add complexity. The thesis reviews contemporary literature on education, achievements, and international standardized tests, culminating in recommendations for future research: incorporating additional variables like monthly household incomes and migration status, analysing teacher responses for potential correlations with student achievements, and exploring school-level questionnaires to understand students' perceptions of teaching methods and discipline.

References

Arikan, S. (2017). Factors predicting creative problem–solving competence in PISA 2012: Evidence from six countries. *Croatian Journal of Education*, 20(2):361–397. doi: 10.15516/cje.v20i2.2419

Avles, F. & Candido, O. (2020). School effect and student performance: A Latin American assessment from PISA. *Economia*, 43(86): 79–99. doi: 10.18800/economia.202002.004

Avvisati, F. (2020). The measure of socio–economic status in PISA: A review and some suggested improvements. *Large–scale Assessments in Education*, 8(8):1–37. doi: 10.1186/s40536-020-00086-x

Babarović, T., Burušić, J. & Šakić, M. (2009). Uspješnost predviđanja obrazovnih postignuća učenika osnovnih škola Republike Hrvatske. *Društvena istraživanja*, 8(4–5):673–695. https://hrcak.srce.hr/42592

Baucal, A. (2012). Socio–economic status and its impact on educational achievements: Direct and indirect impact. *Primjenjena psihologija*, 5(1):5–24. doi: 10.19090/pp.2012.1.5-24

Behr, A. & Fugger, G. (2020). PISA performance of natives and immigrants: Selection versus eficiency. *Open Education Studies*, 2(1):9–36. doi: 10.1515/edu-2020-0108

Cohen, J., Cohen, P., West, S. G. & Aiken, L. S. (2002). *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences* (3rd ed.). Routledge. doi: 10.4324/9780203774441

Devlin M. & McKay J. (2014). *Reframing 'the problem': Students from low socio–economic status backgrounds transitioning to univeristy*. In Brook, H., Fergie, D., Maeorg, M. & Michell, D. (Eds.), Universities in Transition: Foregrounding Social Contexts of Knowledge in the First Year Experience, 97–126. University of Adelaide Press. doi: 10.20851/j.ctt1t304xh.8

Džumhur, Ž. (2019). *PISA 2018 Izvještaj za Bosnu i Hercegovinu*. Agencija za predškolsko, osnovno i srednje obrazovanje, 1–166. http://anyflip.com/giwgb/lejs/ [accessed January 25, 2024]

Džumhur, Ž. (2019). *TIMSS 2019 Report for Bosnia and Herzegovina*. The Agency for Pre–Primary, Primary and Secondary Education, 1–110. https://aposo.gov.ba/sadrzaj/uploads/TIMSS-2019-izvje%C5%A1taj-za-BiH-engleski-jezik-f-i-n-a-l.pdf [accessed January 27, 2024]

Dragnić, L., Bošnjak M., Đukić, D. & Muhović A. (2020). *Jednakost, pravednost i inkluzivnost osnovnog obrazovanja u BiH*. Centar za politike i upravljanje, 1–136. https://osfbih.org.ba/images/Progs/17+/ED/CPU_Istrazivanje_Jednakost-pravednost-i-inkluzivnost-osnovnog-obrazovanja-u-BiH.pdf [accessed January 24, 2024]

González de San Rom, A. & de la Rica, S. (2012). Gender gaps in PISA test scores: The impact of social norms and the other's Transmission of Role Attitudes. *SSRN Electronic Journal*, IZA Discussion Paper, 6338:1–31. doi: 10.2139/ssrn.2007329

Gregurović, M. & Kuti, S. (2010). Učinak socioekonomskog statusa na obrazovno postignuće učenika: primjer PISA istraživanja, Hrvatska 2006. *Revija za socijalnu politiku*, 17(2):179-196. doi: 10.3935/rspv17i2.918

Gustafsson, J., Nilsen T. & Hansen, K. (2018). School characteristics moderating the relation between student socio–economic status and mathematics achievement in grade 8. Evidence from 50 countries in TIMSS 2011. *Studies in Educational Evaluation*, 57:16–30. doi: 10.1016/j.stueduc.2016.09.004

Lazarević, Lj. & Orlić, A., (2018). PISA 2012 mathematics literacy in Serbia: A multilevel analysis of students and schools. *Psihologija* 51(4)413–432. doi: 10.2298/psi1708170171

Mazurek, J. & Mielcova, E., (2019). On the relationship between selected socio–economic indicators and student performances n the Pisa 2015 study. EM Ekonomie a Management, 22, 22-39.

Milas Vdović, V. (2019). *Socioekonomski status roditelja i odnosi u obitelji*. Sveučilište u Rijeci, Filozofski fakultet. Magistarski rad, 1–98. https://urn.nsk.hr/urn:nbn:hr:186:418121 [accessed November 27, 2023]

Morsy, L., Khevenson, T. & Carnoy, M. (2018). How international test fail to inform policy: The unsolved mystery of Australia's steady decline in PISA scores. *International Journal of Educational Development*, 60:60–79. doi: 10.1016/j.ijedudev.2017.10.018

Neumann, K., Fischer, H. & Kauertz, A. (2010). From PISA to educational standards: The impact of large–scale assessments on science education in Germany. *International Journal of Science and Mathematics Education*, 8:545–563. doi: 10.1007/s10763-010-9206-7

Nguyen, Q. N., Nguyen, T. M., Thi Minh, P. & Do Thi, L. H. (2021). Gender biases in resettlement processes in Vietnam: Examining women's participation and implications for impact assessment. *Impact Assessment and Project Appraisal*, 39(3):206–217. doi: 10.1080/14615517.2021.1904376

Niemann, D. & Martens, K. (2018). Soft governance by hard fact? The OECD as a knowledge broker in education policy. *Global Social Policy*, 18(3):26–283. doi: 10.1177/1468018118794076

OECD, (2017). *Education at a glance 2017: OECD indicators*. Organisation for Economic Cooperation and Development Publishing, Paris. doi: 10.1787/eag-2017-en

OECD, (2019). *Education at a glance 2019: OECD indicators*. Organisation for Economic Cooperation and Development Publishing, Paris. doi: 10.1787/f8d7880d-en

OECD, (2020). *Measuring student knowledge and skills: The PISA 2000 assessment of reading,*

mathematical and scientific literacy. Organisation for Economic Cooperation and Development Publishing, Paris. doi: 10.1787/9789264181564-en

OECD, (2017). *Education at a glance 2017: OECD indicators*. Organisation for Economic Cooperation and Development Publishing, Paris. doi: 10.1787/eag-2017-en

Papanastasiou, C. (2020). Internal and external factors affecting achievement in mathematics: Some findings from TIMSS. *Studies in Educational Evaluation*, 26(1):1–7. doi: 10.1016/s0191-491x(00)00002-x

Pavić, Ž. & Vukelić, K. (2009). Socijalno podrijetlo i obrazovne nejednakosti: istraživanje na primjeru osječkih studenata i srednjoškolaca. *Revija za sociologiju*, 40[39](1–2):53–70. https://hrcak.srce.hr/39824

Pilav–Velić, A., Jahić, H., Okičić, J. & Kokorović–Jukan, M. (2019). The impact of formal and non–formal education on youth employability in Bosnia and Herzegovina. *Croatian Review of Economic, Business and Social Statistics*, 5(1):55–66. doi: 10.2478/crebss-2019-0006

Pulkkinen, J. & Rautopuro, J. (2022). The correspondence between PISA performance and school achievement in Finland. *International Journal of Educational Research*, 114(102000):1–9. doi: 10.1016/j.ijer.2022.102000

Rogošić, S. & Baranović, B. (2018). Differences in social background, study choice motivation and higher education experience between pre–service class teachers and pre-service subject teachers. *Problems of Education in 21st Century*, 76(5):706–719. doi: 10.33225/pec/18.76.706

Rutkowski, D. & Rutkowski, L. (2021). Running the wrong race? The case of PISA for development. *Comparative Education Review*, 65(1):147–165. doi: 10.1086/712409

Salmela–Aro, K. & Tynkkynen, L. (2012). Gendered pathways in school burnout among adolescents. *Journal of Adolescence*, 35(4):929–939. doi: 10.1016/j.adolescence.2012.01.001

Santos, Í. & Centeno, V. G. (2023). Inspirations from abroad: The impact of PISA on countries' choice of reference societies in education. *Compare: A Journal of Comparative and International Education*, 53(2):269-286. doi: 10.1080/03057925.2021.1906206

Sulis I., Giambona F. & Porcu M. (2020). Adjusted indicators of quality and equity for monitoring the education systems over time. Insights on EU15 countries from PISA surveys. *Socio–Economics Planning Sciences*, 69. doi: 10.1016/j.seps.2019.05.005

Štemberger, T. & Kiswarday, V. (2018). Attitude towards inclusive education: The perspective of Slovenian preschool and primary school teachers. *European Journal of Special Needs Education*, 33(1):47–58. doi: 10.1080/08856257.2017.1297573

Takayama, K., Waldow., F. & Sung, Y.–K. (2013). Finland Has It All? Examining the Media Accentuation of 'Finnish Education' in Australia, Germany and South Korea. *Research in Comparative and International Education*, 8(3):307–325. doi: 10.2304/rcie.2013.8.3.307

Vázquez–Cano, E., Gómez–Galán, J., Infante-Moro A. & López–Meneses, E. (2020). Incidence of a Non-Sustainability Use of Technology on Students' Reading Performance in Pisa. *.* 12(2), doi: 10.3390/su12020749

Vazquez–Cano, E., Calle–Cabrera, A., Hervás–Gómez C. & Lopez–Menses, E. (2020). Socio–Family Context and Its Influence on Students' PISA Reading Performance Scores: Evidence from Three Countries in Three Continents. *Educational Sciences: Theory and Practice*, 20(2):50–62. doi: 10.12738/jestp.2020.2.004

Veiga, F. (2012). Proposal to the PISA of a new scale of Students' engagement in school. *Procedia – Social and Behavioural Sciences*, 46:1224–1231. doi: 10.1016/j.sbspro.2012.05.279

Otkrivanje obrazovnih puteva: utjecajni čimbenici uspješnosti bosanskohercegovačkih studenata

SAŽETAK
Ovaj rad istražuje utjecaj socioekonomskog statusa na uspješnost obrazovanja muških i ženskih studenata u Bosni i Hercegovini, koristeći podatke iz programa PISA (engl. *Programme for International Student Assessment*) za 2018. godinu. U istraživanju su definirani ključni pojmovi poput obrazovanja, socioekonomskog statusa i međunarodnog studentskog vrednovanja, naglašavajući značaj kvalitetnog obrazovnog sustava za društveni razvoj. Korištenjem tri modela za znanstvenu pismenost, matematiku i čitanje, rezultati ukazuju da obrazovanje roditelja i posjedovanje kulturnih dobara značajno utječu na postignuća studenata. Studenti čiji su roditelji više obrazovani i posjeduju više knjiga kod kuće postižu bolje rezultate na PISA testovima. Međutim, spol nije utvrđen kao statistički značajna varijabla. Istraživanje naglašava važnost "tihog prostora za učenje", sugerirajući da studenti s takvim okruženjem postižu bolje rezultate na znanstvenim testovima. Iako uzročnost nije utvrđena, analiza pruža uvid u inicijalni utjecaj socioekonomskog statusa na postignuća studenata. Rad zagovara nastavak sudjelovanja u projektu međunarodnog vrednovanja poput PISA radi praćenja obrazovnih postignuća i informiranja o politikama utemeljenim na dokazima. Dobiveni nalazi ističu praktične implikacije za donositelje obrazovnih politika te preporuke za unapređenje obrazovnog sustava Bosne i Hercegovine.

KLJUČNE RIJEČI
BiH, obrazovanje, međunarodno vrednovanje, PISA, socioekonomski status