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Research Article

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Impact of teacher professional development on student achievement with a focus on Bosnia and Herzegovina: Analyzing TIMSS 2019 results in Western Balkan countries and Croatia

Naida Bikić [1]*, Nevzudin Buzađija [2], Ines Nuić [3]

[1] Faculty of Philosophy, University of Zenica, Zenica, BOSNIA AND HERZEGOVINA
[2] Faculty of Polytechnic, University of Zenica, Zenica, BOSNIA AND HERZEGOVINA
[3] Faculty of Science, University of Sarajevo, Sarajevo, BOSNIA AND HERZEGOVINA
***Corresponding Author:** naida.bikic@unze.ba

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ABSTRACT

Students in Bosnia and Herzegovina (B&H) score very low on international assessments (TIMSS & PISA), lower than the countries in the region with which it shares similar background. In this paper the characteristics of teachers' professional development (TPD) in the region of Western Balkan countries (Albania, B&H, Kosovo, Montenegro, North Macedonia, and Serbia) and Croatia are brought into correlation with average results in mathematics and science on TIMSS 2019. Research questions analyze teachers' attitudes towards their profession and investigate the impact of professional development (PD) of mathematics and science teachers in the last two years, with a specific focus on the situation in B&H, on students' achievement in mathematics and science. The findings indicate a lack of TPD as a contributing factor to lower results in B&H. The research suggests that B&H should consider reforms in the education system and enhance teachers' attitudes towards their profession through intensified PD programs to advance education and learning.

Keywords: professional development, mathematics and science achievement, Western Balkans, TIMSS 2019

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INTRODUCTION

International assessments of science performance showed that students in Bosnia and Herzegovina (B&H) scored very low. Comparing the average scores, it is evident that B&H scores lower than the countries in the region with which it shares a similar historical and cultural background. B&H has so far participated in three international large scale studies: TIMSS 2007, PISA 2018, and TIMSS 2019. In TIMSS 2007, 20% of the Bosnian-Herzegovinian 8th grade students did not reach the lowest benchmark; the country's average score was 466 points, far below the scale average (500 points). PISA 2018 study revealed that 15-year-old students from B&H scored below the OECD average (489 for mathematics and science, 487 for reading) in all three areas: mathematics (406 points), science (398 points), and reading (403 points).

TIMSS 2019 also indicated that the 4th grade students (ages nine-10) also scored low: average achievements in mathematics were 452 points and in science 459 points; both are below the average set of 500 points. 5,628 students of the 4th grade of elementary schools, 2,876 boys and 2,752 girls from 178 schools in B&H, participated in the research. In this paper the accent is set to the characteristics of the teachers' professional development (TPD), their interest in teaching, years of experience and level of their education in the selected states in the region of the Western Balkan countries (Albania, B&H, Kosovo, Montenegro, North Macedonia, and Serbia) and Croatia in the light of average results on TIMSS 2019. As a part of TIMSS research, teachers, students, parents and school representatives answer questions through questionnaires. The answers serve as a basis for analyzes through which an attempt will be made to explain their connection with the achievements of students in mathematics and sciences. Furthermore, regression analysis was conducted with the aim to estimate the relationship between students achievement on several independent variables. The intention was to learn more about the variables affecting the Bosnian-Herzegovinian 4th grade pupils' academic progress. Using teachers' answers to questions about their attitudes toward the profession, their participation in professional development (PD) over the previous two years, and their need for further PD in mathematics and science, the focus is on increasing teacher effectiveness and its impact on student achievement. The choice for focusing on these factors was made because of their critical importance in education and the abundance of research indicating the strong correlation between teacher competency, experience, and attitudes and student accomplishment. However, we are aware that additional elements, such

as socioeconomic position, educational policies, the school environment, individual student characteristics and different cultural factors can also have a major impact on children' academic outcomes. However, by taking this approach, we want to offer a more thorough understanding of the impact of these particular variables within the framework of Croatia and Western Balkan nations.

About Education Systems in Selected Countries

The education system in B&H reflects the organization of the state, as defined by Constitution (2015a, 2015b). There are 14 ministries of education in B&H: two ministries at entity levels in Federation of Bosnia and Herzegovina (FB&H) and Republic of Srpska (RS), 10 ministries across the cantons within FB&H, the Ministry in Brčko District (Statute of the Brčko District, 2015) and the Ministry of Civil Affairs, with the education sector having a coordinating role at the state level.

Compulsory primary education in B&H lasts for nine years, and some parts of the country include compulsory preschool education in the year prior to grade 1. Children typically enroll in primary school in the year they turn six.

The education system in the Republic of Croatia is centralized and controlled by the Ministry of Science and Education. At the age of six or seven, children start attending compulsory primary education, which lasts eight years.

Primary education in Serbia is compulsory and free of charge and consists of two cycles: classroom teaching in grade 1 to grade 4 and subject teaching in grade 5 to grade 8. Compulsory education totals nine years in Serbia (preschool education included). Children enroll in the first grade when they are 6½ to 7½ years old.

In Kosovo, primary (ages six to 10) and lower secondary (ages 11 to 14) education is mandatory. An external assessment is conducted at the end of primary education, the end of lower secondary education, and the end of upper secondary education. After lower secondary education, students can attend either vocational education or gymnasium.

In the Montenegrin education system, primary education is also compulsory and free of charge for all children aged six to 15 years. It lasts for nine years and is divided into three cycles. In Montenegro, primary and lower secondary education are organized as a single structure. At the end of the third cycle of primary school, students participate in an external assessment of their knowledge.

In Albania, basic education is offered to students over six years old for a duration of nine years and is compulsory. External student assessment is carried out at the end of grade 5, then national basic education examinations (end of grade 9), and state matura exams at the end of upper secondary education (end of grade 12).

Primary and secondary education in the Republic of North Macedonia is compulsory and free for all students. Primary education lasts nine years and is for students aged six to 15. Elementary education includes general education for grade 1 to grade 5 and subject teaching for grade 6 to grade 9.

THEORETICAL BACKGROUND

Innovations in teaching and learning are only possible when teachers are capable and willing to adopt them; hence learning opportunities for teachers are extremely important (Cohen & Hill, 2001). According to several Organization for Economic Co-operation and Development (OECD) publications, initial teacher education is insufficient to prepare teachers for all of the issues they would face in their instructional practices, so the high-quality TPD should be delivered as a part of the in-service training process (Musset, 2010; OECD, 2005). Furthermore, TPD has been central to educational reform throughout the 2000s.

TPD characteristics that are helpful in enhancing teaching practice and student outcomes are referred to as high-quality TPD. The most common features are content-focused learning, active learning, and collaborative learning (Song et al., 2018). Lay and Chandrasegaran (2018) showed that higher science achievement on TIMSS 2011 among the Singaporean 8th grade students was related to teachers having more teaching experience, being confident in science teaching, and being satisfied with their careers. There is evidence that teacher preparation is a strong predictor of student accomplishment, possibly even higher than socioeconomic and linguistic characteristics. Although solid science content knowledge appears to be a precondition for good science teaching, there is limited data that directly links science teacher training to student achievement (Lay & Chandrasegaran, 2018). A meta-analysis evaluating the effects of teachers' subject matter knowledge on their students' mathematics and science achievement showed a favorable effect, but overall results were mixed (Wilson et al., 2002). TPD focused on science content had a considerable positive influence on student achievement, according to meta-analyses of research undertaken in the United States (Blank & de las Alas, 2009). Moreover, the amount of PD (more than 14 hours) was an important factor (Yoon et al., 2007). PD, according to Supovitz and Turner (2000), is at the center of practically every educational attempt to improve students' achievements. However, not all PD activities are beneficial to students and lead to their success (Unal et al., 2011).

There is a significant body of research across the world about the effects of teacher variables on students' achievements, both at the level of the 4th and the 8th grade students. Higher science achievement was related to teachers having more teaching experience, being confident in science teaching, and being satisfied with careers (Lay & Chandrasegaran, 2018; Yildirim & Demir, 2014). Participation in information technology PD programs is found to have positive effects on science achievements as well as collaboration between teachers at school (Atar, 2014).

TIMSS 2007 and TIMSS 2011 studies for Turkish students showed that students' mathematics achievement has a positive and significant relationship with teacher's emphasis on the academic achievement (Yavuz et al., 2017).

The study by Lay and Chandrasegaran (2018) showed that teachers with more teaching experience, confidence, and satisfaction with their careers were associated with higher science achievement among the Singaporean 8th grade students. Alharbi et al. (2020) explored TIMSS 2015 results regarding the features of teachers affecting students' achievements in Hong Kong, Japan, Saudi Arabia, and Singapore. Alharbi et al. (2020) reported the following findings:

(1) students from Japan and Saudi Arabia taught by female teachers outperformed those taught by male teachers in mathematical achievement,

(2) teaching experience, teacher's qualification or teacher's specialization had no effect on students' mathematical achievement, and

Table 1. Selected variables from TIMSS 2019 Teacher Questionnaire

Variable code	Question	Question answer
ATBG01	By end of this school year, how many years will you have been teaching altogether?	Write number
ATBG03	How old are you?	Under 25, 25-29, 30-39, 40-49, 50-59, 60+
ATBG08A-ATBG08AE	How often do you feel the following way about being a teacher? (1) I am content with my profession as a teacher, (2) I find my work full of meaning & purpose, (3) I am enthusiastic about my job, (4) My work inspires me, & (5) I am proud of work I do	1–very often, 2–often, 3–sometimes, 4–never or almost never
ATBG10A	How many students are in this class?	Write number
Professional development to teach mathematics ATBM09AA/ATBM09AB-ATBM09AG/ATBM09BG	(A) In past two years, have you participated in professional development in any of following? & (B) Do you need future professional development in any of following? (1) Mathematics content, (2) Mathematics pedagogy/instruction (3) Mathematics curriculum, (4) Integrating technology into mathematics instruction, (5) Improving students' critical thinking or problem-solving skills, (6) Mathematics assessment, & (7) Addressing individual student needs	Yes/no
Professional development to teach science ATBS08AA/ATBMS08AB-ATBS08AG/ATBS09BG	(A) In past two years, have you participated in professional development in any of following? & (B) Do you need future professional development in any of following? (1) Science content, (2) Science pedagogy/instruction (3) Science curriculum, (4) Integrating technology into science instruction, (5) Improving students' critical thinking or inquiry skills, (6) Science assessment, (7) Addressing individual student's needs, & (8) Integrating science with other subjects?	Yes/no
About student	When were you born?	Write answer

(3) teacher's PD showed positive impact on the level of students' mathematical achievement only in Hong Kong.

Alharbi et al. (2020) explained the last finding by the lack of relevance of TIMSS requirements in PD of the teachers in other three countries.

CURRENT STUDY

Research on teacher mindsets and PD is vital to the ongoing enhancement of instructional strategies and the achievement of improved student outcomes. This study is to investigate the relationship between the PD and attitudes of mathematics and science teachers in the 4th grade of Western Balkan primary schools and student achievement. It also intends to offer pertinent insights into improving the educational process. For that reason, we pose the following research questions:

RQ1. What are the attitudes of the 4th grade mathematics and science teachers in the Western Balkan countries towards their profession and are there any correlations with students' achievements?

RQ2. Did the mathematics teachers have the opportunity for their PD in the last two years and what is the situation in B&H regarding PD? Is there a correlation between mathematics teachers PD and students' achievements?

RQ3. Did science teachers have the opportunity for their PD in the last two years and what is the situation in B&H regarding PD? Is there a correlation between science teachers PD and students' achievements?

Findings in the Western Balkans context contribute to the understanding of the importance of teachers taking part in high-quality PD and provide evidence that spans national boundaries. It encourages policymakers to make decisions based on the best available evidence and to continuously engage teachers in their professional learning to improve teaching and learning.

METHODS

Design & Participants

TIMSS 2019 is a recent large-scale database that provides comparable national statistics. It is the seventh assessment cycle of mathematics and science achievements, carried out since 1995 by the International Association for the Evaluation of Educational Achievement (IEA). A total of 64 countries and 8 benchmarking systems were included in this study. At the 4th grade level, 58 countries participated, while at the 8th grade level, 39 countries participated; for the first time, all countries from the Western Balkan region participated (Džumhur, 2019).

TIMSS 2019 in B&H was conducted in the 4th grade of primary education (students' aged 9.5-10.5 years, mean [M]=10.1 years). Therefore, the characteristics of regional national educational systems were compared with the focus on the 4th grade TPD and the 4th grade students' achievements. The focus of this study is on comparing the achievements of Bosnian-Herzegovinian students' to those of the students in the region, as well as exploring the characteristics of teachers and their PD in these countries. Hence, the data gained through the Teacher Questionnaire for the 4th grade were selected for the analysis. The general and technical reports, containing information on the data, testing, and sample techniques, can be found in *TIMSS 2019 international results in mathematics and science* (Mullis et al., 2020). A total of 5,628 4th grade students and 334 4th grade schoolteachers from B&H participated in TIMSS 2019.

There were seven categories within PD activities examined in TIMSS 2019 for mathematics and science teachers as in **Table 1**.

Instrument, Measures, & Variables

In B&H, TIMSS 2019 survey was conducted between May 20 to June13. In TIMSS 2019 study, two different instrument types were employed: surveys and 14 exam booklets with questions from science and mathematics. One of three cognitive domains–factual knowledge, knowledge application, or reasoning (synthesis and evaluation)–is examined in each task.

Table 2. Results in mathematics & science by countries

Country	Number of participants	Mathematics achievements (standard deviation)	Science achievements (standard deviation)
Albania	4,263	494.00 (81.23)	489.00 (84.32)
B&H	5,617	451.68 (75.13)	458.59 (78.64)
Croatia	3,785	509.50 (67.32)	523.86 (59.06)
Kosovo	4,496	444.35 (80.30)	413.06 (86.79)
Montenegro	5,076	452.78 (85.48)	453.32 (89.16)
North Macedonia	3,396	471.72 (98.12)	426.04 (102.78)
Serbia	4,380	507.88 (84.43)	516.91 (81.22)
Average	4,430	472.99 (81.80)	465.30 (82.94)

Table 3. Years of teacher experience & number of students per class by countries

Country	Years of teaching (M±SD)	Average number of students in class	Teachers older than 49 years (%)
Albania	22.63 (10.78)	22.57	34.7
B&H	18.42 (10.78)	20.54	19.0
Croatia	22.80 (10.07)	18.71	46.0
Kosovo	15.64 (11.78)	22.62	28.6
Montenegro	19.72 (9.58)	23.66	32.7
North Macedonia	19.01 (10.57)	20.95	37.7
Serbia	23.78 (8.82)	21.82	53.6

Note. M: Mean & SD: Standard deviation

Table 4. Correlation of PD of teachers in last two years with student achievements in B&H

Country ID-Numeric ISO code		Content	Pedagogy	Curriculum	Integrating technology	Problem solving skills	Assessment	Student needs
Mathematics sum	Pearson correlation	-.01	.02	.01	.00	-.03*	.01	-.02
	Sig. (2-tailed)	.53	.24	.70	.81	.02	.48	.22
	n	5,541	5,560	5,541	5,517	5,580	5,580	5,561
Science sum	Pearson correlation	-.03	.01	.01	-.01	-.04**	.02	-.02
	Sig. (2-tailed)	.07	.42	.39	.36	.00	.22	.20
	n	5,541	5,560	5,541	5,517	5,580	5,580	5,561

Note. **Correlation is significant at 0.01 level (2-tailed) & *Correlation is significant at 0.05 level (2-tailed)

We used the Teacher Questionnaire for this investigation. Teachers of the participating children completed the questionnaire. The purpose of this questionnaire is to gather information about the academic and professional backgrounds, classroom supplies, instructional strategies, and teaching attitudes of teachers who instruct pupils. It is predicted that this questionnaire will take teachers about thirty-five minutes to complete. **Table 1** shows the selected variables that we will observe in the context of the questionnaire for teachers.

The dependent variables in this research were the results of students' achievements in mathematics and science. The influence on the dependent variable is treated by five variables from mathematics and science that will show the influence on the dependent variable and whether they have a statistically significant influence according to the results achieved by the students in these two areas.

RESULTS

For data processing, we used IDB Analyzer and SPSS 25.

Table 2 shows the results achieved by students in mathematics and science as dependent variables. The aim of the research is to see how much influence independent variables have on the achievements of students in the countries of the Western Balkans and Croatia, with a special emphasis on the results achieved in B&H. **Table 2** shows that only Serbia and Croatia achieved an average above TIMSS scale average (500). Compared to Kosovo, B&H has better results in mathematics and science, and compared to North Macedonia, it has a better result only in science. Many factors observed in TIMSS survey could show that B&H has many shortcomings in the current education system.

Table 3 shows that Croatia and Serbia have teachers with the most years of teaching experience, while Kosovo and B&H have a lower average. Considering that Serbia and Croatia have better results in terms of student achievement in class, it can be assumed that this variable has an impact on the learning outcomes. In all the countries that are analyzed in this research, the number of students in the class is approximately the same, which means that it is not necessary to investigate the impact of this variable on the learning outcomes.

In Croatia and Serbia, we have a higher percentage of teachers over age of 49 than in other countries. This may indicate the quality and competence of teachers who have completed their education in different systems, as well as importance of teaching experience. It is also evident that these two countries have a greater number of teachers who have more years in teaching. It can be seen that teachers in countries whose students have higher achievements are well aware of importance of PD, because a higher percentage answered that they needed PD.

Table 4 shows the results of the correlation analysis for all the factors of PD that was carried out until the time of testing in the countries of the Western Balkans for B&H. The summary results for each observed factor and its influence on the achieved results of students in mathematics and science are shown. Compared to the other countries of the Western Balkans, B&H developed and implemented the strategy of professional training of classroom teachers in the field of mathematics and science the least.

Table 5. Teachers' answers by countries

	Number of cases	G08	M09A	M09B	S08A	S08B
		Mean (standard deviation)				
Albania	4,370	1.18 (.40)	1.54 (.49)	1.40 (.48)	1.58 (.48)	1.42 (.49)
B&H	5,528	1.30 (.52)	1.83 (.37)	1.53 (.47)	1.87 (.34)	1.52 (.48)
Croatia	3,716	1.38 (.57)	1.58 (.49)	1.24 (.40)	1.61 (.48)	1.25 (.41)
Kosovo	4,390	1.13 (.34)	1.74 (.43)	1.18 (.39)	1.80 (.39)	1.15 (.35)
Montenegro	4,981	1.35 (.55)	1.73 (.44)	1.40 (.48)	1.75 (.43)	1.37 (.47)
North Macedonia	3,323	1.36 (.51)	1.70 (.45)	1.52 (.49)	1.79 (.41)	1.49 (.50)
Serbia	4,377	1.36 (.53)	1.64 (.47)	1.60 (.47)	1.73 (.43)	1.59 (.48)

Table 6. Correlation between student achievement & teacher's answers to questions (G08, M09, & S08)

Plausible value mathematics	Correlation between student achievement & teacher's answers to questions	G08	M09	S08
Albania	Correlation coefficient	-,03	.10	.05
	Sig. (1-tailed)	.06	.03	.05
B&H	Correlation coefficient	.03	.09	.02
	Sig. (1-tailed)	.07	.03	.15
Croatia	Correlation coefficient	.16	.11	.08
	Sig. (1-tailed)	.04	.10	.05
Kosovo	Correlation coefficient	.02	.07	.01
	Sig. (1-tailed)	.13	.05	.18
Montenegro	Correlation coefficient	.03	.08	.01
	Sig. (1-tailed)	.16	.05	.18
North Macedonia	Correlation coefficient	.03	.06	.03
	Sig. (1-tailed)	.07	.04	.10
Serbia	Correlation coefficient	.15	.10	.07
	Sig. (1-tailed)	.04	.03	.07

This is also visible in the Pearson correlation values for B&H (<50%). The same results were recorded for Montenegro. That is why there is a significance that is not statistically significant in B&H except for problem-solving skills (Sig.<0.05).

When observing the countries that achieved results above the average in mathematics and science, it is evident that many factors of PD have a Pearson correlation (>50%) and that the influence on the achieved results is statistically significant (<0.05).

It is precisely the lack of PD for teachers that is one of the reasons that B&H has lower results and as a priority, more work needs to be done on the training of classroom teachers when it comes to all the skills they should possess. Professional training of teachers must be one of the main tasks of the development of the education strategy.

If the answers of teachers in B&H for variables M09A and S08A are compared with the answers of teachers from other countries (**Table 5**), it can be seen that the mean values (1.83 and 1.87) are the highest. This means that in B&H, the need for professional training is most pronounced. If we observe their answers to the questions defined by variables M09B and S08B, which are related to their attitudes about the need for PD, we can conclude that the answers are worrying with values of 1.53 for mathematics and 1.52 for science. Although in Croatia the students' achievements are better than in B&H, it is interesting that their teachers point out that they have an increased need for professional training (mean value is 1.24).

Teachers from all countries answer affirmatively to the questions related to the variable G08, but it is still evident that the answers of teachers in B&H are more affirmative than in Serbia and Croatia, i.e., where students' achievements are better, teachers are more likely to choose an answer other than one.

Therefore, as indicated in **Table 5**, it is evident that the results in Albania, Croatia, and Serbia are better compared to B&H. When the variables from **Table 5** are considered, which speak about teachers' attitudes about their vocation and PD, it can be concluded that the observed variables are important for the achievement of results in mathematics and science. The professional training covered in the survey questionnaire has an impact on the results and it is evident that in these countries we have a systematic approach regarding the professional training of teachers. Statistical significance cannot be determined from **Table 5**, and therefore a correlation analysis was performed to determine the mutual dependence of the results achieved by the students and the displayed variables, and the results are shown in **Table 6**.

In **Table 5** we saw the mean value of the teacher's answer to the question: "*How often do you feel the following way about being a teacher?*" with five sub-questions, and in **Table 6** we see that this variable (G08) has a statistically significant influence on the achievements of students in Croatia and Serbia ($p<0.05$), while in B&H no statistically significant connection with learning achievements was observed.

In Albania, B&H, and North Macedonia, there is a statistically significant influence on the results, that is, on the achievements of students when we look at the variable M09. This is an indicator that in the educational system, teachers do not have enough methodical knowledge and PD on the topic of applying problem-solving tasks. When it comes to the correlation of student achievements and teachers' responses to the topic of PD in the last two years, no statistically significant relationship was observed.

From all of the above, we can conclude that B&H should approach the reform of the education system and a planned approach to the education of current and future teachers in order to improve teachers' attitudes about their vocation.

DISCUSSION & CONCLUSIONS

Croatia and Serbia have a higher average than TIMSS scale average in terms of student achievement, with better results in mathematics and science compared to other country in this study. TIMSS survey reveals several shortcomings in the current education system in B&H Croatia and Serbia have more experienced teachers, which may impact learning outcomes. The research also reveals a higher percentage of teachers over 49 in Croatia and Serbia, indicating the quality and competence of teachers with different education systems and the importance of teaching experience. Teachers in countries with higher student achievements are more aware of the importance of PD, as a higher percentage of them believe they need it. The study reveals that B&H has the least PD strategy for teachers in mathematics and science compared to other Western Balkan countries and Croatia, which is evident in the Pearson correlation values (<50%). However, countries with higher results in these areas show significant Pearson correlations (>50%) for many PD factors. The lack of TPD is a contributing factor to lower results in B&H. The study found that teachers' attitudes towards being teachers have a significant influence on students' achievements in Croatia and Serbia, but no significant connection was observed in B&H. In Albania, B&H, and North Macedonia, there is a significant influence on student achievements in mathematics due to inadequate methodical knowledge and PD in problem-solving tasks in the field of math. However, no significant relationship was observed between student achievements and teachers' responses to PD in science. The study's conclusions highlight the need of more investigation and focused interventions to comprehend and address the various factors influencing student achievement in B&H. These include the necessity of improving teacher effectiveness and PD.

Results indicate that in the countries covered by this study, the factor "problem-solving" has a statistically significant impact on student outcomes. For this segment of mathematics and science instruction, teachers are required to have adequate competencies in solving problem tasks and fostering logical reasoning skills in students. From this, we can infer that teachers need professional support in developing their own approaches to fostering logical reasoning in students.

Teacher attitudes show that there is no strategic planning of their needs (**Table 6**), and countries that better plan teacher needs have better student outcomes. In addition to the factor "teacher attitudes toward their job," which has a statistically significant impact on the obtained results. Countries that have achieved better student outcomes compared to B&H have universities ranked ahead of those in B&H on the Webometrics list (webometrics.info). From this, we deduce that besides all factors influencing student outcomes in TIMSS study, the quality of higher education also plays a significant role, which should also be addressed, and guidelines should be provided in future research.

The findings of such a research may help mathematics and science educators and policy makers to identify and nurture the strong learning prerequisites of early adolescents in different education systems.

Limitations, Future Research, & Final Notes

TIMSS 2019 survey in B&H was conducted only among students in the 4th grade. A more complete picture would be obtained if we had data for B&H for the 8th grade, however, students of that age group were not tested within the 2019 team.

This year, on March 7th, the Agency for Pre-Primary, Primary, and Secondary Education (APOSO) and representatives from 60 countries attended the 6th TIMSS 2023 NRC meeting in Prague to determine scoring rules and organize training for scorers. They received a scoring guide, practical exercises, and materials for scoring procedures. B&H also attended regional representatives' meetings. The meeting gathered representatives from Albania, B&H, Kosovo, Montenegro, North Macedonia, and Serbia to discuss the implementation of TIMSS 2023 survey, address issues, and exchange experiences. IEA provided support, and all the participating countries agreed to share materials and help (APOSO, 2023).

Author contributions: NB: idea, concept & design, methodology, drafting manuscript, & data interpretation. **NB:** technical details, experiment, data acquisition, data analysis, & data interpretation; **IN:** administration, supervision, final approval, & critical revision of manuscript. All authors approved the final version of the article.

Author Notes: Western Balkans is a political neologism coined to refer to Albania and the territory of the former Yugoslavia, except Slovenia, since the early 1990s. The institutions of the European Union have generally used the term "Western Balkans" to mean the Balkan area that includes countries that are not members of the European Union, while others refer to the geographical aspects. Croatia, considered a part of the Western Balkans, joined the European Union in July 2013.

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