

ANALYSIS OF LEARNING IN ARMENIA

Table of Contents

List of figures, tables, boxes, and maps	2
Acknowledgments	3
Abbreviations	4
1. Introduction	5
2. Background	7
2.1 Structure of General Education	7
2.2 Education Expenditure.....	8
3. Data and Methodology	11
4. Quality of Learning in Armenia	12
4.1 Student Performance across population groups	14
4.2. Student Performance across Regions	16
5. Factors associated with learning outcomes in Armenia	19
5.1 Variance explained by students, schools and regions	19
5.2 School-Level Factors and Student Performance	20
6. Policy Recommendations.....	25
ANNEX.....	29

List of figures, tables, boxes, and maps

FIGURES

FIGURE 1.	GROSS ENROLLMENT RATE, 2017 OR LATEST AVAILABLE DATA	8
FIGURE 2.	INITIAL GOVERNMENT FUNDING PER STUDENT AS A PERCENTAGE OF GDP PER CAPITA, 2017 OR LATEST AVAILABLE DATA	8
FIGURE 3.	STUDENT-TEACHER RATIO, 2018 OR LATEST AVAILABLE DATA	9
FIGURE 4.	LEARNING POVERTY IN ARMENIA AND COMPARATORS, 2016 OR LATEST AVAILABLE DATA	13
FIGURE 5.	TIMSS MATH AND SCIENCE AVERAGE SCORE FOR ARMENIA	13
FIGURE 6.	TIMSS MATH SCORES IN 4TH GRADE BY PERCENTILE, 2011, 2015 AND 2019	14
FIGURE 7.	TIMSS 4TH GRADE MATH SCORE DIFFERENCES BY GENDER, LOCATION, AND SOCIOECONOMIC LEVEL, 2019	16
FIGURE 8.	VARIATION IN GRADE 4 MATH SCORES ATTRIBUTABLE TO SCHOOLS IN ARMENIA AND COMPARATOR COUNTRIES, TIMSS 2011, 2015 AND 2019	19
FIGURES 9.	PERCENTAGE OF VARIANCE IN MATH EXPLAINED BY SCHOOLS AND PERCENTAGE OF LOW LEARNERS, 2019	20
FIGURE 10.	DISTRIBUTION OF AVERAGE TEACH SCORES BY AREA AND OVERALL	22
FIGURE 11.	DISTRIBUTION OF AVERAGE TEACH SCORES BY ELEMENT.....	22
FIGURE 12.	CONDITION OF THE SCHOOL BUILDING BY SCHOOL LOCATION, 2019	23
FIGURE 13.	PERCENTAGE OF LOW LEARNERS AND PERCENTAGE OF SCHOOLS WITH SATISFACTORY CONDITION, 2019.....	24

TABLES

TABLE 1.	PERCENTAGE OF LOW LEARNERS IN 9TH GRADE BY SUBJECT AREAS IN YEREVAN, 2019.....	18
TABLE 2.	PERCENTAGE OF LOW LEARNERS BY SUBJECT, 2019	18

BOXES

BOX 1.	MAIN ROLES OF CENTRAL AND REGIONAL BODIES IN THE FIELD OF GENERAL EDUCATION.....	10
BOX 2.	COVID-19 PANDEMIC'S IMPACT ON LEARNING	15
BOX 3.	TEACH ARMENIA FINDINGS.....	22

MAPS

MAP 1.	PERCENTAGE OF LOW LEARNERS IN 9TH GRADE, AVERAGE ACROSS ALL SUBJECT AREAS, 2019	16-17
MAP 2.	DISTRICT VARIATIONS ACROSS YEREVAN IN PERCENTAGE OF LOW LEARNERS, GRADE 9, MATHEMATICS, 2019	17

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Abbreviations

ATC	Assessment and Testing Center
CIS	Commonwealth of Independent States
ECA	European and Central Asia
EU	The European Union
GDP	Gross Domestic Product
GLAD	Global Learning Assessment Database
HCI	Human Capital Index
ICT	Information and Communication Technologies
IEA	The International Association for the Evaluation of Educational Achievement
LAYS	Learning-adjusted Years of Schooling
LT	Long-term
MoESCS	The Ministry of Science, Education, Culture, and Sport
NaCET	The National Center for Education Technology
NLSA	National large-scale standardized assessment
OECD	The Organization for Economic Co-operation and Development
PISA	Programme for International Student Assessment
READ	Russia Education Aid for Development
ST	Short-term
STEM	Science, Technology, Engineering and Math
STR	Student Teacher Ratio
TIMSS	Trends in International Mathematics and Science Study
UIS	The UNESCO Institute for Statistics
UNESCO	The United Nations Educational, Scientific, and Cultural Organization

1. Introduction

Following several years of high growth and poverty reduction, Armenia was hit hard by the crises of the last decade, and progress on social and economic development slowed. Between 2004 and 2008, poverty fell dramatically—the share of poor people (those with incomes under the national upper poverty line) dropped from 54 percent to 27 percent. However, the effect of the 2008 crisis on the Armenian population was deeper than in other countries in Europe and Central Asia (ECA). Armenia’s economic performance recovered during 2017–2019, but the global economic crisis of 2020 contracted Armenia’s economy by 7.6 percent.¹

The education sector in Armenia has challenges with low learning levels and additional pressures imposed by the COVID-19 pandemic. The World Bank’s human capital index (HCI) shows that a child who starts school at age four in Armenia can expect to complete 11.3 years of schooling by the age of 18. An analysis of learning outcomes factoring in what children actually learn, however, shows that expected years of schooling equate to only eight years. This results in a learning gap of 3.3 years. The COVID-19 pandemic may have exerted additional hurdles to improve learning outcomes. Due to the pandemic, Armenia risks losing 0.3 learning-adjusted year of schooling as calculated by World Bank simulations. This translates to an average annual earning loss of US\$6,457 per student. Additionally, around 26 percent of children at late primary-school age in Armenia are not proficient in reading.² This, also known as learning poverty, means being unable to read and understand a short, age-appropriate text by age 10. Learning poverty in Armenia is 17.2 percentage points worse than the average for the ECA region (8.9 percent on average).

Firms face problems in recruiting and retaining workers with the required skills, and they see the lack of workforce skills as a major obstacle to their activities. The extent to which education provides practical skills and updated knowledge has emerged as a problem. In addition to technical skills, young workers lack generic skills related to problem solving, critical and creative thinking, teamwork, languages, and leadership (Rutkowski, 2013). While employers report skill constraints, a large share of the labor force is unemployed or inactive. Alleviating the skill constraints of Armenia’s firms is crucial to boost productivity and competitiveness (World Bank, 2018).

Armenia does not rank high in the HCI, which is largely attributable to its challenges with access to and quality of education services and this has important implications on productivity levels in the country. HCI suggests that a child born in Armenia today will be only 58 percent as productive when (s)he grows up as (s)he could have been if she enjoyed complete education and full health.³ This is lower than the average for both the ECA region (69 percent) and upper middle-income countries of the Commonwealth of Independent States (CIS) (63 percent). Students from poor and rural families have lower future productivity, worse learning outcomes, and less expected years of schooling. Youth in Armenia do not attain their full development potential because of inadequate access to social services and poor-quality education and health systems.⁴

¹ World Bank, World Development Indicators (2021).

² The learning poverty number for Armenia is calculated using the Global Learning Assessment Database (GLAD) harmonization based on TIMSS. The Minimum Proficiency Level (MPL) threshold used was low level (400 points). For more details, please consult the GLAD and learning poverty repositories in GitHub.

³ Between 2018 and 2020, the HCI value for Armenia has remained almost unchanged, but learning outcomes have improved over time.

⁴ Human Development Enhancement Program, *Sector Assessment (Summary): Education and Health* (n.d), <https://www.adb.org/sites/default/files/linked-documents/51129-002-ssa.pdf>.

Quality education provision and skills development are priorities for the government. Quality of education is a key challenge causing a gap between the formal qualifications of graduates and the skills sought by employers. This mismatch is potentially hampering economic growth, leading to underutilized human capital for the country, and slowing labor market demand and overall productivity. Learning gaps are a significant issue with implications not only on the education systems of countries, but also for the well-being and productivity of individuals over a lifetime, especially in countries with an ageing population as Armenia. The population is ageing rapidly, with the number of elderly people (age 65 and above) increasing and the number of children and youth decreasing.⁵ Ensuring that students learn necessary skills at school is the most effective way to help them build a fulfilling future and become competent participants of society that contribute to their country's economy. An education system that can promote learning has the potential to improve outcomes around employment, productivity, earnings, health, and poverty reduction. Having highly skilled human capital also galvanizes innovation, strengthens institutions, and encourages social cohesion.

The government sees the development of education and science as a priority through which to achieve sustainable and inclusive development. This direction is reflected in the strategic objectives of: (i) enhancing human capital through better access to quality services including healthcare, education, culture, and basic infrastructure and (ii) expanding employment through high-productivity and decently paid jobs. Armenia is also currently embarking on an ambitious curriculum reform to address the learning and education quality challenges in line with the government goals listed above. Through new reforms, Armenia is looking to transition into a competency-based education system with more inquiry-based, student-centered, and outcome-oriented teaching, learning, and assessment. This is accompanied by measures aimed at improving teachers' policies and the necessary infrastructure while strengthening the education-science-labor market link since there is a pressing need to improve skills and labor productivity in Armenia.

The main motivation of the report is to analyze critical human capital dynamics that play into labor productivity, especially that of learning and its determinants. Armenia's performance in international assessments have been relatively below average but slightly improving over the last decade. This report is also exploring the overall performance of Armenia in terms of learning, where any improvements have occurred and whether they are timely and sufficient in ensuring sustainable growth and productivity. The report will first look at the background of the education system in Armenia including education expenditures and explain the methodology of the study; then analyze the quality of education; focus on differences in student performance across regions followed by factors associated with overall learning outcomes. Finally, it will present recommended ways forward based on the analysis.

⁵ The overall population in Armenia declined from 3.07 million in 2000 to 2.88 million in 2011, mainly due to out-migration, and increased slightly to about 2.95 million in 2019.

2. Background

This section provides an overview of features of the Armenian education system that influence the acquisition of foundational skills, such as the structure of general education, education expenditure and education governance. The section concludes with a brief summary of the methodology used for the analysis.

2.1 Structure of General Education

Armenia’s education system has 12 years of compulsory education. This includes primary (grades 1–4), basic school (grades 5–9), and high school (grades 10–12), delivered in 1,400 schools. The country has a student population close to 563,000 in general and professional schools. About 97 percent of schools are public. As of 2017, Armenia had 808 community, 10 public, and 50 private preschool education facilities.⁶

Access to both pre-primary and higher education is low and inequitable. The net attendance rates in pre-primary education suggest that only 35 percent of 3- to 5-year-old children attended this level in 2018 (UNESCO UIS 2020). The gross enrollment rate for children aged 0–5 years was 30.9 percent—36.6 percent in urban communities and 20.6 percent in rural communities. The Integrated Living Conditions Survey 2017 noted that the main reasons for non-attendance was access and financial constraints.⁷ Enrollment rates in tertiary education are similar to those of other ECA countries with the same level of development, but below to that of advanced economies. The gross enrollment rate for tertiary education is 56 percent, with more female students (62 percent) enrolled compared to male students (52 percent). Students from better-off households are more likely to attend tertiary level institutions (53 percent) compared to 29 percent for worse-off households and 0 percent for households living in extreme poverty.⁸

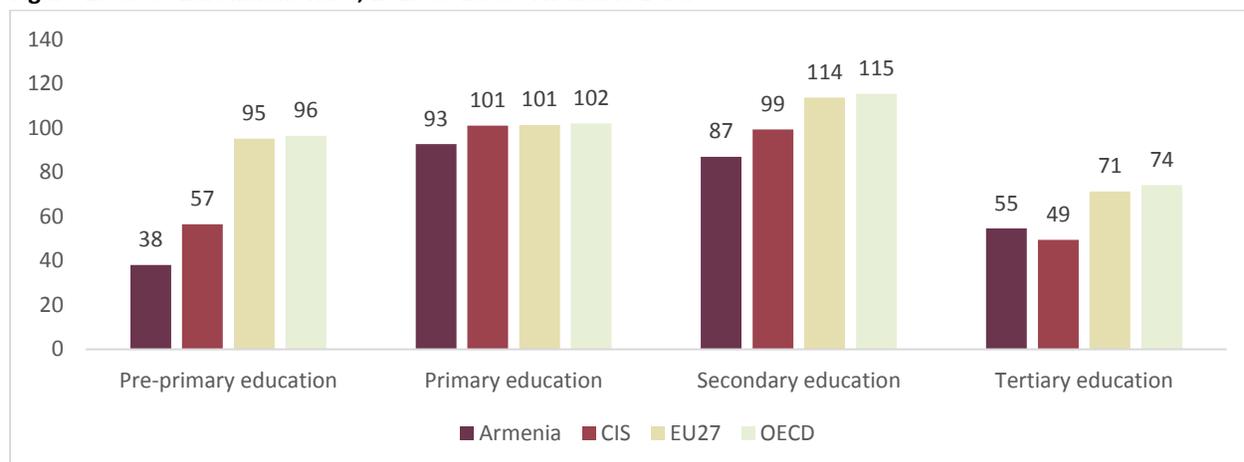
Enrollment rates suggest that in Armenia, access to primary and secondary education is high, but universal education is not achieved, especially at the high school level. As of 2019, gross enrollment was high at primary (91.3 percent) and secondary (90.1 percent) levels but dropped to 65.5 percent specifically at the high school level. Armenia’s enrollment rates are lower at each level of education compared to the European Union (EU) and Organisation for Economic Co-operation and Development (OECD) averages (figure 1).

⁶ Statistical Committee of the Republic of Armenia (Armstat) and World Bank, *Social Snapshot and Poverty in Armenia: Statistical and Analytical Report* (Yerevan, 2018).

⁷ Armstat. “Household’s Integrated Living Conditions Survey”, *Anonymized Microdata Database (by Households)* (2017). <https://www.armstat.am/en/?nid=205>.

⁸ Ibid.

Figure 1. Gross Enrollment Rate, 2017 or Latest Available Data

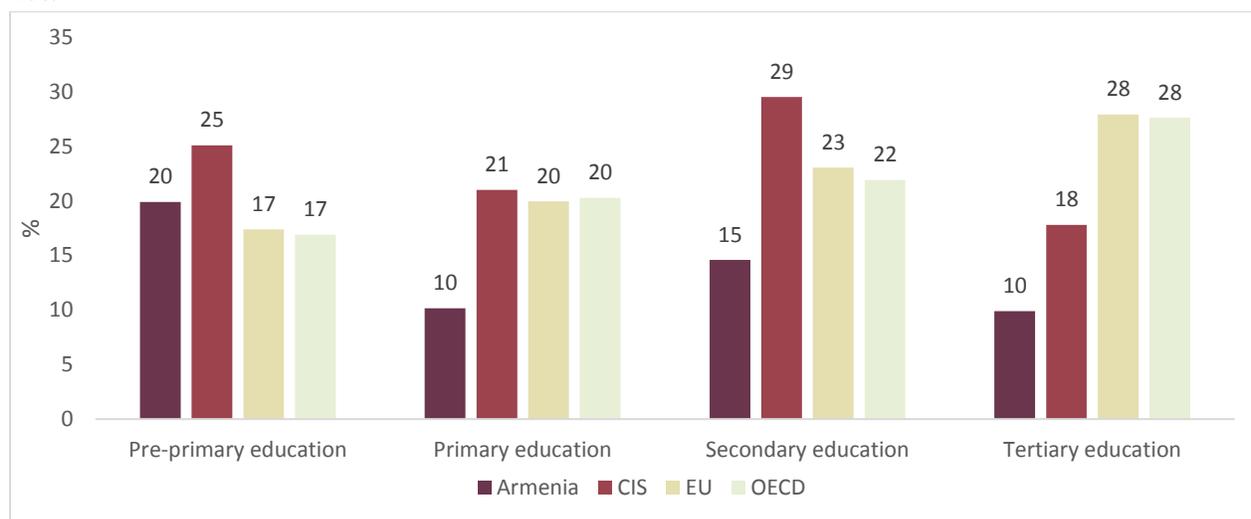


Source: UNESCO UIS 2020.

2.2 Education Expenditure

Government expenditure on education is relatively low. In 2017, the government expenditure on education was only 2.7 percent as a percentage of GDP, which is significantly below the recommended expenditure of at least 4-6 percent of GDP.⁹ The per-student government expenditure on primary and tertiary education as a share of the GDP per capita is half of that of the benchmark group of countries (figure 2). In secondary education, the per-student expenditure represents 15 percent of the GDP per capita, still below comparators. Ensuring adequate levels of public expenditure on education provides the basis to expand educational opportunities, and in turn, positively impact long-term economic development.

Figure 2. Initial Government Funding Per Student as A Percentage of GDP Per Capita, 2017 or Latest Available Data



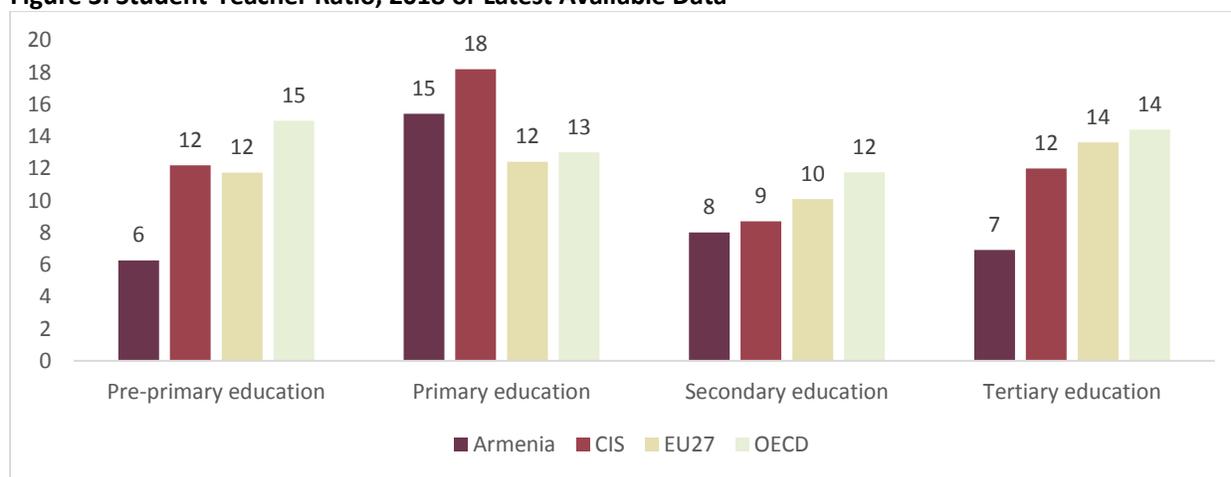
Source: UNESCO UIS 2020.

⁹ According to The Third International Conference on Financing for Development (in Addis Ababa, July 2015).

Expenditure composition leaves little room for investing in core services to improve learning. Capital expenses are high and the expenditure on recurrent expenses, other than staff compensation, represents 15 percent of the total expenditure, as compared to 23 percent in OECD and EU countries, and 25 percent in CIS countries. It suggests that Armenia allocates proportionally less resources towards critical services to support learning, such as schoolbooks and teaching materials, ancillary services (food, transport, administration), and other support activities.

The low student-to-teacher ratio (STR), especially in pre-primary and secondary education, and the comparable share of education expenditure devoted to staff compensation suggests low teacher salaries. In 2018, STRs were low in pre-primary and secondary education. It was only 6 students per teacher in pre-primary education, much lower than in CIS countries (10 students per teacher) and OECD/EU countries (15 students per teacher). In secondary education, the STR was only 8 students per teacher, while it was 13 in OECD/EU and 18 in CIS countries (figure 3). Meanwhile, the expenditure on staff compensation (teaching and non-teaching staff) accounts for about 73 percent of the total education expenditure, only slightly above that of regional peers (70 in both CIS and OECD) suggesting that teacher salaries are relatively low.¹⁰ Overall, the average teacher salary represents 63 percent of the GDP per-capita, while in OECD countries, the starting teacher salary represents around 90 percent.¹¹

Figure 3. Student-Teacher Ratio, 2018 or Latest Available Data



Source: UNESCO UIS 2020.

Education expenditure is also decentralized. Armenia is composed of ten *marzes* (regions) and Yerevan city. Marz governors implement the regional policy of the government. They coordinate the activities of local branches of the executive authority, except as otherwise specified by law. Financing for schools under marzes accounted for about 54 percent of the sector budget in 2018, which was then transferred to marzes for the distribution to schools. Regions oversee about 34.1 percent of the expenditure, while the national bodies oversee the remaining 11.9 percent. Roles of the Ministry of Education, Science, Culture and Sports (MoESCS) and the marzes in general education are described in box 2.

Box 1. Main Roles of Central and Regional Bodies in the Field of General Education

¹⁰ UNESCO UIS.

¹¹ The average teacher salary in Armenia was extracted from the Teacher Survey Questionnaire.

Ministry of Education, Science, Culture and Sport

1. To develop, approve and implement state programmes of general education
2. To give consent, as prescribed by law, for the establishment of other types of nonstate education institutions
3. To establish the time periods of and the procedure for holding state final examinations
4. To establish the procedure for enrolling school-age children in general education
5. To carry out the testing or attestation of mastering the educational programmes by learners, as well as the procedure for grade-completion and graduation of a learner
6. To ensure the development, expertise and publishing of the forms of syllabuses, textbooks, manuals and school registers
7. To develop and approve the model procedure for calling competition for the vacant position of a teacher of an educational institution
8. To define the requirements to the content of training of pedagogical workers and director; to offer training programmes for teachers
9. To exercise supervision over and state inspection of educational institutions and carry out assessment of the activities thereof
10. To recommend for allocation, on a competitive basis, of additional targeted financing to an educational institution from the State Budget

Territorial Administration Body and of the Mayor of Yerevan

1. To ensure the implementation of state policy in the marzes and in Yerevan
2. To supervise schools' use of the education legislation as well as the implementation of educational programs in line with the state standard for general education
3. To coordinate record keeping of school-age children; to ensure their enrollment in educational institutions
4. To ensure the construction, use, and maintenance of buildings is properly transferred to educational institutions under the law
5. To hire and manage the contract of the school principals as prescribed by the Government of the Republic of Armenia
6. To assist in the process of evaluating learners and graduates of educational institutions and to assist in the process of teacher attestation
7. To exercise other powers established by laws and other legal acts of the Republic of Armenia. General law on education also prescribes competences in the education sector for local self-government bodies.

Source: Law of General Education, 2015.

The governance style of education finances may be undermining resource efficiency. The structural arrangement of education finance in Armenia complicates the delegation of authority, responsibility, and accountability by the MoESCS towards schools, making it difficult to implement policies and monitor school performance. For example, only high schools are directly under the jurisdiction of the MoESCS; all other schools are under marzes, some of which report to the Ministry of Territorial Administration and Infrastructure.¹² As a result of all these factors, Armenia would greatly benefit from an in-depth analysis of expenditure patterns to improve efficiency, equity, and effectiveness of public spending on education.

¹² Human Development Enhancement Program, *Sector Assessment (Summary): Education and Health*.

3. Data and Methodology

This study used data from IEA's Trends in International Mathematics and Science Study (TIMSS) and the National Center for Education Technology (NaCET) - the agency of the MoESCS responsible for the management of educational administrative and performance data. TIMSS is an international large-scale achievement study in mathematics and science for grades 4 and 8 conducted since 1995 in 4-year intervals. The study conducts a two-stage stratified sample. In the first stage, schools are sampled by probability proportional to size. In the second state, grade 4 mathematics classes are selected in each school in an equal probability sample with all the students within each class selected. Sampling weights are used to account for difference in the sampling of subgroups and to adjust for nonresponse. In each country, in addition to the assessments conducted among students, additional surveys were conducted to collect information on their individual and household characteristics. Questionnaires specifically design for teachers were applied to gather information on their individual background and the work experience in the school. Similar instruments were applied to the principals to collect information on the school characteristics. Armenia has participated in TIMSS since 2003 up to 2019, the most recent round. In 2019, Armenian participation were limited to the assessments conducted in grade 4. The overall sample consisted of 5,399 students, 216 classes, 212 teachers and 150 schools. Some comparative analyses were conducted in this report using the samples of Bulgaria, Croatia, Georgia, Kazakhstan, Serbia and Russia. The sample sizes are reported in Table A1.

NaCET provided several three sources of data. First is the data on students' examinations which are used to assess learning and make decisions about student progress. These examinations are conducted by the Assessment and Testing Center (ATC) at the end of the academic year in grades 4, 9, and 12. NaCET provided examination score data by subject, aggregated at school level (counts of number of students receiving a certain score) for grade 4. In grades 9 and 12, the examination scores provided were at student level for different subjects. In the examinations, students received scores on a scale from 0 to 20. Due to privacy/security concerns, no student background information (sex, age or socioeconomic variables) was provided. Datasets provided are for the years 2015 to 2019 and geographic coverage include schools in all regions (marzes) with coverage (number of schools reported) improving in recent years. At the time of writing this report, a national large-scale Standardized Assessment (NLSA) to determine student performance is not available. The last NLSA was conducted in 2010 in Armenian language and literature and Armenian history. The second source of data is a teachers survey conducted in all schools across Armenia by NaCET in December 2019. Teachers' characteristics collected in the survey were gender, date of birth, area of study, year of graduation, education institutional graduated from, training, position title, workload measure, date appointed as teacher, grades taught, subjects taught, salary and bonuses. School identifiers include the marz the school is located, community, type of school (primary, basic, high, and secondary school). The final source of data was dataset on school quality/school infrastructure prepared by NaCET in December 2020. The dataset includes a subset of school characteristics: location of the school (marz, region, community and area classification as urban (town) or rural (village), grades and education levels coverage provide by the school, legal status (public, private), condition of the school building, access to services (water supply, sewage, power supply, gas supply, heating, hot water, landline phone, internet), number of classrooms per grade, enrollment per grade, and number of teachers (full-time, primary teachers, part-time).

Following several iterations, we constructed a dataset with 1229 schools, 31034 students tested in 2019. Due to lack of harmonized school id/school codes across datasets, merging required to use two common open text

fields: name of the region and name of the school. The analytical dataset consisted of 28995 students tested in mathematics grade 9 attending basic (grades 1-9) and secondary (grades 1-12) public schools (state-owned).

Analytical procedures

In this study we use a hierarchical multilevel analysis. A multilevel approach was adopted to capture the hierarchical structure of students nested within schools making it possible to investigate the association between measures at student level and school characteristics. The TIMSS 2019 data was analyzed with a two-level hierarchical linear model to study the relationship between the school variables and the grade 4 student mathematics achievements. To describe the relationship at level 1, the model includes student level variables, and at level 2, school level variables from both the teacher and the school questionnaires were included in the model. A description of the variables used in the model are provided in Table A2. Analyses are adjusted with the house weight at student level, a normalization of the total student weight so the weighted sample corresponds to the actual sample size in each education system. The national examinations also were analyzed following a multilevel hierarchical linear modelling approach (students nested in schools), however the results of the analysis are limited to the relationship of school characteristics to students performance in the exams due to the no availability of students variables. Variables used in the analysis are reported in Table A3.

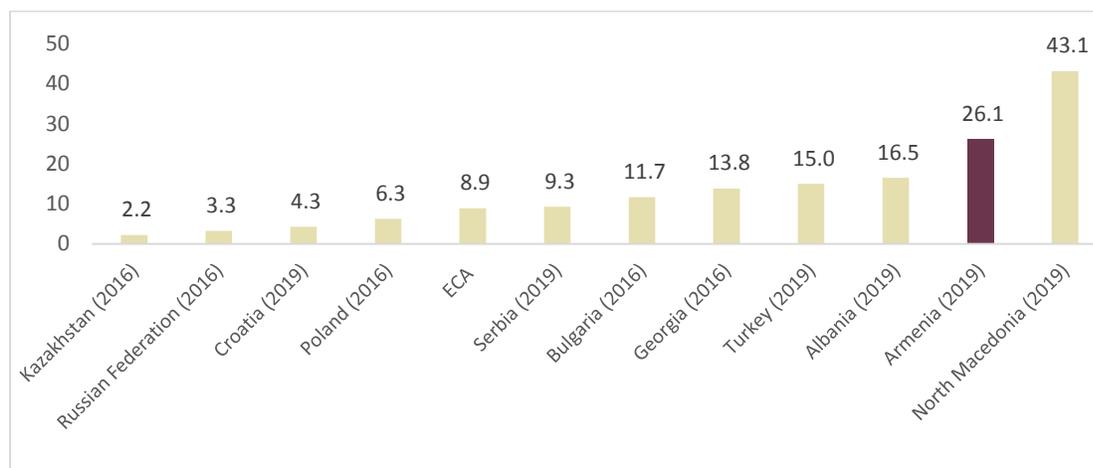
The analyses were conducted in two steps. First the variance between and within schools in relations to mathematics achievement (TIMSS scores and Examinations scores) was estimated using a null model with no predictors. This model allows to estimate the variance attributed to each level of analysis. Second, the model was adjusted by introducing student-level (only for TIMSS), and school level variables. The analysis of the National Examinations datasets was conducted with all the schools, and for three separate samples based on location of the schools, schools in Yerevan, schools in urban areas, and schools in rural areas.

4. Quality of Learning in Armenia

More than a quarter of children in Armenia are not proficient in reading, but this share has been declining. Around 26 percent of children at late primary-school age are not proficient in reading.¹³ This, also classified as learning poverty, means being unable to read and understand a short, age-appropriate text by age 10. Learning poverty in Armenia is 17.2 percentage points worse than the average for the ECA region (figure 4).

¹³ The learning poverty number for Armenia is calculated using the Global Learning Assessment Database (GLAD) harmonization based on TIMSS. The Minimum Proficiency Level (MPL) threshold used was low level (400 points). For more details, please consult the GLAD and learning poverty repositories in GitHub.

Figure 4. Learning Poverty in Armenia and Comparators, 2016 or Latest Available Data

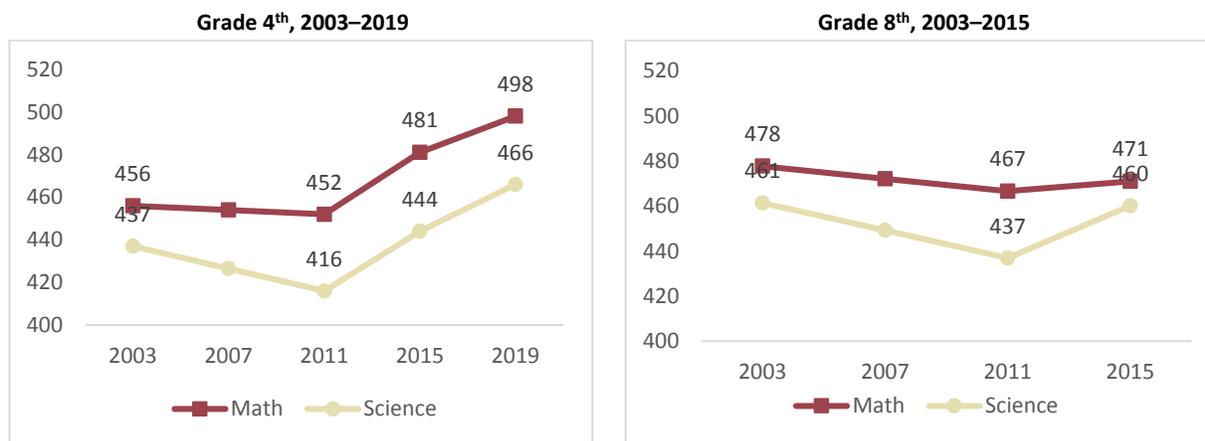


Source: Author’s calculations using World Bank data, 2016–2019.

Note: ECA average comprises latest available data between 2016–2019.

Armenian students’ learning levels in math and science have been improving since 2011, especially in early grades. A large-scale learning assessment, Trends in International Mathematics and Science Study (TIMSS) indicate that students are fast approaching the international benchmark levels in math and science, especially in 4th grade.¹⁴ The highest scores achieved by Armenia in both science and math in the 4th grade were recorded in 2019 (figure 5).

Figure 5. TIMSS Math and Science Average Score for Armenia



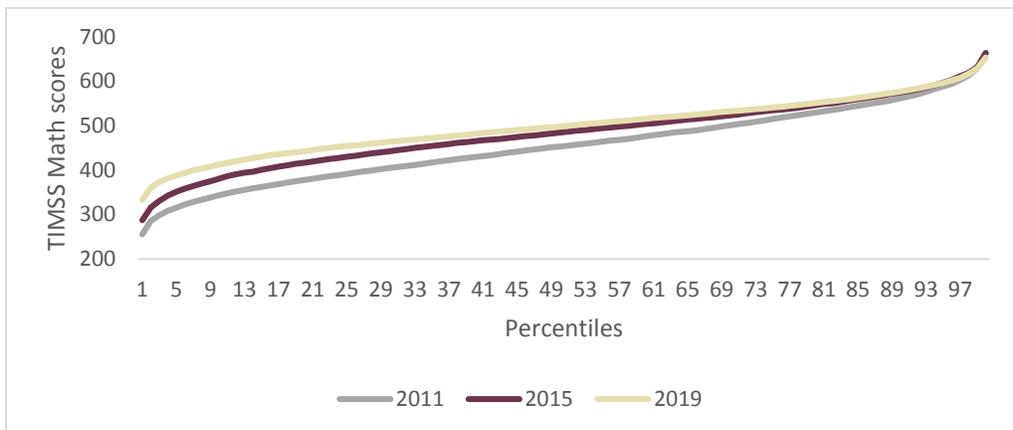
Source: Authors’ calculations using International Association for the Evaluation of Educational Achievement (IEA) data, 2004–2020. Note: TIMSS describes average ‘low’ scores as those between 400 and 475, average ‘intermediate’ scores as those between 475 and 550, and average ‘high’ scores as those above 550. The 2017 results are not comparable.

Students at the bottom levels of proficiency improved much more than top performers in 2015 and 2019. Those with the most improved performance have been the low performers, which is a very valuable achievement. Over the last two TIMSS rounds, math performance improved particularly among low

¹⁴ TIMSS has been conducted every four years since 1995 and has been a valuable tool for monitoring international trends in mathematics and science achievement at the fourth and eighth grades.

performers. Math scores for the 5 percent of students with the lowest proficiency levels increased 72 points, from 316 in 2011 to 388 in 2019. Overall, the improvement was higher between 2011 and 2015 than between 2015 and 2019. Top performers, however, have only slightly improved. This suggests that there is still a long way to go for students that are at higher levels of proficiency in math and science (figure 6). This is significant because the qualifications of students performing at a higher level is an important measure of skills relevance, future productivity, and the health/competitiveness of the labor market.

Figure 6. TIMSS Math Scores in 4th Grade by Percentile, 2011, 2015 and 2019



Source: Authors' calculations using IEA data, 2011–2019.

Armenia's significant improvement in TIMSS could be an indication that reform efforts of the last decade are paying off: Armenia has focused on assessment, supported in part by the Russia Education Aid for Development (READ) trust fund designed to enhance the country's capacity in student assessment. Specifically, the assessment capacity of the teaching workforce has been improved; the scope of the National Large-Scale Assessments (NLSA) was expanded; qualified assessment specialists were trained, and a sustainable cadre of local assessment specialists were developed.¹⁵ Participation in TIMSS assessments led to the introduction of national assessments of different subjects and had an impact on the process of education reform in Armenia. Due to the impact of TIMSS on pedagogical reforms in Armenia, the testing process is used widely for all subjects and includes several methods (e.g., continual assessments, final and unified exams, and national and classroom assessments). The MoESCS has based decisions regarding curricula, textbooks, methods of assessment, and continual assessment on TIMSS results.¹⁶ These changes together are believed to have made an impact on improved TIMSS results in Armenia over the last decade. It is important to note that Armenia still have not reached the international average (500) in science or math in either Grade 4 or 8 in TIMSS which signifies being able to apply and demonstrate basic knowledge of concepts and material. However, the improvement of learning, especially in the 4th grade, is a significant achievement that should be enhanced going forward.

4.1 Student Performance across population groups

Educational inequalities can have long-lasting effects on educational and economic opportunities. Students from lower socioeconomic backgrounds may perform worse in schools than students from higher

¹⁵ World Bank READ Trust Fund: Armenia Brief, 2020.

¹⁶ IEA, 2019.

socioeconomic backgrounds. They are also more likely to attain lower education levels and earn less in the labor market as adults. In addition, learning levels and quality in Armenia have likely been greatly impacted by the Covid-19 pandemic since it has caused widespread school closures and learning interruptions. Its estimated impact on learning in Armenia is observed in box 3.

Box 2. COVID-19 Pandemic's Impact on Learning

The COVID-19 pandemic caused school closures and learning disruptions at unprecedented levels. The World Bank built a simulation model to estimate the learning losses for each country as a result of COVID-19. Based on this model's assumptions that (i) schools were closed for ten and that (ii) remote teaching in the country is half as effective as face-to-face teaching, it is estimated that learning-adjusted years of schooling (LAYS) in general education in Armenia would fall from their baseline of 7.9 years to 7.6 years in an intermediate scenario. Hence, it is critical to mitigate the potential adverse impacts of COVID-19 by supporting teachers and students (Azevedo et al. 2020).

The effect of COVID-19 on education may lead to economic harm unless action to recover learning losses and protect human capital is effectively taken as soon as possible. Armenia, much like other countries, needs to protect education spending, ensure remediation to recover learning losses, and invest in building a resilient education system for other potential disruptions in the future. Supporting teachers is a big part of these efforts as well. The World Bank outlines three key principles in order to ensure teacher effectiveness and prepare teachers for challenges and disruptions related to COVID-19 both now and in the foreseeable future: (a) support teacher resilience (b) support teachers instructionally and (c) support teachers technologically.

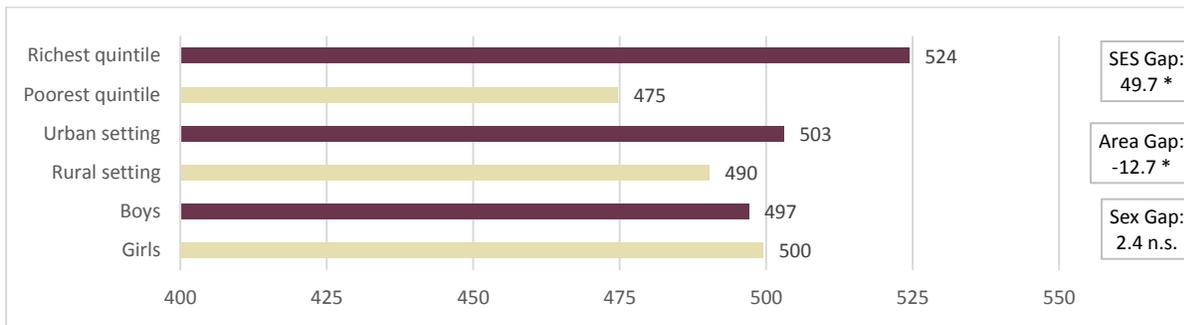
Source: Beteille et al (2020).

Note: LAYS is an indicator that takes into account the average years of schooling in general education while adjusting those years by the actual amount of learning that takes place.

There are learning gaps between different groups of students, particularly between the wealthiest and poorest quintiles. On an average, in Armenia, students from families with higher socioeconomic status have higher scores. In the TIMSS 2019 4th grade math assessment, there was a 50-point score difference between the students from the wealthiest and those from the poorest quintiles, which is equivalent to roughly two years of schooling (figure 7).¹⁷ This means students at the lowest socioeconomic level (bottom 20 percent) are, on an average, two years behind in learning compared to their peers from the top 20 percent. Even though there is a clear score advantage to being in an urban location (10-point score difference when compared with those in a rural setting), which is especially large and significant for 4th grade math scores, the largest and most significant score differentials are still between the socioeconomic levels of students. Although math scores do not reflect a difference between gender, girls perform slightly better in science than boys (471 vs 462 points, respectively) and learning poverty (measuring reading skills at the end of primary education) is higher for boys (28 percent) than girls (23.8 percent).

¹⁷ Thirty to forty points is roughly equivalent to one year of schooling.

Figure 7. TIMSS 4th Grade Math Score Differences by Gender, Location, and Socioeconomic Level, 2019



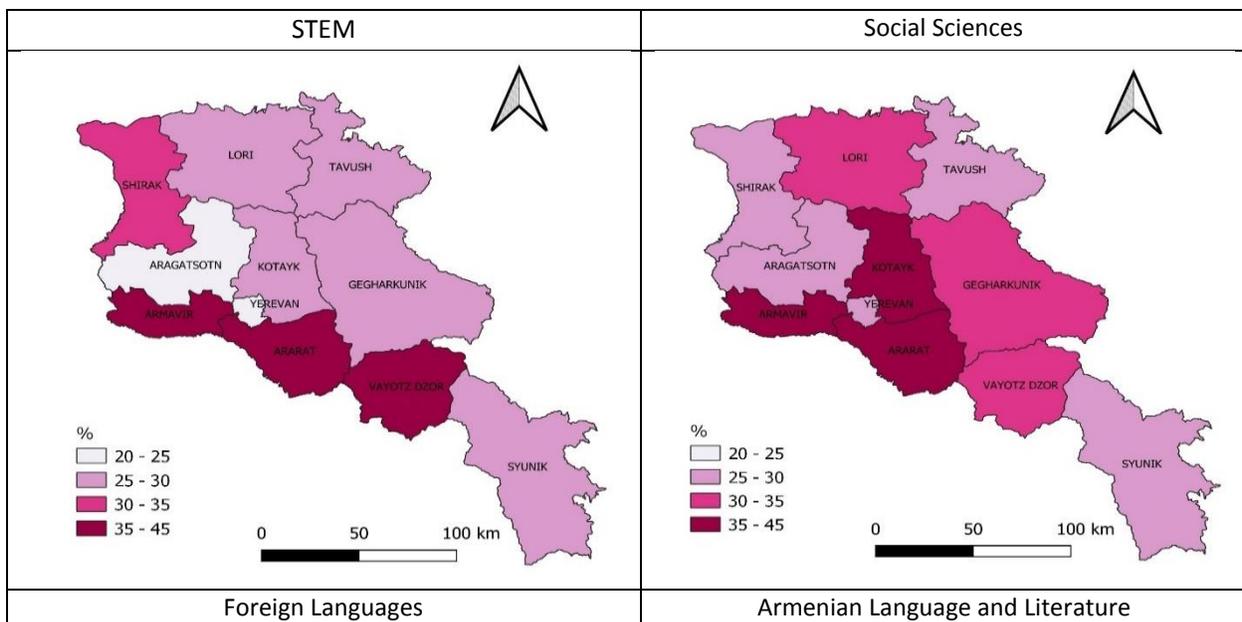
Source: Authors' calculations using IEA data, 2019.

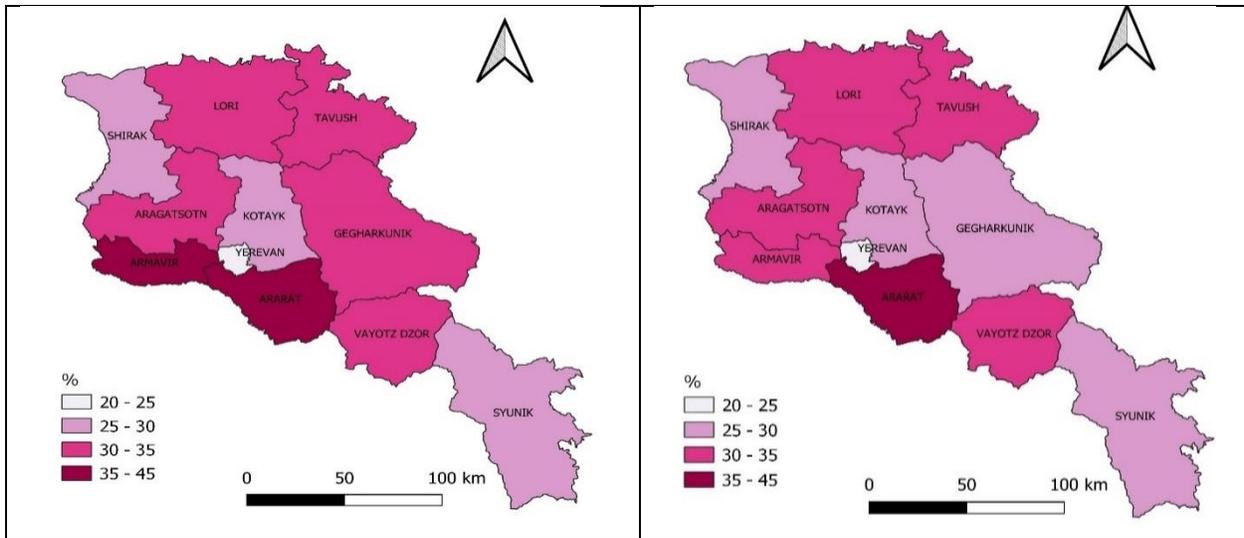
4.2. Student Performance across Regions

Low learners are widespread across all Armenian marzes (regions). The analysis of learning at the regional level is conducted based on the 9th grade national test for 2019. Low learners are defined as students who are in the lowest quartile of the national distribution of scores per year and subject –proficiency thresholds are not directly provided in the national exams. Across all regions and subject areas, low learners represent at least 20 percent of total students who took the 9th grade national examination in 2019 in each region (map 1). This suggests that in all regions, there is a need to ensure the acquisition of basic competencies and skills.

However, differences exist among the marzes with Yerevan having a consistently smaller proportion of low learners than the rest of the marzes. Yerevan has the lowest share of students among low learners. Other regions such as Syunik and Shirak also have relatively low proportion of low learners (below 30 percent in all subject areas). In contrast, Ararat region has the largest proportion of low learners across all subject areas, followed by Armavir (map 1). There is a spatial distribution of learning across regions, with those located in the south (except Syunik) registering the highest proportion of low learners.

Map 1. Percentage of Low Learners in 9th Grade, Average across All Subject Areas, 2019



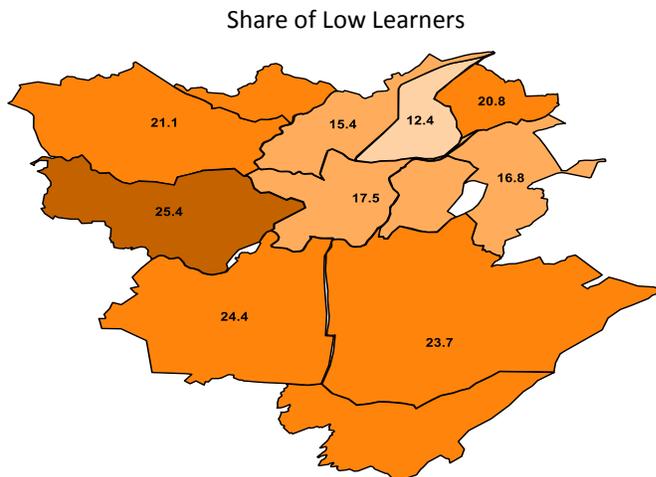


Source: Authors' calculations using national exam data.

Note: Science, technology, engineering and mathematics (STEM) subjects include biology, chemistry, physics and mathematics; foreign languages include English and Russian; social sciences include geography and history.

Within the city of Yerevan, a spatial clustering of results is observed. Students attending schools in districts located on the west side of the city (Shengavit and Malatia-Sebastia) have math scores that placed them in the lowest quartile of the distribution each year (see map 2). The opposite occurred among students in schools located in the districts of Arabkir, Kentron/Nork-Maras, Erebuni/Nubarashen, and Kanaker-Zeytun; they are consistently ranked as the top scorers. Arabkir, Kentron/Nork-Maras and Kanaker-Zeytun are also the districts with the lowest rate of low learners in almost all subjects (see table 1). The districts with the top scorers are those that are the most affluent, and this may be partly or fully responsible for this trend as families with access to more resources have the ability to procure assistance and tutoring for their children.

Map 2. District Variations across Yerevan in percentage of Low Learners, Grade 9, Mathematics, 2019



Source: Authors' calculations using national exam data.

Table 1. Percentage of Low Learners in 9th Grade by Subject Areas in Yerevan, 2019

	STEM	Social Sciences	Foreign Languages	Armenian Language and Literature
Ajapnyak (Davtashen)	24	27	24	22
Arabkir	16	23	17	19
Avan	22	20	25	21
Erebuni (Nubarashen)	29	29	25	25
Kentron, Nork-Maras	18	26	17	16
Malatia-Sebastia	30	32	27	24
Nor Nork	24	27	20	18
Kanaqer-Zeytun	12	27	19	13
Shengavit	27	32	28	21
Minimum	12	20	17	13
Maximum	30	32	28	25
GAP	19	13	11	12

Source: Authors' calculations using national exam data.

Disparities in learning across regions are more marked in STEM subjects. The gap between the regions with the highest and lowest share of low learners is about 20 percentage points in STEM subjects (43 for Ararat and 24 for Yerevan), while the gap is only 14 percentage points in social sciences. Across STEM subjects, the gap is substantially high for chemistry and much lower in biology. The percentage of low learners in chemistry is 61 percent in Vayots Dzor, while it is only 13 percent in Aragatsotn. However, in both STEM and social science subjects, at least one in five students is a low learner across all regions (table 2).

Table 2. Percentage of Low Learners by Subject, 2019

	STEM				Social Sciences		Foreign Languages		Armenian Language and Literature	
	Biology	Chemistry	Mathematics	Physics	Armenian History	Geography	English Language	Russian Language	Armenian Language	Armenian Literature
Aragatsotn	27	13	28	28	22	35	31	32	35	27
Ararat	36	49	38	45	36	44	36	38	41	36
Armavir	35	46	33	38	33	41	34	38	34	35
Yerevan	22	25	20	23	23	32	22	24	18	22
Gegharqunik	28	30	24	33	25	36	36	30	29	27
Kotayk	27	29	26	27	34	36	25	34	28	32
Lori	29	15	28	35	28	36	31	31	33	29
Shirak	28	31	26	37	21	33	27	26	30	24
Syunik	25	20	25	33	24	31	24	31	27	26
Tavush	29	15	34	36	30	30	25	36	38	31
Vayots Dzor	30	61	31	40	27	37	34	36	39	28
Minimum	22	13	20	23	21	30	22	24	18	22
Maximum	36	61	38	45	36	44	36	38	41	36
GAP	14	48	18	22	15	14	14	14	23	14

Source: Authors' calculations using national exam data.

The next section explores the key predictors of learning outcomes in Armenia, analyzing how variations in educational inputs are associated with variations in learning.

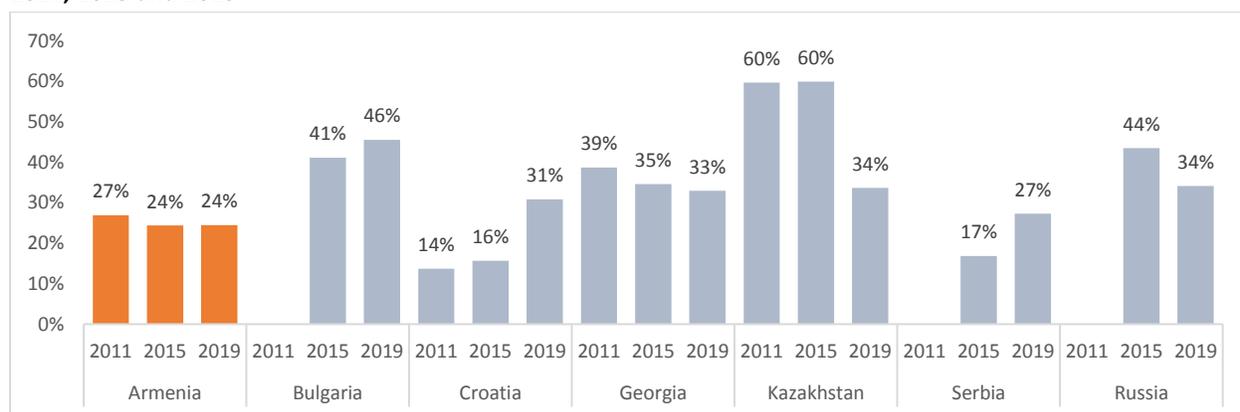
5. Factors associated with learning outcomes in Armenia

This section references national and international assessments to evidence how various inputs relate to learning. The main dimensions of analysis are students' characteristics, schools' characteristics, and teachers' characteristics. Regression analyses, for both TIMSS and national exam, were used to provide evidence on the association between those factors and student learning¹⁸. On TIMSS, the results correspond to the 2019 math assessment of 4th grade students for Armenia and some comparator countries such as Bulgaria, Croatia, Georgia, Kazakhstan, Russia, and Serbia (Table A3). On national assessments, results correspond to grade 9 math achievement in 2019, but factors associated to students were not available in the national exam (Table A4).

5.1 Variance explained by students, schools, and regions

In Armenia, the largest part of the variance in learning results is explained at the student level, followed by schools, with a very low contribution of regions. In TIMSS 2019, the decomposition of the total variation in grade 4 scores in mathematics shows that 76 percent of the total variation is associated with students and the remaining 24 percent is associated with schools.¹⁹ In comparison with other countries, the school variation in Armenia has remained stable compared to the previous rounds of TIMSS assessments (figure 8). The analysis of the results of national exams in mathematics in grade 9 shows a similar share of the variation attributable to schools (20.9 percent). In grade 12, the share of the variation attributable to schools is higher at 32 percent (Table A4). Differences in regional attributes explained a smaller part in performance variation. In the national exams, regions capture a statistically significant but very reduced fraction of the total variation, around to 2 percent (Table A5).

Figure 8. Variation in Grade 4 Math Scores Attributable to Schools in Armenia and Comparator Countries, TIMSS 2011, 2015 and 2019



Source: Authors' calculations using IEA data for 2015 and 2019 TIMSS rounds. Share in variation is estimated with a null multilevel regression model with students nested in schools.

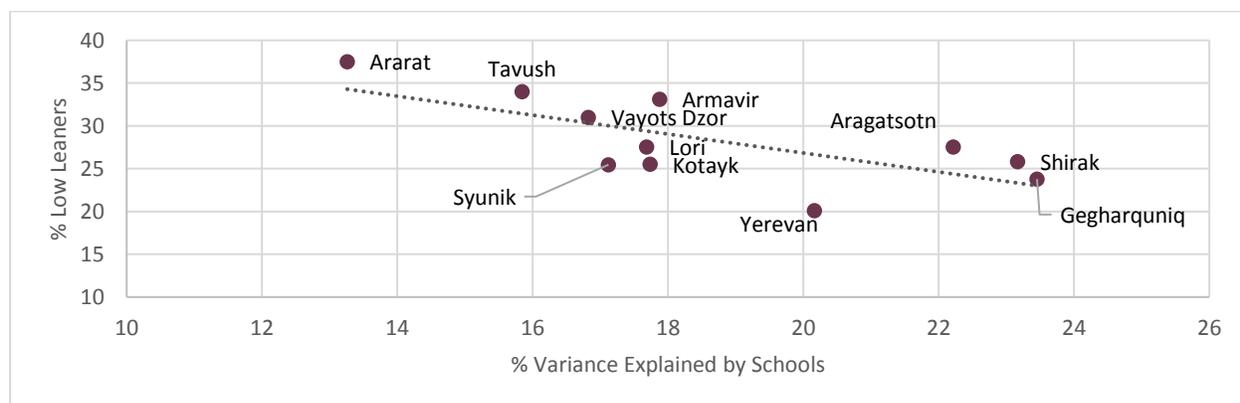
¹⁸ For both TIMSS and national exams, a multilevel regression model (hierarchical linear model or mixed model) of two levels was applied with students nested within schools.

¹⁹ The relative distribution of the variability in the scores of the students within each school and the average variability between schools were estimated with a multilevel null regression model without predictor variables. The variability at the regional level was also added for the 9th national test.

Socioeconomic background and attitude toward learning are the key drivers of performance at the student level. In TIMSS 2019, the index of socioeconomic level measured as “Home Resources for Learning” is one the strongest factor associated with math performance in grade 4 in Armenia and all other ECA countries in Table A3. It also manifests equity issues. While some degree of variation in education outcomes is to be expected in any school system, equity means that whatever variations there may be in education outcomes, they are not related to students’ background²⁰. At the student level, attitude toward learning mathematics also matters. In TIMSS 4th grade, students who tend to like learning mathematics and are more confident with mathematics were more likely to perform better, not only in Armenia but in other ECA countries (Table A6).

Schools play a significant role in equalizing learning opportunities, especially across regions. In Armenia, 21 percent of the variation in learning outcomes in mathematics in national exams is explained by schools, as described before. In regions where schools have higher contribution to students’ learning (as measured by the part of the variance explained by schools) have lower shares of low learners (figure 9). This is also the case for Shirak, in which the proportion of low learners is below expected, given poverty levels which is one of the highest in the country, but where schools explain one of the highest percentages of math performance—a variance explained of about 23 percent. Next section will explore key determinants of learning at the school level.

Figure 9. Percentage of Variance in Math Explained by Schools and Percentage of Low Learners, 2019



Source: Authors’ calculations using national exam data.

5.2 School-Level Factors and Student Performance

Armenia’s teacher training system and teacher policies need improvements as teachers are critical for the development of cognitive and non-cognitive skills in schools. In Armenia, about 31,018 teachers teach in general schools (Grades 1–12). The law in education establishes that teachers should have obtained a pedagogical qualification or have higher education²¹ and at least five years of service of pedagogical (or teaching) activities in the last ten years. Nonetheless, the effectiveness of in-service and pre-service training is low, and teachers do not always come into the profession having mastered modern teaching methods and

²⁰ OECD (2019), PISA 2018 Results (Volume II): Where All Students Can Succeed, PISA, OECD Publishing, Paris, <https://doi.org/10.1787/b5fd1b8f-en>.

²¹ The higher education system in Armenia consists of state and private institutions including universities, academies, institutes, and conservatoires.

technologies.²² Teacher qualification was an important driver of learning in TIMSS 2015, but lack of robust data prevents the examination of this relationship in 2019. While TIMSS 2015 showed a positive relationship between the highest level of education attained by teachers (especially those with bachelor's degrees and higher) and student results in the 4th grade math test, this is not the case in TIMSS 2019. The results in TIMSS 2019 might be attributable to a methodological issue in the data collection for this question. However, this should not mean that higher levels of teacher professionalization in the form of bachelor's, master's, or doctoral degrees (accompanied by high quality of the aforementioned programs) do not lead to enhance quality of education among students. In the most successful education systems such as Finland and South Korea, teachers are required to have advanced degrees.

In Armenia, teacher professional development matters in student learning, while teachers report that they need training in curriculum, ICT, and working with students with special needs. Teacher professional development allows educators to develop the knowledge and skills to address learning challenges. In Armenia, the number of teachers who participated in professional development in math is positively correlated with TIMSS math scores. Teachers who report that they need training in math in the future positively correlates with learning, suggesting that the open-minded attitude towards new skills acquisition is important. In this regard, the new curriculum that is being piloted in Armenia is a critical intervention as teachers reported new training, ICT skills for teaching and skills for teaching students with special needs as their main challenges.²³

²² Republic of Armenia Ministry of Education and Science, *Armenia: Education for All 2015 National Review* (2015), https://www.globaldisabilityrightsnow.org/sites/default/files/related-files/275/Education_Report__2015__English.pdf.

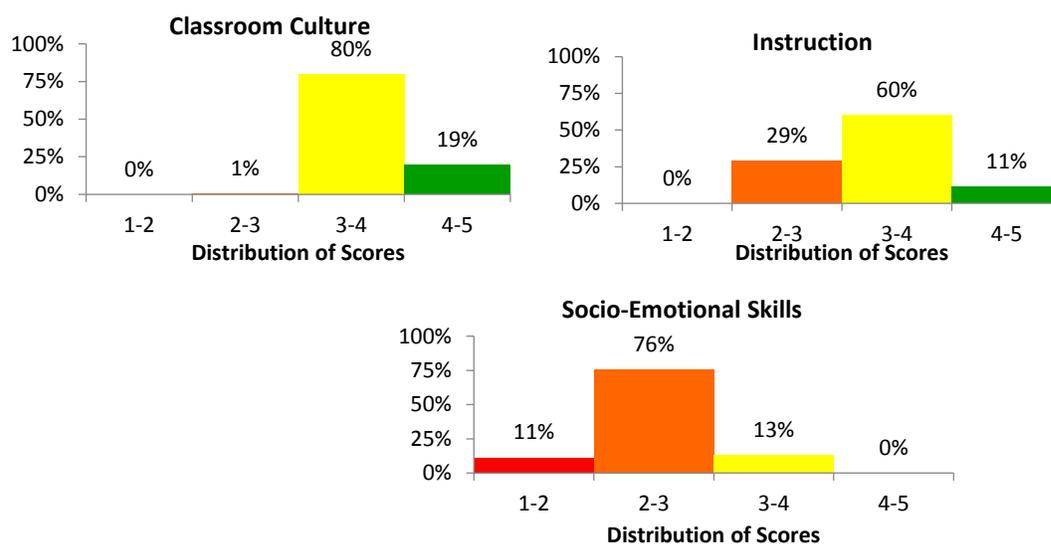
²³ These findings were based on a teacher training questionnaire developed by the World Bank Armenia team and implemented by NaCET.

Box 3. Teach Armenia Findings

Teach measures (i) the time teachers spend on learning and the extent to which students are on task, and (ii) the quality of teaching practices that details classroom culture, instruction, and socio-emotional skills. *Teach* Armenia measured teacher practices of 80 teachers in grades 2, 4, 5, 7 and 8 across several subjects in 20 primary schools in Tavush and Yerevan. Findings from the study are summarized below:

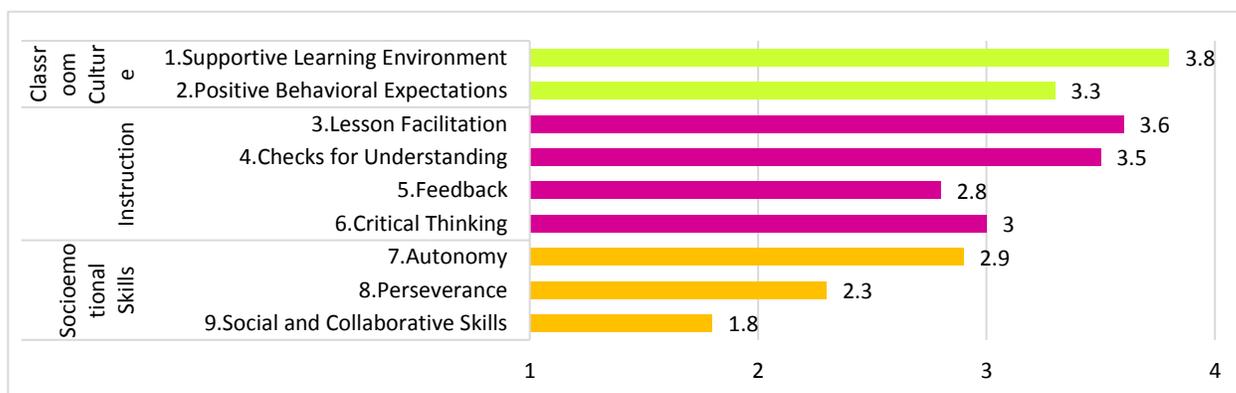
- Teachers in Armenia provide a learning activity to students 97 percent of the time and when the learning activity is provided, all students are on task most of the time (78 percent).
- Armenian teachers have strong ability in classroom culture and instruction. However, they exhibit weaker ability in socio-emotional skills (76 percent have a score lower than 3 and 11 percent lower than 2) (figure 10).

Figure 10. Distribution of Average Teach Scores by Area and Overall



- Teachers are relatively skilled at creating a supportive learning environment, setting positive behavioral expectations, facilitating the lesson and checking for understanding. However, they score around the medium range for providing feedback and encouraging students to think critically. They also score around the medium range in promoting student autonomy but are weaker at fostering perseverance and social and collaborative skills (figure 11).

Figure 11. Distribution of Average Teach Scores by Element

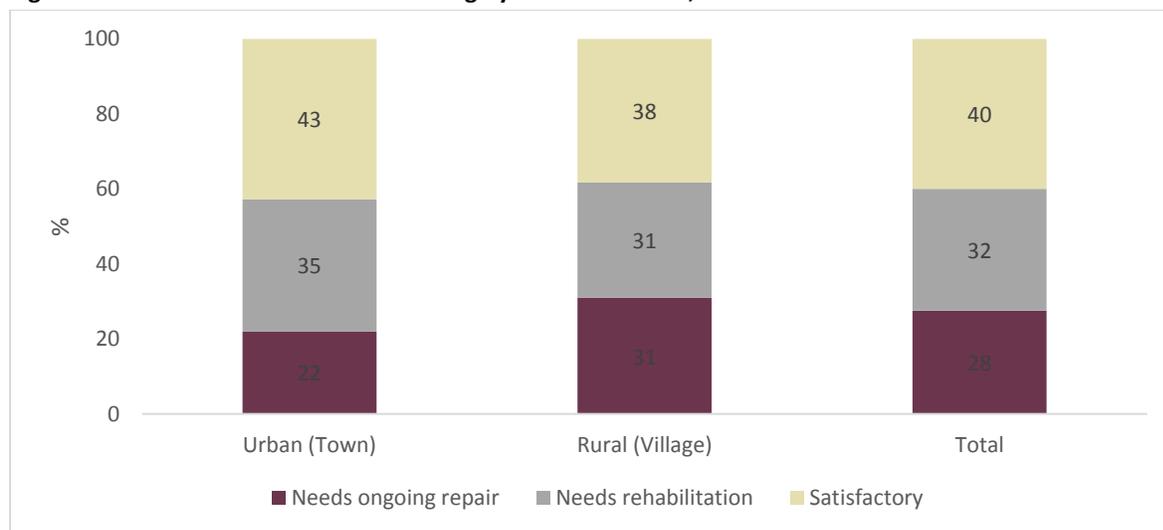


Source: Teach Armenia (World Bank 2021).

Disciplinary environment in the classroom is a good predictor of student learning in Armenia. In Armenia, school discipline was found to be a predictor of math scores in TIMSS 2019, and it is one of the few factors that show a positive association with results in most countries in the Programme for International Student Assessment (PISA). In particular, the index of school discipline and index of safe and orderly schools were both positively correlated with TIMSS 4th grade math scores. This may reflect the fact that teachers with a positive learning environment are more effective in classroom management and can focus their efforts on academic activities. Likewise, while a positive school climate is associated with other socioeconomic factors that are related to performance, TIMSS analysis suggests that once these factors are accounted for, the school environment remains an important determinant of results (table A6).

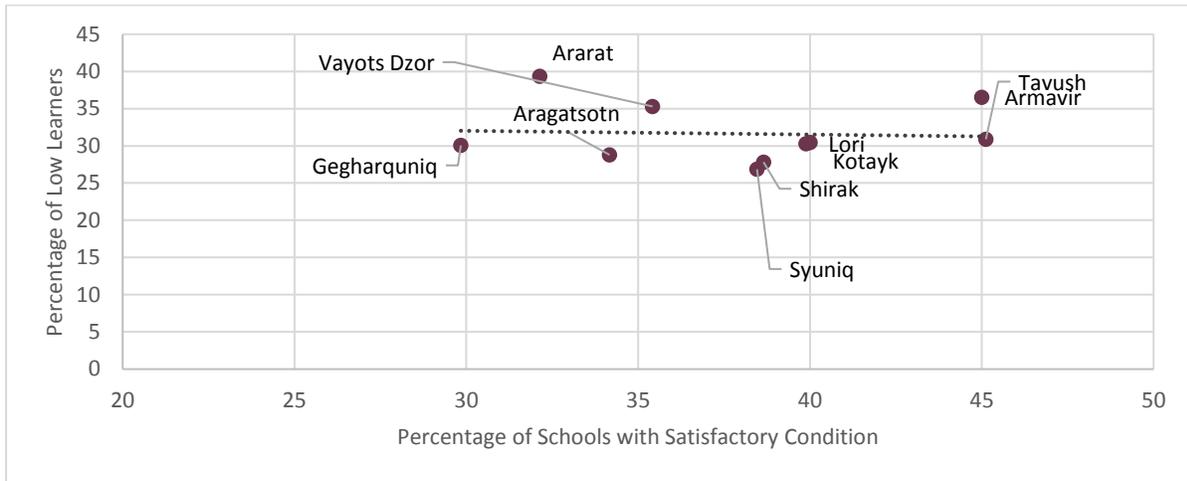
Physical conditions of the school buildings in Armenia need to be improved, especially in schools where basic utilities are not guaranteed. The results of the regression analysis from national examination finds that the average performance of the schools is correlated with by infrastructure (bivariate model), but once other factors are added to the model, this relation become not significant (multivariate model – Table A7). This is consistent with global evidence that shows either mixed or positive correlations on learning, while it is generally accepted that strongest drivers of learning rely on what happen in classroom, which include teachers and learning practices. Despite the high share of the education expenditure devoted to infrastructure, about 28 percent of school facilities need repair and another 32 percent need rehabilitation. These rates are higher in rural schools. In terms of access to basic utilities, 8 percent of rural schools do not have access to water supply, 15 percent do not have sewage systems, and 45 percent do not have gas supply (figure 12). These numbers along with the decline of the population brings an opportunity to enhance physical conditions, while schools are rationalized – maintaining proper class sizes, as large class size were negatively correlated with leaning in both TIMSS and national exams (figure 13).

Figure 12. Condition of the School Building by School Location, 2019



Source: Authors' calculations using administrative data.

Figure 13. Percentage of Low Learners and Percentage of Schools with Satisfactory Condition, 2019



Source: Authors' calculations.

Note: Average of all subjects in grade 9.

The location of a school is significant in understanding the differences in the aggregated performance, which show that schools in Yerevan, followed by other urban areas perform better. Both TIMSS and national exam show that Yerevan perform comparatively better than other urban and rural areas. This finding is consistent after accounting for student's socioeconomic background. Additionally, other urban areas perform better than rural areas, difference that is positive and significant in national examination for grade 9th, but non-significant in TIMSS 4th grade. It may suggest that disparities increase as student progress through the education system. The multivariate regression analysis of student performance in the national exams reveals that teachers the presence of larger share of teachers older than 40 years old has a positive and statistically significant association in the Math test, but the percentage of those teacher is 9 percentage points in Yerevan than in rural areas (see table A8).

There are other potential factors behind the relatively high learning poverty rate and low learning levels in Armenia that could not be tested for due to lack of data. These are (i) assessment data not informing instruction; (ii) inadequate support given to teachers for lesson planning; and (iii) relevant content missing in the reading material and in the curriculum. These potential explanations make it important to consider interventions around curricular reform and more effective teacher policies that align with the needs of learners. It is noteworthy that Armenia is going through policy changes exactly along these lines.

6. Policy Recommendations

The findings of this study support the following three recommendations, which focus on improving learning across all education levels in Armenia: **(i) improving effectiveness of teaching, (ii) ensuring high quality and equitable educational resources across regions, and (iii) measuring learning and implementing relevant programs targeting low learners to fill the learning gaps.**

- (i) Improving effectiveness of teaching.** Teachers are the most important drivers of learning. The analytical work shows that both pre-service (qualification) and in-service (continuing professional development) training make substantial contributions to the development of skills and competencies of Armenian students.²⁴ Based on the findings of the Learning Analysis and *Teach Armenia*, it is important to focus on ensuring a strong practicum component in pre-service education so that teachers are well-equipped to transition to and perform effectively in the classroom. *Teach Armenia* findings show that teachers have challenges with providing feedback, encouraging students to think critically, promoting student autonomy, and fostering perseverance and social and collaborative skills. Providing continuous support to teachers in the form of high-quality, in-service training that focuses on these specific issues and the broader technical aspects of teaching would benefit both teachers and students alike and possibly lead to better learning outcomes. Finally, it is important that teachers learn to employ ICT to enhance their ability to reach every student.²⁵ This has been especially relevant in the context of COVID-19, which provided an opportunity for teachers to build technological skills. Once school systems stabilize, teachers should be encouraged to maintain and improve their technological skills. School leadership can support this through investments in hardware, connectivity, and continuing professional development in ICT. These solutions should be tested locally before scaling.
- (ii) Ensuring high quality and equitable educational resources across and within regions and locations.** In Armenia, disparities in learning outcomes across urban and rural areas are significant, but the Learners' Report shows that schools can compensate for pre-existing socioeconomic disadvantages. As part of the national goal of promoting local development, a more decentralized approach to distribute educational resources can be considered to enhance learning outcomes in all regions. This may include policies related to teachers and infrastructure, and the analysis of how the transfer of public financial resources to regions can contribute to improved learning. The current low expenditure on education offers an opportunity to devote additional resources toward the education sector in an efficient manner. Increasing expenditure can support the transformation of the teaching profession and infrastructure development. More importantly, it can support vulnerable students that struggle to acquire basic skills and competencies. Material and financial resources can be delivered to all schools by: (i) sustaining education budgets and investing where returns are greatest, or more specifically, ensuring that critical expenditures are maintained to keep children enrolled (and minimize dropouts) and to protect the most vulnerable and more disadvantaged students, (ii) using targeted

²⁴ In order to enhance teacher effectiveness, teachers can be trained in areas in which they feel they need training. In Armenia, this includes student assessment for the new curriculum, ICT skills for teaching, and teaching students with special needs.

²⁵ Béteille, Tara and David K. Evans. 2019. *Successful Teachers, Successful Students: Recruiting and Supporting Society's Most Crucial Profession.*

block grants to ensure that funds reach disadvantaged/vulnerable schools, and (iii) making sure that levels of teacher salaries are maintained and that teachers are paid on time.²⁶

- (iii) **Measuring learning and implementing relevant programs that target low learners to fill the learning gaps.** In the post-pandemic period, measuring learning loss and regularly monitoring learning will be critical in tackling learning inequalities. This period presents an opportunity to implement learning recovery policies as permanent elements into education systems to improve learning equity and reduce learning poverty. The emerging consensus on education quality and learning poverty suggests that policies on learning equity should: (i) identify the issues associated with disparities in learning outcomes between mainstream and disadvantaged groups in the population, such as access to quality teachers, pedagogical resources, compensatory programs, and the need for educational materials in the student's main language, (ii) clearly define equity goals and the resources needed to improve learning equity, (iii) implement policies and innovations for hybrid instruction in a way that does not increase the workload on teachers, (iv) monitor learning outcomes by tracking learning progress in real time, testing students often, within the context of instructional change, (v) promote a climate of innovation for improving hybrid/blended methods of education delivery using the individual experiences of schools as a means of testing what works and seeing whether it can be scaled up, (vi) invest in digital pedagogy that oversees the provision of training to upgrade teachers' digital skills and solicit the participation of trained teachers in the development of a new digital pedagogy, and (vii) use impact monitoring and evaluation to track progress in learning, learning equity, and learning performance under the hybrid methods of instruction to ensure the efficiency and accountability of the education system at large. This type of monitoring is crucial for the long-term transformation of education.²⁷

²⁶ Arcia, Gustavo, Rafael de Hoyos, Harry Patrinos, Alina Sava, Tigran Shmis, and Janssen Teixeira. 2021. *Learning Recovery after COVID-19 in Europe and Central Asia: Policy and Practice*. World Bank, Washington, DC.

²⁷ *Ibid.*

Recommendation	Actions	Responsible Entity	Timing: ST (< 1 year); LT (> 1 year)	Fiscal Cost: Small, Medium, Large	Priority (highest= 1)
1. Improving effectiveness of teaching	<p>Focus on <u>ensuring a strong practicum component in pre-service education</u> so that teachers are well-equipped to transition to and perform effectively in the classroom</p> <p><u>Provide continuous support to teachers in the form of high-quality in-service training.</u> Teach Armenia findings show that teachers have challenges with providing feedback, encouraging students to think critically, promoting student autonomy, and fostering perseverance and social and collaborative skills. Teacher training focused on these specific issues and the broader technical aspects of teaching would benefit both teachers and students alike and possibly lead to better learning outcomes.</p> <p><u>Use technology wisely to enhance the ability of teachers to reach every student.</u> This is especially relevant in the context of COVID-19, which provided an opportunity for teachers to build technological skills. Once school systems stabilize, teachers should be encouraged to maintain and improve their technological skills. School leadership can support this through investments in hardware, connectivity, and continuing professional development in ICT. These solutions should be tested locally before scaling.</p>	MoESCS and other relevant partners	Short term (building into long term results)	Small to medium	1
2. Ensuring high quality and equitable educational resources across regions	<p>A more decentralized approach to distribute educational resources can be considered to enhance learning outcomes in all regions. Resources can be delivered to all schools by: (i) <u>sustaining education budgets and investing where returns are greatest, (ii) ensuring that critical expenditures are maintained to keep children enrolled (and minimize dropouts) and to protect the most vulnerable and more disadvantaged students, (iii) using targeted block grants to ensure that funds reach disadvantaged/vulnerable schools, and (iv) making sure that levels of teacher salaries are maintained and that teachers are paid on time.</u></p>	MoESCS, Ministry of Finance	Long term	Medium	1
3. Measuring learning and implementing relevant programs targeting low learners to address learning gaps and	<p>In the post-pandemic period, <u>measuring learning loss and regularly monitoring learning</u> will be critical in tackling learning inequalities. Policies on learning equity should: (i) <u>identify the issues associated with disparities</u> in learning outcomes between mainstream and disadvantaged groups in the population, such as access to quality teachers, pedagogical resources, and compensatory programs and the need for educational materials in the student's main language, (ii) clearly <u>define equity goals and the resources</u> needed to improve learning equity, (iii)</p>	MoESCS	Long term	Large	2

<p>further improve learning</p>	<p><u>implement policies and innovations for hybrid instruction</u> in a way that does not increase the workload on teachers, (iv) <u>monitor learning outcomes</u> by tracking learning progress in real time, testing students often, within the context of instructional change, (v) <u>promote a climate of innovation</u> for improving hybrid/blended methods of education delivery using the individual experiences of schools as a means of testing what works and seeing whether it can be scaled up, (vi) <u>invest in digital pedagogy</u> that oversees the provision of training to upgrade teachers' digital skills and solicit the participation of trained teachers in the development of a new digital pedagogy, and (vii) <u>use impact monitoring and evaluation to track progress in learning, learning equity, and learning performance under the hybrid methods of instruction to ensure the efficiency and accountability of the education system at large.</u></p>				
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REFERENCES

- Arcia, Gustavo, Rafalel de Hoyos, Harry Patrinos, Alina Sava, Tigran Shmis, and Janssen Teixeira (2021). *Learning Recovery after COVID-19 in Europe and Central Asia: Policy and Practice*. World Bank, Washington, DC.
- Armstat (2017). Households' Integrated Living Conditions Survey, Anonymized Microdata Database (by Households) (2017).
- Asian Development Bank (2019). Human Development Enhancement Program, *Sector Assessment (Summary): Education and Health*. Retrieved from <https://www.adb.org/sites/default/files/linked-documents/51129-002-ssa.pdf>
- Azevedo, João Pedro, Amer Hasan, Diana Goldemberg, Syedah Aroob Iqbal, and Koen Geven (2020). *Simulating the Potential Impacts of Covid-19 School Closures on Schooling and Learning Outcomes: A Set of Global Estimates*. Washington, DC: World Bank.
- Beteille, Tara, and David K. Evans (2019). *Successful Teachers, Successful Students: Recruiting and Supporting Society's Most Crucial Profession*. Washington, DC: World Bank.
- Beteille, Tara; Ding, Elaine; Molina, Ezequiel; Pushparatnam, Adelle; Wilichowski, Tracy (2020). *Three Principles to Support Teacher Effectiveness During COVID-19*. World Bank, Washington, DC.
- International Association for the Evaluation of Educational Achievement (IEA). (2019). TIMSS 2019 Encyclopedia: Education Policy and Curriculum in Mathematics and Science in Armenia.
- OECD (2019), PISA 2018 Results (Volume II): Where All Students Can Succeed, PISA, OECD Publishing, Paris, <https://doi.org/10.1787/b5fd1b8f-en>.
- Republic of Armenia Ministry of Education and Science (2015). *Armenia: Education for All 2015 National Review*, https://www.globaldisabilityrightsnow.org/sites/default/files/related-files/275/Education_Report_2015_English.pdf
- Rutkowski, Jan. 2013. *Skills Employers Seek. Results of the Armenia STEP Employer Skills Survey*. Report no. 98904. Washington, DC: World Bank. <http://microdata.worldbank.org/index.php/catalog/2567>
- Statistical Committee of the Republic of Armenia (Armstat) and World Bank, Social Snapshot and Poverty in Armenia: Statistical and Analytical Report (Yerevan, 2018). <https://www.armstat.am/en/?nid=205>.
- UNESCO Institute for Statistics (UIS), 2020. <http://uis.unesco.org/country/AM>
- World Bank (2018). *World Development Report 2018: Learning to Realize Education's Promise*. Washington, D.C.: World Bank.

World Bank (2020). READ Trust Fund: Armenia Brief, 2020.

<https://documents1.worldbank.org/curated/en/552741619466400084/pdf/READ-Trust-Fund-Armenia.pdf>

ANNEX

Table A1. Sample sizes of selected participant countries in TIMSS 2019 Grade 4 Mathematics and Science Assessment

ISO Code	Country	Students	Classes	Teachers	Schools
ARM	Armenia	5399	216	212	150
BGR	Bulgaria	4268	211	209	151
HRV	Croatia	3785	263	263	153
GEO	Georgia	3787	223	220	154
KAZ	Kazakhstan	4791	224	224	168
SRB	Serbia	4380	214	214	165
RUS	Russia	4022	200	200	200

Table A2. Description of variables used in the analysis of TIMSS 2019 Grade 4 Mathematics Assessment

Variable	Definition	Measurement
Math Achievement in Grade 4	Based on 5 plausible values	Continuous
Student Characteristics		
Male	Student's sex is male (ITSEX).	Indicator (dummy 0/1)
Students Age	Student's biological age.	Continuous
Socioeconomic Status (Home Resources for Learning)	SES scale. This scale measures the availability of resources suitable for learning at the student's home. In the TIMSS International Report this scale is referred as the Home Resources for Learning Scale (ASBGHRL).	Continuous
Students Like Learning Mathematics	Scale of nine questions concerning student's interest and attitude toward mathematics (ASBGSLM).	Continuous Scale. Standardized within country.
Students Confident in Mathematics	Scale based on the responses to seven questions concerning student's confidence on learning mathematics (ASBGSCM).	Continuous Scale. Standardized within country.
Student Bullying	Scale based on the responses to seven questions concerning student's self-report to experiences related to bullying (ASBGSB).	Continuous Scale. Standardized within country.
Teacher Characteristics		
Sex	Teacher's sex is female (ATBG02).	Indicator (dummy 0/1)
Age	Teacher's age measured in intervals (ATBG03). Transform into binary indicator for teachers of 40 years or more.	Indicator (dummy 0/1)
Education Attained	Highest level of education of the teacher: Secondary Bachelor and Master/PhD (ATBG04).	Categorical
Majored in Ed and Math	Derived as a binary indicator when the teacher's major was in Education and the area of specialization was Mathematics (ATDMMEM).	Indicator (dummy 0/1)
Professional Development in the past	Have participated in Professional Development in Math in the past two years (ATBM09A)	Indicator (dummy 0/1)
Professional Development in the future	Will need Professional Development in Math in the future (ATBM09B)	Indicator (dummy 0/1)
Job Satisfaction	Teacher's responses to five items on the level of satisfaction in the current job (ATBGTJS).	Continuous Scale. Standardized within country.
Safe and Orderly Schools (standardized)	Scale based on teacher's responses to eight items related to security and orderly behavior of the students in the school (ATBGSOS).	Continuous Scale. Standardized within country.
Class size	Number of students in the class the student attends (ATBG10A).	Continuous Scale
Weekly time spent teaching mathematics in the class	Number of weekly hours dedicated to teaching mathematics	Continuous Scale
School Characteristics		
School location	Area where the school is located and consist of three categories: 1) schools are located in a large city, corresponding to schools located in areas with a population of 500 thousand persons or more and extracted from	Categorical

Variable	Definition	Measurement
	<p>the question “how many people live in the area” (ACBG05A)^{1/};</p> <p>2) schools located in urban areas corresponds to schools in urban–densely populated areas, suburban–on fringe or outskirts of urban area and medium size city or large town per responses in the question “immediate area of the school” (ACBG05B);</p> <p>3) schools located in rural areas based correspond to the following responses in question ACBG05B: small town or village or remote rural.</p>	
School has a problem of teachers arriving late	Principal’s report on teachers arriving late as a moderate or serious problem in the school. (ACBG16A).	Indicator (dummy 0/1)
School has a problem of teachers’ absenteeism	Principal’s report on teachers’ absenteeism as moderate or serious problem in the school. (ACBG16B).	Indicator (dummy 0/1)
School Discipline Problems	Direction of the scale inverted. Higher values indicate better discipline climate in the school (ACBGDAS).	Continuous Scale. Standardized within country.
Instruction Affected by Math Resource Shortage	Scale based on Principal’s responses to 13 items to measure school capacity to provide general and subject-specific resources (ACBGMRS).	Continuous Scale. Standardize within each country.
Total Instructional Time in a typical day (hours)	Total number of hours in a year dedicated to providing instruction (ATBM01)	Continuous

Table A3. School characteristics associated to Student Scores in Mathematics in grade 9.

Variable	Definition	Source
<i>Student level</i>		
Student Score	Scale from 0 to 20	Examinations
<i>School level</i>		
Location of the school	(Town_Village): Urban or Rural	NaCET school level dataset (2020)
School type	Education level provided by the school categorization as Basic (grades 1-9) or Secondary (1-12 grades)	
PTR across all school grades	Total number of students across all grades enrolled divided by the total number of full-time teachers in the school	
Pupil-Classroom Ratio (PCR) in Grade 9	Total number of students across in grade 9 enrolled divided by the total number of classrooms in the school in grade 9	
Infrastructure Index	An index built using Principal Components Analysis (PCA) and a polychoric correlation matrix. Results indicate that retaining one factor about 51% of the shared variance is explained. Items included in the index are: gas supply is available, water Supply is centralized, sewerage is centralized, heating is centralized, hot water supply is available, landline phone is available	
<i>Teacher Characteristics</i>	<i>(aggregated at school level)</i>	
Share of Female Teachers	Average proportion of female teachers at school level	Teachers Survey (2019)
Share of Teachers ages 40 or more	Average proportion of teachers of age 40 or more at school level.	
Share of Teachers trained in 2015 or after	Average proportion of teachers who received training in 2015 or after.	

Table A4. Variance Decomposition in Mathematics (Two-Level Analysis: Students and Schools)

Grade: 9			
	2017	2018	2019
<i>Schools (L2)</i>			
Variance Estimate	24.2%	22.5%	20.9%
Lower Bound	22.4%	20.7%	19.2%
Upper Bound	26.1%	24.4%	22.7%
Schools (L2)	1277	1196	1214
Students (L1)	29083	29187	30985

Grade: 12			
	2017	2018	2019
<i>Schools (L2)</i>			
Variance Estimate	31.3%	33.7%	32.3%
Lower Bound	28.8%	30.6%	29.7%
Upper Bound	34.0%	36.9%	35.1%
Schools (L2)	863	754	839
Students (L1)	15656	7289	14249

Note: Share of variance using a hierarchical two-level null regression model with students (L1), nested in schools (L2). Lower and upper bounds of the variance estimate calculate at a 95% confidence interval.

Source: World Bank staff based on National Exam 2017-2019

Table A5. Variance Decomposition in Mathematics (Three-Level Analysis Students, Schools and Regions)

Grade: 9			
	2017	2018	2019
<i>Marzes (L3)</i>			
Variance Estimate	1.5%	1.8%	1.6%
Lower Bound	0.6%	0.7%	0.6%
Upper Bound	3.9%	4.5%	4.1%
<i>Schools (L2)</i>			
Variance Estimate	23.9%	22.3%	20.5%
Lower Bound	21.9%	20.2%	18.5%
Upper Bound	26.0%	24.5%	22.5%
Marzes/Regions (L3)	11	11	11
Schools (L2)	1260	1190	1209
Students (L1)	28790	29021	30827

Grade: 12			
	2017	2018	2019
<i>Marzes (L3)</i>			
Variance Estimate	2.1%	1.8%	1.6%
Lower Bound	0.8%	0.6%	0.5%
Upper Bound	5.7%	5.4%	4.6%
<i>Schools (L2)</i>			
Variance Estimate	31.7%	33.6%	32.8%
Lower Bound	28.9%	30.4%	30.0%
Upper Bound	34.6%	37.0%	35.7%
Marzes/Regions (L3)	11	11	11

Schools (L2)	848	749	834
Students (L1)	15139	7158	13970

Note: Share of variance using a hierarchical three-level null regression model with students (L1), nested in schools (L2), nested in marzes/regions (L3). Lower and upper bounds of the variance estimate calculate at a 95% confidence interval.

Source: World Bank staff based on National Exam 2017-2019

Table A6. Multilevel model of the factors associated to Math TIMSS performance, grade 4.

	Armenia	Bulgaria	Croatia	Georgia	Kazakhstan	Serbia	Russia
Student characteristics							
Female	-0.62 (2.23)	-4.28* (2.20)	-8.07*** (2.32)	-8.45*** (2.88)	-3.00 (1.89)	1.59 (2.92)	-3.57** (1.79)
Students Age (standardized)	2.78*** (1.07)	3.35** (1.31)	2.04** (1.00)	1.74 (1.60)	1.82 (1.15)	0.85 (1.54)	0.11 (1.07)
Home Resources for Learning/SCL (standardized)	10.69*** (1.18)	25.14*** (1.98)	16.63*** (1.38)	13.38*** (1.51)	5.89*** (1.15)	27.99*** (1.48)	9.91*** (1.25)
Students Like Learning Mathematics/SCL (standardized)	6.38*** (1.11)	-6.16*** (1.49)	-6.97*** (1.43)	1.92 (1.76)	1.06 (1.33)	-10.74*** (1.92)	-3.91*** (1.17)
Students Confident in Mathematics/SCL (standardized)	18.15*** (1.25)	30.72*** (1.69)	32.41*** (1.76)	25.84*** (2.07)	16.33*** (1.23)	39.31*** (1.73)	24.61*** (1.39)
Student Bullying/SCL (standardized)	-0.47 (1.11)	-3.33** (1.31)	1.25 (1.12)	-7.52*** (1.75)	-2.30** (1.07)	-0.89 (1.26)	-3.46*** (0.99)
Teacher characteristics							
Teacher Majored in Ed and Math (dummy)	-4.40 (4.47)	14.53* (8.66)	-5.24 (4.60)	7.35 (10.69)	-3.90 (8.68)	-1.93 (4.31)	1.67 (5.13)
Teacher age is 40+ (dummy)	4.85 (5.16)	-13.51* (8.00)	9.03** (4.23)	6.79 (10.25)	6.94 (5.85)	5.16 (5.63)	-5.64 (6.49)
Have participated in Professional Development in Math in the past two years	12.15** (5.10)	7.69* (4.15)	6.43 (4.66)	5.28 (11.68)	-8.81 (8.67)	9.21* (5.39)	14.99** (6.03)
Will need Professional Development in Math in the future	13.58** (5.33)	1.67 (6.46)	-2.48 (10.68)	5.39 (8.38)	13.37 (10.31)	3.24 (6.46)	-7.06 (6.55)
Teachers Job Satisfaction/SCL (standardized)	2.01 (2.50)	4.65*** (1.79)	-0.81 (1.76)	-2.08 (3.80)	-0.10 (3.19)	-1.70 (2.17)	-1.35 (2.46)
Safe and Orderly Schools-Teacher/SCL (standardized)	3.95** (1.95)	-0.24 (2.11)	0.16 (1.61)	4.46 (4.09)	-3.68 (3.89)	-2.57 (2.56)	0.87 (2.43)
Class Size (per 10 students)	-9.15** (4.45)	17.94* (9.77)	9.03** (4.11)	-10.83 (6.65)	-13.00* (6.84)	3.63 (4.11)	0.87 (5.74)
Weekly time spent teaching mathematics in the class (in hours)	5.58 (6.34)	2.04 (3.61)	-5.04** (1.98)	-0.85 (3.20)	0.25 (2.07)	-0.89 (2.68)	-3.37 (3.95)
School characteristics							
Large city (500k+ pop) ^{1/}	11.34* (6.42)	29.53*** (10.04)	1.87 (5.28)	18.41* (9.99)	18.09 (11.21)	13.03 (8.27)	18.42** (9.03)
Other urban area	5.96	12.51	-2.90	-3.68	24.91***	3.60	6.09

	Armenia	Bulgaria	Croatia	Georgia	Kazakhstan	Serbia	Russia
Teachers arriving late Is a moderate or serious problem	(6.30) -0.02	(8.36) -82.79***	(4.42) 13.94**	(8.93) 0.30	(8.81) 13.01	(6.52) 9.94	(9.07) 15.29
Teacher absenteeism Is a moderate or serious problem	(20.12) 17.77	(25.88) 92.01***	(6.13) 0.46	(14.94) 6.04	(27.54) -3.84	(6.92) -0.13	(11.54) 0.00
School Discipline (Index) (standardized)	(20.65) 5.96**	(25.99) 7.16	(6.19) -0.37	(12.47) 0.45	(20.98) 9.97**	(7.70) 3.70	(.) 4.60
Math School capacity to provide instruction affected by shortage (standardized)	(2.84) 0.47	(4.70) 1.53	(2.33) 0.07	(4.87) -2.00	(5.08) -4.30	(3.68) 1.79	(4.42) 2.60
Total Instructional Time in a typical day (hours)	(2.33) -3.25	(3.55) -0.54	(1.87) 2.09*	(3.05) 6.54**	(3.29) -0.26	(2.22) 2.63	(2.95) -3.02
	(6.67)	(2.32)	(1.14)	(2.95)	(2.74)	(1.81)	(4.68)
Constant	494.08*** (40.43)	469.71*** (32.21)	495.10*** (17.10)	456.99*** (27.39)	526.14*** (20.74)	475.13*** (20.94)	579.26*** (24.94)
Cases							
Schools (Level 2)	133	124	141	104	141	147	178
Students (Level 1)	3883	3134	3098	2145	3576	3656	3476
Variance							
Total Variance	3033	3591	2650	4289	3548	3628	3155
Student Level (Residual)	2391	2645	2220	3338	2407	3007	2144
School Level	643	947	430	951	1141	622	1011
correlation ICC at school level							
Estimate	0.21	0.26	0.16	0.22	0.32	0.17	0.32
Standard Error	0.04	0.04	0.03	0.04	0.03	0.03	0.03
Model converged	1	1	1	1	1	1	1

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

Note: 1/ In Armenia, Yerevan is the only largest city with a population of more than 500 people. In other countries also one city has a population over 500k: in Bulgaria, Sofia (1.1m); in Croatia, Zagreb (792k); in Georgia, Tbilisi (1.1m); and in Serbia Belgrade (1.7m). In Kazakhstan three cities meet the criteria (Almaty 1.8m, Nur-sultan 1.1, and Sshymkent 1.04m). In Russia more than 38 cities have population over 500k+.

Table A7. Predictors of average student score in Grade 9 Mathematics National Exam in 2019

	Armenian Schools	
	(1)	(2)
	Bivariate	Multivariate
Student Score		
School Resources		
Pupil Teacher Ratio across all school grades	0.007*	0.000
	(0.00)	(0.00)
Pupil-Classroom Ratio (PCR) in Grade 9	0.018***	-0.019**
	(0.01)	(0.01)
School Infrastructure		
Infrastructure Index	0.265***	0.034
	(0.04)	(0.06)
Teacher Characteristics (aggregated at school level)		
Share of Female Teachers	2.610***	0.407
	(0.52)	(0.62)
Share of Teachers ages 40 or more	1.440***	0.941**
	(0.36)	(0.35)
Share of Teachers trained in 2015 or after	-0.132	-0.126
	(0.22)	(0.21)
Location of the school		
Yerevan	1.190***	1.214***
	(0.13)	(0.16)
Other Urban Areas	0.859***	0.923***
	(0.12)	(0.14)
Intercept		10.686***
		(0.55)
Cases		
Students (Level 1)		28707
Schools (Level 2)		1103
Decomposition		
Total Variance		9.91
Student Level (L1 Residual)		8.23
School Level (L2)		1.68
(ICC) at school level		
ICC Estimate		0.17
ICC Standard Error		0.01
Explained_r2_from_Full_Model		
r-squared Schools (L2)		0.16

Notes:

The results reported in this table are estimated using a two-level hierarchical regression estimated using random intercepts with students nested within schools.

Coefficients in column (1) are estimated separately with one regression per predictor and then stacked.

Column (2) reports the results of a model with all predictors estimated simultaneously.

Significance levels: + p<0.10 * p<0.05 ** p<0.01 *** p<0.001

Note: This analysis is restricted to students in basic (grades 1 to 9) and secondary (grades 1 to 12) public schools

Table A8. Average Teacher Characteristics in Schools Located in Urban and Rural Areas

	Yerevan	Other urban areas	Rural areas
Share of Female Teachers	92%	89%	80%
Share of Teachers ages 40 or more	73%	68%	64%
Share of Teachers with tenure 15+ years	49%	51%	54%
Share of Teachers trained in 2015 or after	24%	30%	27%
Share of Teachers graduated before 2000	52%	49%	40%
Share of Teachers graduated from the Armenian State Pedagogical University	34%	25%	25%
Share of Teachers teaching in Middle Grades (5-9)	72%	73%	79%
Share of Teachers with salaries over 100k (LCU)	49%	55%	55%
Share of Teachers classified as Teaching Staff	96%	96%	94%