

Student Learning at primary grades in Uzbekistan: Outcomes, Challenges, and Opportunities:

**A summary of Uzbekistan National Learning
Achievement Study, Grade IV, 2018**

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Acknowledgement

Student Learning at primary grades in Uzbekistan: Outcomes, Challenges, and Opportunities is the first comprehensive study of how children are performing in terms of learning at primary level, and the causes and correlates of learning and education quality in Uzbekistan. This report presents the findings of a study on the learning levels among primary school children in Uzbekistan, carried out jointly by the Ministry of Public Education (MOPE), Government of Uzbekistan and UNICEF, Uzbekistan office.

This report was prepared by Ms. Deepa Sankar (Chief of Education, UNICEF Uzbekistan). Ms. Sankar was also responsible for the conceptualization of the study as well as all data analysis that fed into the preparation of the report.

The study was carried out under the general direction of Mr. Sascha Graumann, Representative and Mr. Afshin Parsi, Deputy Representative, UNICEF Uzbekistan. Afshin Parsi (previously the Chief of Education, UNICEF Uzbekistan) was behind the initial conceptualization and decision to carry out a study of this nature, which is among the first of its nature within UNICEF globally.

This report would not have been possible without the relentless efforts by a team of committed people. This report is the result of the cumulative effort of various people whom we would like to acknowledge here.

The Ministry of Public Education (MOPE, Government of Uzbekistan) partnered with UNICEF for this study. MOPE set up a Working Group of experts to facilitate the study. The experts worked with a team of international consultants and UNICEF for: (a) preparing the national assessment study tools for Uzbekistan, ensuring that the items in the tests were in alignment with the Uzbekistan's grade IV curriculum; (b) carrying out the pilot study and finalizing the tools; (c) providing all the background information for finalizing the sampling methodology; (d) facilitating the training and participating in the field work; (e) evaluating the test papers and marking them; and (f) entering the all the test scores and other data in the format provided by international consultants. Among the MOPE team, Mr. Nosirov Abdurakhim, former Head of Main Department on Organizing Educational Activity in Secondary Education Schools (MOPE) and currently with the State Inspection for the Supervision of the Education Quality (SISEQ) under the Cabinet of Ministers and Mr. Tursunov Tajimurat, Leading Specialist, Department on the Improvement of the State Educational Standards and Monitoring of the Quality of Education (MOPE) deserves special mention for their leadership within the MOPE for ensuring the quality of the study.

UNICEF sought the services of PPMI, a Research group from Lithuania, providing timely and quality support in the following aspects of the study: (a) working with the MOPE experts in adaptation of tools and methodology from Lithuania for the study in Uzbekistan, including the preparation of manuals and guidelines for various levels; (b) developing other supporting tools; (c) piloting and finalizing the tools and methodology for the study, (d) preparing the sampling framework for field work; (e) training of field investigators on the test administration and other data collection; (f) training of experts in evaluating the test items and scoring the same; (g)

preparing data entry and compilation programmes; and (h) data cleaning and preparation for analysis. PPMI also prepared an initial descriptive analysis of the data. PPMI made a presentation of the initial analysis to various stakeholders in education in a workshop organized by UNICEF in September 2018. UNICEF would like to acknowledge the timely manner, in which the study was conducted.

In UNICEF, Yulia Narolskaya, (former) Education Officer coordinated the study during its initial phase, especially working with PPMI and MOPE Working Group, ensuring that the field work was conducted in a smooth and timely manner and with high quality. Later, Sherzod Hoshimov, (former Consultant, UNICEF) carried on the coordination of the work with PPMI. Yulia Narolskaya, Vazira Nazarova, Deepa Sankar and Umida Islamova from UNICEF Education team and Komolakhon Rakhmanova from UNICEF M&E team participated in the monitoring of the field study and provided valuable insights on the process and outputs of the study. Kamila Alimdjanova provided all logistical support for the entire process of the study. Colleagues from M&E team, Komolakhon Rakhmanova and Zokir Nazarov facilitated the processes related to quality assurance within UNICEF. Yana Chicherina, Education Officer and Umid Ermanov and Education Programme Associate provided comments and support during the preparation stages of the report.

The author is responsible for the choice and the presentation of the facts contained in this report and for the opinions expressed therein.

The Principals, Teachers and students from the 268 schools who participated in the study deserves a special acknowledgement without whom this study would have been impossible. This Report aims to contribute to the education policy dialogues in the country and evidence-based quality improvement interventions and hence is dedicated to the children of Uzbekistan.

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Abbreviations and Acronyms

ACER	Australian Council for Education Research
CPD	Continuous Professional Development
CTT	Classical Testing Theory
CIS	Commonwealth of Independent States
ECE	Early Childhood Education
EMIS	Education Management Information System
ESP	Education Sector Plan
EVS	Environmental Science
GDP	Gross Domestic Product
GER	Gross Enrollment Ratio
GMR	Global Monitoring Report
GNI	Gross National Income
GOU	Government of Uzbekistan
GSE	General Secondary Education
ICT	Information Communication Technology
IEA	International Association for the Evaluation of Educational Achievement
IRT	Item Response Theory
HCI	Human Capital Index
HDI	Human Development Index
HER	Home Educational Resources
HLM	Hierarchical Linear Model
LMICG	Lower Middle-Income Country Group
MDG	Millennium Development Goal
MOPE	Ministry of Public Education
NAS	National Assessment Study
NALOPSG	National Assessment of Learning Outcomes of Primary School Graduates
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Square
PISA	Programme for International Students' Assessment
PPS	Probability Proportional Size
PIRLS	Progress in International Reading Literacy Study
PTR	Pupil Teacher Ratio
SAS	Summarized Achievement Score
SEN	Special Educational Needs
SDG	Sustainable Development Goal
TIMSS	Trends in International Mathematics and Science Study
UNESCO	The United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund

Executive Summary

This report presents the findings of a nationally representative learning achievement survey carried out among grade IV students in general secondary schools in Uzbekistan. The report analyzes the observed learning levels of children in grade IV in terms of test scores and the various school, teacher and child /household related characteristics that are correlated with higher test scores.

The study was carried out to meet the growing demands for evidence on learning to support and inform the ongoing reforms in education sector in the country. The country unleashed a series of sector-wide reforms in 2017 under the Uzbekistan Development Strategy 2017-2021, aimed at economic growth, employment generation and enhancing the human capital potential. The country's demographic window of opportunity requires focusing on quality of education. Uzbekistan's commitment to international Sustainable Development Goals (SDG) require the tracking of learning among children. Uzbekistan has also decided to participate in Programme for International Students' Assessment (PISA) 2021.

While the country has made remarkable progress in improving access to general secondary education and there is apparent gender parity in the enrollments, there is very limited information on the quality of education. This study is an attempt to bridge some of these gaps in understanding quality of education in the country. This study is a first step towards assessing observed learning levels and their correlates in primary grades in Uzbekistan.

The study uses tools and methodologies that are used in international learning assessment survey such as Progress in International Reading Literacy Study (PIRLS) and Trends in International Mathematics and Science Study (TIMSS). Around 7000+ students in grade IV from 268 schools were tested in Reading Comprehension (Uzbek/ Russian), Mathematics and Science/ Environmental Studies. The test items for the study were carefully selected to facilitate understanding students' knowledge and ability in subject-content areas as well as cognitive domains. Information were also collected from students, teachers and school principals to understand the context in which learning takes place.

The study provides information on two types of outcomes and an analysis of its determinants. First, the study provides information about levels of learning of children at the end of primary grades in the country. This information is used to understand where the students of Uzbekistan stands in international scenario. Second, the study also provides information on what grade IV students of Uzbekistan "know" and "can do" – implying students learning levels by content /subject areas and cognitive domains.

The study identifies learning as a big challenge facing the education system in the country. Observed learning levels in grade IV shows children performed average compared to expected competencies for that grade, indicating that children require additional time to acquire these competencies. This is true for all three subjects. The pace of learning in primary grades seems to be low and need to be accelerated.

In Reading Comprehension, students were good at identifying the more obvious information, while they struggled to identify more complicated information or to interpret or evaluate the information or text content. In the case of Mathematics, where the task was clearly set out and uncomplicated, students tended to do well while they struggled with complex mathematical problems. In general Science, students were good at simple, straight recall questions. However, students struggled with questions that required application of knowledge and reasoning /problem solving.

Overall, the results reveal significant differences in the average achievement levels of students of various categories/ groups. Some differences are accounted for by contextual factors, but the results suggest that the quality of educational outcomes is far from equal across the schools in the country. The results show great diversity in achievement between the highest and lowest performing schools and within schools, among students. Differences in school /teacher characteristics explain about half of the variation in test scores. The remaining variations are due to heterogeneity at student levels within schools and noise in the data, keeping geographical and school factors constant.

The multivariate regression analysis shows that on an average, student attributes and home factors (controlling for school effects) explain close to 55 percent of the variations in students' learning levels while between-school variations explains the rest. Along with school and student attributes, if regional (provincial) variations are analyzed, then the regional attributes explain around 15 percent of the variations in learning; and student attributes and home factors explain around half of the variations. School level variations explain around 45 percent of the variations, but in the presence of regional attributes, the influence of school level factors come down to 35-38 percent. Inequity of outcomes suggest that higher achieving students are receiving support while their less achieving peers may not be receiving adequate support and opportunities to reach more acceptable levels of learning.

The analysis shows that girls outperformed boys in Reading Comprehension tasks while in no such differences were observable in other subjects. Students in urban areas performed better than students in rural areas in Mathematics and Science subjects while there were no significant differences in Reading Comprehension across rural and urban students. Students in Russian medium schools performed relatively poorer in Reading Comprehension compared to their Uzbek peers whereas the Russian medium students did significantly better in Science than their Uzbek peers.

The survey used three questionnaires designed for schools, teachers and students to collect information on background factors that could potentially influence learning outcomes. The results from these findings give strong evidence on the direction of influence of these factors on students' learning. However, it is important to treat some of these results with caution and should only be used to indicate where more research and study can be usefully done to help guide educational improvement. They also show only where a certain factor is associated with improved achievement and not that it necessarily causes it. Some factors lie outside the school and educational system, for example, parent's attitude and home resources; both are associated with achievement. But some background factors are under the control of the

educations system and by looking at how these impact upon achievement it is possible to identify areas where policy makers and academicians can research further to determine what the problems are, what seems to work and how they can best improve performance. The more significant of these factors are taken into account when determining if other factors have an impact and are used in the analysis as the 'key variables'. For example, home educational resources (HER), language spoken at home and used for instruction in the school.

The predictors of learning outcomes were estimated through multi-level models. Hierarchical linear model (HLM) in this analysis nested students within schools and schools within regions, and this provided for examining multiple interactive relationships in nested organizational structure. It partitions out the effects of student characteristics and the effect of group behavior within schools/ classrooms on the relationships at the individual level.

The analysis of factors that predicted learning outcomes presented new insights which were hitherto unexplored. The analysis decomposed the relative roles of household environments along with individual student endowments, most of which are exogenous to the education sector, and school level factors, which could be addressed through institutional reforms within the education sector.

The evidences suggest that schools varied significantly in learning achievements of students. High-performing schools exhibited lesser inequality in learning levels of its students compared to low-performing schools, where some students did exceedingly well while most students performed poorly. The class size (number of students in the class) did not make any impact on the overall students' performance, reaffirming many international evidences in this direction. However, the physical environment of classrooms, especially facilities that enable children to adjust to difficult weather conditions, furniture and teaching -learning materials – affect children's performance in learning achievement.

The results suggest that students who had attended a preschool before entering primary grades did perform better than those who had not attended preschool education. This is significant given the variable quality of preschools in the country when these students were preschoolers. This means that even with average quality, preschool experiences contribute to sustained learning in primary education. Students who could recall family providing them with early learning /literacy experiences also performed better than those who reported a deprivation of such experiences. Indeed, better performing students had an early start in literacy and numeracy.

Within school, student endowments and characteristics varied, and these had some profound impact on test scores. These include: gender of the child, students' early childhood education and experiences of early engagement and stimulation from family, students' attitudes and approach to studies, students' experience of bullying in schools, students' discernment about physical facilities in school/classrooms, and extent of time and opportunity to study outside home through homework.

The home/family environment also contributed to better learning outcomes. Resources and environment that promotes a culture of reading and learning at home, family support for

children's studies, family prioritization of studies for children and family's socio-economic status contributed to better test scores of students.

An important determinant in better learning outcomes is related to language of education and language at home. The results show that children whose language of education is the same as spoken at home performed significantly better than those whose medium of education is different from their home language. The fact that students in Uzbek medium schools did much better than those in Russian schools in Reading Comprehension supports the same evidence.

Other Home factors: High performing students have home environments that support learning. The results suggest that higher the support and involvement from parents/ family and better the home resources, the better the student's performance.

School factors: There are several school factors associated with students' learning achievement. High performing students attend well resourced, academically oriented schools. The results show that safe schools contribute to better learning achievements. Students at schools who reported behaviour problems, such as late arrivals, absenteeism, skipping classes or violations of school rules, tend to do worse.

Student perspective: Student perspective is very important and anything that affects students' ability or desire to attend school and pay attention to various curricular activities could be associated with better learning achievement. Students with positive attitude towards learning also perform better in tests.

Teacher: Teacher has a key role in mediating learning and the study looked at various factors around the teacher and their teaching practices. A teacher with some experience and a modern higher education contributed to better student performance than a new teacher or a teacher who was a product of the old Soviet education model. Students who had their homework checked by their teacher every day tend to do better. Some interesting results emerge from analyzing teacher characteristics. Students taught by teachers of first category (teachers with 3-5 years of experience or with a Master's degree) performed better than students taught by "specialist" teachers (entry level teachers with either secondary special pedagogical education or Bachelor's degree); however, teachers in higher categories (teachers in "first" and "highest" categories with higher qualification, experience and expertise as certified by the government) had a negative impact on students' test scores. This aspect requires further investigation in terms of the existing teacher qualification framework and professional standards, and teacher attestation mechanisms, as well as the impact of teacher categories on learning levels for higher grades of general secondary education.

The outcomes of the study are important for policy at various levels. At the macro level, the Ministry of Public Education (MOPE) may start exploring ways of how to optimize existing resources – including school resources and teacher time and efforts to provide children with a better learning opportunity. For the pedagogic experts, it provides challenge to design curriculum in such a manner that the subject content load is balanced with a competency-based approach. Teacher training institutions and teacher accreditation/ attestation systems needs to be reviewed to ensure that teachers are prepared for effective instruction. Besides,

training should be modified to make teachers implement more child-centric learning methods, rather than following teacher-centric traditional methods that involve teacher “instructing” and students merely “listening”. Reforms are important in assessment systems and in creating a robust education information system. The country can draw lessons from other countries who in the past two decades systematically reformed the education sector quality through concrete sets of interventions.

1. Introduction

This report presents the findings of a study on the learning levels of children in Uzbekistan at the end of primary grades (grade IV). The study was designed in line with internationally comparable methods and tools and was carried out jointly by the Ministry of Public Education (MOPE), Government of Uzbekistan (GoU) and UNICEF – Uzbekistan in 2018. This is the most comprehensive assessment of students' learning in Uzbekistan till date. This comprehensive study covered over 7000 students of grade IV drawn from a nationally representative sample of schools and hence can be considered as a “National Achievement Survey” (NAS).

While there is ample information available to suggest that Uzbekistan has achieved near-universal primary and secondary education enrollments, there was very little information on the quality and learning achievement of students in the country, in the absence of a standardized, robust NAS. National learning achievement surveys are considered key to diagnose the strengths and weaknesses of the education systems and to identify the gaps and challenges to enable appropriate policies and decision making. This study is an attempt to fill some aspects of the huge vacuum in understanding education quality in the country.

The study tested children for their subject knowledge and skills in Language (Reading Comprehension), Mathematics and General Science (mainly topics related to “the World Around Us”). In addition to the tests, using specific questionnaires, information was collected on school and teacher characteristics and students' school experiences and home background. The testing and survey was carried out during April-May 2018.

This report reports on the findings of the study in terms of observed learning levels, particularly what students “know” and “can do” at the end of primary education, and the various school, teacher and child related characteristics that are associated with better learning levels of children in the country. The report also provides a glimpse into the potential areas for further investigation as well as areas where education sector interventions could be directed.

1.1. Development Context

Uzbekistan, a resource-rich, double-landlocked country, strategically located in the heart of Central Asia, is home to more than to 32 million people, approximately half of whom live in urban areas. As per the World Bank's classification of 2011, Uzbekistan is a lower middle-income nation, with a GDP per capita of \$1535 (current prices) and \$ 6240 (in PPP, 2011 constant prices)¹ and a Human Development Index (HDI) value of 0.701 in 2017 (which places the country at 105 in ranking among 188 nations²).

The Republic of Uzbekistan gained independence from the former Soviet Union in 1991, but unlike many other countries born after the collapse of Soviet Union, Uzbekistan had pursued a

¹ <https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.KD?locations=TJ-UZ-KG-TM-KZ>

² http://hdr.undp.org/sites/default/files/2018_human_development_statistical_update.pdf

cautious and gradual approach to transition to a market economy. The economic reforms received a renewed focus when the new leadership assumed government office in late 2016. In early 2017, the Government had announced a broad market-oriented reform programme, which included “fostering social development” as one of the five priority policy areas³. This priority area includes education⁴ as a predominant sector and strategy for country’s development⁵.

The social sector reforms assume importance given the country’s potential to benefit from the steady demographic transition that Uzbekistan has been going through since independence and the role of economic growth and human development in boosting a true demographic dividend. Uzbekistan is well placed to leverage its demographic window of opportunity provided the country prioritizes the following: (a) enhancing the quality of education, and health care and nutrition to strengthen the nation’s human capital; (b) prioritizing economic flexibility and entrepreneurship; (c) scaling up technological access and innovation; and (d) fostering social participation and cohesion (UNICEF, 2018). Education reforms are key to enable a more productive, innovative, inclusive and stable society in the longer term in the country. It is evident that the potential demographic dividend is possible only when the children and youth of the country attains relevant skills and competencies.

1.2. Education sector context:

The Constitution of Uzbekistan (1992) guarantees “right to education” for all as enshrined in Article 41: ‘Everyone shall have the right to education. The state shall guarantee free secondary education. Schooling shall be under state supervision’. The general secondary education⁶ (GSE) is “free” (implying no tuition fees) as well as compulsory in the country, resulting in a near-universal enrollments in the sub-sector. While the overall gross enrollment ratio (GER) in grades 1-9 was around 97 percent in 2016-17, for primary grades (grades 1-4), this was estimated to be 100 percent, with 99 percent of students completing grade 4 successfully transiting into grade 5 (UNESCO Global Monitoring Reports (GMR)) and for secondary education levels (grades 5-9), it was 94 percent⁷. Until 2017, GSE in Uzbekistan consisted of nine years of compulsory education (grades 1 to 9). In 2017-2018 school year, the Government

³ The five priority policy areas for Development Strategy 2017-2021 are: (i) enhancing state and public institutions; (ii) securing the rule of law and reform of the judicial system; (iii) promoting economic development; (iv) fostering social development; and (v) ensuring personal and public security through inter-ethnic and religious tolerance and constructive foreign policy.

⁴ Uzbekistan Development Strategy 2017-2021 priority area # 4.4 is about development of education and Science. Other priority areas in social sphere include: 4.1: Income and Job creation; 4.2: improving social security system and health care, enhancing socio-political activity of women; 4.3: affordable housing, modernization of transport, engineering, communication and social infrastructure; and 4.5: youth policy.

⁵ <http://tashkenttimes.uz/national/541-uzbekistan-s-development-strategy-for-2017-2021-has-been-adopted-following->

⁶ In Uzbekistan, General Secondary Education refers to the whole school cycle, encompassing both primary and secondary education.

⁷ Uzbekistan Education Sector Plan 2019-2023.

of Uzbekistan decided to expand compulsory general secondary education years from 9 to 11 years of study.

At present the education system in Uzbekistan comprises of a total of 16,423 educational institutions including 5,138 preschools, 9,719 secondary schools, 144 Academic Lyceums and 1,422 Professional Colleges, covering a total of 6.975 million students with 482,500 teachers, resulting in an overall Student: Teacher Ratio (PTR) of 14.5:1; and a PTR of 12:1 at general education (State Committee on Statistics). The dominant language of instruction in schools is Uzbek (82.5 percent of general secondary schools), while Russian (7.6 percent), Kazakh (3.5 percent), Karakalpak (3.3 percent), Tajik (2.2 percent), Kyrgyz (0.5 percent) and Turkmen (0.4 percent) are also used as medium of instruction in several schools (State Committee on Statistics, 2017). Reflecting the demographic transition discussed above, total number of learners in GSE has been increasing - it had increased from 4.49 million in 2012 to 4.825 million by 2017-18, an increase of 7.4 percent (Uzbekistan ESP II: 2019-2023).

Though the country has recorded tremendous accomplishments in improving overall access to GSE, certain groups of children are still vulnerable and face challenges in accessing formal education. While the efforts in reducing child labour and child trafficking had immediate results, children in remote rural areas and children with disabilities still face challenges in accessing regular, mainstream schools. The UN Situation Analysis of Persons and Children with Disabilities in Uzbekistan (2019) shows that only 56 percent of children with disabilities were in formal, mainstream schools; 30 percent of them were either in special schools or home schooled while 14 percent of children with disabilities were outside any form of formal education system in 2018 (Joint UN- Draft Situation Analysis on Children and Adults with Disabilities in Uzbekistan, 2019). In 2015, around 20,000 children lived in residential institutions while only 14 percent of them were indeed orphans – others (86 percent of the resident children), were placed in these facilities based on the socio-economic challenges in their families (UNICEF Uzbekistan 2016). Such children require extra support to access the same educational facilities as children from economically better-off families. Although accessibility to general secondary education was guaranteed through eleven years of compulsory education, affordability remains an issue – though the GSE is “free”, there are many informal costs in education.

In the national budgets of Uzbekistan, education, along with health care, continues to be one of the main priorities of government social policy. Among the lower middle-income group (LMIG) countries, Uzbekistan allocates one of the highest level of public resources to the education sector. The Government of Uzbekistan spent around 6.4 percent of its GDP in education in 2017. This is more than what other Commonwealth of Independent States (CIS) countries invested in education (Kazakhstan: 2.8 percent of GDP; Tajikistan: 5.23 percent; Belarus: 5 percent; and Russia: 3.8 percent). In the past decade or so, Uzbekistan had allocated 8-12 percent of its GDP for education sector. As a proportion of government budget, education expenditures accounted for approximately 32.4 percent in 2017 and this remained in the range of 30 – 34 percent in the past decade or so (Uzbekistan ESP 2019-2023). Uzbekistan’s expenditure per student is also reasonably high: In nominal prices, the government invests UZ soums 1.51 million on a general secondary school student in 2016. If the 2016 official exchange

rate (of 1 US\$ = 3218 Uz soum⁸) is applied, then the per student public expenditure in general secondary education would have amounted to US\$ 470 (Uzbekistan ESP 2019-2023).

While there is clear information on the access to general secondary education and education related inputs, including some information on the education financing, the quality of the education provided in the country is unknown due to paucity of reliable, standardized and robust data on various aspects of education quality. UNICEF (2010) reported that, although enrolment is high, very little information is available on the quality of education and on learning outcomes (UNICEF Uzbekistan, 2010). The situation has not changed even after almost a decade now - we have very limited information on “what students know” and “what they can do”.

In the absence of robust data and analysis, evidence-based and contextualized policies and programmes to reform education sector quality and equity issues remain a challenge in Uzbekistan. World Bank (2019) reported that the results of National Assessment of Learning Outcomes of Primary School Graduates (NALOPSG), a sample study carried out in 2013 under the World Bank’s Basic Education Project -II, showed that on average grade 4 students were not able to correctly respond to at least 50 percent of the tested content in native language and reading. Government’s own analysis of their assessments (using non-standardized tests) points towards an average learning achievement of 63 percent scores. With informal sector is poised to provide a sizeable employment in the country in the coming years, it is even more important to know about quality and adaptability of education system, particularly the foundational skills, transitional skills (competencies such as critical thinking, problem solving, creativity, communication etc.) as well as digital skills.

Recent developments in education sector

Ever since the adoption of the “Strategy of Actions for the Development of Uzbekistan for 2017-21” in 2017, the Government of Uzbekistan (GOU) has been introducing major education sector reforms, including an ambitious plan to universalize preschool education by 2030 from below 30 percent in 2018. As part of the reforms in general secondary education sector, the government has been in the process of revising the existing Law on Education (1997); and has extended the general secondary education cycle from 9 years to 11 years. The Government has also been planning to revise the present curriculum to give it a major re-orientation in terms of competency-based approach.

However, one of the major developments in education sector in recent times is the government’s decision to participate in the 2021 Programme for International Students Assessment (PISA), the OECD-led international assessment of children of 15 years of age for their skills. Uzbekistan has set an ambitious goal of reaching among the top 30 countries in PISA results by 2030, as illuminated in the Presidential Decree #PF 5712 dated April 29, 2019⁹.

⁸ <https://www.focus-economics.com/country-indicator/uzbekistan/exchange-rate>

⁹ Decree about the endorsement of the Concept on Development of Public Education System of the Republic of Uzbekistan by 2030.

At the global level, the government has also decided to join the Human Capital Index (HCI) project of the World Bank in 2018, where educational achievements of country are not measured by the mean years of schooling (which is the approach adopted in the UN HDI), but by the “Learning Adjusted Years of Schooling (LAYS)” (Filmer, D., H. Rogers, N. Angrist and S. Sabarwal, 2018). Though Uzbekistan is one of the early mover country in this project, the HCI will be calculated only after the country completes a standardized national assessment survey.

These reforms have placed the quality of education and learning outcomes at the center-stage of education debates in the country and have intensified the demand for understanding where the students in the country are in terms of their knowledge and skills. The second Education Sector Plan (ESP II) 2019-2023, places a greater emphasis on improving educational processes and outcomes, including learning at all levels and establishing systems for measuring learning at various levels.

Recognition of Education Quality issues – SDG 4.

The Millennium Development Goal (MDG) related to education was focused on attaining universal access to primary education and enhanced gender parity in primary education enrolments. During this period, governments and the international community had invested heavily into improving school infrastructure, training teachers, and developing and supplying learning materials, mainly in countries with limited access to and low participation in school education. The number of out-of-school children has fallen dramatically since the start of the century, and gender disparities have narrowed significantly in many parts of the world (UNESCO, 2013). Obviously with the high enrolment rates, Uzbekistan came across as a relatively successful country in education enrolments.

While the international learning assessments has been in existence for a long time, especially since the International Association for the Evaluation of Educational Achievement (IEA) first introduced large-scale comparative studies of education systems in the late 1950s¹⁰, it is only in the early decade of the new millennium that many countries, especially emerging and aspiring economies, started taking the learning and skilling aspects more seriously. There is an increasing recognition that to sustain the momentum created in increased the access to and participation in education requires quality learning outcomes, that beyond getting children in the classroom, it is imperative that they learn (UNICEF and ACER, 2016). As UNESCO (2013) report on the Global Learning Crisis highlights, “despite increased enrolments, an estimated 250 million children cannot read, write or count well, whether they have been to school or not. Across the world, 200 million young people leave school without the skills they need to thrive plus an estimated 775 million adults – 64 percent of whom are women – still lack the most basic reading and writing skills” (UNESCO 2013).

Ensuring inclusive and quality education for all has been recognised as a key objective in the 17 Sustainable Development Goals (SDG) of the UN as quality education is an important factor for achieving other societal and economic goals. Good quality education can help individuals break

¹⁰ <http://www.freshedpodcast.com/dirkhastedt/>

free from poverty, contribute to gender equality and live more healthy and sustainable. Furthermore, education promotes tolerance and leads to more peaceful societies (UN). The right to education and the goal to improve education around the world does not only focus on ensuring that all children get equal access to education, but also that they equally participate in learning and succeed (Winthrop, R. and K. Simons, 2013). As a signatory to the UN Sustainable Development Goals (SDG), Uzbekistan is also responsible for achieving the targets for the education goal, the most prominent one being the target 4.1, i.e. “by 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and Goal 4 effective learning outcomes”. It also reflects the knowledge that enrolment and participation in Preschool programmes, formal schooling or adult education are the means to attain results and improved learning outcomes at every stage, from school readiness among young children through achieving literacy and numeracy at primary school to equipping young adults with knowledge and skills for decent work and global citizenship. Uzbekistan is committed to work towards improving the SDGs, as rightly emphasized in the Second Education Sector Plan 2019-2023 (approved in January 2019). The Government of Uzbekistan has adapted the SDG indicators for the country (December 2018) and it includes indicators on learning of children.

UNICEF’s support to education reforms in Uzbekistan

UNICEF recognizes the “global learning crisis”, which emanates from the fact that not all children who do attend school are learning. The causes of this learning crisis range from low domestic budgets to the lack of adequate research into the impact of education systems on the learning levels of children, as well as interconnectedness of a variety of school and education system factors influencing children’s performance. Solutions for such crisis needs to be built on strong data and the specific context of a country (UNICEF).

UNICEF’s approach to learning is guided by the principle that “every child learns”. To address the Learning goal, UNICEF supports systematic tracking of learning outcomes. Considering that improving quality of education and improving learning is both a global and national priority, UNICEF has been providing technical support to various activities aimed at improving quality of education in the country. UNICEF has supported the development of the National Quality Education Conceptual Framework and is in the process of developing a monitoring system (Education Management Information System- EMIS) for education related inputs, processes, outputs and outcomes, especially focusing on the quality of education. UNICEF is supporting the Government of Uzbekistan in reforming the curriculum, based on a set of transitional skills /competency frameworks. The present study is part of UNICEF’s efforts towards supporting the country in developing capacity to do national learning assessment systems. The present study is aimed at understanding “what students know” and “what they can do and beyond” and the factors influencing learning among children.

1.3. Objectives of the study

This study explores the learning levels of children in Uzbekistan at the end of primary education, and in addition, try to explore the factors that enable better learning as well as those creating barriers to learning for children in Uzbekistan. The rationale for conducting such a study is to facilitate the government of Uzbekistan to comprehend factors behind the current status of education quality and learning outcomes in the country.

Greaney and Kelleghan (2008) points out that a learning assessment survey aims to understand the causal factors in learning, and generally seek answers to one or more of the following questions:

- How well are students learning in the education system (with reference to general expectations, aims of the curriculum, preparation for further learning, or preparation for life)? Does evidence indicate strengths and weaknesses in students' knowledge and skills?
- Do different subgroups in the population perform differently? Do disparities exist, for example, between the achievements of (a) boys and girls, (b) students in urban and rural locations, (c) students from different language / ethnic groups, or (d) students in different regions of the country?
- What factors are associated with student achievement? To what extent does achievement vary with characteristics of the learning environment (for example, school resources, teacher preparation and competence, and type of school) or with students' home and community circumstances? and
- Are government standards being met in the provision of resources (for example, textbooks, teacher qualifications, and other quality inputs)?

The present study too seeks to address similar questions. The study mainly tries to explore answers to the following questions related to learning. Specifically:

- Levels of students' learning – Where does children in Uzbekistan stand in terms of overall learning? How does it compare with their years of schooling?
- What does children in Uzbekistan “know” and “can do” - How much children know by subject-content (knowledge) and cognitive domains (competencies)?
- How does learning differs across various groups - Do different subgroups in the population perform differently? Do disparities exist between the achievements of (a) boys and girls, (b) students in urban and rural locations, (c) students from different language groups, or (d) students in different regions of the country? and
- What are the factors associated with student achievement? To what extent does achievement vary with characteristics of the learning environment – student, home, school and country context? Is the relationship between student performance and various student, teacher and school characteristics similar to those found in other countries?

Based on the above questions, the report uses the findings of the study to:

- determine the level of students' learning levels in Uzbekistan;
- analyze variations in students' learning levels by region, gender, location, and other socio-economic and family characteristics;
- explore factors that influence students' learning levels at primary education (which is part of general secondary or basic education in Uzbekistan);
- create a reliable baseline data for reference for any future learning assessment studies; and
- generate recommendations for policy making to improve educational quality.

The results of the study are expected to trigger policy debates among various education stakeholders – government, development partners, parents, teachers, civil society organizations (CSO) and other key players in education - about the quality of education in Uzbekistan and what really contributes to better learning and skills development. It is expected that based on the findings, government will be able to come up with a strategy to focus on the most effective interventions to improve education quality in an equitable manner. Further, it is expected that the findings of the study are expected to raise questions on areas hitherto unknown in terms of education quality in the country, and hence lead to further inquiries and research in education.

With the above intentions, the study results will be converted into a technical report first (which is presented here), followed by more lucid policy notes and briefs on specific topics aimed at specific audiences, including government, development partners and donors, parents and community at large. This technical report presents the study with all technical details, including methodology, analytical and analytical frameworks and multivariate analysis.

Value Added by this study

As explained earlier, this is the first systematic study on the learning levels of children in school education in Uzbekistan. The study has used tools and methods that are in line with international best practices. This is also the first study in the country that provides some insight on the factors that enable learning enhancements as well those that hinder the same. The whole process of designing and implementing the study has created enhanced awareness among the stakeholders on the importance of measuring and assessing learning levels among children as a measure of education system quality and looking beyond enrollments and inputs.

The usual time frame for conducting national assessment studies is 2-3 years, starting from a mapping of the curriculum and designing of test and other materials in accordance with national education standards. Despite the limited time frame, this study was completed within a year because of the vast experience that the UNICEF team had elsewhere in conducting such studies and the skillful adaptation of research materials (tests and questionnaires) from Lithuania to Uzbek context with the help of local curriculum and monitoring experts. Therefore, this study provides just initial insights on learning levels of Uzbek children and factors that might explain them; however, further comprehensive research is necessary to create a complete picture.

Limitations

This study was carried out amid several constraints imposed by the systemic and structural issues in the sector. Hence, the results of the study and the processes should be interpreted and understood in the context of its varied limitations.

In the absence of clearly defined learning standards in Uzbekistan, it was not possible to analyze the results vis-à-vis the expected learning levels. In this context, drawing emphatic conclusions on the overall achievement results (according to Uzbek national curricula) of the sample of students participating in this study as improving or declining, or high or low was not possible due to lack of reference point to do so.

There were comparatively large shares of unanswered questions in background questionnaires (in some cases the rate of missing answers was up to 30 percent). This is despite using only few questions on the socio-economic background of the children, and most of the questions were, rather focused on students' attitudes towards education as enabling factors. The high proportion of positive responses towards such questions point towards a tendency to confirm in a culture where conformity is expected. The large proportion of non-response was taken into consideration while interpreting the study results. It was also identified as an issue (non-response) to be considered while designing future questionnaires for field studies.

Organization and Structure of the report

This report presents the key findings of the assessment study. The report is structured as follows: In the next section, the study methodology is elaborated. The results on grade IV students' learning levels are presented in the third section, followed by an analysis of the findings on what student "know" and "can do" by subject content areas and cognitive domains. In the fourth section, the analysis focuses on the learning outcomes by various aspects of students' endowments and characteristics. Fifth section looks at home environment and learning outcomes. School, classroom and teacher level characteristics in relation to learning outcomes are carried out in the sixth section. In the seventh section, the results of multivariate analysis are described. The final section presents the way forward, drawing lessons from international experience for informing the ongoing reforms in education sector in Uzbekistan is presented along with some recommendations.

2. Study Design and Methodology

Given the present context of education reforms in Uzbekistan, this NAS serves four main objectives:

- For the first time, generating robust information on the levels of students' learning in the country using tools and methodology that are standardized for international practices;
- Again, for the first time, assessed what students in Uzbekistan at the end primary stage (grade IV) "know" and "can do" in terms of content and cognitive domains in core subjects; and since the NAS was conducted on grade IV children, which is the final grade of primary education in Uzbekistan, contributes to the system-wide efforts to understand learning deficits early on in education system;
- Provide some basic evidences on the factors that impact students' learning levels in Uzbekistan, and this information is expected to facilitate the Ministry of Public Education (MOPE) in designing targeted interventions and policies to improve quality of education, particularly for initiating reforms in curriculum and instructional aspects; these evidences are also useful in understanding whether the factors affecting learning levels in Uzbekistan are similar to those in other countries or different; the knowledge of which is useful while deriving lessons from other countries and adapting some of the good practices for improving learning elsewhere; and
- Finally, the process of designing and carrying out the study in a collaborative manner with active involvement of the experts from MOPE and other education stakeholders, and their participation in all stages of the study, has contributed to not only enhancing their understanding of the nature and purpose of national assessments, but also building their capacity to reform the national learning assessment systems and to join international learning assessments in the future.

This section is organized into the following: First, we look at the various frameworks that are used globally to define and understand education quality and learning outcomes. This will be followed by a detailed discussion on the methodology of the study and analytical frameworks.

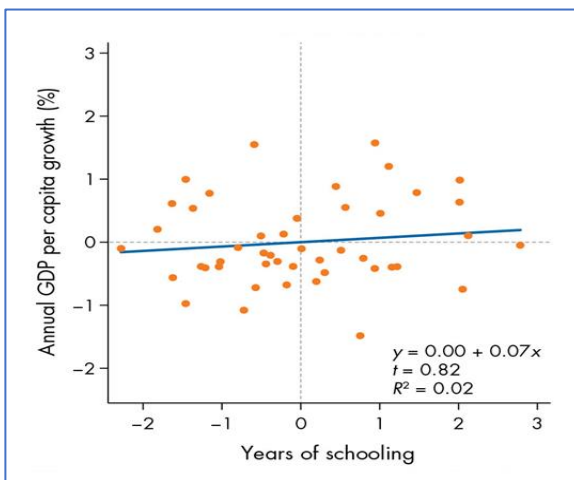
2.1. A framework for understanding quality education and learning outcomes

Empirical literature suggests that globally the efforts to explain what leads to better education quality and learning outcomes had taken three different perspectives: (a) education quality and learning outcomes as an output of an education production function; (b) the learning achievement as an measure of education quality, which is the results of a combination of education inputs, contexts and innate characteristics of child; and (c) learning outcomes as a fulfilment of child's right to, rights in and rights through education perspectives.

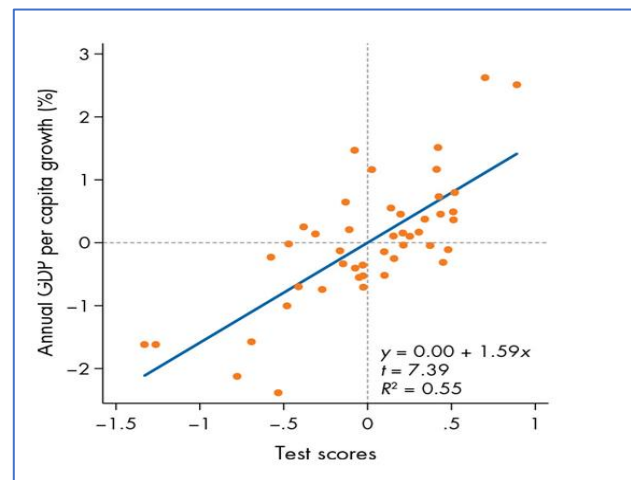
Education quality explained in production function approach

There is growing global evidence that emphasizes that quality of education is what matters for economic development (Masino, S. and M. Nino-Zarazua, 2016). Hanushek and Kimko (2000) and Barro (2001), for example, found that test scores are better predictors of real per capita GDP growth than years of schooling attainment. Hanushek and Woessmann (2008, 2012), Hanushek et al. (2010), Jamison et al. (2007), Laurini and Andrade (2012), and UNESCO (2011), among others, show that cognitive skills are more strongly associated with increases in earnings and development outcomes than schooling attainment (Masino, S. and M. Nino-Zarazua, 2016). See graphs 1A & 1B.

Graph 1A: Schooling (# of years) and Economic Growth



Graph 1B: Test scores and Economic Growth



Source: WDR 2018, based on Hanushek and Woessmann (2012)

The education production function approach presents two dimensions to the improvements in quality education: first one is related to the production function approach; and the second one, the human capital development approach. While the first dimension focuses on the role of quality education in driving economic activities and growth; and the second one focuses on outputs or outcomes of education to fit people to changing work/life demands.

In the economic production-function approach to analyzing educational quality, the achievement of individual students is treated as the output of the educational processes that is directly related to inputs that both inputs and outputs are directly controlled by policy makers (e.g., the characteristics of schools, teachers, curricula, and so forth); and are not so controlled by factors such as families and friends and the innate endowments or learning capacities of the students. Further, while achievement may be measured at discrete points in time, the educational process is cumulative; inputs applied sometime in the past affect students' current levels of achievement. Family background is usually characterized by such socio-demographic characteristics as parental education, income, and family size. Peer inputs, when included, are typically aggregates of students' socio-demographic characteristics or achievement for a school or classroom. School inputs typically include teacher background (education level, experience,

sex, race, and so forth), school organization (class sizes, facilities, administrative expenditures, and so forth), and district or community factors (for example, average expenditure levels). (Hanushek, E.A, 2007). Three institutional features that may be part of a successful system for providing students with cognitive skills: choice and competition; decentralization and autonomy of schools; and accountability (Hanushek, E.A & L.A. Woelfman 2007).

A major addition to its production-function approach is the World Bank's initiative on System Approach for Better Education Results (SABER). The World Bank's "Education Sector Strategy 2020: Learning for All" argues that effective action to promote learning requires a more balanced analysis of the whole education system, aimed at identifying the binding constraints to learning, wherever they are (World Bank, 2013). The SABER is a response to that and points out that the results chain for learning includes the quality of policies and institutions and the quality of policy implementation; both are likely to be major influences on the quality of education delivered, which in turn affects student learning and other outcomes (World Bank, 2013).

Chart 1. World Bank SABER Approach to Quality: SABER and the Results Chain for Learning



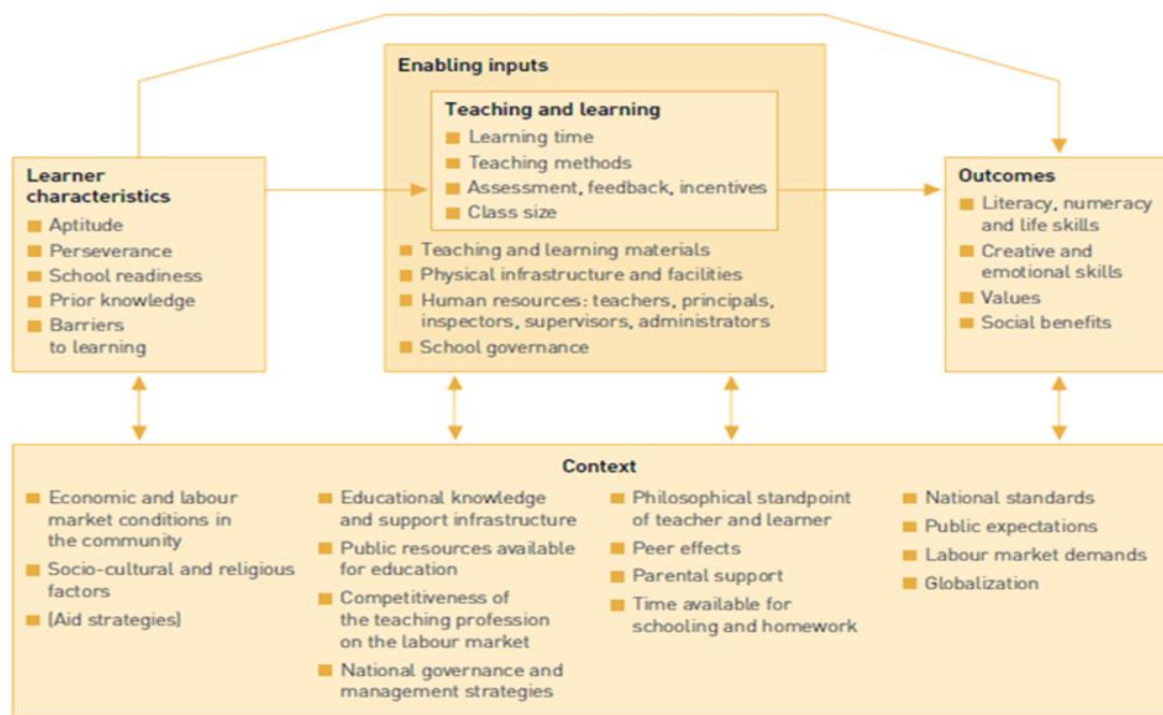
Source: The World Bank (2013)

Learning assessments as a measure of education quality:

The UNESCO – GMR 2005 states that while there is no single definition of quality, two principles characterize most attempts to define the objectives of education: the first identifies learners' cognitive development as the major explicit objective of all education systems. Accordingly, the success with which systems achieve this is one indicator of their quality. The second emphasizes education's role in promoting values and attitudes of responsible citizenship and in nurturing creative and emotional development. The achievement of these objectives is more difficult to assess and compare across countries. (UNESCO- GMR 2005). UNESCO-GMR has elaborated the learning process, particularly the creative interaction between students and teachers in the classroom as means to achieving learning outcomes. Lessons from learning as outcome for education quality shows that good schools are typically characterized by strong leadership, an orderly and secure classroom environment, emphasis on acquiring basic skills, high expectations regarding students' attainment and frequent assessment of their progress (GMR, 2005).

The quality education framework, as outlined in the UNESCO GMR (2005) characterize the central dimensions influencing the core processes of teaching and learning, resulting in learning and other outcomes. As per the UNESCO- GMR (2005) framework, learners' individual characteristics along with the enabling school environment /inputs will result in a range of education outcomes in a given system and context.

Chart 2: Education Quality Framework (UNESCO 2005)



Learning outcome as a fulfilment of Child rights to education:

While UNESCO’s framework approaches quality education through the learning prism, UNICEF’s approach focuses on child-rights and hence a learner-centered approach to quality. In the rights-based approach, learner is the center of the education processes. The rights-based approach talks about children’s “rights **to** education, rights **in** education and rights **through** education”. The right **to** education focuses not only on the availability and accessibility of education, but more specifically to equitable access to quality education. The rights **in** education argues for quality education that is acceptable and adaptable to the needs of all children, including those with special needs. Children’s rights **through** education to learn and develop their full potential should be ensured through adaptability and quality of the education system. To fulfil children’s rights to education, the system, schools and families have obligations for creating an enabling environment.

The upcoming UNICEF Education Strategy (2019-2030)¹¹ defines a conceptual framework that defines an enabling environment for learning, which includes: (a) system level (macro level factors); school/classroom/other learning environment level; and (c) Child/ household/ community level (micro level).

¹¹ <http://www.unesco.org/new/fileadmin/MULTIMEDIA/FIELD/Santiago/pdf/8-UNICEF-Education-Strategy-Consultation-Presentation.pdf>

Chart 3: UNICEF – Enabling Environment for Learning: Conceptual Framework (2019)



2.2. Learning outcomes and related factors: A summary of factors from Empirical evidences

A review of the vast amount of literature available globally regarding the factors that influence learning levels of children using the conceptual approaches explained above reveal that children’s learning is affected by a range of factors, with relative explanatory power. Based on the conceptual approaches above, these factors could be grouped into: (a) factors related to the child’s individual characteristics; (b) factors related to the child’s family background and home context; (c) factors related to the classroom environment and school context; and (d) general education system factors.

Student Characteristics

Apart from the obvious students' characteristics such as age and gender, empirical studies, especially those based on international assessments such as PIRLS and TIMSS suggests that students' academic attitudes and aspirations are closely interconnected with their educational outcomes¹². Factors such as child's social skills, motivation, abilities, prior academic achievement and knowledge (gained in pre-primary and primary education), learning difficulties and learning habits are also aspects of child's individual characteristics that impact his/her success at school (Peček, M. and C. Razdevšek-Pučko, 2003). Clemens, T (2008) in his work on social cognitive model of education (2008) argued that academic self-perception and self-regulation contribute significantly to a student's achievements. For example, higher reading achievements are linked to positive attitudes of children to their reading assignments (PIRLS, 2016). A poor performance could be the result of a behavioural problem, or a result of difficulties with the curriculum or an unsupportive environment (Rumberger, R and S. Lim, 2008). Li, Y et al. (2008) shows that students with high resilience scored higher in their level of school engagement, effort and school attendance. In addition, high level of school engagement is often associated with positive emotions, adaptive coping (Reschly et al., 2008), and better adjustment to school (Simons-Morton and Crump, 2003). Moreover, high self-esteem and efficacy promote students' engagement in school (E. Demerouti et al., 2001).

Home Context

As can be seen from UNICEF's Conceptual framework on quality, home environment is a crucial component of factors contributing to better learning among children. Some of these factors that are described below.

Socio-economic status: There is a strong difference between the levels of performance of children in an advantaged socio-economic position compared to those in a disadvantaged position. Children of highly educated parents also score higher than children of less educated parents (Considine, G., and G. Zappala, 2002). The social background, language and labour market linkages influence the educational achievements of a child (Markussen, E, 2010). The place of residence of a child can also play a role in learning levels, although conclusions about this factor cannot be generalized.

Home Language: Language is commonly indicated as a crucial determinant of educational achievement, especially for children from immigrant and minority language children (Azzolini, S and Palmer, 2012). Language forms an important barrier to learning as well. Children from ethnic minorities are also more likely to underachieve (Parreira do Amaral, et al., 2013). Language of instruction is also an issue when many parents and communities believe their children will get a head-start in education by sending their children to a school that uses the prominent international language of the place as the medium of education, thus by bypassing the home language for education. However, the evidence suggests otherwise.

¹² However, Banerjee and Lamb (2016) note that a clear causal relationship between attitudes, aspirations and children's educational outcomes is not well-established in literature in the absence of robust evaluations.

A crucial learning aim in the early years of education is the development of basic literacy skills: reading, writing and arithmetic. Essentially, the skills of reading and writing come down to the ability to associate the sounds of a language with the letters or symbols used in the written form. These skills build on the foundational and interactional skills of speaking and listening. When learners speak or understand the language used to instruct them, they develop reading and writing skills faster and in a more meaningful way. Introducing reading and writing to learners in a language they speak and understand leads to great excitement when they discover that they can make sense of written texts and can write the names of people and things in their environment. Research in Early Grade Reading (EGRA) has shown that students who develop reading skills early have a head-start in education (Kioko, 2015).

Belonging to vulnerable groups: Children with mental or physical disabilities are more likely to underachieve, similar as children with a foreign background, which is indicated for example in the TIMSS studies (Mullis, I. 2005).

Family environment: Better educated and highly involved parents positively contribute to learning levels of children, although less educated parents who transmit their high educational aspirations have a positive impact as well. Children from single-parent households or from families with a violent atmosphere tend to perform lower. This shows the importance of a good family climate and strong family cohesion (Matkovic, 2013). The results of the TIMSS 2015 test among fourth graders indicated that students with better educational resources at home performed better at Math than those without such resources.

Classroom and school-level context

School environment and practices are those that directly influence children's experiences and well-being at school and are crucial for children's successful learning.

Different classroom characteristics (e.g., class size and PTR) have been found to be associated with the learning levels of children (Fredriksson, P.; B. Öckert, and H. Oosterbeek, 2012). However, there are several other studies that reveal that after a certain threshold, reducing the size of class rarely influence performance in Math and Science (European Commission, 2013).

Teaching methods, as well as assessment practices employed in the classroom can also affect children's learning experiences. Developing students' cognitive and non-cognitive skills requires teachers to use different capacities and techniques (Bjorklund-Young, A. 2016). Blazar and Kraft (2015) found that the teachers whose students have the largest success are demonstrably good at providing emotional support to their students and at organizing the classroom. Teachers also need to understand how various practices work and to have specific strategies available to develop students' perseverance, mind-sets, learning strategies, or social skills directly as part of their day-to-day work in the classroom. The quality of teaching also depends on the availability of clear strategies that teachers can use to develop learning materials and practices.

Class size has been found to have an impact on students' engagement in classrooms and school: the smaller the class size, the less afraid students feel to ask questions and their behaviour is less disruptive (Dee, T.S and M.R. West, 2011). Karoly et al (2005) have found that at school

level, besides better trained staff and favorable staff/child ratios, more interactive pedagogies lead to larger and longer-lasting positive outcomes for children, including their non-cognitive skills. Curricula with integrated interactive activities contribute to improved children's executive function skills (Diamond, A. 2013).

School climate and peer-to-peer relationships, as well as student -teacher interactions shape students' learning. For instance, schools where students report feeling unsafe, generally have higher dropout rates (Rumberger, R. and S. Lim, 2008). Schools with more affluent than disadvantaged children performed better in Math and students in safe schools outperformed those in disorderly environments (TIMSS 2015). Peer groups' influence on school engagement also increases with age because during adolescence peers become more significant and friendships more complex than earlier. One more closely related factor from a cluster of peer-group negative influence is bullying (Adetoro, J.A., 1999). Research evidence suggests that bullying depletes skills in school children (Sarzoza, M., 2016). At the same time, this depletion of skills makes individuals more likely to experience bullying in later years. Therefore, bullying triggers a self-reinforcing mechanism that opens an ever-growing skills gap. Research findings on interventions designed to improve children's behaviour and school engagement suggest that community schools approach contribute to promoting students' sense of school as a welcoming place, which is in turn associated with improved motivation and academic confidence (Castrechin, S and R.A. London, 2012).

Education system characteristics

The education system of a country plays a role in determining children's academic achievement. The research shows that high quality early childhood development services (ECD) contribute to children's positive socio-emotional development and later social outcomes, such as reduction in negative social behaviour (Leseman, 2002). The 2016 PIRLS test demonstrated that attendance of pre-school education contributes to better scores of children in reading. The students with prior reading experience also performed better in the reading competencies than their peers without such experience in schools.

The way education systems are designed can exacerbate initial inequities and have a negative impact on student motivation and engagement. The more and the earlier students are divided into separate groups according to their academic performance, the more the students' socio-economic background matters for their academic performance.

The curriculum itself can also affect a child's performance. The more relevant and flexible the curriculum, the more engaged the students. This requires more autonomy for the teacher as well. If the curriculum itself is too broad, the teacher may feel the need to rush through all information, failing to support children in developing necessary competences.

Furthermore, it is possible that textbooks provided do not match the curriculum which is taught by the teachers. This gap can be based on the content of the book, but also on the methodology. For example, a teacher may focus on competency-based teaching, while the book is filled only with information and facts (UNESCO, 2015).

The lack of collaboration of schools can also have a detrimental impact on student success reducing the capacity of schools to understand and address different needs. Policies need to ensure that schools prioritize their links with parents and communities and improve their communication strategies to align school and parental efforts to support struggling students.

Teacher education, both initial and continuing, is considered an important way of supporting teachers to work with diversity in the classroom and to provide students with targeted support. Without supportive working conditions, even the most eager teachers may feel ineffective and be more likely to move to other schools or quit teaching altogether. Furthermore, people who benefited from longer compulsory schooling were more likely to leave their place of growing up, were more likely to be employed and commanded higher wages.

At the system level, adequate financing benefiting children in an equitable manner and promoting the goals of enhanced access and quality learning means not only quantity of finances invested in the sector, but also efficient and effective use of the resources. Enhanced learning levels require a national curriculum, which is inclusive and relevant for the cultural and linguistic context and to life skills and labour market needs. This means that the curriculum needs to be one which not only promotes subject -content areas, but also transactional competencies and skills. Gaps in the availability, quality and reliability of administrative data (for example, data from Education Management Information System (EMIS), data from National Assessment Surveys etc.), analysis of the data and its use for evidence-based programming is an important for enabling quality learning outcomes, including the SDG 4 indicators.

At the school, classroom and other learning spaces, teachers play an important role. Hence, teacher development along with enhanced instructional time and practices are crucial for enhancing learning outcomes. How teachers and school management and leadership use school resources, particularly teaching learning materials for enhancing learning experiences of students is an important process in education outcomes. At the child, household and community levels, enabling environments at home and family/community involvement in the teaching learning process is very important. Fostering family/community engagement is instrumental for reducing institutional barriers and improving access and learning. Similarly, fostering dialogue and collective problem-solving around local education related barriers and challenges is essential, especially for vulnerable children.

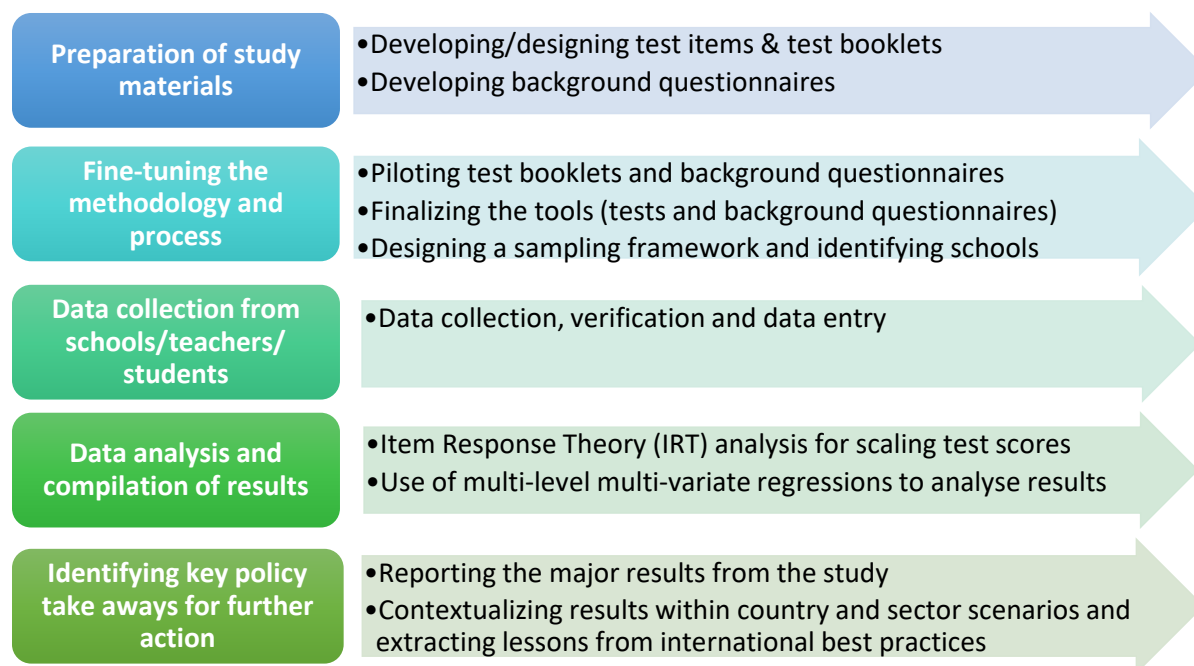
It is in these conceptual frameworks that this study places its methodological base and tools.

2.3. Methodology

This study was designed based on the quality education conceptual frameworks and international best practices of measuring learning. The target group for this learning assessment study was students at the end of grade IV (mean age of 10), and hence end of primary stage of education. Academic literature validates a “Matthew effect”¹³ in learning, that learning difficulties encountered by children at an early age tend to persist during later learning. Therefore, the best way to tackle issues related to low achievement is to address the factors for low achievement during early years (for example, by providing early childhood education (ECE) /preschool education) as well as in primary grades. Hence, the selection of grade IV for testing was considered appropriate.

The steps involved in the process of designing and conducting the study are summarized in the figure below.

Chart 4: Different Stages of the study/ Assessment



¹³ The Matthew effect, Matthew principle, or Matthew effect of **accumulated advantage** is summarized as "the rich get richer and the poor get poorer"(Gladwell, M. 2008; Shaywitz, D. A.,2008). The concept is applicable to cumulative advantage of economic capital. The term was coined by sociologist Robert K. Merton (1968) and takes its name from the Parable of the talents or minas in the biblical Gospel of Matthew (Wikipedia). In the educational community, "Matthew Effect" refers to the idea that, in reading (as in other areas of life), the early learners progress better while the worse-off gets poorer. In education, the term "Matthew effect" has been adopted by Keith Stanovich, a psychologist who has done extensive research on reading and language disabilities. Stanovich used the term to describe a phenomenon that has been observed in research on how new readers acquire the skills to read: Early success in acquiring reading skills usually leads to later successes in reading as the learner grows, while failing to learn to read before the third or fourth year of schooling may be indicative of life-long problems in learning new skills (<https://www.wrightslaw.com/info/test.matthew.effect.htm>).

Preparation of study materials

The present study measured the skills of a sample of grade IV students in Uzbekistan in three subjects, Mathematics, Language (Reading Comprehension) and Science/Environmental Studies (In grade IV of Uzbekistan, this subject is called as “the World Around Us”), and on competences related to these subjects (such as the ability and willingness to use mathematical models, the ability and willingness to use knowledge to explain the natural world, identify questions and draw evidence-based conclusions; ability to interact with language, symbols and text, and reflecting on the deeper meaning and construction of written texts). The assessment questions also included transversal skills, such as problem solving and critical thinking.

Usually, the development and implementation of the whole cycle of assessment require several years, and in many cases, at least two years. In the process of developing a new learning assessment, subject-specific assessment frameworks are usually developed based on common core content and competencies included in the curriculum. The content areas and competencies to be covered becomes the basis for the number and type of items to be used for testing each domain. In Uzbekistan, given the limited experience of mapping content areas and competencies / cognitive domains for assessment purposes, it was assessed that carrying out such an exercise might take more time and resources than conducting the study itself. Moreover, it was decided that the national assessment tools from countries which have education systems similar to Uzbekistan could be adapted.

For the study, UNICEF engaged the services of an international research group – PPMI from a Lithuania - to design the tools of the study and carry out initial analysis. The present learning assessment study in Uzbekistan is modelled on existing Lithuanian national learning assessment tools and framework, which is fully compatible with similar assessment tools and procedures developed by the International Association for the Evaluation of Educational Achievement (IEA) and The Organization for Economic Co-operation and Development (OECD) for their international assessment programmes. The adaptation of Lithuanian tools was necessitated by the time-constraint on the one hand and the potential it offered to “leapfrog” in terms of using a tested model. The Lithuanian tools already contained an adaptation of international assessment tools, with Russian as the main language of assessment. As Russian is one of the main languages in Uzbekistan, the testing materials in Russian was easily adaptable in the context of Uzbekistan. Thus, using the adapted Lithuanian model as a starting point saved time and efforts in the context of Uzbekistan where the study was planned and executed jointly by MOPE and UNICEF within a period of six months, without compromising on the necessary quality standards and procedures.

The test items used in this study were adapted in line with the relevant constructs of curriculum in grade IV for Reading Comprehension, Mathematics and Science/Environmental Studies. The subject specific constructs used are described below.

Reading assessment framework

Defining reading literacy: According to the PIRLS 2016 framework, reading is a notion that includes the ability to reflect on written texts and to use these texts as tools for attaining individual and societal goals, also known as “reading to do”. Reading literacy is therefore defined as “the ability to understand and use those written language forms required by society and/or valued by the individual. Readers can construct meaning from texts in a variety of forms. They read to learn, to participate in communities of readers in school and everyday life, and for enjoyment.” (PIRLS, 2016).

It is expected that the students by the end of fourth grade must be able to read silently and understand what they are reading. Hence, fiction and non-fiction texts were used to assess reading abilities. Fiction included fairy tales, fables, sagas, tales, novellas, dramas, poems, short stories, etc. Non-fiction included: information texts, such as letters, messages, announcements, invitations and other texts from the press, travel, leisure, cooking, natural and environmental science books, encyclopedias, etc.; Simple game instructions, warranty documents; documents regulating activities at school, camp, on a trip or in the entertainment centre; identity documents (certificate of birth, travel passport, travel ticket, student identity card, etc.).

In completing tasks of reading comprehension, students were required to answer text comprehension questions that require skills of different levels (finding information, making t conclusions, interpretations, and assessments). The following aspects are covered when compiling reading test tasks:

- Understanding the essence of the text,
- Discussing the text as a whole and distinguishing details,
- Expressing opinion on the read text,
- Distinguishing and discussing characters and/ or objects,
- Recognizing the nature of the text,
- Understating elements of linguistic expression of the text.

Domains of reading literacy (incl. transversal skills)

Several aspects of text comprehension are tested during the reading assessment. The specific abilities of students are listed below.

Table 1: Distribution of students’ reading abilities according to aspects of comprehension of the text being read	
Aspects of text comprehension	Brief description of students’ expected reading abilities
Essence of the text	Students are able to answer text comprehension questions describing the topic of the text, its main idea and/or purpose, and to tell the essence of the text in the given name.
Text as a whole and its details	Students are able to distinguish and discuss primary and secondary actions mentioned in the text, facts, statements events and details, and to link them; they are able to find and explain cause and effect relationship (between

	events, facts and answers) and answer questions summarizing the text as a whole.
Opinions/ views	Students are able to express their thoughts on the read text, to substantiate their opinion or expressed views, and to make conclusions on the basis of text information.
Characters / objects	Students are able to describe characters / objects and assess their actions based on the read text, a specific text fragment or in own words, and to identify the narrator.
Nature of the text	Students are able to identify fiction and non-fiction text and to assess the nature of information presented in different texts (reality or fiction); to discern types of fiction texts (prose, poetry, drama) and non-fiction text types (letter, announcement, invitation, etc.).
Linguistic expression	Students are able to explain elements of linguistic expression (discourse markers and sayings, figurative words and sayings, synonyms, antonyms, comparisons, addresses, calls, etc.) and understand the sense of linguistic expression tools used in the text.

Reading comprehension tests allow the assessment of different abilities: knowledge and understanding, application and critical thinking abilities.

Mathematics assessment framework

Defining mathematical literacy: According to PISA 2015 framework, mathematical literacy can be defined as an individual's capacity to formulate, employ and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts and tools to describe, explain and predict phenomena (OECD 2015). The contracts of mathematical literacy presented below reiterate the model based on PISA and TIMSS definitions and frameworks, taking the level of tested students (4th grade).

Domains of mathematical literacy (incl. transversal skills): The testing of mathematics includes both areas of mathematical content and related cognitive skills. The areas of mathematical content examined in the study and the testing time planned for the questions in each area are presented below.

Table 2: Areas of mathematical content	
Numbers and calculations	<ul style="list-style-type: none"> • Numbers • Actions with numbers • Use of actions with numbers
Expressions, equations, inequations	<ul style="list-style-type: none"> • Calculation of expression values • Basics for solving equations and inequations • Use of expressions and equations
Geometry, units of measure and measurements	<ul style="list-style-type: none"> • Plane shapes • Spatial shapes • Axial symmetry • Units of measure and operations with fuzzy numbers • Direct measurements

	<ul style="list-style-type: none"> • Indirect measurements (calculations of area, perimeter, volume)
Statistics	<ul style="list-style-type: none"> • Reading frequency tables, diagrams, interpreting data, making conclusions
Communication and general problem-solving strategies	<ul style="list-style-type: none"> • Reading the task of the mathematical text / problem, understanding and visualizing it (use of drawings and diagrams) • Presentation/ writing of the solution of a mathematical problem • Interpretation of calculation results, drawing conclusions • Thinking by analogy (transfer), identification of regularities • Redistribution of options, problem solving by working backwards

Tasks for assessing fourth grade achievement in mathematics are aimed at assessing three groups of mathematical cognitive abilities of students: knowledge and understanding, application of mathematical knowledge and higher-level thinking skills. Table below present the descriptions of groups of cognitive abilities.

Table 3: Group of Cognitive abilities in Mathematics	
Group of cognitive abilities	Abilities
Knowledge and understanding of mathematics. Basic knowledge, which allows students to easily repeat mathematical concepts and comprehend basic facts, numerical relationships, symbols and spatial relationships. It forms the basis for further meaningful mathematical thinking of students, which helps them resolve usual daily situations in real life.	<ul style="list-style-type: none"> • Reproduction. Students are able to recall and reproduce basic mathematical concepts, symbols, definitions and numerical properties. • Recognition. Students recognize mathematical objects (shapes, numbers, phenomena, etc.). They are able to recognize equivalent mathematical objects (for example, equivalent known simple and decimal fractions, geometric shapes arranged in different ways). • Calculation. Students are able to perform operations of algorithmic addition, subtraction, multiplication and division, to round and compare numbers, perform usual algebra operations (calculate expression values, solve equations and inequations). • Finding of information. Students are able to select information from diagrams, tables and other sources of information (for example, scoreboards, schedules), to read simple scales. • Measurement. Students are able to use measurement tools, determine measurements, properly choose and apply units of measure. • Classification, reorganization, grouping. Students are able to classify, group things, shapes, numbers, factors by common characteristics, correctly decide on belonging to one or another group, correctly attribute the object to a certain category according to the specified attribute.
Application of mathematics. Use of mathematical tools (solving methods, algorithms, drawing and measuring tools, etc.) in various contexts. Problems	<ul style="list-style-type: none"> • Selection. Students are able to solve usual tasks of a known algorithm by selecting an efficient operation, method or strategy. • Illustration. Students are able to present mathematical information (data) in diagrams, tables and charts, to illustrate information presented one way in a different way.

<p>and contexts are usual, familiar, standard; students are taught solving them in application of respective techniques and methods during lessons.</p>	<ul style="list-style-type: none"> • Modelling. Students are able to create an appropriate model, for example, a numerical representation or a diagram, to solve a simple problem. • Implementation. Students are able to follow mathematical instructions and implement them, to draw a shape following a given condition. • Application. Students are able to use data from charts, tables, graphs and maps. • Argumentation. Students are able to provide arguments (justify, explain) the solution to the problem and to write it down in appropriate ways, to answer questions, provide arguments and conclusions so that others could understand and assess them.
<p>Higher level thinking abilities. Logical, systematic thinking. Intuitive and inductive comprehension substantiated with examples and regularities. Creative solving of non-routine problems, which have a context of daily life or may also be of mathematical content. Reasoning, which requires the ability to raise hypotheses, summarize and draw conclusions based on assumptions or solution results.</p>	<ul style="list-style-type: none"> • Analysis. Students are able to identify and describe relationships between objects in mathematical situation or to use them. They are able to apply proportional thinking, to decompose geometric shapes in order to simplify the solving of a problem, to compare and match the same data presented in different ways, to make reasoned conclusions from the provided information. • Summary and application. • Students are able to apply mathematical thinking and problem-solving results in a broader context, using more general and more widely used terms. • Integration and synthesis. Students are able to match various mathematical procedures in order to receive results and combine them in pursuit of further results, to link elements of knowledge and summarize mathematical ideas. • Justification. Students are able to determine if a statement is correct or false using the known mathematical facts, algorithms or in practice. They are able to justify their answer based on mathematical results or properties. • Problem solving. Students are able to solve problems, which they are likely to have not faced before, i.e. choose efficient strategies in unusual situations and apply mathematical procedures in unfamiliar and complex context. They are able to apply mathematical models or rules in non-standard situations in a specific case. • Identification of regularities. Students are able to formulate generalizations and identify regularities, to assign the object to a particular group.

Science assessment framework

Defining scientific literacy: According to the 2015 PISA framework, scientific literacy relates to the ability of a person to explain phenomena scientifically; evaluate and design scientific

enquiry, and; interpret data and evidence scientifically.¹⁴ This assessment will review students achievement according to our framework, which we developed using information from various international studies (such as TIMSS and PISA) and local context and curriculum. Table below illustrates areas of content and operations of science to be examined in this assessment study and the testing time planned for studying them.

Table 4: Science: Areas of content and operations	
Studies/ research	
Living nature and human being	<ul style="list-style-type: none"> • Organisms and their groups • Organs and their functions • Organism and the environment • Human health and safety
Non-living nature and human being	<ul style="list-style-type: none"> • Materials and their properties • Energy • Forces
Environment and human being	<ul style="list-style-type: none"> • Earth's surface and processes • Environmental orientation • Solar system
Living together	<ul style="list-style-type: none"> • Democratic society • Historical time flow and changes

Domains of scientific literacy: There are two aspects involved in testing students' abilities in science, namely their knowledge of different areas of content of science and their cognitive skills in relation to interpretation of this content.

Table 5: Areas of Science content and operations			
Areas of content & operations	Components of the area	Description	Abilities
Research		Steps and procedures of the research. Safe research rules. Measurements, units of measure. Search for and management of information and data	Students are able to identify or formulate questions which can be answered conducting simple research, to set the goal of the research, to choose instruments and tools, to plan the course of the research, to specify or compare readings of instruments and tools, to summarize results and draw conclusion and to plan for further objects of research. They are able to explain why the research must be conducted accurately and safely. Students are able to find the necessary information in the specified or the selected sources of information and the environment, to evaluate it, associate, compare, interpret, summarize and present it in writing, in a drawing or a simple diagram.

¹⁴ OECD "PISA 2015 science framework", accessible via: <http://www.oecd.org/publications/pisa-2015-assessment-and-analytical-framework-9789264281820-en.htm>.

Living nature and human being	Organisms and their groups	Attributes of life, grouping organisms according to the attributes	Students are able to describe general attributes of living organisms: respiration, nutrition, growth, movement, reproduction. They are able to identify animals and plants attributed to the main groups of organisms according to their key external attributes, or to give their examples. They are able to distinguish grasses, shrubs and trees according to their external features.
	Organs and functions	Main organs and functions of human beings and mammals. Purpose of parts of plants. Reproduction of plants, animals and human beings and stages of their life. Stages of evolution of butterflies and frogs	Students are able to describe the role of certain organs of human beings and mammals in the body. They are able to tell the purpose of the parts of the plant, to recognize in diagrams and to characterize the stages of evolution of butterflies and frogs. Students are able to specify or describe the main stages of life of the plant, animal and human being. They are able to show that plants, animals and human beings reproduce and their descendants look like their parents based on their own or the given examples.
	Organism and the environment	Adaptation of plants and animals to the environment, examples of community animals. Plants as producers of food or all organisms and conditions necessary for their growth. Organism nutrition relationships	Students are able to recognize external attributes of adaptation of plants and animals to the environment and to explain how these attributes help them survive. They are able to give examples of community animals and explain why living in communities makes it easier for animals to survive. They are able to describe plants as producers of food for all organisms, to tell that all plants and animals receive energy from food. They are able to create simple nutrition chains from plants of the closest environment, herbivores and predators, and to explain them. They are able to describe relationships between nutrition of organisms in the specified ecosystem.
	Human health and safety	Human health and safety. Healthy lifestyle. Protection from communicable diseases. Safe behaviour in home environment and the nature.	Students are able to specify ways of spreading communicable diseases and to explain what needs to be done in order not to avoid getting infected or to infect others. They are able to explain that proper nutrition, daily routine, movement, fitness and hygiene help stay healthy. Students are able to tell how to behave safely on the road, in case of a fire, gas leakage, storm, very cold or hot air temperatures.
Non-living nature and human being	Materials and their properties	Physical properties, states, origin (artificial and natural) of materials. Use of materials Solubility of materials and mixtures. Reversible and irreversible changes in materials. Conditions necessary for combustion.	Students are able to recognize, compare and group materials according to their physical properties, and to distinguish the states of the materials. They are able to link the use of materials in everyday life to their properties, to give examples of natural and artificial materials and to group them. Students are able to recognize examples of material mixtures in household and to explain how mixed materials can be separated. They are able to give examples of materials that are soluble or insoluble, flammable or inflammable, magnetic and non-magnetic; to explain how to speed up dissolution of materials; to indicate reversible and irreversible change in the materials used in everyday life; to specify that

			combustion requires air and to explain how this can be used to extinguish burning objects.
	Energy	<p>Natural energy sources, examples of energy use. Light sources and phenomena.</p> <p>Most basic electrical circuit, conductive materials. Safety around electricity.</p>	<p>Students are able to indicate or describe sources of energy; give practical examples of energy use, evaluate the circumstances and / or possibilities of using different energy sources. They are able to identify natural and artificial light sources, to explain the conditions when the light reflection, the shadow of the object can be seen and to illustrate them.</p> <p>Students are able to specify the main parts of the electrical circuit and their purpose; to explain how a simple electrical circuit should be constructed so that it operates. They are able to specify the kind of materials used to make conductive objects and to define the basic rules of safety around electrical appliances.</p>
	Forces	<p>Examples of forces, their impact on bodies. Inert movement of bodies. Properties of a magnet.</p>	<p>Students are able to identify forces, which affect the movement of bodies or change their shape; to compare the impact of higher and lower forces on bodies and their speed of movement; to associate inert movement of bodies with safe traffic; to indicate that magnets have different poles, that the like poles repel each other, while opposite poles attract each other, and that magnets can attract items made of iron.</p>
Environment and human being	Earth's surface and processes	<p>Earth's surface. The dependence of people's lifestyle on natural conditions. The impact of human activity on landscape. Natural resources and their use</p> <p>Water circulation in nature. Weather. Natural phenomena and their marking</p> <p>Sources of water and air pollution; impact of pollution on the nature and the human being. Methods of pollution reduction and sustainable use of resources.</p>	<p>Students are able to describe the Earth's surface, to explain that the Earth is surrounded by air by giving examples. They are able to describe and compare landscapes, give examples of the impact that human activity has thereon, also to give examples of the ways that natural conditions and resources affect the lifestyle of people, giving examples of their use. Students are able to give examples of natural resources of the country and tell where they are used, also to associate the use of Earth's resources with responsible consumption.</p> <p>Students are able to explain water flow in nature by using a scheme, to describe the weather according to the basic weather indicators: temperature, precipitation and wind strength, and to recognize often observed natural phenomena, different types of precipitation and the legend marking them.</p> <p>Students are able to give examples of sources of water and air pollution; to indicate or explain the impact that pollution has on nature and the human being; to explain ways to contribute to the reduction of water and air pollution and waste management in the immediate environment. They are able to associate the saving of electricity, heat, water and the recycling of waste with conservation of natural resources; to give examples of scientific and technical inventions that help reduce environmental pollution</p>

	Environmental orientation	Knowledge of the map of the country and the world. Reading and drawing of the plan	Students are able to identify continents and oceans in the map, to describe the geographic location of the continents, to tell directions of the countries of the world according to the position of the geographical object. They are able to recognize or name the country, to describe its geographical location; to name the largest lakes and rivers, the neighboring states and their capitals. Students use the legend and/or create own marks to mark the missing objects on a simple plan or a route, to finish drawing the plan or the route. They are able to draw a plan or a route of a location or premises according to a given picture, painting or a description, to choose the route in the location map and to mark it using a legend.
	Solar system	The Sun. Solar system. Earth's rotation around its own axis and around the Sun. Moon and its phases.	Students are able to describe the Sun as a star and as a source of light and heat for the entire Solar system. They are able to indicate certain planets on the Solar system scheme, to refer to the Moon as a satellite and to recognize its phases, to associate the change of the day and night with the Earth's rotation around its own axis, and the change of the seasons - with the Earth rotating around the Sun.
Living together	Democratic society	Living in a democratic society. Rights and duties of citizens. Democratic state institutions, their purpose. State symbols.	Students are able to detect in the immediate environment examples of life of the democratic society and to define the features of democracy. They are able to provide examples of rights and duties of citizens in the state. They know rights and duties at home and at school. Students are able to indicate the key institutions of a democratic state; to distinguish state and local government institutions and to define their purpose. They are able to indicate state symbols, days of state and national holidays, to explain their purpose and traditions.
	Historical time and evolution	Chronological description of historical events, historical time Characteristics of periods of the history of the state	Students are able to use certain concepts of historical time, indicating the time of historical events and objects, also the time of practice of certain prominent personalities. They are able to arrange historical events, objects and personalities in chronological order or in the timeline. Students are able to recognize or describe and compare people's lifestyles in different historical periods (from the prehistoric to the modern times), to explain causes and effects of such change, associating it with technical and scientific achievements. Students are able to recognize and describe certain key historical events, objects and personalities of the state and indicate their historical significance. They are able to define the key features of periods of the world's history (prehistory, ancient history, medieval times, new times and the latest times).

The aim of the current assessment of the fourth-grade students' achievement in science is to assess three groups of cognitive abilities of students: knowledge and understanding,

applications and higher thinking abilities. Table below provides the description of cognitive abilities in science.

Table 6: Categories and descriptions of cognitive abilities in science	
Group of cognitive abilities	Abilities
Knowledge and understanding. Knowledge and understanding includes the facts, objects, concepts, images, regularities, symbols and legends of living and non-living nature, the natural environment and the public life, which students are able to recall, recognize, define, describe and illustrate with examples. Knowledge and understanding help students to successfully engage in cognitive and research activities	<ul style="list-style-type: none"> Recall. Students are able to recall, select or name the facts, statements, concepts, symbols and legend, also, to define the features, attributes and properties of objects, phenomena, processes and events. Recognition. Students are able to recognize and identify facts, objects, concepts, phenomena, processes, events, symbols, legends, and to distinguish them from others based on images and their characteristic features. Definition. Students are able to properly use concepts, to define and explain them in their own words. Description. Students are able to define and describe the facts, objects, phenomena, processes, events, their attributes, signs, properties, structures, purpose, relationships and changes. Giving examples. Students are able to give examples which prove that they perfectly understand the concepts, facts, processes, phenomena and events. Knowledge of sources and instruments of research. People are able to select objects or sources and instruments of research. They are able to find information directly presented in sources, to understand meter readings and to choose appropriate units of measure, also to list the steps of the research.
Applications. Applications cover the abilities to distinguish features, attributes, properties and to classify, group, compare, associate, interpret, explain facts, objects, events, processes, phenomena and research data based thereon; to use models; to search for information on the needed topic in various sources and contexts, for answers to questions and solutions to problems. The application abilities reveal the understanding of concepts and regularities.	<ul style="list-style-type: none"> Classification, grouping, comparison. Students are able to distinguish the features, properties and characteristics of the facts, objects, events, processes and phenomena, to group them based on these characteristics and arrange them in certain groups. They are able to identify, describe and specify similarities and differences of individual facts, objects, phenomena, processes, events or their groups. Use of models. Students are able to tell and define the key properties, stages and components of certain facts, objects, phenomena, processes and events as well as the interaction between them using diagrams, schemes, maps, plans and models. Illustration. Students are able to illustrate the presented information and data in a diagram, a table, a scheme, a plan, a drawing, etc., and to illustrate information presented in one way in a different way. Linking. Students are able to link features, properties and attributes of facts, objects, phenomena, processes and events to one another and to the context. Explanation and interpretation. Students are able to explain phenomena, processes and events, their interrelationship, to discuss the course and the data of the research. They are able to comment on and to explain information presented in the text, scheme, table, graph, diagram, map or the plan.
Higher level thinking abilities. Higher level thinking abilities cover the ability to analyze, integrate, synthesize, find relationships, dependences,	<ul style="list-style-type: none"> Analysis. By breaking down the object of research into its components, students are able to identify and describe properties, features, relationships and interactions between those components. They are able to analyse steps of performance of the research or tasks. Students are able to compare and

to raise research questions, develop models, substantiate the views, draw conclusions and make critical assessments. Higher level thinking abilities create preconditions for solving problems in usual and unusual situations, in familiar and unfamiliar context.

interpret data presented in different ways, different sources of information, evidence, views and concepts.

- Integration and synthesis. Students are able to link data, the available knowledge of the facts, objects, phenomena, processes and events, and to identify their interrelationships; they are able to apply summarized information in new situations; to formulate conclusions, propose or make decisions, provide arguments and create models. Students are able to link concepts from different fields of science.
- Raising research questions or hypotheses. Students are able to link knowledge and understanding of facts, objects, phenomena, processes and events to information known from experience or accumulated through observations, and to formulate research questions or raise hypotheses.
- Justification. Students are able to justify answers, conclusions, statements, views, concepts and choices based on knowledge and research data. They are able to use arguments to justify their attitude towards causes and effects of phenomena, processes and events, and to explain their influence on the change of the natural environment and the society.
- Evaluation. Students are able to critically evaluate sources, information, situations, performance and results of the research; to propose alternative solutions and to evaluate them. They are able to provide arguments in justification of different views

Different types of questions used for the assessment of the achievement of students in the three subjects. These included:

- Multiple choice questions (test items). These are questions when several possible (multiple choice) answers are provided along with the problem (question): one of them is the correct answer (the key) and others are incorrect (distractors); Multiple choice items are considered solved when the correct answer is chosen;
- Questions of linkage. Answering these questions requires linking respective elements (words, statements, images, etc.);
- Short answer and short solution test items. These are questions that require naming, a brief description or explanation requiring one or two-step tasks when students have to write correct answer only or tasks, which require minimum solution (showing how the answer was reached);
- Test items that require justifications or detailed solutions: These are questions where answers must be based on knowledge of objects, phenomena, processes, regularities, examples, facts, data or evidence. These questions may be started by choosing Yes or No (I agree or disagree, etc.), but only a justified answer is assessed. These are multi-step tasks, the conditions of which ask to additionally lay down the solution, to justify a statement, or which requires entering points next to the task, which help understand the number of steps in the solution of the problem that must be demonstrated by the student.

- Structured task questions (test items). This is the task, which provides introductory information, source, etc., also a few questions related to this information. When performing the task, the initial information may be supplemented, asking additional questions. The structured task combines multiple choice, short answer or justification questions.

Background Questionnaires

To ensure the reliability of the assessment results, the study used six testing booklets, which were distributed throughout each classroom falling within the selected sample. Each of the six booklets included a different set of questions and competence areas in two out of three subjects. This ensured that all important curriculum topics were covered.

Student Background Questionnaire: Besides test questions, each test booklet contained background questionnaires for students, consisting of two parts: general questions related to the students' background, home and classroom/school context and attitudes to learning, as well as; specific questions related to learning environment and teaching methods used in class, students' motivation and attitudes to certain tested subjects and their experiences with learning these subjects (Science/Environmental Studies, math and reading/language, as well as learning to learn competence). The tools also included background questions on students' attitudes and knowledge about sustainable development; citizenship education, and; ICT literacy.

Teacher Questionnaires: The teacher questionnaires are administered on teachers of grade IV tested. This questionnaire is designed to gather information on teacher characteristics as well as the classroom contexts for teaching and learning language, mathematics and science, and the topics taught in these subjects. In particular, the teacher questionnaire asks about teachers' backgrounds, their views on opportunities for collaboration with other teachers, their job satisfaction, and their education and training as well as professional development. The questionnaire also collects information on characteristics of the classes tested, instructional time, materials, and activities for teaching mathematics and science and promoting students' interest in the subjects, use of computers, assessment practices, and homework (Michael O. Martin, Ina V.S. Mullis, and Pierre Foy, 2013).

School Questionnaire: The principal of each school covered by the NAS is asked to respond to this questionnaire. It asks about school characteristics, instructional time, resources and technology, parental involvement, school climate for learning, teaching staff, the role of the principal, and students' school readiness (Michael O. Martin, Ina V.S. Mullis, and Pierre Foy, 2013).

Methodology and sampling

The sampling framework used for this study was modelled on the international assessment programmes (TIMSS and PIRLS) implemented by IEA. These programmes employ rigorous school and classroom sampling techniques so that achievement among the student population as a whole may be estimated accurately by assessing just a sample of students from a sample of schools.

For this study, a two-stage random sampling design, with a sample of schools drawn at the first stage and one or more intact classes of students selected from each of the sampled schools at the second stage. Such sampling design allowed the team to pay specific attention to students' curricular and instructional experiences, which are typically organized on a classroom basis. This also provided an operational advantage of less disruption to the school's day-to-day business than individual student sampling.

The sampling process involved the following stages:

- Creating a sampling framework by listing all the schools in the country that have classes with students in the grade IV, disaggregated by region. This information was available from administrative statistics of the Ministry of Public Education (MOPE).
- Determination of the final population coverage and exclusions. In accordance with the national stakeholders' priorities, it was decided that the study to be focusing only on mainstream education schools located in urban and rural areas. Taking into consideration the challenges in reaching out to the schools in remote areas, it was decided to exclude the small remote schools from the current study.

The assessment took place in a sample of schools representing all 14 regions of Uzbekistan and covered the two biggest language groups or medium of instructions in the country (Uzbek and Russian). It was ensured that the final list of exclusions did not exceed 10 percent of the total population of the 4th graders in the country. The following predefined exclusion criteria were used:

- Geographical location (exclusion of schools in remote inaccessible areas).
- Linguistic parameters (only Uzbek and Russian language schools were included into the study due to time constraints).
- Special educational needs (SEN). Since the focus of the study was mainstream education, the boarding schools for children with special education needs did not fall within the scope of the assessment, and therefore, were not included in the sample. The curricula for these children were expected to have been specially developed to the needs of the children and therefore the tests results of children from the boarding schools cannot be compared with the results from mainstream schools.

For the first sampling stage, schools were sampled with probabilities proportional to their size (PPS) from the list of all schools in the population that contain eligible students. Here, two separate/independent sampling procedures were carried out: one for schools with Uzbek language of instruction, the other for schools with Russian language of instruction. Out of the total sampling size, it was decided to include 5489 students from schools with Uzbek language of instruction and 1513 students from schools with Russian language of instruction. For sampling of schools with Uzbek language of instruction, the schools were stratified according to the "urbanization level". For sampling schools with Russian language of instruction, no stratification variables were used.

The applied method of selection included a random nested sampling, which means that a class of students, rather than individual students, were selected for the sample (in some cases

several classes were selected from a single school to the sample by random selection). The study also covered teachers (the main “class teacher” of a class/section that was selected) and school principals from the sampled schools.

The second sampling stage consisted of the selection of one (or more) intact class from the target grade of each participating school. The classes were selected with equal probabilities within schools. All students in each sampled class were aimed to take part in the assessment.

Piloting: Once the draft assessment tools were developed in consultation with MOPE curricula experts, the tools were piloted in a sample of Russian language schools in Tashkent. After the pilot, the assessment materials (both test and background questionnaires) were finalized. The preparation, piloting and finalization of the assessment materials were completed during the period February -March 2018.

Translation: The finalized assessment materials were translated into Uzbek language with the MOPE experts. For a sample of tests, reverse translation was conducted to check and ensure that the meaning and the difficulty of test items was not changed in the translation process.

Data Collection

The assessment process in schools took place from the last week of April till the 2nd week of May 2018. The working group and the field investigators contacted the sample schools beforehand and agreed with them on the exact time for carrying out the tests at school (day and time). In the next stage, the field investigators visited the selected schools and administered the testing of students by distributing the test materials (test booklets) to the students; by supervising the independent completion of the tests by students, and; by ensuring that teachers did not help students or students did not help each other.

Besides students in grade IV, the study also covered primary school teachers and school principals, who were asked to fill-in questionnaires elaborating on their school climate, governance processes, as well as how the learning and teaching was organized in respective schools and classes. The principal of each of the school included in the sample was asked to fill-in the principal questionnaires. The main “class teacher” of each of the grade IV class included in the sample was asked to fill-in the teacher questionnaires.

The filled-in test booklets and questionnaires were collected by the field administrators and transferred to UNICEF office for marking and coding. All field investigators and experts working with data from this research were required to maintain respondents’ privacy and anonymity. Each individual test booklet was assigned an identification number so that the name and identity of children and school staff cannot be traced.

The Working Group of experts formed under the MOPE for this study (who were trained by international experts from Lithuania in evaluating and coding the answers) carried out the task of marking and coding the tests once they were completed by students. The marking took place from 15 May 2018 till 30 July 2018 and consisted of the following aspects:

- The tests of each subject were marked by qualified markers; in strict accordance with the marking schemes provided by the expert team.
- The marking team consisted of primary teachers and subject teachers/specialists.
- In a marking team at least one specialist for each language (Russian, Uzbek), one specialist for Mathematics and one specialist for Science/Environmental Studies were present.
- Quality assurance of the marking was guaranteed by requiring at least 10 percent of randomly selected tests of each subject to be marked twice by different markers.

Once the tests were coded, the working group was required to enter the test results and questionnaire data into the relevant computer software prepared for the study by the international experts.

The quality of the data entry was assured by requiring at least 10 percent of randomly selected tests and questionnaires to be entered twice by different persons. At the completion of the data entry and validation of accuracy and reliability, three separate databases were created: a database for students; a database for the teachers, and; a database for school principals.

Data Analysis and Results

The main steps of the analysis of the data included the following:

- **Cleaning, tabulation and preparation** of the datasets for statistical analysis. This also involved preparing the raw data into scaled scores, indices, dichotomous, ordinal as well as continuous variables. The initial cleaning and tabulations were carried out by the international experts.
- **Descriptive analysis:** This mainly involved computing mean scores, standard deviations of test scores, standard errors, percentile scores, significant differences between the groups etc.
- **Multi-level and Multivariate analysis:** The impact of intervening variables was analyzed by using simple linear as well as hierarchical linear models.
- **Synthesis of results and identification of policy recommendations:** Based on the descriptive and multi-variate analysis and a thorough review of all available evidences from international assessment studies such as PIRLS and TIMSS, UNICEF prepared this report, including key conclusions and policy recommendations.

IRT Scale scores for gauging Learning achievement

The established norm in international tests such as PISA or TIMSS is to weight questions or items used in the test by their difficulty and students' ability. Many studies calibrate ability of students using test scores as the true ability of a student is an unobservable variable. Observed test scores, aggregated using Classical Test Theory (CTT) methods, assume that students with the same score have the same ability irrespective of the differences in test items correctly answered. The observed raw test scores in this study for each student in all three subjects were converted into IRT ability scores which weights items on a test according to difficulty. The

process of assigning these weights and computing weighted test scores is known as Item Response Theory (Das, J, P. Pandey, and T. Zajonc, 2006).

Throughout this report, results are reported using 'scale scores' calculated using Item Response Theory (IRT). The scale scores are different from percentage scores (percentage of correct scores) of Classical Test Theory (CTT). The scale scores have some advantages compared to percentage scores. Hence, results are reported in IRT scale scores in addition to the classical approach as is the practice of major international surveys. IRT uses a mathematical model to link a student's chance of success on a particular item to two main factors: the student's level of ability and the item's level of difficulty. In this model, the difficulty of an item does not depend on the group of test takers. This allows the use of multiple test booklets which can be linked.

General results in Reading Comprehension, Mathematics and Science/Environmental Studies in this study are reported using standardized scores, which were calculated using Item Response Theory (IRT) scaling with 2PL (two-parameter logistic) model. This approach allows the performance of a sample of students in a subject area to be summarized on a common scale even when different students are tested with similar, but not identical, tests. Using the IRT scaling to express the results of tests of different subject areas allows to combine students' reading, math and other instructional subject tests results into composite indicators representing students generalized academic achievements. Such scale is also useful for comparison of the results of different years.

For reporting IRT scale scores, the chosen scale in this study range from 0 to 1000. The mean score for the whole population is initially set at 500. This means that if learning gaps are presented on a scale, the average child scores 500, while the worst child scores zero and the best, 1,000. The distribution has a standard deviation of 100, so that a child who scores 400 is one standard-deviation below the average. In addition, the weighting ensures that the differences in the learning between a child who scores 300 and one who scores 400 is identical to that between a child who scores 700 and one who scores 800 (Das et.al, 2006).

Chart 5: IRT Scale Scores: Reporting Scale



Initial scores of each test in this study were transformed into achievement scales with the mean 500 and standard deviation 100. This scale avoids negative values for student scale scores and eliminates the need for decimal points in reporting student achievement (similar methodology is used in international surveys as TIMSS, PIRLS, etc.).

When interpreting the results of a study, it should be kept in mind that if the average score of standardized points of one group of students is less than 500, that means that the average score of this group of students is lower than the national average, if it exceeds 100 – it is higher than the national average. Summarized Achievement Score (Indicator) is used with the purpose of combining and summarizing the results of all three subjects' areas (Reading, Math and Science/Environmental Studies). Such indicator is useful when analyzing general learning outcomes and relationships between various factors and students' achievements in general. The mean of Summarized Achievement Score (SAS) is 500 and standard deviation 100.

Multivariate Analysis using multi-level models

Multi-variate analysis is used here to identify the determinants or correlates of learning achievement. Through the analysis, the attempt is to answer the questions such as: Are variations in learning achievement or learning gaps (student level) attributable to school and teacher level factors (school level), or students individual characteristics (family and home environment)? If so, how much of the variation is explained by between school and within school factors?

The analysis here uses both Ordinary Least Square (OLS) model as well as Hierarchical Linear Model or multi-level for the multi-variate analysis for the purpose. Traditional regressions models such as OLS fail to identify group effects on individual behavior as they deal with only one level at a time and not with simultaneous effects of group and individual characteristics on outcomes. Thus, they fail to measure proportions of variation in outcomes between individual and group. This is not desirable when the goal of the research is to assess the effects of policies implemented in classrooms or schools on individual student learning outcomes (Cronbach, Lee. J., 1976). The advantage of Hierarchical Linear Methodology (HLM) is that it provides for examining multiple interactive relationships in nested organizational structure. It partitions out the effects of student characteristics and the effect of group behavior (organizational - such as class or school) on the relationships at the individual level.

One of the most important characteristics of education system is its hierarchical structure. In such a structure, students with their individual/ family characteristics are 'nested' in classrooms and / or schools (Raudenbush, S.W. and Bryk, A.S. 2002), with unequal sampling probabilities, and schools are nested within geographical units or regions. In such a multi-level structure, test scores of students within the same classroom may be correlated due to exposure to common factors (for example, same teacher teaches them; they have access to same resources etc.) and hence nesting them within the same classrooms helps to address the correlations due to common elements. Similarly, the performance of schools within the same regions may be correlated because of their shared socio-economic and geographical features. The learning assessment data should be therefore treated in a hierarchical structure, with students nested within classrooms (schools) which are in turn nested within regions (Huber, C. 2013). The details of the analytical models are given in annex.

Ethical considerations

- Following the UNICEF Procedure for Ethical Standards, ethical clearance was obtained for this study from an external Ethical Review Committee. Further, the research team had taken utmost care in reviewing the methodology to ensure compliance with the procedural guidelines of UNICEF. Ethical considerations were part of all activities and products of the study.
- The execution of the assessment by the field investigators were the main aspect of the study where researchers encountered human subjects, namely the children taking the test as well as the teachers and school principals who were requested to fill in questionnaires.
- The study was guided by the Do No Harm principle, aiming to protect the rights of the children involved in the assessment. This principle was broadly applied to the study and was based on further principles of respect for the students and fairness of the assessment. The study was also guided by the Avoid Score Pollution principle where the test performance does not reflect the actual knowledge and skills of the students, for example due to prior practicing with the materials or due to modification of scores (Green, S.K et.al., 2007).
- The data was collected only for those parameters where it was necessary to conduct a specific task. This data shall not be used outside the assignment and shall not be transferred to other individuals or entities. The Consortium has also implemented appropriate technical and organizational measures to ensure a level of security appropriate to the risks represented by the processing and the nature of the personal data to be protected. Specifically, all the personal data was kept in two safeguarded servers (1 TB capacity) with mirror backup system to prevent any unauthorized disclosure or access, accidental or unlawful destruction or accidental loss, or alteration, and to prevent all other unlawful forms of processing.
- In the final study report, only impersonal data is used which is presented in a way to illustrate general trends, and the identification is limited to the aggregated levels (respondent categorization by age, gender, nationality or etc.).
- To ensure that the key ethical principles for the conduct of studies involving human subjects were followed, especially for primary data collection, each participating school was given full information about the study including the purpose and potential benefits of the study, their rights, and how the information collected was intended to be used. School administration was responsible for informing the teachers, students and parents about the study, as well as the benefits and potential risks of the project. All participants were informed of their right to discontinue their participation at any point.

3. Overall Performance of Grade IV Students in Learning Assessment

In this section, overall performance of students in grade IV by Reading Comprehension, Mathematics, Science as well as a Summarized Assessment Score (SAS) is presented. However, overall scores by subjects camouflage the range and dimensions of students' knowledge and skills. Hence, students' overall performance is further analyzed by subject content and cognitive domains. Performance of Uzbekistan grade IV students is analyzed also in the context of recent international assessments for grade IV, like TIMSS 2015 for Math and Science and PIRLS 2016 for Reading Comprehension.

3.1. Overall Results of the Learning Assessment

Overall scores – student level

The overall scores (hereafter referred to as SAS or the Summarized Achievement Score) estimated using the Classical Testing Theory (CTT) show that grade IV children in Uzbekistan were able to answer on an average 55 percent of the of all test questions correctly. However, as in the case of international tests like PISA, PIRLS and TIMSS, the raw test scores of this study were calibrated into “scale scores” based on Item Response Theory (IRT) approach – this means that each item carried a different weight in overall scoring based on their item discrimination power and difficulty levels. As mentioned earlier, the IRT scale scores used in this analysis range from 0 to 1000 with the mean set at 500, with a standard deviation (SD) of 100.

Graph 2. Mean percentage test scores using classical (CTT) and modern (IRT) approach

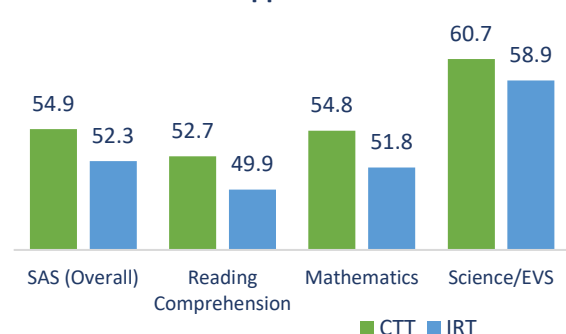


Table 7: IRT scale scores achieved by students

Percentile Scores	SAS	Reading	Math	Science
Lowest	154	209	135	162
10 th	363	358	365	369
25 th	435	433	435	433
50 th	507	508	504	503
75 th	572	572	573	571
90 th	623	625	625	625
Highest	767	764	782	737
Overall range	613	555	647	575
Inter-quartile range	137	139	138	138

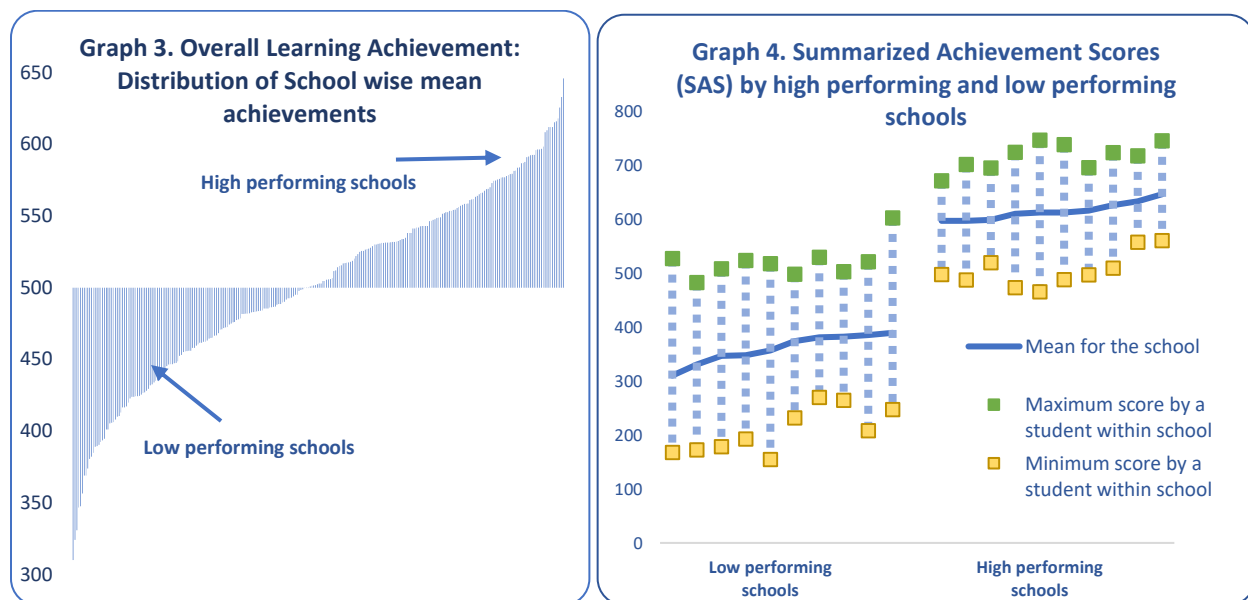
After standardizing the test scores for item difficulty and discrimination, the students' average achievement on SAS is corrected to 52 percent. Similarly, for Reading Comprehension, the

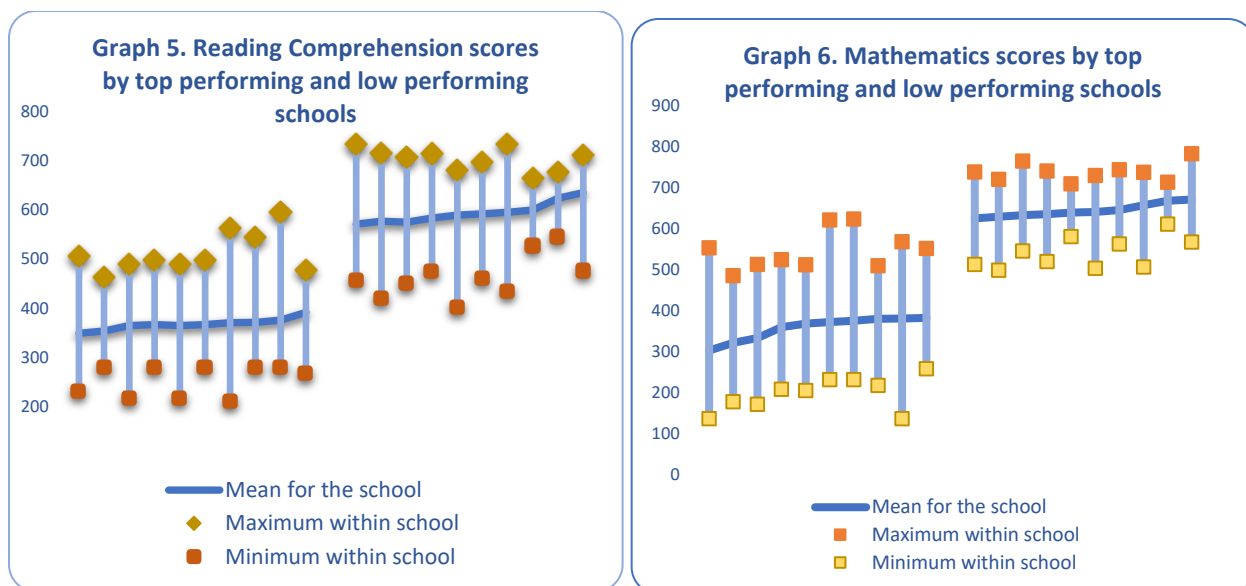
mean test scores using CTT averaged at 52.7 percent, but after correction using IRT, it came down to 50 percent. In Math, the average score is around 52 percent while for Science, it was 59 percent. It is evident that the average performance of students in Science/EVS was better than their performance in Reading Comprehension and Math. There were also few students who scored zero in Reading Comprehension, indicating very low Language skills.

The overall range as well as the inter-quartile range indicate huge gaps between high (top 25 percent students by IRT scale scores) and low performing (bottom 25 percent students by IRT scale scores). Such results may indicate that the education system in Uzbekistan is characterized by high inequities in learning outcomes. Overall, the results demonstrate that primary school students' achievement at the end of grade IV is not sufficiently high in Uzbekistan. These results corroborate the World Bank's NALOPSG study (2013) that on average, grade IV students were not able to correctly respond to at least half of the tested content in native language and reading.

School level Performance in student learning achievement

While students' achievement shows huge variations, school performances in terms of the mean test scores achieved by all the students in the school also vary. Overall, 52 percent of the schools achieved a mean SAS above national average of 500. The best performing school in the SAS scored an average of 646, a score that is more than double of mean SAS achieved by the least performing school in the country (310 in scale scores), a difference of 336 points. The range between the top and bottom students within schools in overall assessment ranged between a high of 508 and a low of 114 points in the overall scale scores. The data also indicate that the within-school variations were higher in low performing schools vis-à-vis schools with high mean scores. The between-school variations on SAS was reflective of the variations for each of the subject tested – meaning whether it is Reading Comprehension, Math or Science, the variations across schools as well as within schools were apparent.





Where do children of Uzbekistan stand in international comparison?

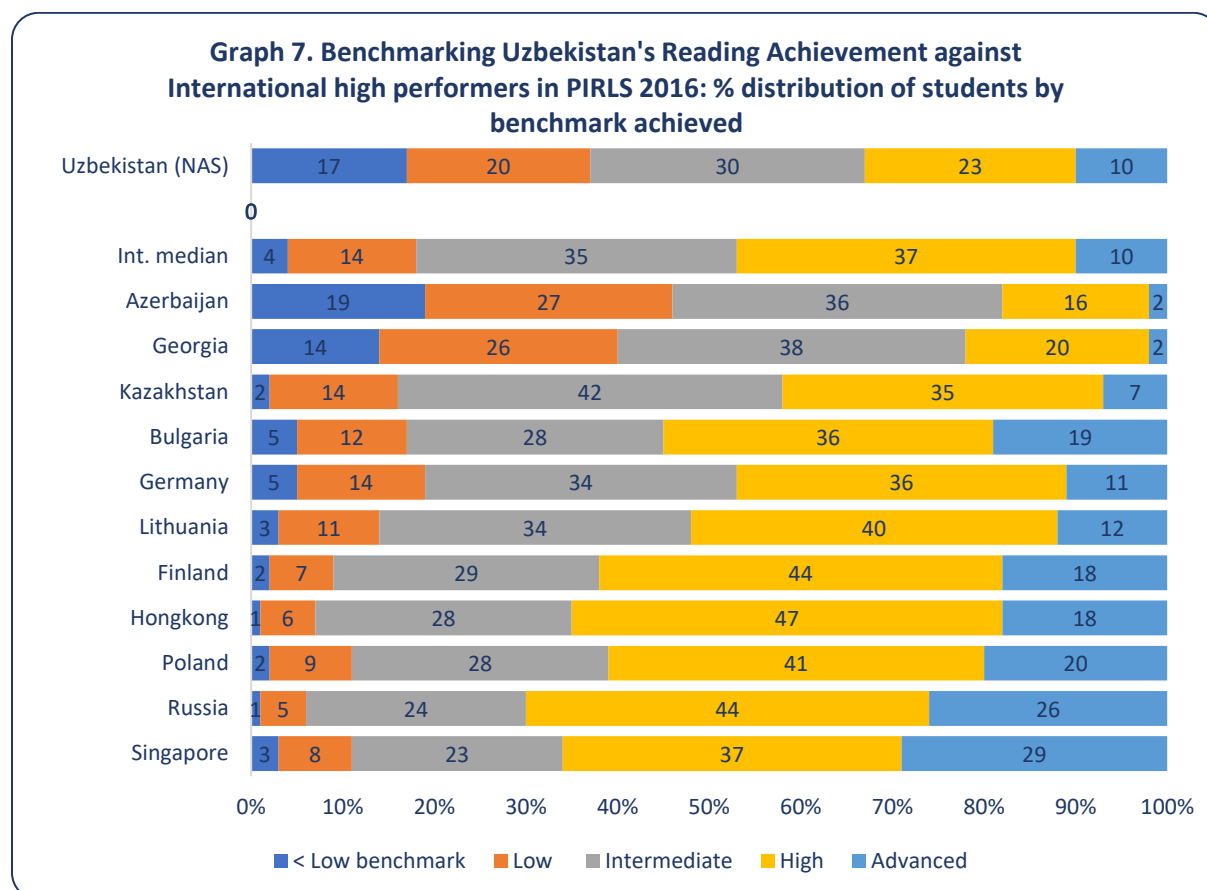
First and foremost, it must be noted that this study is a stand-alone study with IRT scale scores estimated specifically for the test scores obtained in this study, with a mean of 500 and SD of 100. Hence, the results of this study in a strict sense is not comparable to any other study. However, given the similarity of tools and procedures of the study with international assessments, it is possible to look at the results from the study in the context of PIRLS 2016 for Reading Comprehension and TIMSS 2015 for Mathematics and Science. It is to be noted here that a comparison of absolute scale scores is not feasible here. However, it is possible look at the proportion of children who achieve desirable benchmarks as a proxy measure.

It must be noted that among the countries of the Eastern Europe and Central Asia, only a few countries participated in PIRLS 2016. Of the countries that participated, Bulgaria and Kazakhstan performed above the PIRLS mean scores (500), while Georgia and Azerbaijan were below the average PIRLS scores. For the purpose of understanding the performance range, some of the best performing education systems are included in the presentation.

In PIRLS 2016 as well as TIMSS 2015, a scale score of 625 is considered as advanced benchmark, 550 as high benchmarks, 475 as intermediate benchmarks and 400 as low benchmarks. PIRLS 2016 results indicate that on an average, 10 percent students achieve advanced benchmarks. Another 37 percent students achieve high benchmarks (cumulatively 47 percent students achieve or surpass high benchmarks). On an average, 18 percent students achieve only low benchmarks or below that.

In Singapore, 29 percent students achieved advanced benchmarks and cumulatively, 66 percent achieved or surpassed high benchmarks in reading. Only 11 percent students in Singapore lagged as low achievers and below that. Russia is another high performer in PIRLS 2016, with 70 percent children achieving or surpassing the high benchmarks. Kazakhstan, who shares a common legacy with Uzbekistan performed reasonably well, with 42 percent students achieving

/surpassing the high benchmarks and only 16 percent students falling into low performers overall.



Source: for PIRLS data: Mullis, I. V. S., Martin, M. O., Foy, P., & Hooper, M. (2016);

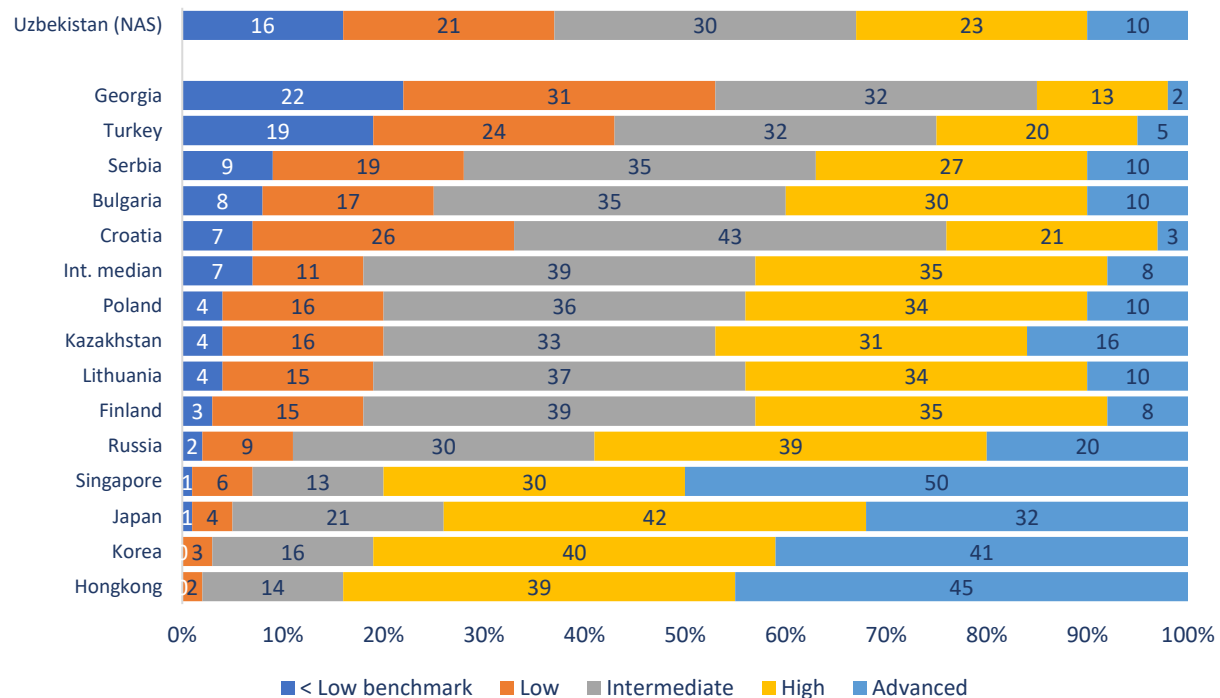
<http://timssandpirls.bc.edu/timss2015/international-results/>

For Uzbekistan data: UNICEF-MOPE (2018)

In the case of Uzbekistan, the results of this study show that 37 percent of the students could not reach intermediate benchmarks (on a scale that is pitched at a mean of 500 and an SD of 100), and out of this, 17 percent could not even reach low benchmarks. Proportionately, less children in Uzbekistan has achieved high or advanced benchmarks.

In TIMSS 2015 Math, half of the children in grade IV in Singapore had achieved or surpassed advanced benchmarks, and another 30 percent had surpassed high benchmarks – thus cumulatively 80 percent students surpassing high benchmarks. Around 84 percent students in Hongkong and 81 percent students in Korea had surpassed high benchmarks in Math. In the neighboring Kazakhstan, 47 percent students in grade IV had achieved or surpassed high benchmarks. On an average, 43 percent of students in all participating countries in TIMSS 2015 had achieved high benchmarks as evident from the international median.

Graph 8. Benchmarking Uzbekistan's Math Achievement against International high performers in TIMSS 2015: % distribution of students by benchmark achieved



Source: for PIRLS data: Mullis, I. V. S., Martin, M. O., Foy, P., & Hooper, M. (2016);

<http://timssandpirls.bc.edu/timss2015/international-results/>

For Uzbekistan data: UNICEF-MOPE (2018)

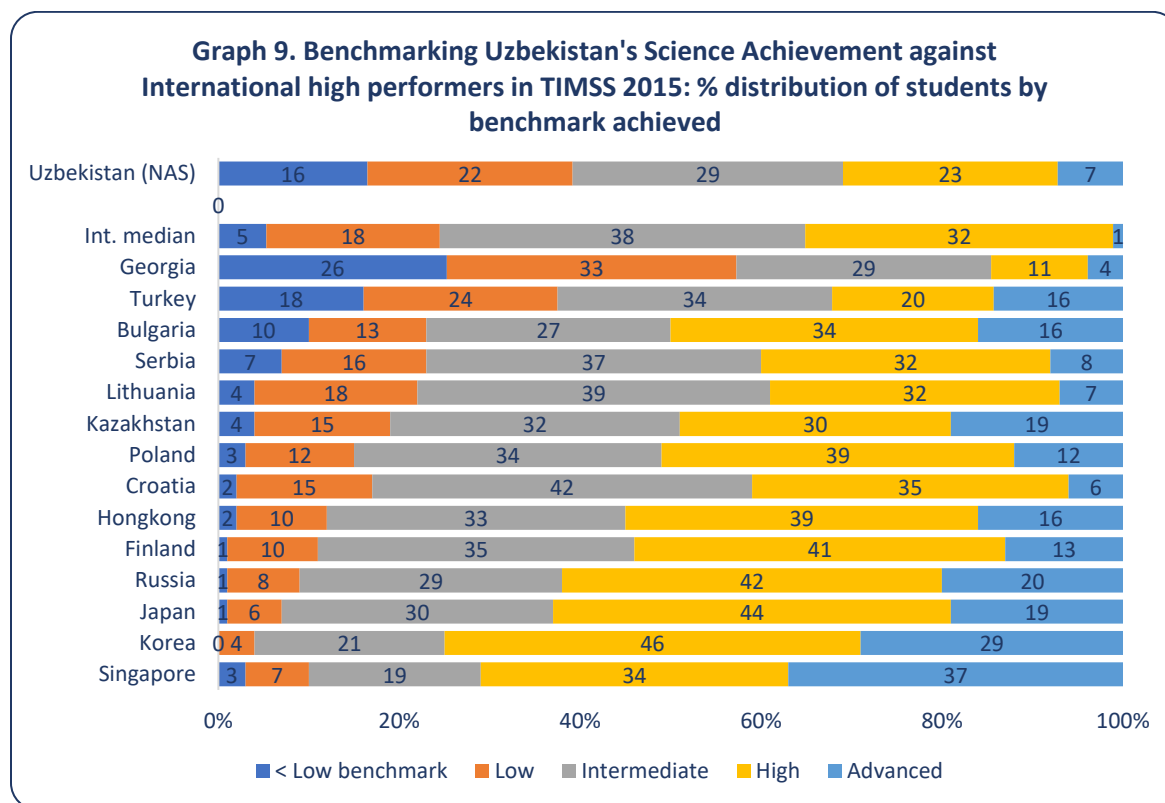
In Math, TIMSS 2015 data shows that countries from Eastern Europe, Central Asia /CIS performed poorly than international averages (except Kazakhstan, Poland and Lithuania). In Uzbekistan, only a third of the grade IV students (33 percent) had achieved or surpassed the high benchmarks in Math, even for a test customized to country curriculum. Only 10 percent students in the study achieved an advanced benchmark. A large share of students – 30 percent – were average performers, passing the intermediate benchmarks. However, what is worrying is the fact that a whopping 37 percent of students in the country were at low benchmarks or below that. Around 16 percent students failed to reach even the low benchmark scores.

For Science, TIMSS 2015 results show that Singapore and Korea were high performers, with more than 70 percent students in these countries achieving or surpassing high benchmarks. Internationally, close to 40 percent of students in participating countries on an average achieved or surpassed high benchmarks. Close to half of the grade IV children in Kazakhstan achieved or surpassed high benchmarks in Science subjects.

In Korea, all students surpassed the low benchmarks, and only 4 percent were below the intermediate benchmarks. In Singapore, Russia and Japan, less than a tenth of the students

could not reach the international benchmarks in Science. International averages show that around 23 percent students in participating countries were at low benchmarks or below that.

In the present study in Uzbekistan, the results show that a third of the students (33 percent) achieved or surpassed high benchmarks (just as in the case of Mathematics), out of which 10 percent had achieved or surpassed advanced benchmarks. Around 29 percent of students were at intermediate benchmarks while 38 percent students were lagging at low benchmarks or below that. Just as in the case of Mathematics, 16 percent students failed to reach the low benchmarks as well.



Source: for PIRLS data: Mullis, I. V. S., Martin, M. O., Foy, P., & Hooper, M. (2016);

<http://timssandpirls.bc.edu/timss2015/international-results/>;

For Uzbekistan data: UNICEF-MOPE (2018)

Overall, the results demonstrate that primary school students' achievement is not sufficiently high in Uzbekistan, especially compared to the performances of various countries in international assessments like TIMSS and PIRLS. Furthermore, there is a significant gap between the lowest and highest performing students. Such results indicate that the education system in Uzbekistan fails to ensure equity in learning outcomes of primary school children. Schools also vary generally in their average achievement of students in all subjects. Within schools, students' test scores show wide variations as well. However, the within-school, student level variations were more evident in schools with average low performance scores compared to schools with high average performances.

3.2. What do Grade IV students in Uzbekistan “Know” and “Can do”

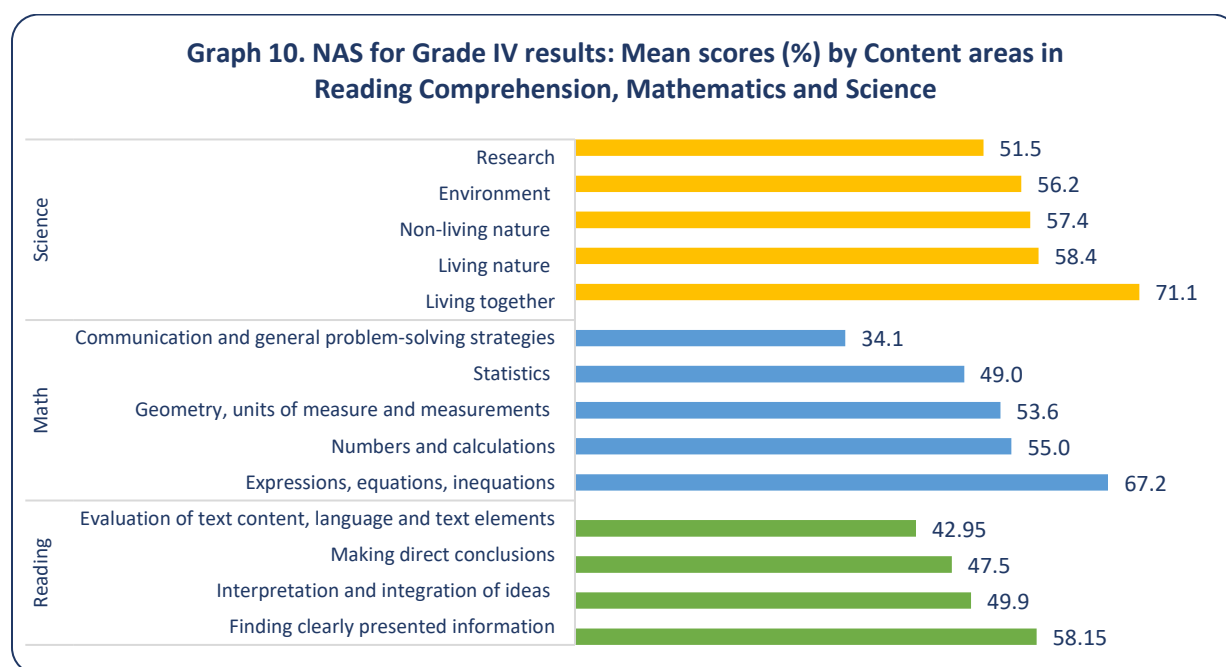
The overall scores, even subject- specific scores, camouflage the range of students’ knowledge and their skills. An analysis of the students’ performance by subject content and cognitive domains is taken up here. For this purpose, content-specific and cognitive domain-specific items were converted into scale scores using IRT scores of each item. Such analysis is expected to inform review of curricular areas and for curricular reforms. Apart from creating the scale scores, a summary scores on each of the content and cognitive domains were estimated using item-wise ability score, which enabled an estimation of percentage scores for comparison.

Performance by Subject Content areas:

The subject content areas tested under Reading Comprehension, Mathematics and Science are described in section 2.3. To summarize it here:

- In Reading Comprehension, four content domains were tested: (a) locating /retrieving clearly presented information; (b) making direct conclusions/ assessing straightforward inferencing; (c) grasping ideas and interpreting them; and (d) inferring, evaluating and critiquing content items.
- In Math, the test items contained subject domains such as (a) numbers and calculations; (b) expressions, equations and inequations; (c) geometry, units of measure and measurements; (d) statistics; and (e) communication and general problem-solving strategies.
- In Science, areas covered included: (a) living together; (b) living nature and human beings; (c) non-living nature and human beings; (d) environment; and (e) research.

The mean percentage scores for each of these 14 content areas is presented in the graph below.



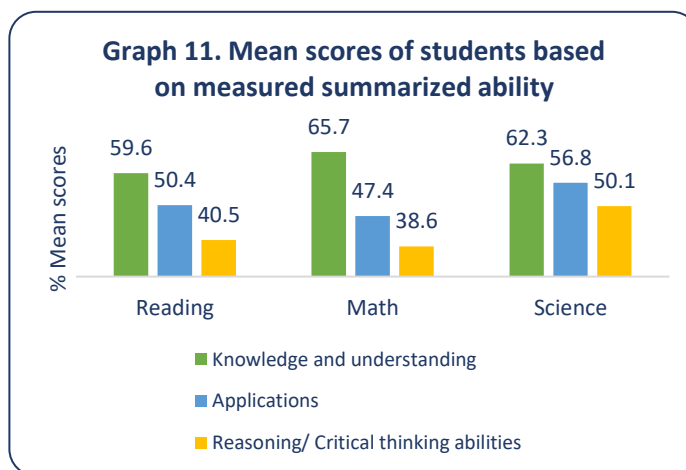
The analysis shows that students scored on an average 58 percent in “finding/retrieving clearly presented information” under Reading Comprehension test – which means students on an average were able to locate information which is direct and non-complex. Around a fifth of the students were successful in locating all the “clearly presented information” in the text, while a little less than a tenth of the students could not locate even a single, simple information presented in the text. Students’ mean ability to make direct, straightforward conclusions using the information in a given text averaged around 48 percent. Around 6.5 percent students failed in doing even a single task under this category, while 4.8 percent students got all the tasks related to conclusions right. Despite the students’ failure in making direct conclusions in more than half of the instances, they were able to complete half of the tasks related to interpret ideas and integrate different ideas. Around 12.5 percent students failed completely in interpreting and integrating ideas, while 6.6 percent students successfully completed all associated tasks in this domain. Students on an average scored 43 percent in Reading Comprehension tasks that required them to evaluate the content, language and text elements. Here again, around 13.5 percent students failed in all tasks related to evaluation of text content and language, while 12 percent students got all of them correctly.

In Math, students on an average scored 67 percent in the content area related to mathematical expressions, equations and inequations, but scored only 34 percent in communication and general problem-solving strategies. In numbers and calculations, very few students got all the items correct and even less who got zero scores. Same is the case with geometry, units of measure and measurements. In the case of expressions, equations and inequations, more than a third of the students got all items correct while only 3 percent got all wrong. Slightly less than a fourth of the students got all items related to communication and general problem-solving strategies. However, in the case of statistics, around equal number of students got all items right, all items wrong and some items right.

In Science, students in grade IV scored a high mean score of 71 percent in tasks related to “living together” but could get only 51.5 percent on items that required exploration and some research. Around 41 percent students scored all items correctly in the case of “living together”.

Performance by Cognitive domains:

Performance of students were also analyzed based on the cognitive domains that the test items covered. In all the three subjects, cognitive domains covered: (a) knowledge and understanding; (b) applications; and (c) reasoning and critical thinking. In all the subjects, students of grade IV in Uzbekistan showed their dominant skills in absorbing knowledge compared to application of knowledge to a specific situation or using the

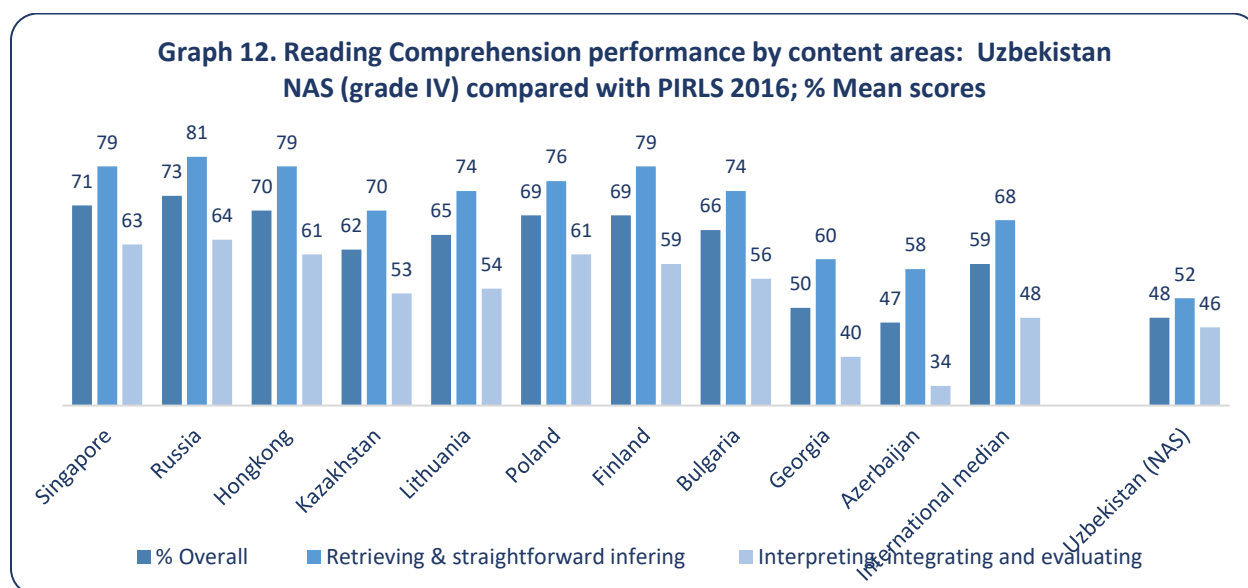


knowledge for reasoning and critical thinking. Students on an average scored 60 percent or above in the cognitive domain of “knowledge and understanding”. On the other hand, they could score around 50 percent in skills related to application, and below 40 percent in reasoning and critical thinking areas related to Math. This points towards the fact-based teaching and learning happening in the classrooms in Uzbekistan. Skills related to application and reasoning are transversal skills and critical for an ever-evolving labour markets and its job requirements.

How does Uzbekistan fare internationally in performance by content areas?

Compared to high performers like Singapore, Russia and Korea, where children got on an average more than 70 percent of the items correct overall, in Uzbekistan, grade IV children on an average were able to get half of the tested items in Reading Comprehension right. In Kazakhstan, a Central Asian neighbor, students got 62 percent of the language items in the PIRLS correctly. Results of PIRLS 2016 in Poland (Eastern Europe) also shows that children on an average got 69 percent of the reading items correct. The international median is 59 percent, which is 9 percentage points ahead of Uzbekistan’s NAS score as estimated for this study.

What is important is the disaggregation of the reading comprehension results into reading abilities of children. Internationally on an average, more than two-thirds of the students (68 percent in grade IV) were able to retrieve information and do straightforward inferences, as evident from the PIRLS 2016 results. Interestingly, in Russia, on an average, children were able to correctly do 81 percent of the test items, with children in Singapore and Hong Kong not being far behind. In Kazakhstan, students got 70 percent of similar tasks correctly.



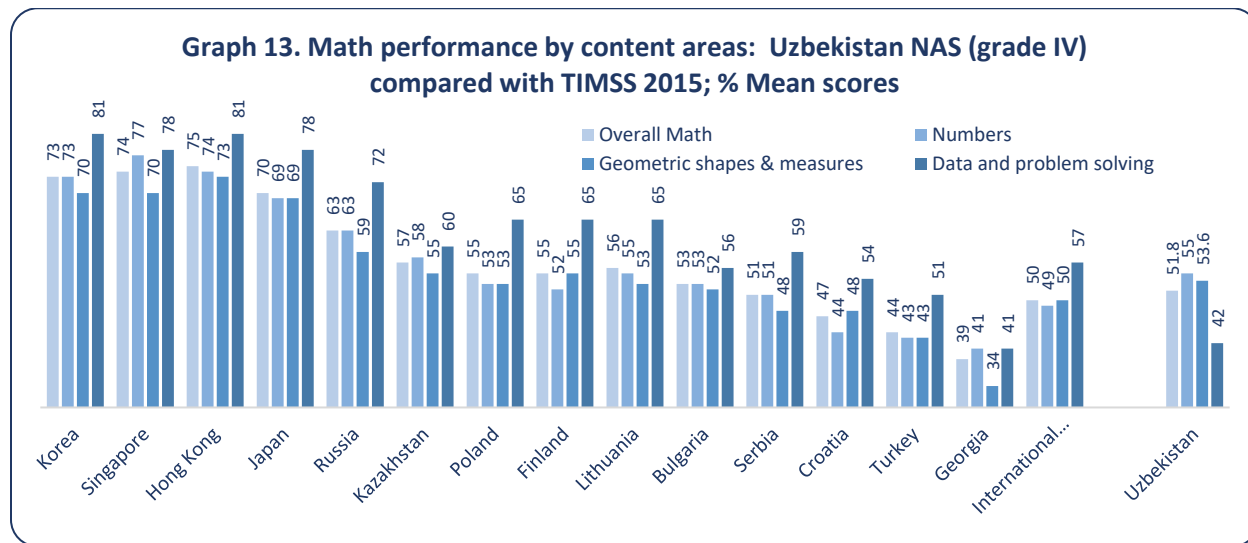
Source: for PIRLS data: Mullis, I. V. S., Martin, M. O., Foy, P., & Hooper, M. (2016); <http://timssandpirls.bc.edu/timss2015/international-results/>;
For Uzbekistan data: UNICEF-MOPE (2018)

In interpreting and integrating ideas and evaluating text, PIRLS results show that on an average, children were able to do only 48 percent items correct. Here, students of grade IV in Uzbekistan are not far behind, though students in better performing countries like Singapore, Russia, Hongkong and even Poland got more than 60 percent of such items correct.

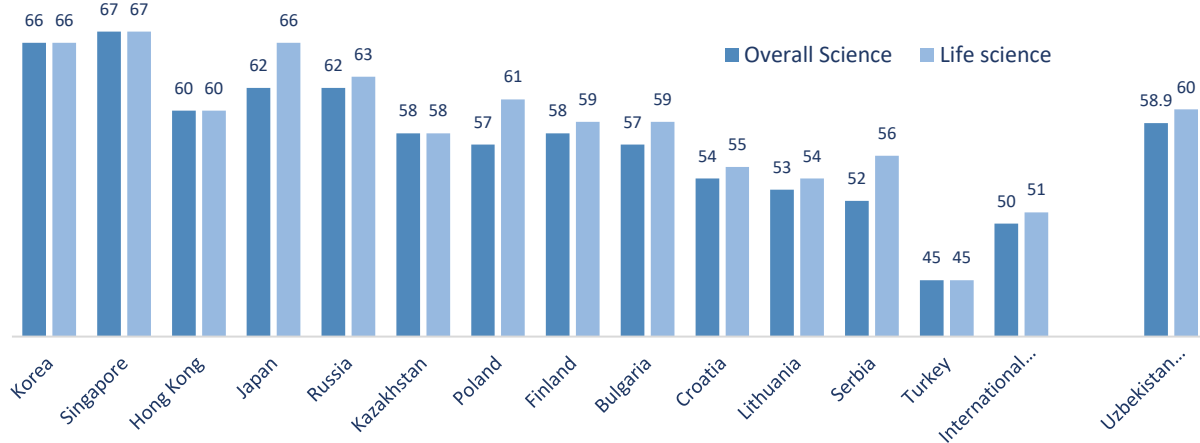
The results of student performance on Reading Comprehension content-wise analysis shows that children were relatively better in retrieving information/knowledge and making straightforward conclusions than analyzing the information, interpreting, connecting and evaluating the text. The results point to the importance of going beyond mere literacy in a language, but also imparting skills on analyzing the language for its content and interpreting it as well as integrating and evaluating the language text content.

In Math, students of grade IV in Uzbekistan compare well with the international averages in numbers and geometric shapes and measures, but not so in the case of data and problem solving. Kazakhstan, the neighboring country had a good show in TIMSS 2015 while some other countries in Europe and Central Asia region such as Georgia and Turkey performed poorly in the international assessment.

Uzbekistan compares well with high or middle achieving countries in terms of performance in Science, at least by the trends available from the present study. Overall, students in Uzbekistan achieved 59 percent in Science, which was dominated by test items in the subject domain of life sciences. This is comparable to the scores achieved by Hongkong, Kazakhstan, Poland and Finland.



Graph 14. Science performance by content areas: Uzbekistan NAS (grade IV) compared with TIMSS 2015; % Mean scores

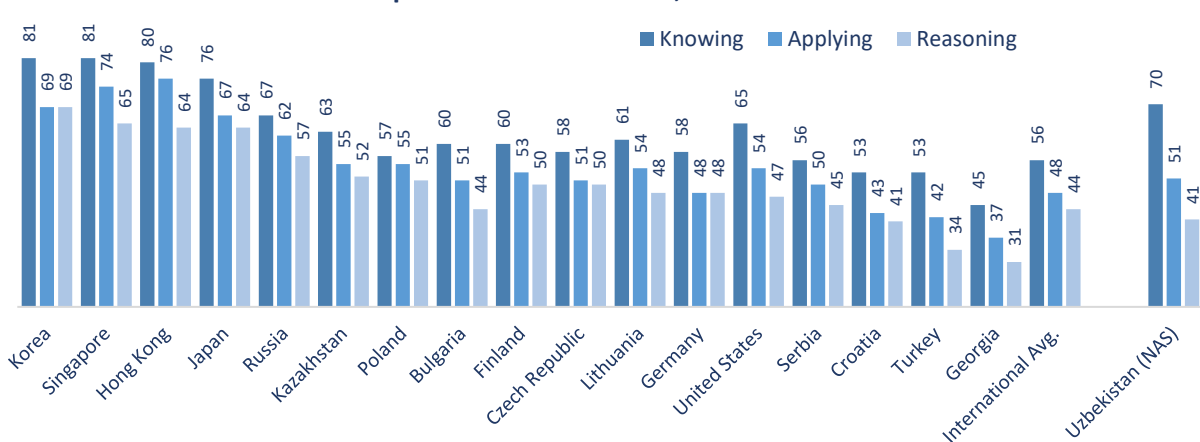


Source: for PIRLS data: Mullis, I. V. S., Martin, M. O., Foy, P., & Hooper, M. (2016);
<http://timssandpirls.bc.edu/timss2015/international-results/>;
 For Uzbekistan data: UNICEF-MOPE (2018)

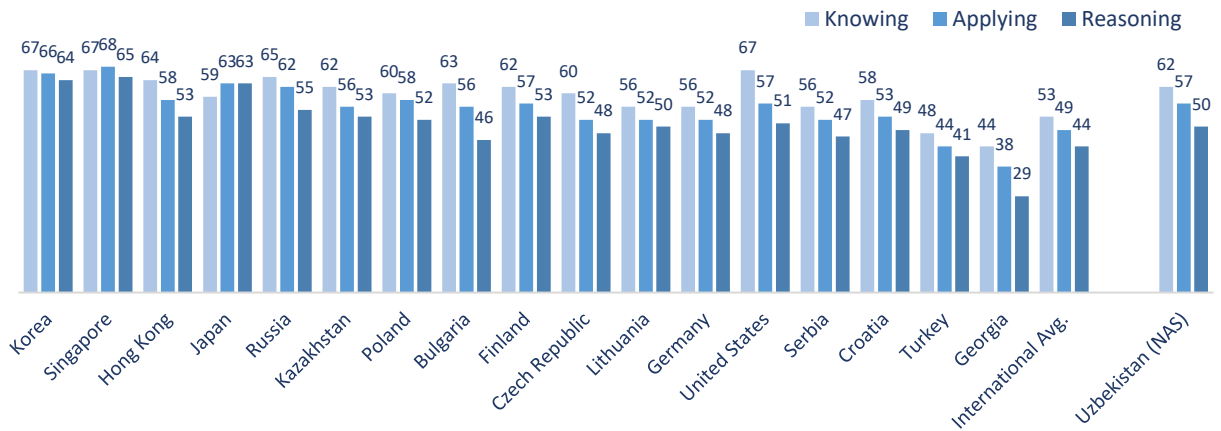
How does Uzbekistan fare internationally in performance by cognitive domains?

Compared to TIMSS 2015 scores, students in grade IV in Uzbekistan is close to the international median or even slightly better with respect to “knowing” and “applying”, but below international averages in “reasoning” skills. In most of the high performing countries in TIMSS 2015, the gap between the average percent correct in “knowing” and that of “applying” and “reasoning” is much less than that in Uzbekistan. For example, in Korea, the gap between the domains was just 13 percentage points while in Singapore, it was 16 percentage points. In Uzbekistan’s NAS, the gap between “knowing” and “reasoning” scores are around 30 percentage points. It is obvious that in Uzbekistan the balance between facts teaching and skills/ competency development activities in the Math curriculum is uneven.

Graph 15. Math performance by cognitive domains: Uzbekistan NAS (grade IV) compared with TIMSS 2015; % Mean scores



Graph 16. Science performance by cognitive domains: Uzbekistan NAS (grade IV) compared with TIMSS 2015; % Mean scores



Source: for PIRLS data: Mullis, I. V. S., Martin, M. O., Foy, P., & Hooper, M. (2016);

<http://timssandpirls.bc.edu/timss2015/international-results/>;

For Uzbekistan data: UNICEF-MOPE (2018)

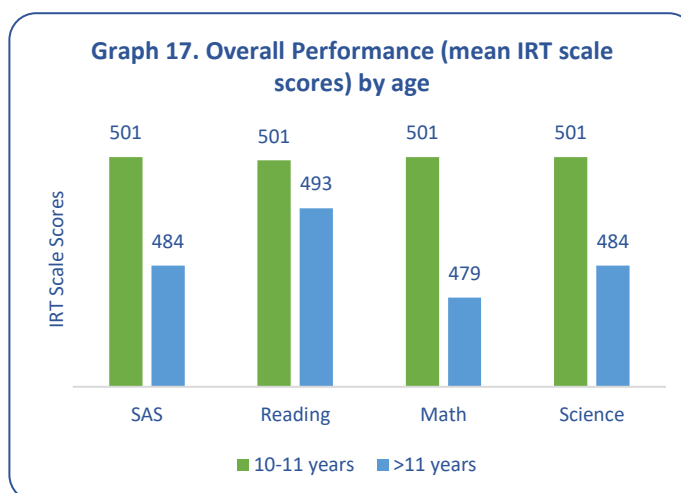
The results of this study in Science testing by cognitive domains show that children in grade IV compare well with international average results available from TIMSS 2015. Uzbekistan's results are quite comparable to countries like Kazakhstan, Poland and Finland in Science subjects.

4. How learning achievement differs by general Student characteristics?

The analysis so far revealed what children in grade IV in Uzbekistan on an average “know” and “can do”. However, decomposing test scores into population (student) subgroups and analyzing the variations is important both academically as well as from the point of view of policy preparations. This section provides an analysis of learning achievements disaggregated by students’ age, gender, location of their residence / schooling, the language spoken at home and in school and preschool experiences. We also look at the effect of these factors on learning achievement of students by looking at the regression results.

Learning Achievement by Age:

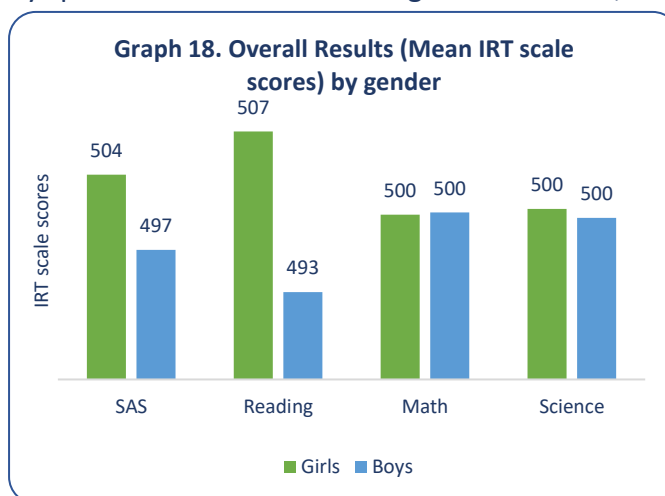
In Uzbekistan, by law, children enter grade I at the age of 7, and this means that children complete grade IV by the time they are 10 or 11 years of age. In the study sample, 78 percent of the children were of 11 years of age, while around 15 percent children reported that they were 10 years of age. Around 6.6 percent students were above 11 years of age. It was not explored whether they were “over-age” due to late entry into school or grade repetition. The raw scores show that children who were in the appropriate age for the grade performed better than children slightly over-aged. The analysis of results by subject wise content and cognitive domains also reiterate the results of overall performance results, i.e., children in the appropriate age group fared better in learning compared to over-age children.



Learning Achievement by Gender:

An analysis of mean (IRT) scale scores by gender shows that girls performed relatively better than boys in Reading Comprehension as well as in overall summarized scores (SAS), while gender differences were negligible in Mathematics and Science. Girls performed better than boys in overall Reading Comprehension, which is also reflected in better performance of girls in all aspects (content areas) in Reading assessment. In terms of cognitive domains, girls did significantly better than boys in “knowledge and understanding” and “applications”, while in “higher level thinking”, they were only slightly better than boys.

Unlike the Reading assessment, in Math, no significant difference was observed between boys and girls in overall scores, nor in terms of any specific content areas. In cognitive domains, there were no significant variations between boys and girls in “knowledge and understanding” or “higher order skills”, but boys performed better than girls in “applications”. Just as in the case of Math test, no significant differences were observed between girls and boys in Science scores by content domains. However, among the cognitive domains, boys exhibited better skills in “knowledge and understanding”, though no significant difference was observed for “applications” and “higher order skills”.



How do the gender-wise results in Uzbekistan NAS compare with International evidences?

PIRLS 2016 results show that girls had higher Reading achievement than boys in most countries participated – girls had higher achievement in 48 out of 50 countries participated, with an average difference of 19 points (international average of scale scores of 520 for girls and 501 for boys). In Uzbekistan, girls scored an average 507 in Reading Comprehension compared to 497 of boys, with the difference between girls and boys amounting to 10 percentage points.

In TIMSS 2015, boys had higher Mathematics achievement than girls in more countries: of the 49 TIMSS 2015 countries, boys had higher achievement in 18 countries, with an average difference of 9 points; girls had higher achievement in 8 countries, with an average difference of 18 points; and in 23 countries, no difference was found between boys and girls in average Mathematics achievement (Martin, M.O., Mullis, I. V. S., Foy, P., & Hooper, 2016). In Uzbekistan too, the results are like the TIMSS 2015 international average results, i.e., no significant difference between the genders in Mathematics achievement.

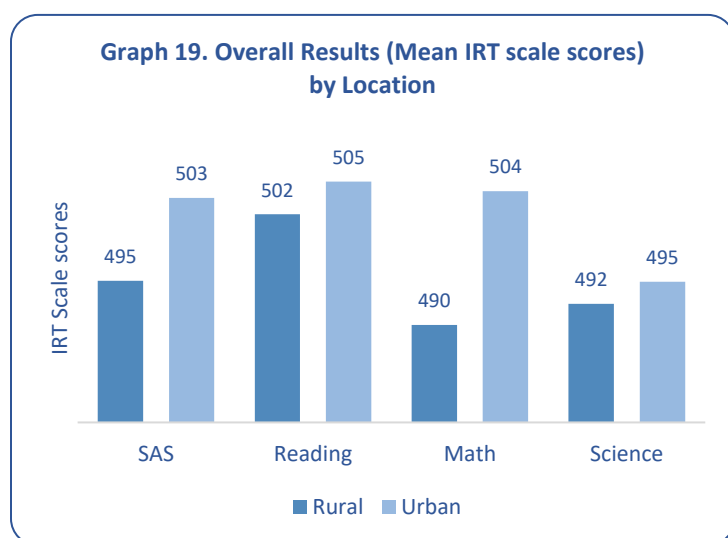
In Science test, TIMSS 2015 results indicate that there was a four-point differences in scale scores between girls and boys (girls scored 508 and boys, 504). However, in Uzbekistan, girls and boys scored 500 each, indicating no significant advantage to any gender in science learning.

Learning Achievement by Location (Rural and Urban):

TIMSS 2011 and PIRLS 2016 points to the fact that in many countries children in urban areas or those who attend urban schools have some advantages vis-à-vis learning. Households in urban areas may have better access to learning resources or schools with better resources than those in rural areas. Urban households have better access to libraries, museums, bookstores etc. as well as exposure to more international resources. In some countries, schools in urban areas

may provide for more supportive environment because of better staffing conditions and the student population coming from more advantaged backgrounds (Erberber, E, 2009).

While designing the study, efforts were made to distinguish locations by big city (Tashkent, big towns/small cities, small towns and rural areas for Uzbek medium schools. Russian medium schools were treated as a separate category. For the specific analysis here, only Uzbek schools are considered. All schools other than those in rural areas is treated as urban (which includes schools from Tashkent city, big towns as well as small towns). Urban students (big city and big towns) constituted 48 percent of the students in the sample while students in small towns accounted for a fourth of the sample.



The analysis of learning achievement by the location of the students / schools in Uzbekistan shows that students in urban areas did better (unadjusted for other factors) than rural students, especially in Math. In Reading Comprehension, urban students did significantly better than rural students in “finding clearly presented information”. They also performed better in the cognitive domain of “knowledge and understanding” as well as “application”. In other aspects of

subject or cognitive domains of Reading Comprehension test, no significant differences were observed between rural and urban students. In Math, students in urban areas performed significantly better than rural students, especially in areas subject domains such as numbers and calculations and geometry, units of measure and measurements. In terms of cognitive domains, significant difference was observed in all areas between urban and rural students. Interestingly, no significant difference between rural and urban students were observed in the subject and cognitive areas related to Science/Environmental Studies topics.

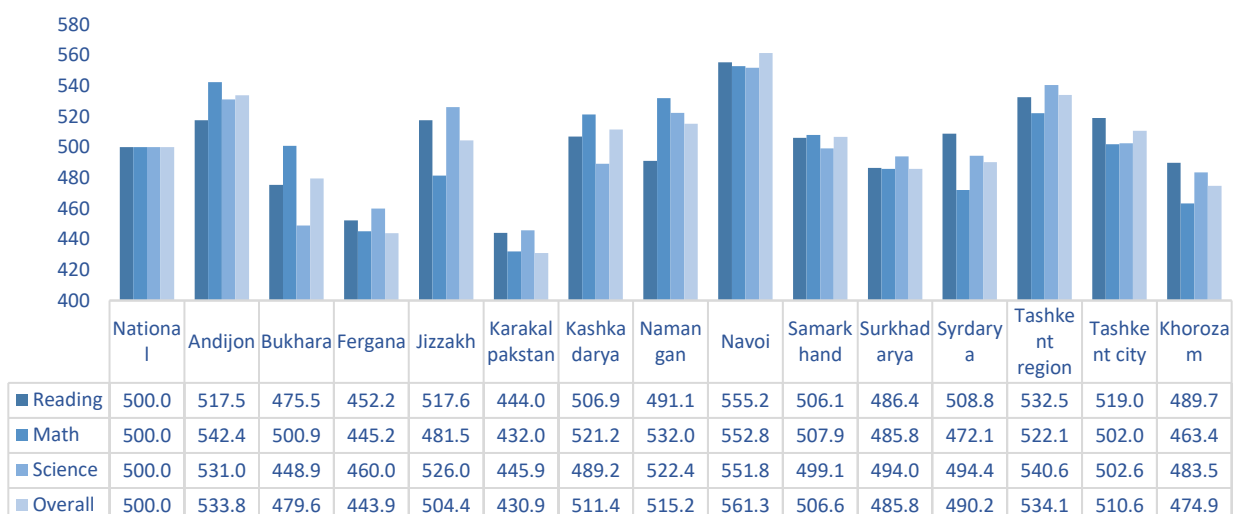
Learning Achievement by Location (Region wise):

In Central Asia, Uzbekistan is one of the biggest countries both in terms of area and its diversity as well as diversity in its population. National averages camouflage regional variations, and even the rural-urban divide is not enough to capture the locational diversity across the regions. Regions also vary culturally as well as in linguistic preferences, which have deeper impact on learning levels of children at early stages of education. While children and schools in Navoi, Andijon, Tashkent region as well as Tashkent city did very well in all subjects, those in Republic of Karakalpakstan, Fergana and Bukhara lagged other regions in learning achievement.

The region-wise dummies were used in the multi-variate analysis (Ordinary Least Square estimates) to understand the regional variations after controlling for other socio-economic

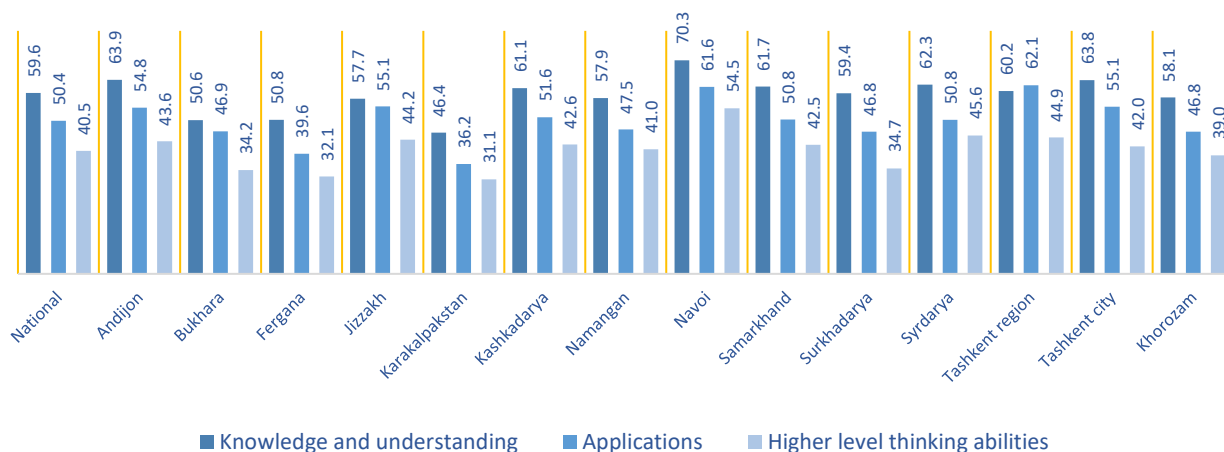
variables. Tashkent city was used as the reference point. The regression coefficients show that students in Andijon, Namangan, Navoi and Tashkent region performed significantly better than students in Tashkent city. Students in Bukhara, Fergana, Republic of Karakalpakstan, Khorozm and Surkhadarya lagged behind students in Tashkent city in their test scores. Students in Jizzakh, Samarkhand and Syrdarya had performance similar to that of students in Tashkent city.

Graph 20. Mean achievement scores in learning assessment survey by Regions

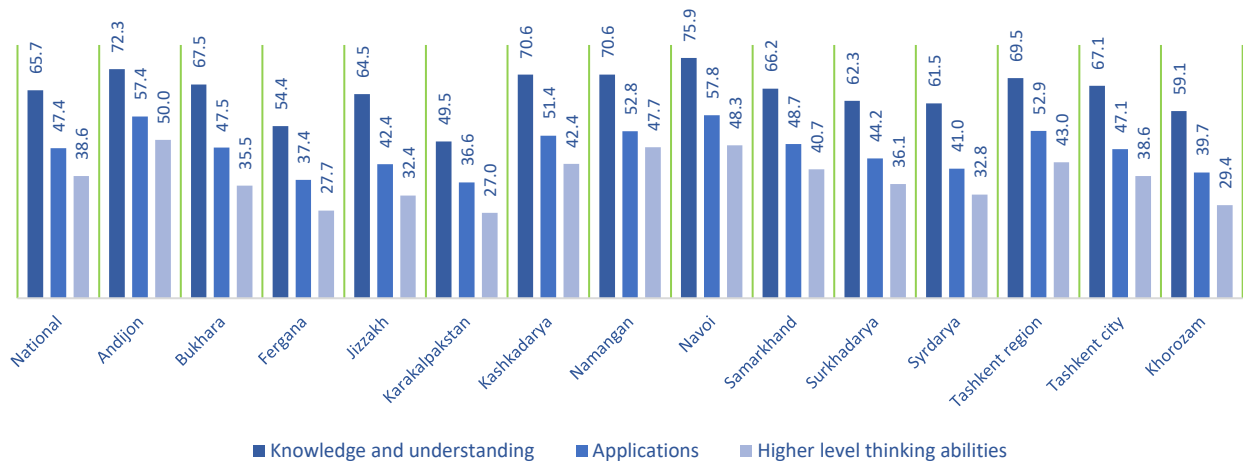


The analysis of results by cognitive domains show that in all regions, students performed better in knowledge related tasks than application and higher order thinking related ones. Please see below the graphs for results in Reading Comprehension and Mathematics.

Graph 21. Mean scores (%) in Reading Comprehension by cognitive domains : By Regions



Graph 22. Mean scores (%) in Math by Cognitive domains: By Regions

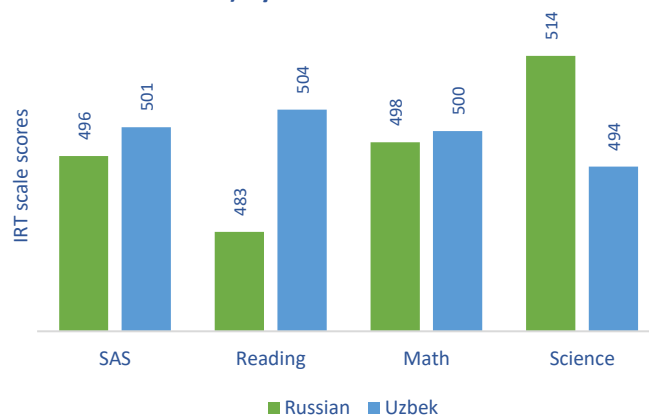


Learning Achievement by the Medium of Instruction

Around 86 percent of students in Uzbekistan study in Uzbek medium schools while another 10 percent attend Russian medium schools (MOPE 2017). The rest 4 percent attend various schools that offer instruction in Karkalpak, Tajik, Kyrgyz, Kazakh and Turkmen languages. The proportion of children attending various language schools differ across regions. Around 44 percent of children in Tashkent city study in a Russian medium school while in Surkhadarya, only 2 percent students attend a Russian medium school. In the study, only Russian and Uzbek medium schools were sampled. More than a fifth of the students in the sample were selected from Russian medium schools.

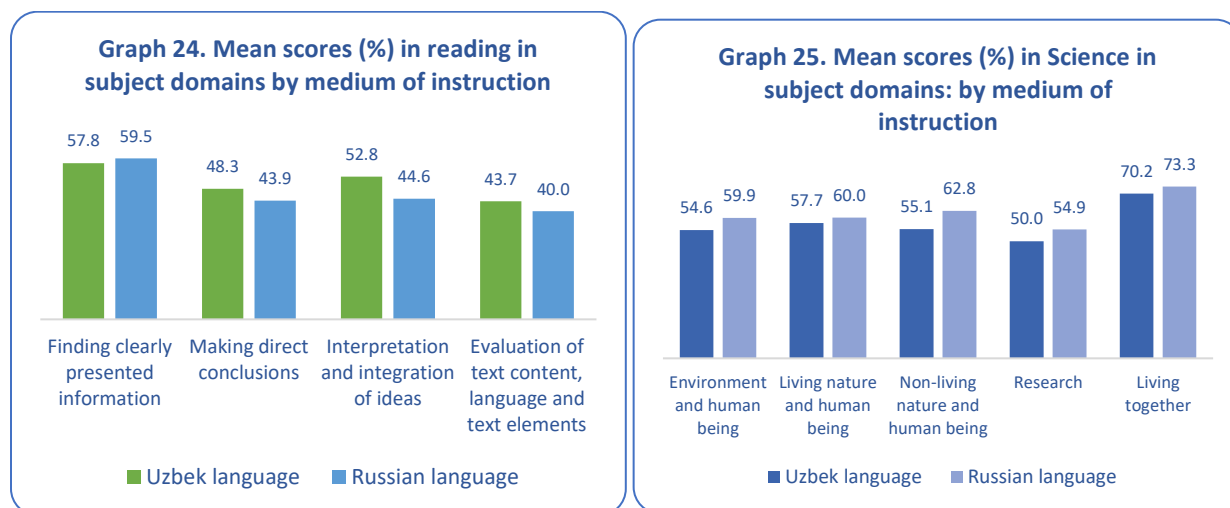
Analysis of learning achievement by the medium of instruction shows interesting results. In Reading Comprehension, children attending Uzbek medium schools did relatively better than those who were attending Russian medium schools. While there were no significant differences in Math results, those who attended Russian medium schools did relatively better in Science than those in Uzbek medium schools. These results, especially those related to Reading Comprehension should be understood in the context of language spoken at home. In Russian medium schools, only 42 students reported that Russian was their first language at home. Another 47

Graph 23. Overall Results (Mean IRT scale scores) by Medium of instruction



percent reported that Russian was spoke at home occasionally. On the other hand, 68 percent of students in Uzbek medium schools were from homes where Uzbek was the main language spoken at home. Another 11 percent reported that Uzbek was also spoken at home, but not as the main language. Clearly, speaking the same language at home gives a comparative edge to students in Uzbek medium schools than those in Russian medium schools in Reading Comprehension. On the other hand, the relatively better performance of Russian medium students in Science need further study. One plausible explanation is related to the availability of learning materials in Russian language more than Uzbek language, but there could be other factors related to Russian medium schools or the children’s households.

Further analysis of the results in Reading Comprehension by content domain shows that students in grade IV Russian medium students were slightly better than Uzbek medium students in tasks related to simple, clearly presented information. However, when it comes to tasks that require children to infer and conclude, interpret and integrate ideas and evaluate text content and elements, students from Uzbek medium schools performed significantly better than students from Russian medium schools. On the other hand, in Science subjects, in all aspects of content, Russian medium students had higher scores.



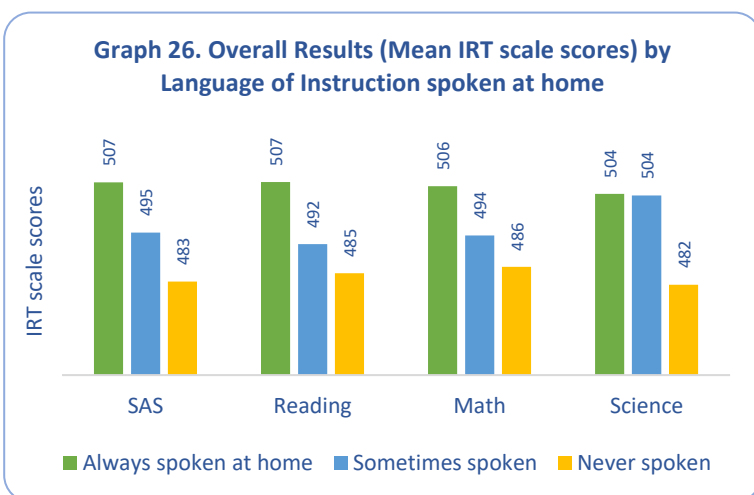
Learning Achievement by Home Language Vs. School Language

Because learning to read is dependent on children’s early language experiences, the language or languages spoken at home and how they are used are important factors in reading literacy development (PIRLS 2011). Although there may be some benefits to being multilingual, students who always speak a language at home different from the language in school may be at a disadvantage in some learning situations, particularly in the early grades, when reading is a focus of instruction (PIRLS 2006). As formal reading instruction begins, children are likely to be at an initial disadvantage if their knowledge of the language of instruction is substantially below the expected level for their age (Scarborough, 2001).

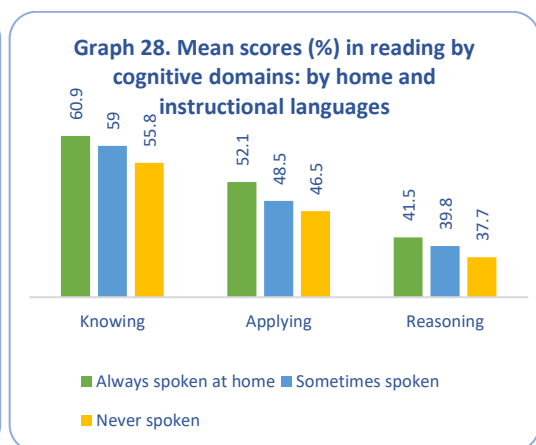
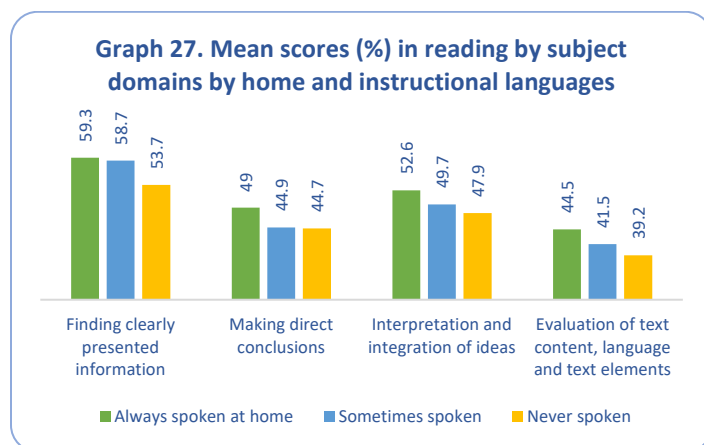
The results of PIRLS 2011 and 2016 reveal that on average, across countries, there was a strong relationship between frequency of speaking the language of the test at home and performance

on the test. The average score for those always speaking the test language at home (508 points in 2011 and 511 in 2016) considerably higher than that for those speaking it only sometimes (474 points in 2011 and 504 in 2016) or never (424 points in 2011 and 433 in 2016). In Uzbekistan, the results of this study show that students who spoke the language at home all the time scored on an average 507 in scale scores while those who spoke it sometimes scored 492 and those who never spoke the language at home scored only 485.

In Uzbekistan, around 62.6 percent students study in a language that is also their home language. However, 37.4 percent of the students are currently studying in a language different from their home language. Around 32 percent of the students in Uzbek schools and 58 percent of students in Russian medium schools have a different home language. The analysis of overall subject wise results indicates that those who study in a language which is their predominant home language do significantly better than those who study in a different language. Children from families where the language is spoken sometimes also do better than those families where the language is not spoken at all. The results reiterate the importance of providing education in a language that children are familiar with, at least in the initial years, and this is in line with international evidences on the language in which children study better.

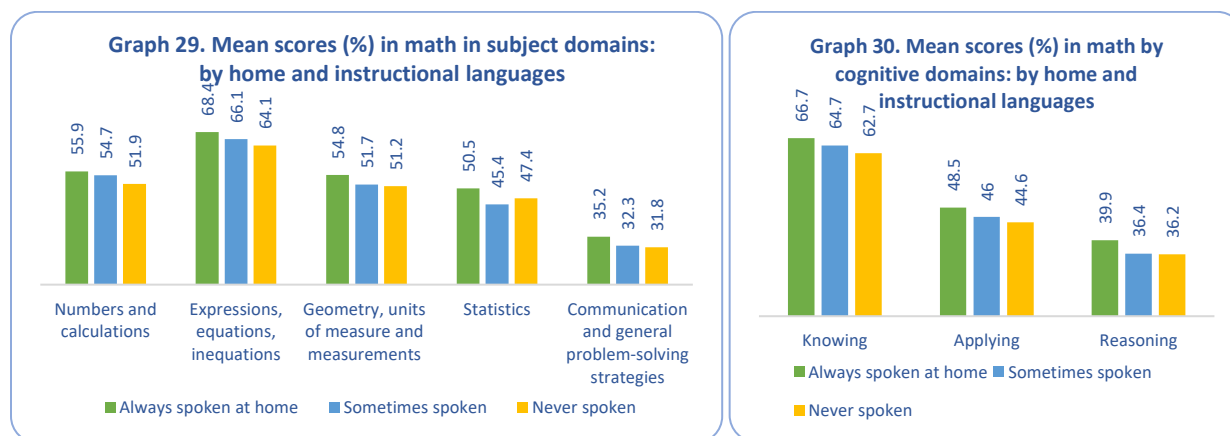


An analysis of Reading Comprehension content areas by language shows that in all areas, students who studied in a school where the language of instruction is same as the predominant language spoken at home did significantly better than who had studied in a different language. Same is the case with results in Reading Comprehension by cognitive domains.



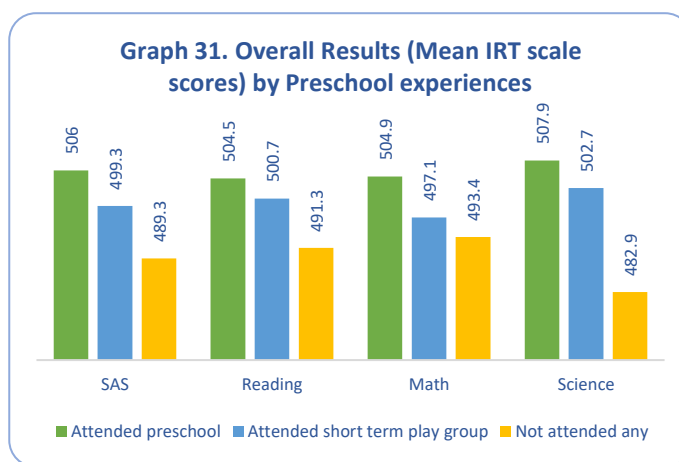
The analysis of Mathematics test scores by content areas and cognitive domains replicate similar results as that of Reading Comprehension. Though Mathematics may look like a language-neutral subject, studying in one's own language enables students to grasp ideas better.

Unlike Reading Comprehension and Math tests, the differences in scores of those who studied in their own home language and different language was not that stark in the case of Science/Environmental Studies content areas and cognitive domain areas, though students with the same language at home and school performed better than those with different languages.



Learning Achievement by Early Childhood Education (ECE) Experience

Pre-primary education plays an important role in preparing children for primary school. PIRLS results (2006, 2011 and 2016) consistently show a positive relationship for fourth grade students between the number of years students attended preprimary education and their reading achievement. PIRLS 2016 results show that those students who never attended any preschool programme scored on an average 472 in scale scores while those students who attended two years or more of preschool education scored 507 and those who did at least 3 years of preschool attained 520 in Reading comprehension. In Uzbekistan, enrollment in preschool education was below 20 percent a few years ago, and it has increased to more than 30 percent only in the past two years (ESP 2019-2023). The analysis of test scores by preschool attendance shows that those who attended preschool had done significantly better than those who had no preschool experience. Subject wise analysis of content and cognitive domains also shows that students who had preschool experiences do better than those who had not. This is despite the limitations imposed by low preschool enrollments and variable quality of services provided in preschools.



5. How learning achievement varies by Home Environment and support?

Learning assessment studies across the globe have provided insight into the importance of home environments for children's learning levels. Children's home experiences lay the foundation for early literacy and numeracy. This section presents the results of the test scores in the context of some of the major aspects of the home environment and support that contribute to better learning among children. This section looks at test scores in the context of the following home factors: socio-cultural and economic resources; family's expectations about studies for children; support for their education as well as family's engagement with children.

Before elaborating the learning achievements by home factors, it is important to note that a large proportion of children, in some cases as high as 20 percent, did not respond to some of the questions. There could be various reasons for this. One plausible reason is their indifference to answering such questions and another could be fatigue factor, after the tests to go through the background questions in detail and answer them in a meticulous manner. There is also the possibility of students being concerned about attracting any disciplinary or punitive actions for giving honest responses, and this is despite providing assurances on the anonymity of the test results as well as interview responses. In any case, our analysis shows that children who did not respond to some of the background questions turned out to be low performers in test scores.

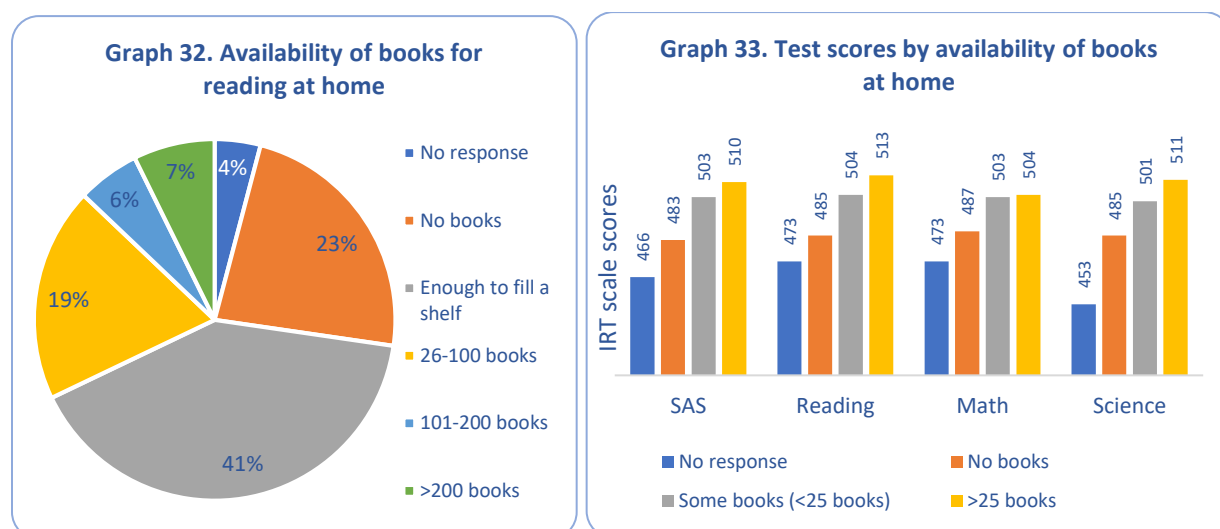
Economic, Social, and Educational Resources

The positive relationship between students' learning achievement and their socio-economic status (SES) has been empirically well-established and well-documented in education quality literature. Parental education, especially that of mother, parental occupation, income and expenditure on children's education are all part of the narrative of such a positive relationship between SES and test scores. Educated parents are expected to be more involved in students' learning processes and they are expected to provide a learning-rich environment at home.

In this study, children were not asked questions about parents' education or occupation but were asked a range of questions that capture various aspects of economic, social and educational resources at home. Children were probed about the availability of reading materials at home, presence of educational aids (computer, study desk for own use, books of their own, and access to magazines) at home, access to digital tools (computer, internet and mobile phone), participation in extracurricular activities (free as well paid) and receiving pocket money from parents. An analysis of these factors helps us in understanding the relationship between SES and test scores in Uzbekistan.

Availability of books: It is often said that a child who reads will become an adult who thinks. Hence, it is important to provide children with apt and adequate reading materials that enable them to read and grow. In the survey, around 23 percent of the students in grade IV reported that there were hardly any books in their homes for reading. Overall, only 73 percent of the

children reported having any reading materials (other than their own text books) at home. Of this, 41 percent reported that they had very few books (less than 25 books – a measure used in TIMSS and PIRLS). Children who reported not having these reading aids were performing poorly in test scores compared to those who reported the availability of these resources. The analysis of test scores by availability and quantity of books at home reiterates the international evidences that having reading materials at home contributes positively to learning improvements among children.



Though many households didn't have a rich environment for reading – defined in terms of having sizeable number of books for reading, a large proportion of children reported having some children's books, magazines, dictionary and other resources for reading /language and learning at home. Those children who reported having these reading materials scored better in the NAS.

Table 8: Resources for Reading and other activities at home						
	% of student responses about availability			Mean Scale scores on SAS for children with the resources		
	No response	No	Yes	No response	No	Yes
Own books	12.0	5.9	82.0	472	472	506
Encyclopedia	17.6	39.5	42.8	474	501	510
Dictionary	15.5	14.3	70.2	471	489	509
Magazines	17.1	21.5	61.4	471	494	510

Digital access and use: In terms of digital access, only 35 percent students reported having a computer at home, but only 29 percent reported that their households have internet connections. Interestingly, digital access does not guarantee better learning outcomes, as evident from the mean test scores disaggregated by availability of computer and internet. So is the case with digital use, measured here as the time spent on the computer and other devises regularly.

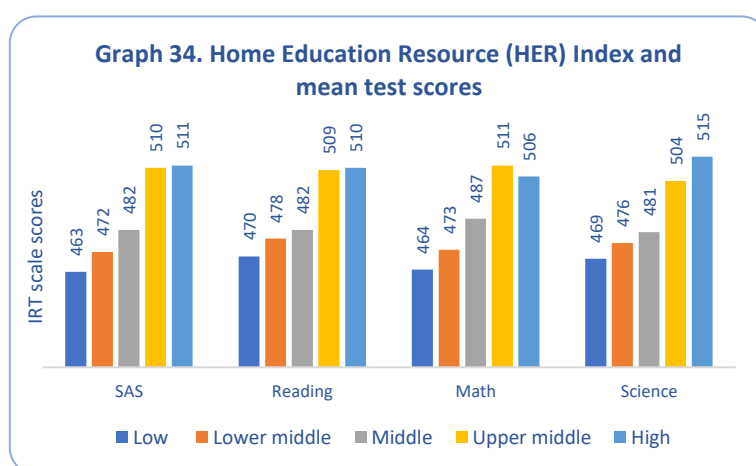
Table 9: Digital access and use at home						
	% of student responses about availability			Mean Scale scores on SAS for children with the resources		
	No response	No	Yes	No response	No	Yes
Personal computer	18.5	46.7	34.8	479	506	503
Internet	20.1	50.6	29.4	476	505	506
Child's own cellphone	18.6	51.3	30.1	474	509	500

Physical facilities as Resources for Learning: Physical / infrastructure facilities at home for the child such as having a desk to study and a quiet place to study seems to enhance learning achievement.

Table 10: Facilities at home as Resources for Reading and other activities at home						
	% of student responses about availability			Mean Scale scores on SAS for children with the resources		
	No response	No	Yes	No response	No	Yes
quiet place for study	14.1	6.4	79.5	468	488	507
Desk for study	14.3	7.0	78.7	470	482	507
Child's own room	14.7	14.5	70.9	472	505	505

Home Educational Resources (HER): Summarized Indicator:

Following international testing like PIRLS and TIMSS¹⁵, an index of Home Educational Resources (HER) was created using information on the availability of reading materials and presence of educational aids (computer, study desk for own use, books to read, and access to magazines) at home. The analysis of test scores using the HER index shows that children with the higher HER also scored high on learning assessments while children whose HER was low also lagged in learning.



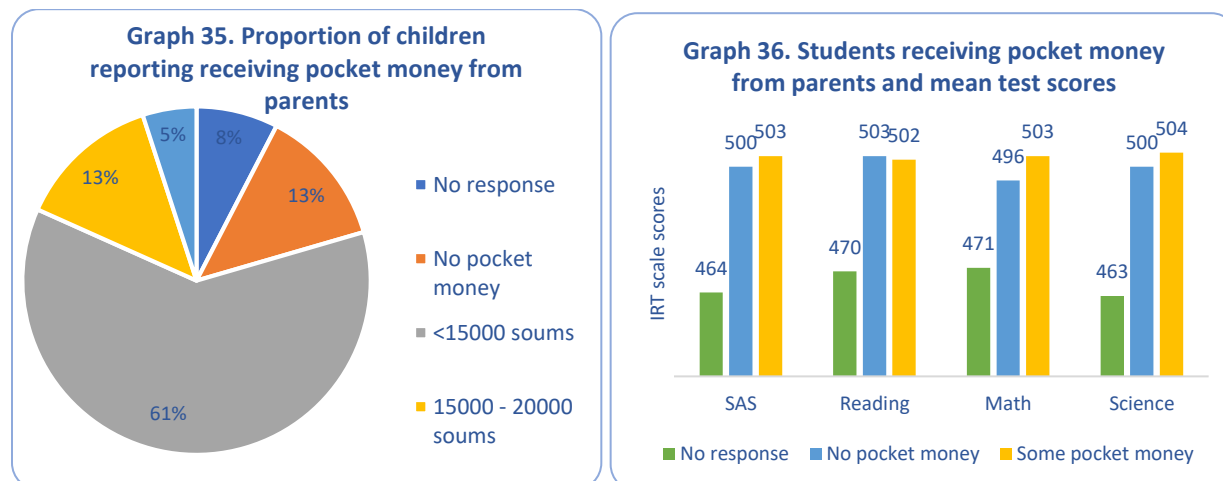
Participation in extra-curricular activities: Close to 59 percent students reported attending an extra-curricular activity which is free, while only 39 percent students were able to attend an expensive extra-curricular activity with out-of-pocket payments. The analysis of test scores shows that while there were no notable differences in the test scores of those who attended

¹⁵ In TIMSS 2015, students were scored according to their own and their parents' responses concerning the availability of five resources on the Home Resources for Learning scale, corresponding to students reporting on number of books at home and both home study supports, parents reporting on children's books, parental education, and parents' occupation, on average. PIRLS 2016 also had similar measures for creating HER index.

free out-of-school activities and those who did not, while children who attended a private, paid extra-curricular activity showed slightly better test scores. However, this is more of an indicator of economic status than the impact of extra-curricular activity, as the overall participation in extra-curricular activities (both free and fee paid) did not result in any variation in test scores.

Table 11: Resources for Education: Participation in extra-curricular activities						
	% of student responses about availability			Mean Scale scores on SAS for children with the resources		
	No response	No	Yes	No response	No	Yes
Musical instrument	19.4	49.4	31.2	477	509	499
Free extra-curricular activities	12.9	28.3	58.8	499	500	502
Paid extra-curricular activities	20.9	40.6	38.5	478	505	507

Household's economic support to children: A proxy used to gauge household's economic support to children is the amount of pocket money provided to children in a month. Around 13 percent children revealed that they did not receive any pocket money, and around 8 percent children did not answer the question. 61 percent of students mentioned receiving a moderate sum of within 15000 Uzbek soums. Interestingly, receiving pocket money or not did not really make any difference to test scores. However, those students who did not respond to the question were lagging compared to those who answered the question in test scores.



The analysis so far directs us to one important lesson: When it comes to monetary, physical and material support from home, what matters is the provision of a learning-enabling environment through HER, mainly providing books to read, a space for studying and materials to facilitate learning.

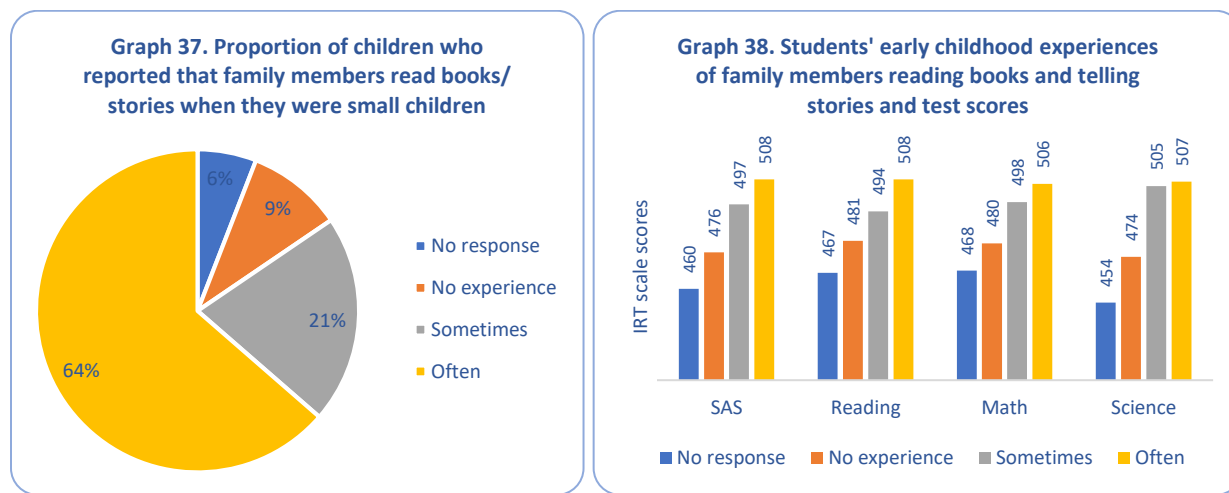
Family's early interventions

Parental/ family involvement in children's early childhood development activities, especially those related to cognitive and language development can have a lasting impact on children's

later cognitive skills. Research has now established that more than 80 percent of the brain development of a child happens by the time the child is three years of age. While preschool education provides some important stimulus in enhancing the “school readiness” of children in literacy, numeracy and social competencies, the foundation for all that is laid at home and throughout a child’s development, the involvement of parents or caregivers remains essential. Hence, one of the central element of home environment influencing primary school children’s learning is related to the early experiences related to literacy-related activities that parents or caregivers engage in with children or encourage and support (Gadsden, 2000; Leseman & de Jong, 2001; Snow & Tabors, 1996; Weinberger, 1996).

One of the most common and important early literacy activity that involves parents/ other family members are related to reading books to young children or telling them stories. When children are read aloud to and encouraged to engage with the text and pictures in books, they learn that printed text conveys meaning and that being able to read is valuable and worthwhile (PIRLS 2011). The results of PIRLS 2016 reveal that students whose parents reported often spending time with children on early literacy learning activities had higher achievement. PIRLS 2016 results shows a trend towards more parental involvement in children’s development in participating countries and that 39 percent of the students had parents who “often” engaged them in early literacy activities and an additional 58 percent had parents who “sometimes” engaged them, with the students in the “often” category having higher achievement (529) than those with engagement “sometimes (505). In several countries a small percentage of students (average 3%) reported having parents who had “never” or “almost never” engaged them in early literacy activities and these students typically had low average reading achievement scores (419) (Mullis, I.V.S. et. al, 2016).

In our study in Uzbekistan, the parents were not interviewed. To examine early literacy experiences, following PIRLS, in this study, students were asked to recall their experiences about parental /family members’ engagement with them in a few activities – like reading books and telling stories, singing lullabies and songs to children - before the child began primary school.



While 64 percent students reported that their family members engaged them often, another 21 percent reported their parents involved at times. The test scores by students' experience of family/ parents' early childhood engagement shows that students who reported higher parental/family engagement in their early years performed significantly better than others.

Parents/Family's support, encouragement and general involvement in children's education

Parents /family can reinforce their expectations and value of learning among children by monitoring children's learning activities and encouraging children through praise and support. Parents' educational aspirations can have a positive relationship on children's academic achievement, as several studies (for example, Hong & Ho, 2005) have revealed in recent times. Parental aspirations also increase students' aspirations and hence greater efforts by students on improving academic performance.

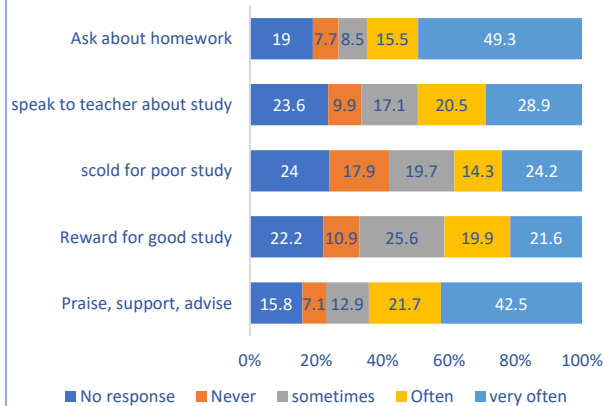
In international assessments like PIRLS and TIMSS, these questions are directed at the parents, but in our study, as we did not interview parents, these questions were asked to the students. Students were asked on various aspects of parental/family involvement in studies: (a) a set of questions were asked about nature of family's encouragement/support for education; (b) a set of questions regarding parental aspirations/ expectations from students and their education; and (c) a set of questions to understand whether they find parents/ family members too busy to communicate/ engage/help them.

Parents / family's support for students' learning cannot be seen in isolation from parents/ family's general involvement in a child's day today life. This was also tested in our study by asking students a few questions related to that. Two-thirds of the students mentioned that the family members knew who students' friends were, and close to 78 percent students mentioned their parents helped them with studies.

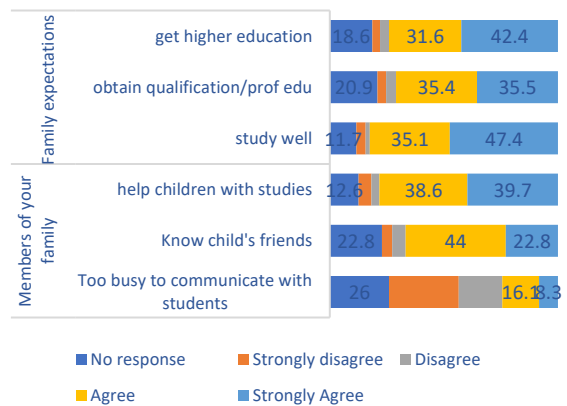
Children were also asked whether they find parents/ family members too busy to communicate/ engage/help them. More than a fourth of the students did not answer this question while another one-fourth of the students agreed /strongly agreed with the statement. Such response shows a sense of deprivation of parental care by students and can have adverse effect on their motivation to study. These children performed poorly compared to children who felt their parents have enough time for them.

On an average, a fifth of the students did not feel confident or were too fatigued to answer these questions. A large majority of students reported support and encouragement from family, albeit in different degrees – two-thirds of the students reported families enquiring about completing homework often/very often; around half of the students reported their parents/families meeting their teachers often to find out about their studies; close to 65 percent parents praising and supporting students on a regular basis and reward them for good performance and in many cases, reprimanding them for poor academic performances.

Graph 39. How often family members follow the studies with students by:

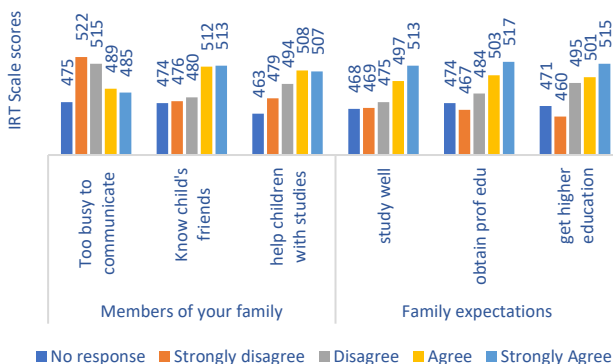


Graph 40: Family's involvement with & expectations from children's education

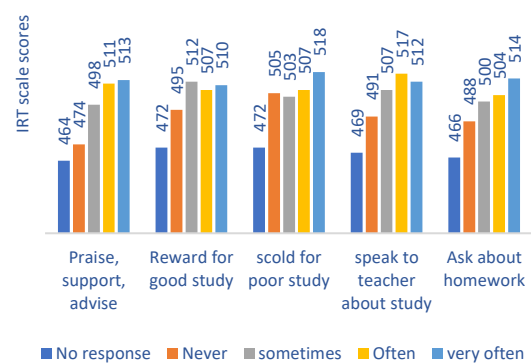


Majority of students reported that their families were highly involved in their studies by encouraging them, supporting them and having high expectations about their studies. However, it is a matter of concern that there were a sizable proportion of children who felt neglected or not prioritized by their families. For example, close to a fourth of the students reported that their parents /family members were too busy to communicate with them, while another 26 percent students did not answer the question. Only half of the students reported that their parents speak to their teachers about their studies.

Graph 41. Family members' involvement with and expectations from students and test scores



Graph 42. Students reporting on family members' following up with their studies



6. How learning achievement diverges by School Contexts and characteristics?

For many children, school is the main place for not only their formal training, but also introduction to any learning activities. Home provides a rich environment for developing children's early literacy, numeracy and socio-emotional skills. However, due to various circumstances, not all children receive a desirable or optimal environment at home for early academic development. The role of schools in not only enhancing children's learning, but also sharing their social behavior assumes even more significance in the case of children from deprived families and vulnerable background.

In most countries it is expected that by the end of primary education or fourth year of formal schooling, students acquire basic language skills as well as mathematic abilities. By this stage, students are not only expected to master learning to "read" and do arithmetic, but also transition into a phase of "reading to learn". When students are at this stage, they start on the long course of reading to "learn the new"—new knowledge, information, thoughts and experiences. (Chall, 1983)¹⁶. Students' educational experiences may be especially significant at this point in their reading literacy development. Many factors in school affect children's learning directly or indirectly. Some of the school related factors that contribute to children's learning, captured through background questionnaire administered on students, teachers and school principals are presented in this section. School contexts and environment in this study are analyzed through the following lens: (a) student attributes and attitudes; (b) school characteristics; and (c) teacher characteristics, including teacher education and instructional practices.

Student attributes and attitudes

Here, student attributes and attitudes are examined through the following indicators: (a) students' "school readiness" before entering school; (b) students' general feeling of wellbeing in school; (c) students' feeling of various forms of violence and bullying within school; and (d) students' efforts in learning.

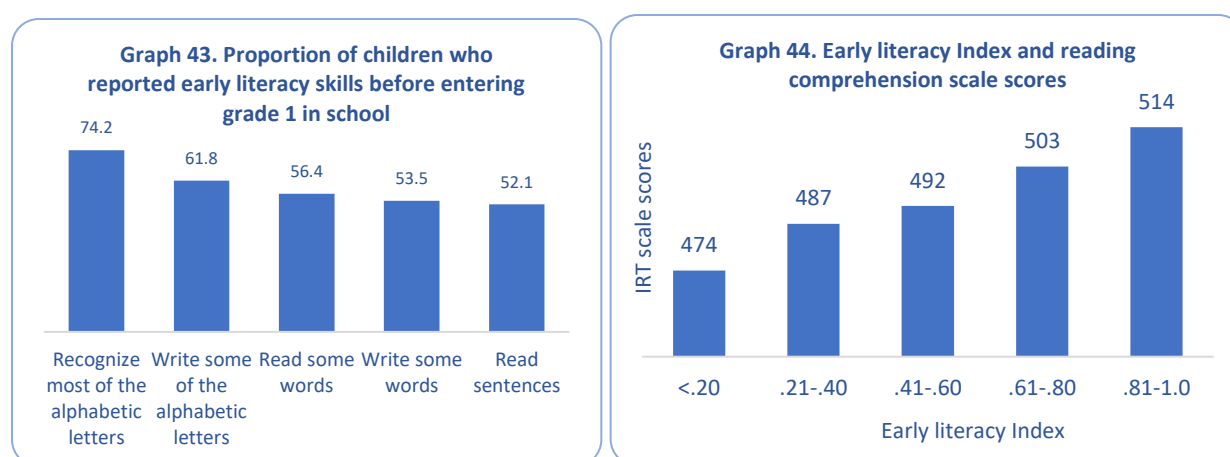
School Readiness:

To provide information about the extent to which students enter primary school equipped with some basic skills as a foundation for formal reading instruction, the PIRLS assessments included a set of questions asking parents how well their child could do various literacy activities when he or she first entered primary school. PIRLS 2016 study reports that early preparation has an effect through the fourth grade. PIRLS 2016 results report that on average across countries, that 29 percent of the students entered school able to perform early literacy tasks "very well" according to their parents and another 35 percent "moderately well". Parent assessment

¹⁶ <http://newlearningonline.com/literacies/chapter-15/chall-on-stages-of-reading-development>

of their children’s early literacy skills corresponded well with reading achievement at the fourth grade, with the children able to perform “very well” having higher achievement than those performing “moderately well” (537 vs. 510). The 36 percent of the students in the “not well” category had the lowest achievement (485) (Martin, M.O., Mullis, I. V. S., Foy, P., & Hooper, 2016).

The present study in Uzbekistan asked questions related to foundation skills before entering schools or “school readiness” to a sub-sample of students. Children were asked about their basic literacy, and more than half of them reported they were able to read sentences before entering grade 1. Based on their reporting of various aspects of early literacy skills, an index was created. The analysis shows that better the early literacy skills before entering school, better the reading comprehension scores of children.

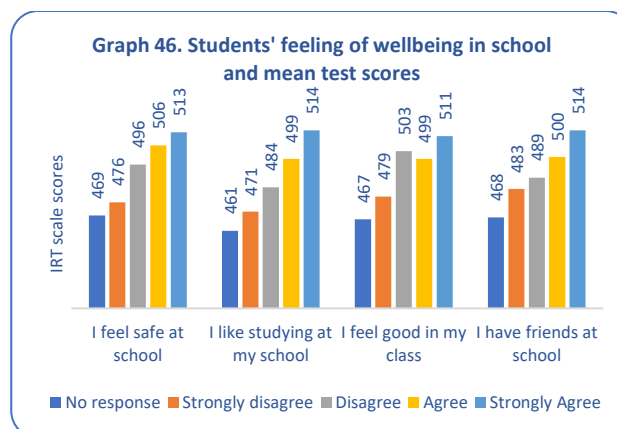
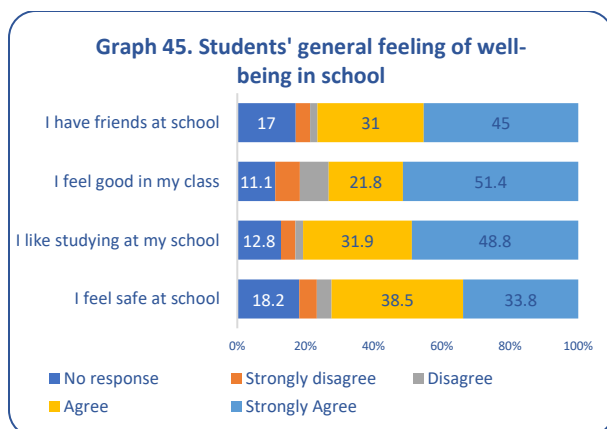


Students’ feeling of well-being in school

The school environment encompasses many factors that affect a student’s learning (Sherblom, Marshall, & Sherblom, 2006). A school with a positive environment enhances students’ general feeling of well-being and contribute to better learning. Students were asked a few questions to understand their general feeling towards being in the school. Analysis of TIMSS 2015 shows that among grade four students, boys who agreed a lot that they felt safe at school achieved, on average, 4.1 points higher in mathematics and 2.9 points higher in science than their peers who felt less safe in school¹⁷.

A large majority of students acknowledged that they like their school, they feel good about the class, they feel safe in the school and that they have many friends in the school. However, on an average, 20 percent of the students either disagreed or did not provide an answer. This means that there is a significant proportion of children who are discontented with the school and learning environment. The analysis of test scores reveals that the degree of students’ feeling of wellbeing has some influence on their learning levels.

¹⁷ http://pub.iea.nl/fileadmin/user_upload/Policy_Briefs/Compass_brief_5_spreads.pdf



Bullying and violence among children in school

Several studies about school safety and bullying in schools found a clear association between school safety and student achievement (Bowen & Bowen, 1999; Chavatzia et al., 2016; Chen, Rubin, & Li, 1997; Hastedt, 2014; Perše, Kozina, & Leban, 2008; Shumov & Lomax, 2001). Bullying comprises of verbal attacks (e.g. name calling, threats), physical behaviors (e.g. hitting, kicking, damaging victim's property) and relational/social aggression (e.g. social exclusion, rumor spreading) (Monks & Smith, 2006; Olweus, 1993; Menesini, E & C. Salmivalli, 2017). Hymel & Swearer (2015) argued that bullying peaks during middle school years and tends to decrease by the end of high school. Rivers and Smith (1994) found that with increasing age, there seems a shift in the type and nature of bullying – from physical to indirect and relational bullying. There is also evidences that show that boys are more likely to be involved in physical forms of bullying while girls tend to do more in terms of relational or verbal forms (Besag, 2006; Crick and Grotpeter, 1995).

The TIMSS 2015 results clearly show that bullying is not isolated to one country. Rather, bullying is an international phenomenon that spans cultures and economies. TIMSS 2015 and PIRLS 2016 provides evidence of a strong international association between bullying and learning achievement in grade IV. The analysis of the international grade IV TIMSS results shows that bullying begins at an early age, and achievement gaps between frequently and infrequently bullied students also emerge in the early years of education¹⁸.

In TIMSS 2015 survey, many students internationally reported almost never being bullied (56%), while, in contrast, 16% of students reported being bullied about weekly, providing ample evidence that bullying is a systemic problem at the international level and that bullying is occurring during the early years of schooling¹⁹. Echoing similar results, the PIRLS 2016 study reported that most grade IV students (57 percent) reported “almost never” being bullied. However, 29 percent reported they were bullied on a monthly basis, and 14 percent on

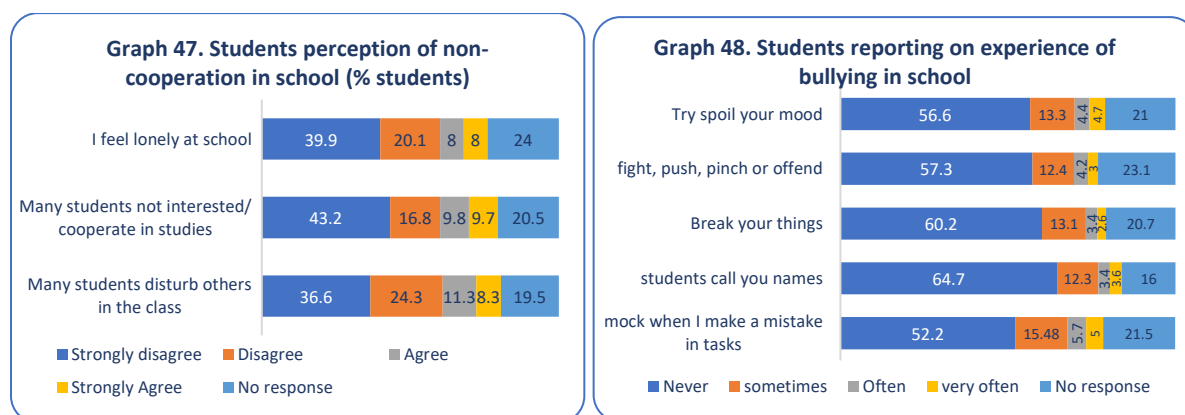
¹⁸ https://adobeindd.com/view/publications/40c57f49-07fa-4e7b-a21e-b5bfb0c52445/ycqt/publication-web-resources/pdf/Compass_briefs_in_education_1_april_2018.pdf

¹⁹ [Ibid](#)

a weekly basis. There were a number of countries where 20 percent or more of the students reported being bullied weekly.

Students of grade IV reports on being bullied were directly related to their average reading achievement, with each successive category of increased bullying being related to a decrease in average reading achievement (In the case of PIRLS 2016, 521 average for “almost never”, 507 for “monthly”, and 482 for “weekly” — for a decrease of 39 points overall²⁰; in the case of TIMSS 2015, 514 average for “almost never”, 505 for “monthly”, and 478 for “weekly”²¹). The data suggests that as the incidence of bullying decreases, students’ sense of belongingness to a school increases. Likewise, in most countries, the stronger the students’ sense of belonging, the better their learning outcomes.

Our study in Uzbekistan confirms with the overall evidence from PIRLS 2016 and TIMSS 2015. In this study, students’ views and experiences on bullying was measured through two sets of questions: The first, related to children’s personal experience of bullying; and second, their observations on bullying in schools. Students were asked to report on their personal experience of bullying in terms of other students calling them names (verbal abuse), destroying their belongings, physical violence and intimidating and irritating through their actions. In the second set of questions, students were asked about their witnessing any form of bullying involving their peers.



Overall, around majority of students reported never facing any incident related to bullying. However, a fourth of the students felt one or other type of bullying in varying frequencies. Around 20 percent of the students did not answer the questions related to bullying. This could be possibly due to fears of reprimand or repercussion or even not able to articulate their experience properly.

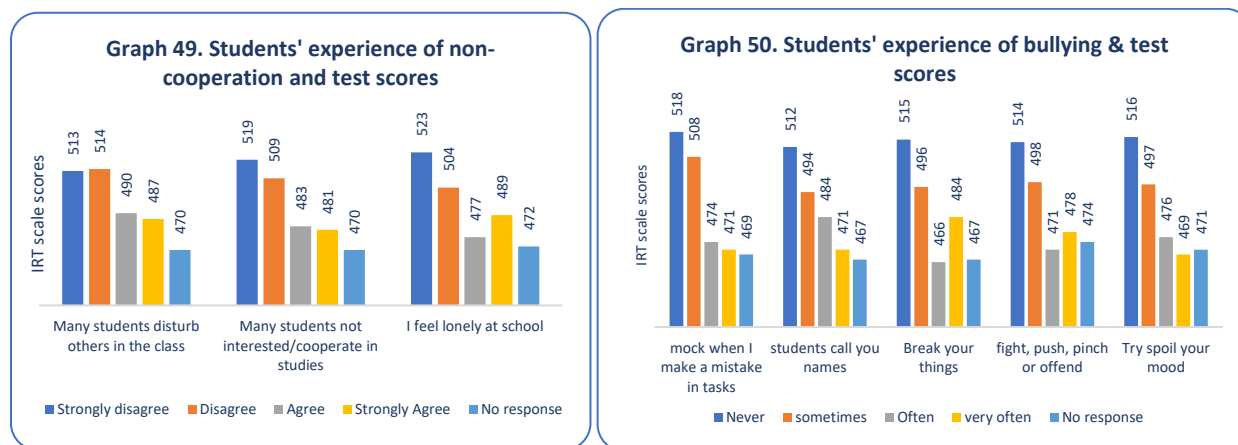
Students who never experienced bullying scored much higher in the tests than those experienced bullying to different degrees. Those who never experienced bullying on an average

²⁰ <http://timssandpirls.bc.edu/pirls2016/international-results/pirls/school-safety/student-bullying/>

²¹ https://adobeindd.com/view/publications/40c57f49-07fa-4e7b-a21e-b5bfb0c52445/ycqt/publication-web-resources/pdf/Compass_briefs_in_education_1_april_2018.pdf

scored 515 points in the SAS scale, while those who experienced bullying more frequently scored on an average around 475, indicating a difference of 40 points difference.

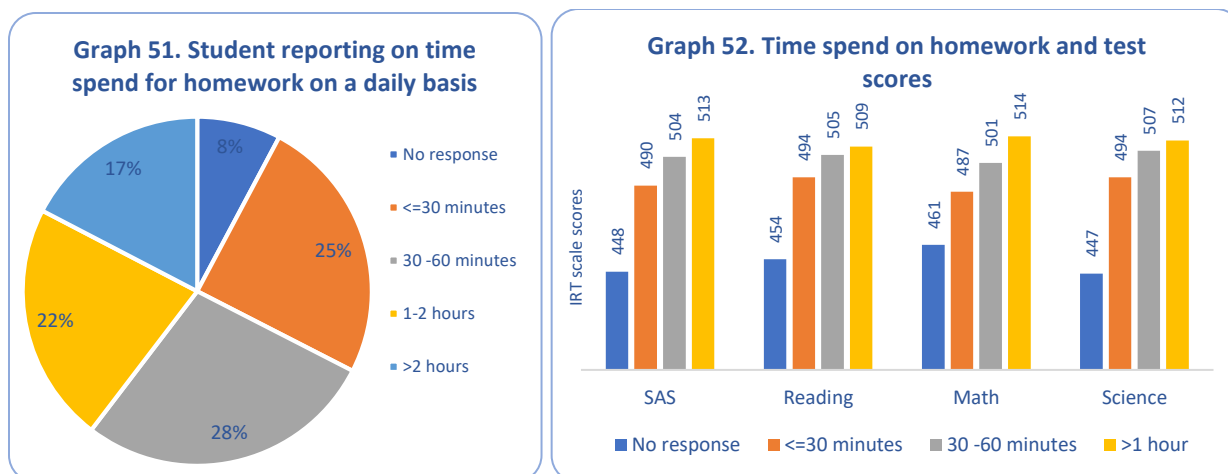
Undesirable behaviour of classmates, which includes perception of bullying at others, also affect children's morale and attitude not only towards classmates, resulting in more lonely feeling, but their own learning. Only 60 percent of students reported that students in the class do not disturb others in the class. Those students with a negative feeling towards their classmates also happens to be low achievers in academic performance.



Students' time on homework

Homework is defined as a set of school tasks that are assigned by teachers for students to complete outside of the non-school hours. This definition explicitly excludes (a) in-school guided study; (b) home study courses delivered through the mail, television, audio or videocassette, or the Internet; and (c) extracurricular activities such as sports and participation in clubs. Variations of homework can be classified according to its amount, skill area, purpose, degree of individualization and choice of the student, completion deadline, and social context (Cooper et al., 2006).

Homework is a way to extend instruction and assess student progress. The amount of homework assigned for reading varies across context. In some countries (by policy) or schools (decision by teachers) homework is assigned typically to students who need the most practice—those who tend to have the most difficulty in the respective subjects. In some other countries/ classes, students receive homework as enrichment exercises (PIRLS 2011). While Cooper et.al (2006)'s review of more than 60 research studies on homework between 1987 and 2003 concluded that homework does have a positive effect on student achievement, various other studies (Mullis, Martin, Kennedy, & Foy, 2007) found that time spent on homework generally has an inverse relationship with achievement, as students for whom learning is difficult require more time to complete the assigned homework.



In the present study in Uzbekistan, a fourth of the grade IV students reported spending less than 30 minutes daily on homework, while another 28 percent report spending half an hour to one hour on homework. Around 39 percent of students reported spending more than one hour in completing homework. The test scores indicate that the time spend on homework has a positive relationship with learning outcomes. Clearly, homework practices in early grades in Uzbek schools seems to be geared more towards enriching and supplementing their learning than for compensating for children’s learning deficit.

The more the time children spent on doing homework, the better their academic performance. Homework improves learning significantly for the children of Uzbekistan. This needs to be looked at in the context of the time available in school for learning and instruction. Uzbekistan’s instructional days and time are limited compared to many other countries performing better in international assessments. This is despite the fact that the curriculum load is relatively high. Teachers compensate it with assigning more homework and students compensate it with time outside school. Supportive families ensure that children complete homework on time and support children with their studies. This is definitely evident in the better scores of children who devote more time for homework.

School factors and student learning

For most students, school is the place that nurtures learning by providing an enabling environment and support, and place where the deprivations at home can be compensated. The learning environment of the school can be a positive influence, encouraging a positive attitude towards academic excellence and facilitating classroom instruction (Mullis, I.V.S, M.O. Martin, P. Foy, and K.T. Drucker., 2012). However, what school can offer to children depends on a variety of factors. These factors include the socio-economic background of the population of the location and hence the student population; school resources; etc. These factors are taken up for analysis in this section.

Schools with Students from different Home Backgrounds

Depending on the school community and location, a school can have students from diverse backgrounds, or more homogenous group of students; the school may have a more socio-economically advantaged population, or the schools may have a concentration of students from

more disadvantaged backgrounds. It is often considered that a class or schools with students from heterogeneous background helps students to develop better social sensitivity and tolerance and respect for plurality and diversity, in addition to enrich their knowledge. Students from disadvantaged family backgrounds can have proxy-benefits from a class with students from advantaged backgrounds.

On an average, school principals reported that 37 percent (TIMSS 2015) to 38 percent (PIRLS 2016) of students in countries that participated in TIMSS and PIRLS attended schools with proportionately more affluent students than disadvantaged students and their average achievement was 530 in scale scores in Reading (PIRLS, 2016) and 527 in Mathematics (TIMSS 2015). On the other hand, 29 percent students in the same countries attended a school where the school principal reported as having more disadvantaged students than affluent students (both TIMSS 2015 and PIRLS 2016). These children on an average scored only 487 in Reading (PIRLS, 2016) and 483 in Mathematics (TIMSS 2015).

In the Uzbekistan NAS, as per the Principals' reporting, around 48 percent of the schools in the survey belonged to the "affluent" schools – those schools with more than half of their students from affluent home backgrounds and not more than a tenth from disadvantaged home backgrounds. Schools with affluent backgrounds on an average had SAS scores of 508, whereas students in schools not affluent on an average scored only 487.

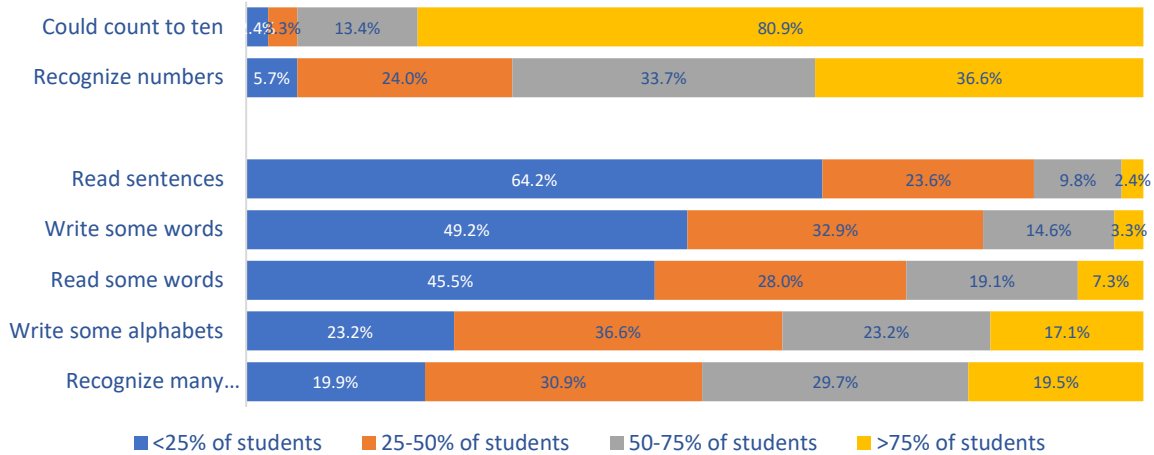
In PIRLS 2006 and 2011, the reading achievement of students was highest for students in schools where most students spoke the language of the assessment as their first language and was progressively lower as percentages of students not having the language as their first language increased. In Uzbekistan NAS, schools that had more than half of the students spoke a language different from their instructional language, scored on an average only 489 in IRT scale scores for Reading Comprehension, whereas other schools scored, on an average 506.

Schools Where Students Are Ready to Learn

An important element of school readiness is having students with the prerequisite skills for the curriculum for their grade—that is, students academically ready to learn. Furthermore, students who begin school with higher reading achievement tend to maintain that advantage.

Following PIRLS, school principals were asked about the percentages of students entering their schools able to perform each of five early literacy skills: recognize most of the letters of the alphabet, read some words, read sentences, write letters of the alphabet, and write some words. In most schools, on an average, 4 out of every 5 children who enter grade 1 could count till number 10 and more than half of the children could recognize different numbers. Principals reported proportionately more children recognized alphabets and could write the same than writing words or reading sentences.

Graph 53. School principals reporting on the proportion of children with basic literacy and numeracy (or "school readiness") at entering the school

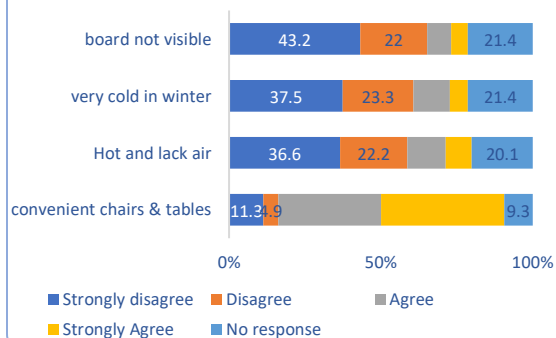


Facilities in classrooms

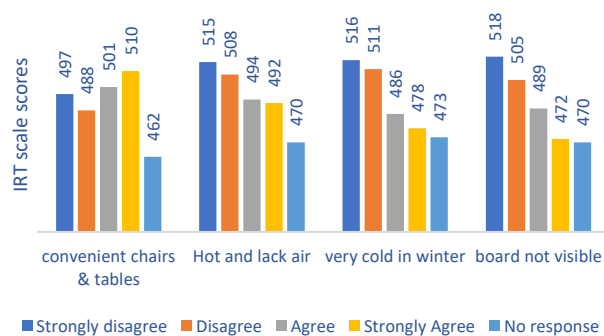
How students feel in terms of physical facilities in classrooms is also important for learning. This was tested through asking students to report on the suitability of chairs and desks/tables they have, classroom conditioning facilities during summer and winter and availability of a visible board. Two-thirds of the students reported that the boards are clear and visible; 61 percent students reported that during winter, classroom is not cold; and around 49 percent students reported classrooms were not hot or lacked air during summer.

The test scores by response category show that the more students felt comfortable physically in classrooms, the better were their test scores. Results of multi-variate analysis confirms that though the extent of the influence of classroom facilities shrink with the introduction of other factors, they are still important in the overall scheme of things for students' learning.

Graph 54. Students comfort with class facilities/ infrastructure (%)



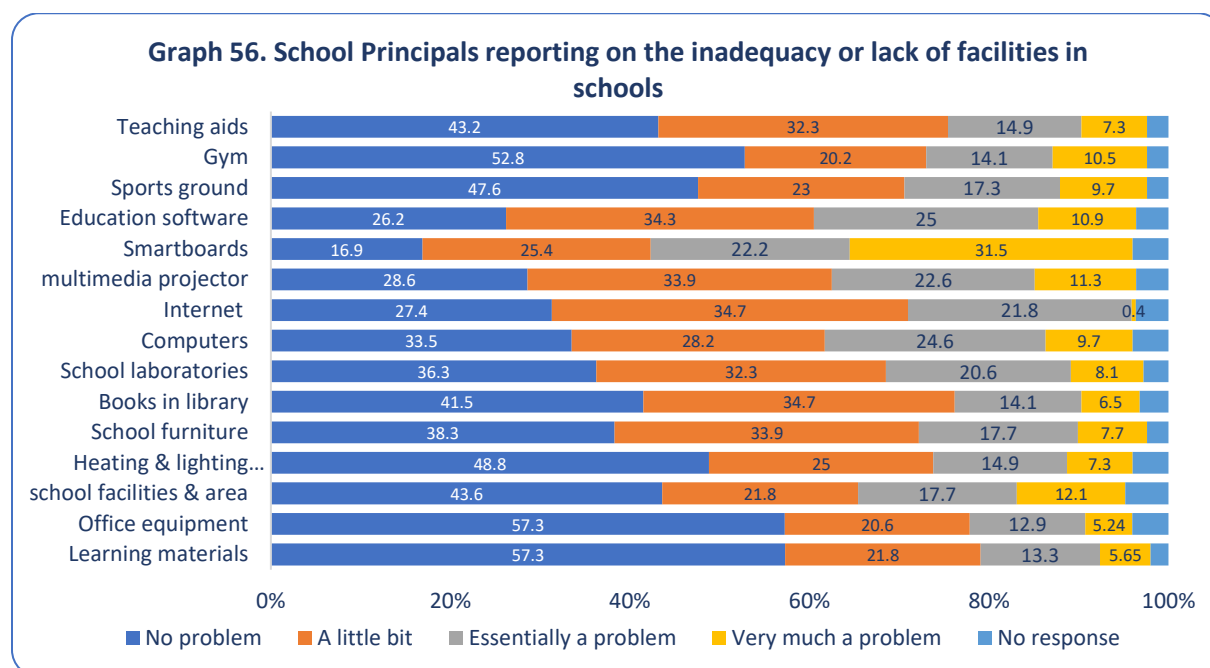
Graph 55. Students' reporting on class facilities and test scores



School Library and the presence of other facilities in school

Our analysis earlier showed that having reading materials and a reading-rich environment at home is positively correlated with learning levels of children. Availability of reading materials is important not only at home, but also in schools, especially since many children do not have rich reading materials at home. Hence, school libraries are important, not only for children but also for teachers who can draw from library additional materials for teaching and introducing instructional diversity.

In the Uzbekistan NAS, the school principals were asked about the existence and size of school libraries. Nearly 48 percent of the principals reported having 500-2000 books in their school libraries and another 36 percent reported having 2000 – 5000 books in the school libraries. Interestingly, Russian medium schools had slightly more books on an average in their libraries compared to Uzbek medium schools.



Schools that reported acute inadequacy and non-availability of facilities on an average scored only 498 in scale scores whereas schools that reported no limitations due to the inadequacy or non-availability of facilities recorded an average scale score of 516.

Teachers in schools

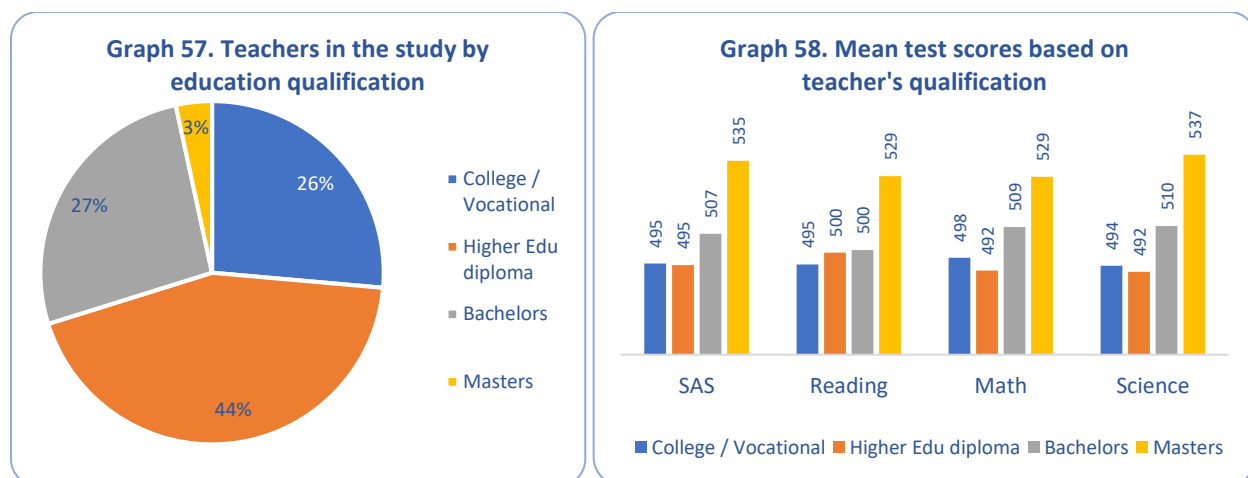
The McKinsey & Company (2007) report stated that “the quality of an education system cannot exceed the quality of its teachers” (Barber and Mourshed, 2007). Teachers are a very influential determinant of the classroom environment and Rivkin, Hanushek & Kain (2005) highlighted the importance of teacher effectiveness in the determination of school quality. Teacher effectiveness comprises of preparation and training, use of particular instructional approaches,

and experience in teaching reading. The qualification, competence and experience of teachers are critical in student learning.

In this study, 94 percent of the teachers surveyed were females and only 6 percent were male. In Russian medium schools, 96 percent teachers were females. Around 32 percent of the teachers in grade IV were in the 30-40 years age group and another 40 percent teachers were 40-50 years age group. Another 24 percent teachers were above 50 years of age. The analysis showed no significant differences in the mean school test scores of students based on teachers' age.

In PIRLS 2016 and TIMSS 2015, on average, 26 percent of the fourth-grade students had teachers with a postgraduate university degree, and another 58 percent (TIMSS 2015) – 60 percent (PIRLS 2015) had teachers with a bachelor's degree (or equivalent) but not a postgraduate degree.

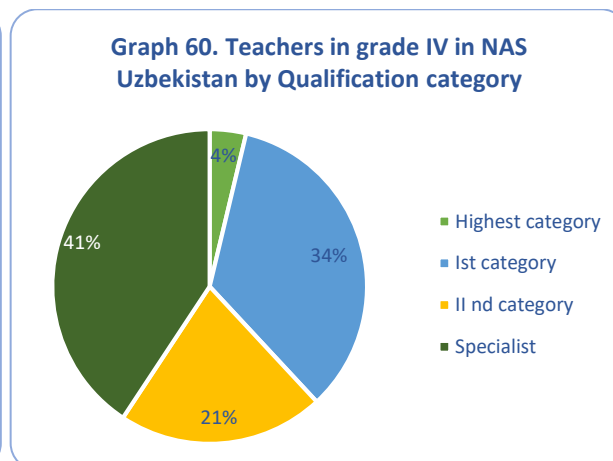
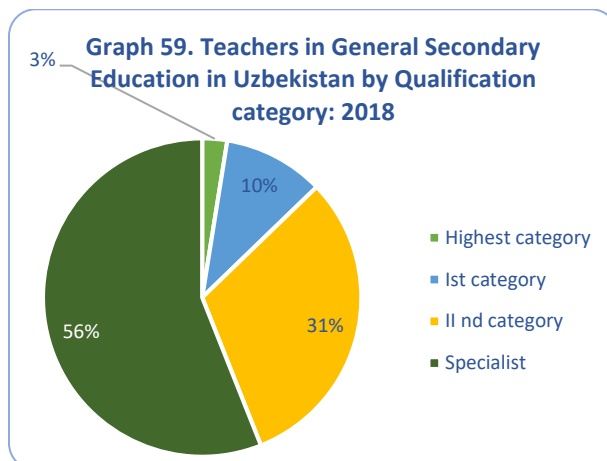
Among the teachers of grade IV covered in this study in Uzbekistan, 26 percent had only vocational education and around 44 percent had "higher education" (those received their qualification of five-year integrated diploma, which was in existence in the country following the Soviet system, but the system ended in 1999). Only 29.4 percent of the teachers had a bachelor's degree and only 3 percent had a master's level qualification. The analysis of test scores show that students scored much higher when teachers had a master's or bachelor's qualification compared to teachers with old higher education diploma or with vocational qualification.



In Uzbekistan, teachers are grouped into four teacher qualification categories for determining the seniority and salary scales. Progression from one category to the next is through attestation. When a teacher passes attestation and is promoted to the next category, they receive a salary increment of roughly 6 percent. The four categories are as follows:

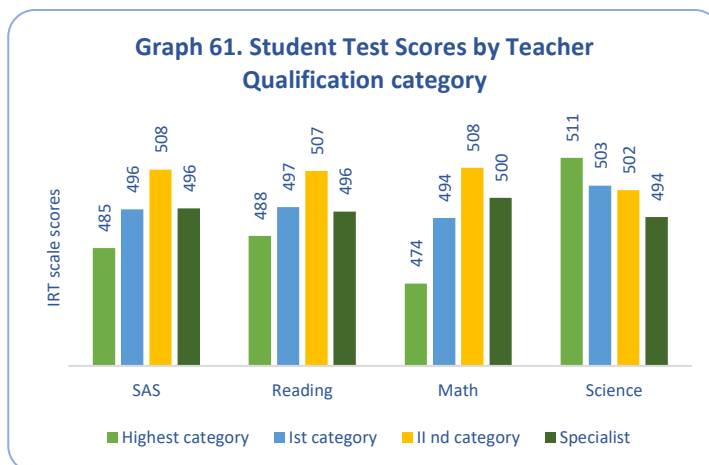
- **Specialist teacher:** A specialist teacher will have either a secondary special pedagogical education in the field of primary education or a bachelor's degree in the field of pedagogy or at least bachelor's degree in science with a certificate in pedagogy-related training;

- **Second Category teachers:** A specialist teacher with minimum 3 years of work experience as teacher can become second category teacher by completing the mandatory in-service training and related attestation. A person with a master's degree can become second category status upon entry into the profession;
- **First Category teachers:** A second category teacher can become first category teacher with at least three years of work experience and the mandatory training and attestation.
- **Highest Category teachers:** Again, a first category teacher can become Highest category teacher after fulfilling three years of work experience and training and attestation.



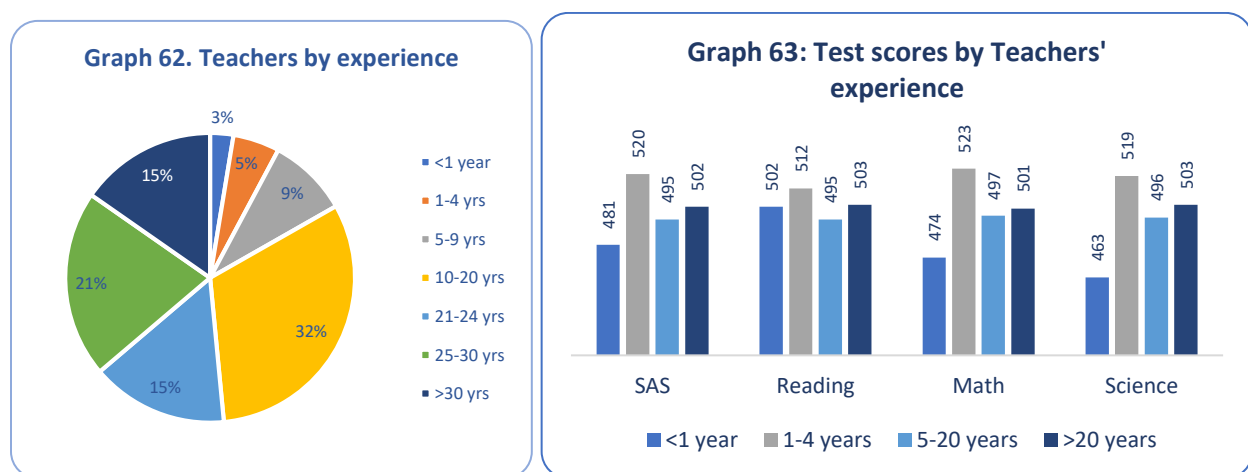
As per the MOPE data, in 2018, 56 percent of the teachers were specialist teachers, but in our study sample, only 41 percent teachers were specialist teachers. The first category and highest category teachers were found to be slightly more in proportion among the grade IV teachers compared to national average. Half of the specialist teachers had a secondary specialized diploma, another 10 percent teachers had integrated higher education diploma. A fourth of them had master's degree. On the other hand, 60 percent of the teachers of the second and first category and 80 percent among the highest category teachers had a higher education diploma. No one with bachelors and master's degree was among the first and highest category teachers. This indicates that most of the teachers in higher categories qualified before 1999.

An analysis of the grade IV teachers in the sample by their experience also reveals that more than 80 percent of these teachers had more than 10 years of experience. An analysis of student test scores with teacher categories shows that students taught by a second category teacher scored more than students taught by a specialist teacher as well as teachers of first or higher categories. This clearly shows that a relatively young teacher with a bachelors or



master's degree and some experience have a better impact on students' scores than mere experience. The relatively young graduates in the profession bring in new knowledge, and they still have some motivation to teach students.

In PIRLS 2016 and TIMSS 2015, on average, 40-42% of fourth grade students had very experienced teachers with 20 years or more of experience, and another 30 percent had teachers with at least 10 years of experience. In Uzbekistan NAS for grade IV, more than half of the teachers had more than 20 years of experience. Some research has found experience can have a large impact on effectiveness, especially during the first few years of teaching (Mullis, I. V. S., Martin, M. O., Foy, P., & Hooper, M, 2017).



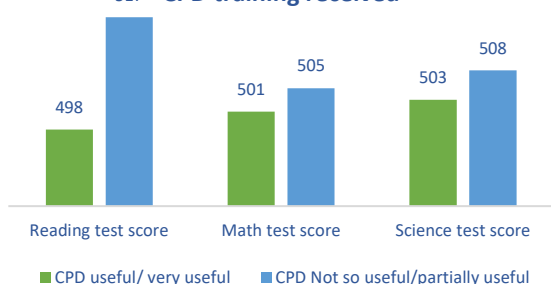
Results in Uzbekistan to some extent confirm such results. Teachers who have just entered the teaching profession have limited experience²². As teachers acquire 4-5 years of experience, their impact on learning achievement of students also increases. However, as teachers become more experienced, the advantage start dwindling, and student scores are not as satisfactory as those teachers who are young and enthusiastic! A recent UNICEF (2018) review of teacher policies suggest that pre-service teacher training programme in its present form in the country prepares subject specialists rather than teachers who are equipped with adequate pedagogical knowledge and skills. Consequently, after graduation from the university, a novice teacher knows more about the academic subject (the WHAT), rather than the skills to teach it effectively (the HOW). This presents a considerable deficiency. It is essential for teachers to have a rich repertoire of teaching strategies, the ability to combine approaches, and the knowledge of how and when to use certain methods and strategies. Only then can they help students with diverse learning abilities and style and different levels of prior knowledge, to learn effectively.

²² Pre-service teacher training programs (for bachelors) in Uzbekistan consists of 204 weeks including practical classroom experience (pedagogical practice). The share of time devoted classroom practices comprises of 15 weeks of purely practical teaching and another 20 percent of the regular teaching weeks.

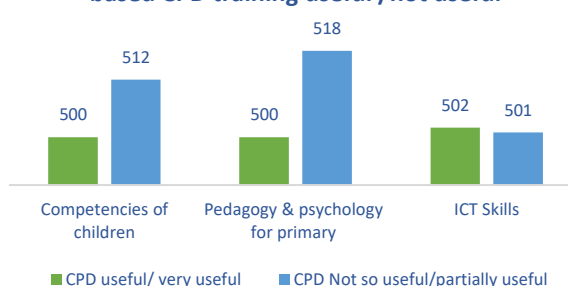
Teachers Continuous Professional Development (CPD)

Close to 90 percent of the teachers reported attending in-service training aimed at CPD. They reported receiving subject specific training as well as some competency-based training (for example, training for ICT, training on pedagogy etc.). Interestingly, students taught by teachers who found the CPD trainings “not useful” or “only partially useful” scored better than those teachers who found the CPD trainings useful. This could be as that teachers who found the training not useful had prior knowledge and skills than others, which got reflected in their teaching and hence test scores, and since they were already equipped, they found the training not adding more value than what they already knew.

Graph 64. Test scores based on teachers' view on the usefulness of subject specific CPD training received



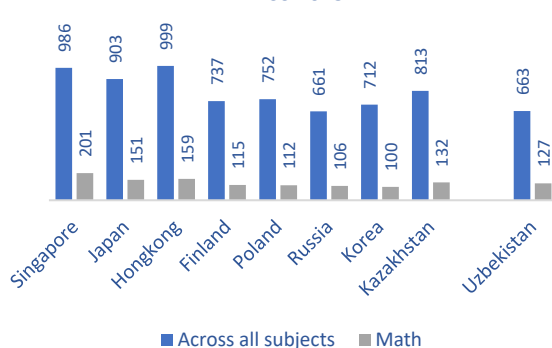
Graph 65. Mean test scores (SAS) for teachers who found different competency based CPD training useful /not useful



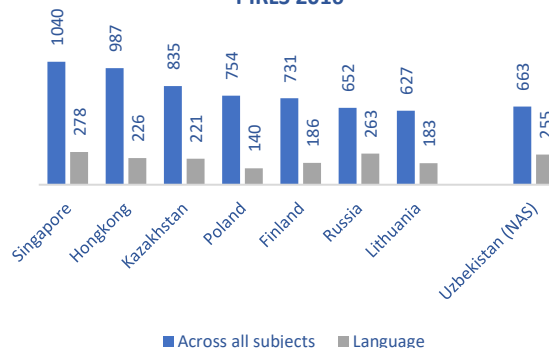
Instructional time

Instructional time remains a crucial resource in considering students' opportunity to learn, even though there are many factors that influence the effectiveness of an educational system. PIRLS 2016 reported that on an average, the fourth-grade students received 898 hours per year of instruction across all subjects, with 27 percent of the time (or 242 hours) devoted to language instruction, including reading, writing, speaking, literature and other language skills.

Graph 66. Mean Instructional hours in schools for grade IV children in Math as reported in TIMSS 2015



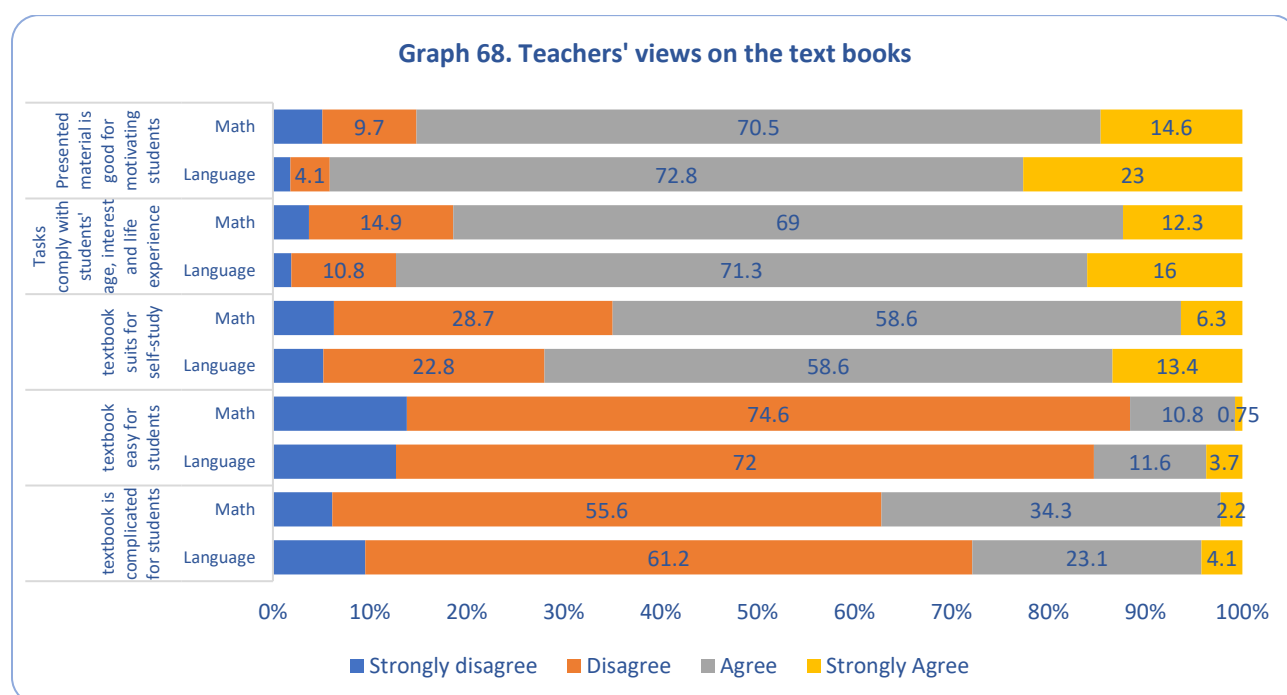
Graph 67. Mean Instructional hours for grade IV students in Language (Main) as reported in PIRLS 2016



An analysis of instructional time in grade IV in Uzbekistan in comparison with some of the best performing countries in TIMSS 2015 and PIRLS 2016 shows that in Uzbekistan, overall learning time is quite low, but hours devoted to Math and Language are higher than in many countries. This points to the fact that it is not only the time that matters, but the use of classroom time in terms of pedagogy.

Instruction and pedagogy in classrooms

Teachers felt that the textbooks for Math and Language are not complicated for children, suitable for self-study, the tasks included in the textbooks comply with students' age, interest and life experience and are good for motivating studies. However, they also felt that that textbooks are not easy for students.

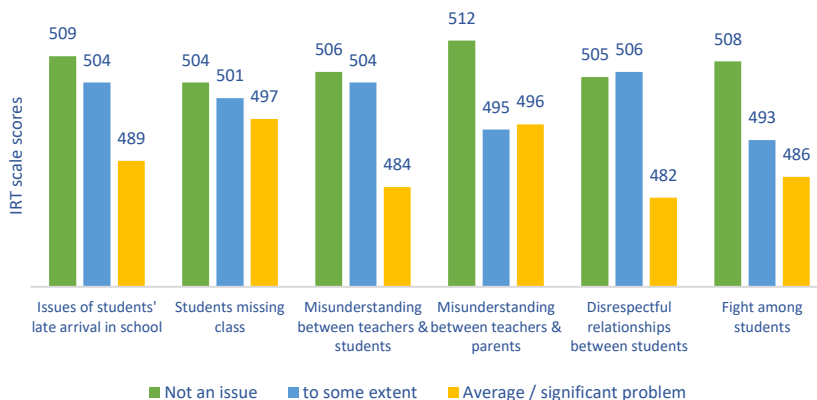


School Management

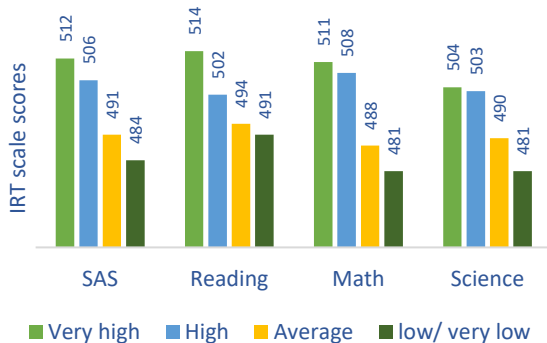
A school with a positive environment has a school principal or head teacher who takes leadership role and confident about schools' day-to-day functioning. The school principals were interviewed to understand the general environment in the school and based on their responses, tried to understand: (a) the general scenario in the school with respect to student attendance; (b) extent of violence and bullying in the school; (c) teachers' general satisfaction; and (d) parental involvement in school functioning. In a positive school environment, students' attendance is generally high; there is less violence among children; teachers are relatively content with their work and professional development and parents are more involved.

An analysis of school level mean test scores (overall SAS) with that of principals' perception or assessment of school level problems shows that schools with the presence of the issue performed poorly in the national assessments whereas the principals were confident about the absence of such issues, students performed much better.

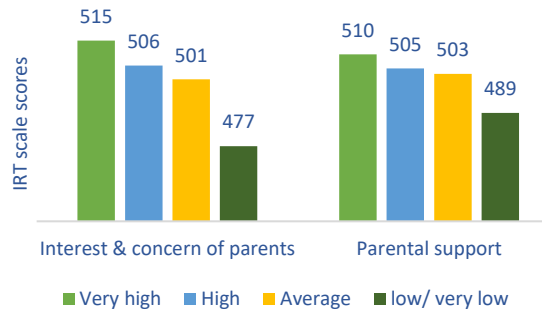
Graph 69. School Principals reporting the extent of problems in School and the mean school test scores



Graph 70. Teacher satisfaction and school level mean test scores



Graph 71. Parental support to students at school level and school mean test scores (SAS)



7. What contributes to learning? Results from Multi-variate analysis

The analysis so far had focused on the student, family and school level factors and the bi-variate analysis mainly focused on understanding the association of the selected factors on learning levels of students in grade IV in Uzbekistan. However, it is evident from global literature that students' learning outcomes is affected or influenced by multiple factors or variables. To understand the effect of multiple independent variables or predictors on the learning outcomes, it is important to analyze the factors discussed so far in a multivariate analysis framework. Multi-variate regression analysis facilitates the estimation of a coefficient for each independent variable, as well as its statistical significance, thus enabling the estimation of the effect of each predictor on the learning levels of students, with other predictors held constant. This section is devoted to the discussion of the multi-variate analysis results. Multilevel analysis is a suitable approach to consider the social contexts as well as the individual actors or subjects.

Analytical Framework

The selection of an appropriate analytical framework is important in multi-variate analysis, which could range from a simple regression analysis to a more complex one. A simple regression using the intercept-only model will produce results which is equivalent to the sample mean. In such a model, the sample mean is the “fixed” part of the model and the difference between the observation and the mean is the residual or “random” part of the model or the “disturbance”. A simple Ordinary Least Square (OLS) regression shows achievement Y of student i in school j and Y_{ij} , modeled as a function of individual and family background characteristics X_{ij} , a vector of school/ teacher characteristics S_j , and a random error term ε_{ij} such that:

$$Y_{ij} = \alpha + \beta X_{ij} + \lambda S_j + \varepsilon_{ij}; \text{ where } \varepsilon_{ij} \sim N(0, \sigma^2) \quad [1]$$

In OLS regression analysis, school or teacher effects and the observable school/ teacher characteristics are used in the same equation – this means that school or teacher characteristics are treated as random variables for each student irrespective of the fact that students in a class is taught by the same teacher. Hence, it is important to go beyond the OLS regression framework.

Panel regression with school fixed effects

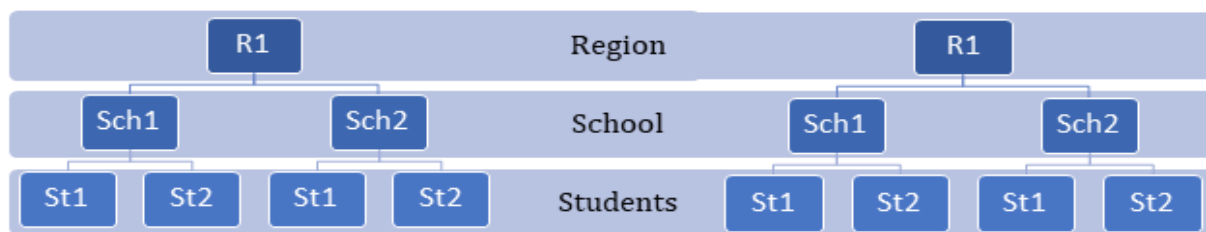
In a panel regression, the school/teacher fixed effects and the observable school characteristics cannot be in the same equation because there would likely be ‘perfect-collinearity’. Hence, a ‘panel’ approach is employed through the modelling of achievement of student i in school j , Y_{ij} as a function of individual and family background characteristics X_{ij} , schools /teacher fixed effects term z_j and a random error term, ε_{ij} . This is feasible given the multiple observations from the same school/for the same teacher.

$$Y_{ij} = \alpha + \beta X_{ij} + \lambda S_j + z_j + \varepsilon_{ij}; \text{ where } \varepsilon_{ij} \sim N(0, \sigma^2) \quad [2]$$

Multi-level or Hierarchical Models

Why a multi-level analysis? The ‘panel’ strategy should, in principle, provide unbiased and consistent estimates of individual and family characteristics. However, in such a panel approach, the unbiased estimates of individual and family characteristics could be measured using random effects model, while school fixed effects need to be measured separately. Often, the school fixed effects and the observable school characteristics in the same equation are not possible in a panel approach because school observable characteristics get dropped from regression due to the likelihood of a perfect-collinearity. Traditional regressions models fail to identify group effects on individual behavior as they deal with only one level at a time and not with simultaneous effects of group and individual characteristics on outcomes. Thus, they fail to measure proportions of variation in outcomes between individual and group. This is not desirable when the goal of the research is to assess the effects of policies implemented in classrooms or schools on individual student learning outcomes (Cronbach, L.J, 1976). The advantage of Hierarchical Linear Methodology (HLM) is that it provides for examining multiple interactive relationships in nested organizational structure. It partitions out the effects of student characteristics and the effect of group behavior (organizational - such as class or school) on the relationships at the individual level.

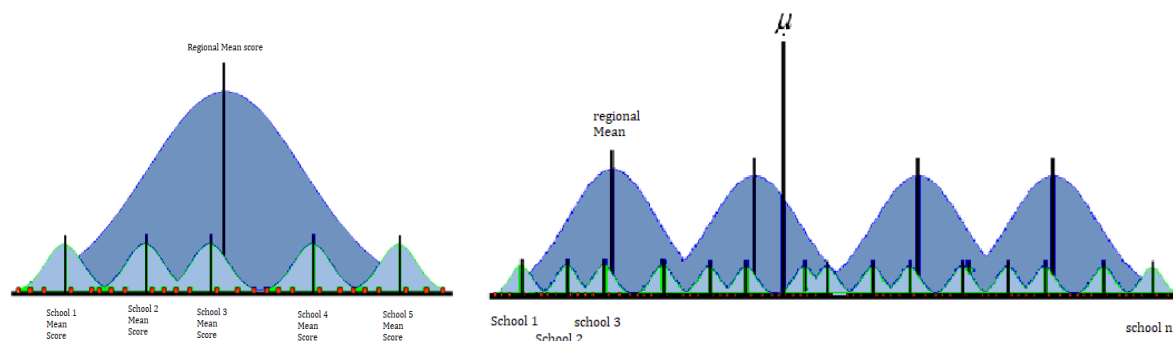
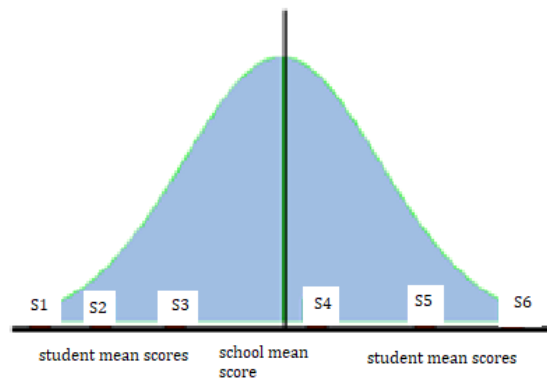
Chart 6: Hierarchical Nature of Analytical framework for learning assessment



One of the most important characteristics of education system is its hierarchical structure. In such a structure, students with their individual/ family characteristics are ‘nested’ in classrooms and / or schools (Raudenbush and Bryk, 2002), with unequal sampling probabilities, and schools are nested within geographical units or regions. In such a multi-level structure, test scores of students within the same classroom may be correlated due to exposure to common factors (for example, same teacher teaches them; they have access to same resources etc.) and hence nesting them within the same classrooms helps to address the correlations due to common elements. Similarly, the performance of schools within the same regions may be correlated because of their shared socio-economic and geographical features. The learning assessment data should be therefore treated in a hierarchical structure, with students nested within classrooms (schools) which are in turn nested within regions²³.

²³ This section is based on: Chuck Huber (2013) <https://blog.stata.com/2013/02/04/multilevel-linear-models-in-stata-part-1-components-of-variance/>

It must be noted that students in each school / classroom have their own mean scores which is different from each other. Their mean scores will contribute to the school mean scores but may differ from school mean. For example, in the figure, the six students (S1-S6) have different mean scores, and their difference from school means are also different. Similarly, the mean score of each region differ from each other and school means within each region vary as well.



Students' test scores within each school varies, the mean score within each school shows that students mean scores within in each school vary from their school mean.

However, one must keep in mind the implications of such nesting: (a) students are not always necessarily randomly assigned or selected to their classes/ schools; and (b) the educational processes occurring within each level of structure ultimately influence learner's achievement and these multi-level processes are interactive simultaneously.

The hierarchical linear model is a type of regression analysis for multilevel data where the dependent variable is at the lowest level. Explanatory variables can be defined at any level (including aggregates of level-one variables) (Snijders and Bosker, 1999). In the jargon of multilevel modelling, the repeated measurements of test scores (of students) are described as "level 1", the classrooms/schools are referred to as "level 2" and the regions are "level 3" (Huber, Chuck, 2013).

Variations in nested data emerges from two sources, namely, within group variation (e.g. individual differences among students within the same school) and between group variation (e.g. between school differences) and hence student achievement models typically specify these two distinct sub-components. Fully conditional or unconditional models do not include within-group and between-group variations, thus leading to the errors and erroneous conclusions (see Snijder and Bosker, 1999) for illustrations for the same). An important statistic in multilevel modeling is the intra-class correlation which is the ratio of between-variance to

total variance (Mok and Ching, 2006). In the “between – group” model, the parameters from the “within-group” models serve as dependent variable. The magnitude of intra-class correlation denotes the extent of variations among level-2 units (e.g. school) compared to the total variance, which is the sum of variances at level-2 and level-1 (e.g. students).

One of the most fundamental question in school effectiveness research is how much of the variation in students’ learning achievement can be attributed to the schools that students attend. Do type of schools and what happens in classrooms makes a difference? A multilevel unconditional or null model is used for analyzing the effect of schools, without controlling for any school or student characteristics. In this model, no predictor variables are used either in the “within school” model or “between school” model.

$$Y_{ij} = \beta_{0j} + \varepsilon_{ij}, \varepsilon_{ij} \sim N(0, \sigma^2) \quad (3)$$

$$\beta_{0j} = \alpha_0 + \mu_{0j}, \mu_{0j} \sim N(0, \tau_0) \quad (4)$$

$$Y_{ij} = \alpha_0 + \mu_{0j} + \varepsilon_{ij} \text{ (combined model)} \quad (5)$$

Equation (3) represents Level 1 model where the achievement level of student i in school j is a function of the average achievement in school j (β_{0j}) and a student level error term (ε_{ij}).

Equation (4) shows the average achievement in school j as a function of the grand mean of all the school means (α_0) and a school-level error term (μ_{0j}). Through this model, the student-level (σ^2) and at the school-level (τ_0) variance components are also estimated using which the total variance could be decomposed into between school effects and within school (across student levels) effects.

From unconditional models to conditional models with random effects are specified for each level in this stage. At student level, student level predictors are used. The random coefficient model for the analysis here is:

$$Y_{ij} = \beta_{0j} + \alpha_{1j} X_{ij} + \varepsilon_{ij}, \varepsilon_{ij} \sim N(0, \sigma^2) \quad (6)$$

X is the mean student characteristics. The intercept term of the conditional model is quite similar to that of the null model, except the mean is now adjusted for the covariates (student-level variables). β_{0j} is the mean outcome of the average students of a particular school.

The intercept and slope parameters are subscripted by j , indicating that each class/ school could have a different intercept and slope. If there is significant variation in intercepts and slopes between classes, these in turn, can be modeled by including predictors at the school level. Thus, the student level intercepts and slopes become outcomes, and the school level ANCOVA model is as follows:

$$\beta_{0j} = \alpha_0 + \alpha_{1j} Z_j + \mu_{0j}, \mu_{0j} \sim N(0, \tau_0) \quad (7)$$

Where Z are the school characteristics and μ_{0j} is the school level random effect. The interpretation of β_{0j} would be the adjusted school mean outcome affected by the school level characteristics. Similarly, the slope coefficients could be described as being affected by Z s, given X 's.

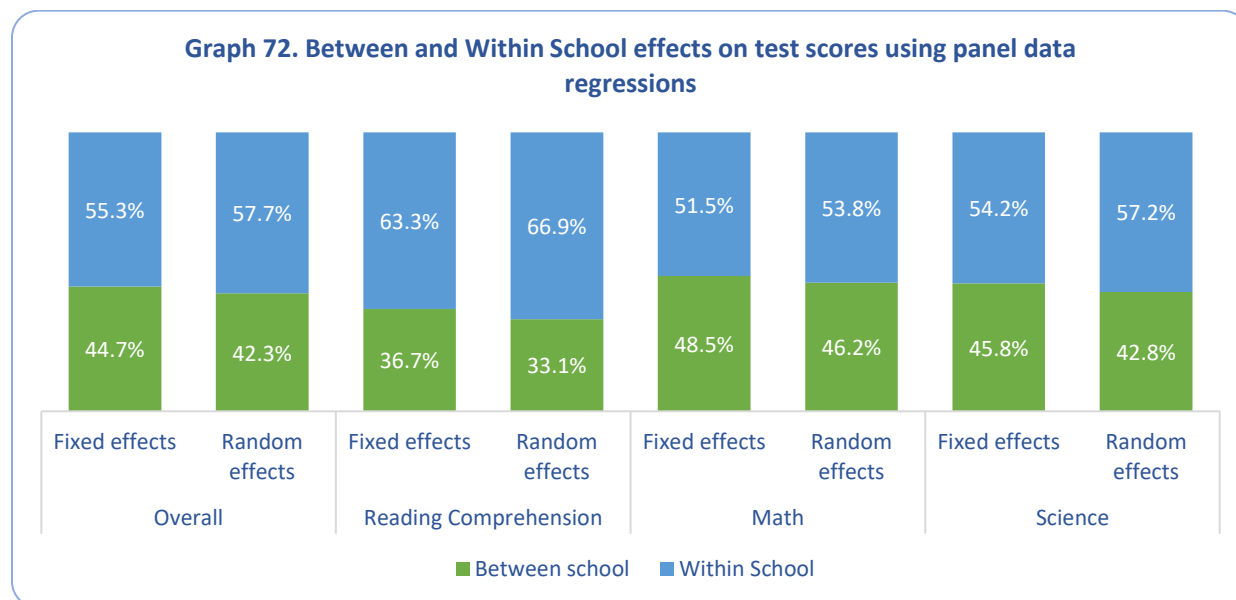
Analysis of Multivariate regression results

The multi-variate analysis consisting of: (i) simple Ordinary Least Square (OLS) regressions, (ii) panel regressions, one with school fixed effects and the other, with random effects; and (iii) HLM or multi-level regressions are analyzed in this section in detail. The analysis was carried out separately for each subject and for overall scores. The Overall regression results are presented in the Annex. A positive sign before a coefficient signifies a positive (and significant) effect; a negative sign denotes a negative (and significant) effect. First, the “between-school” and “within-school” effects as evident from the results are presented, followed by an analysis of the impact of each predictor variable, controlling for other factors.

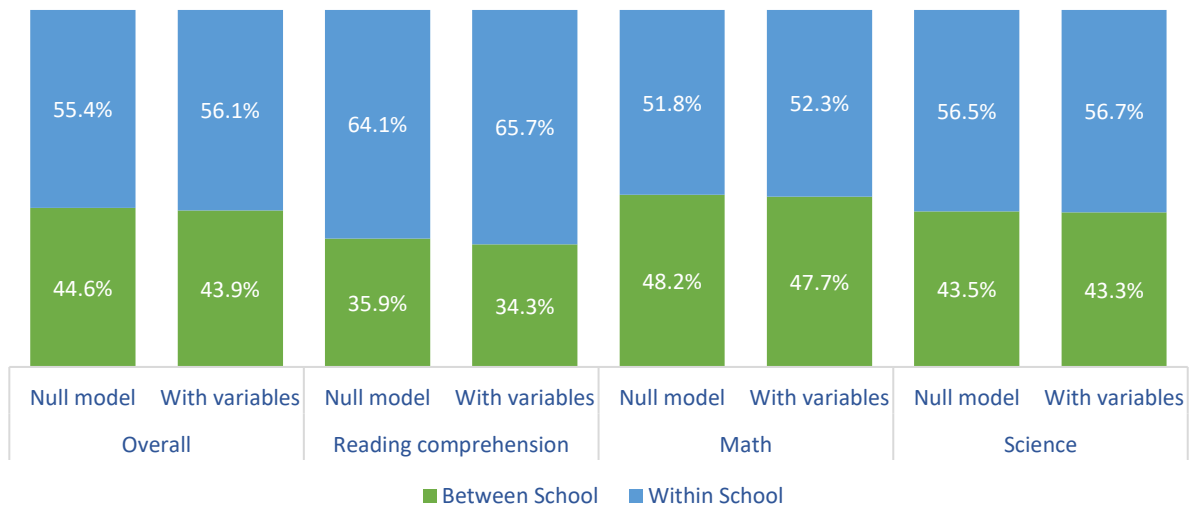
Results: Between school and Within School effects

The regression results show that differences in school resources accounted for around 45 percent of all variations in test scores (as explained by fixed effects panel regression results and multi-level (HLM) null models). This means that the heterogeneity across students within school accounts for a larger share of differences in learning achievement. Within school effects (student level variations) on test scores increases slightly when student level variables (as in the case of HLM model with variables and random effects panel regression models) are allowed in the analysis.

Within-school or student level heterogeneity explained variations in students test scores in Reading Comprehension in a bigger way than Math and Science – only 1/3rd of the Reading test scores were explained by school level factors. In the case of Math, close to 48 percent of the variations are explained by school factors.

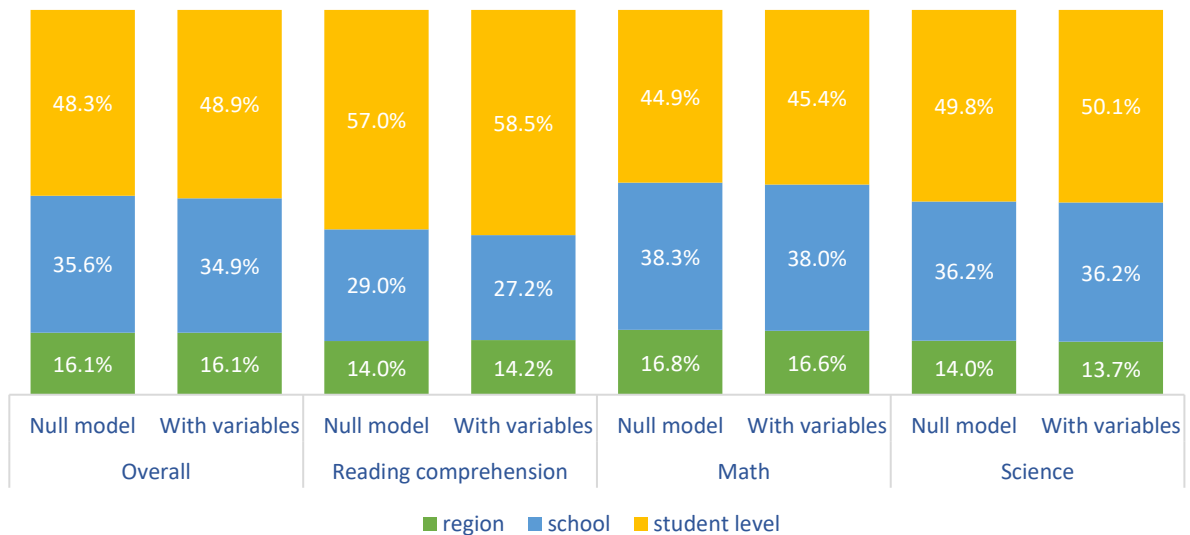


Graph 73. Between and within school effects on test scores using HLM regressions



When region-wide variations are accounted for in the HLM, the results become even more interesting – because regional variations account for some of the variability at student/family level or school levels. The regional variations account for around 16 percent of the variations in overall test scores. The school level effects are now reduced from 45 percent to 36 percent while the effects of within school (student level variations) have reduced from 55 percent to 48 percent. The regional variations were least impactful in the case of Math and Science test scores.

Graph 74. Variations in test scores explained by various levels in HLM



Student level variables

Age: The unadjusted (uncontrolled) regression coefficients gives the impression that a child who enters school late is not doing better in tests scores than others who entered at the appropriate age. However, the multi-variate analysis does not confirm these findings. Except for Reading Comprehension, the learning gaps due to age differences were not found significant in the HLM model. The non-significant results for age shows that the success of the country in ensuring most age-appropriate enrollments have resulted in less variations in the cohort of students who attend the same grade.

Table 12: Regression Coefficients for the effect of age on learning achievement in grade IV								
	Unadjusted gap		Adjusted gap: Ordinary Least Square (OLS) regression		Adjusted Gap: Hierarchical Linear Model (HLM)		Adjusted gap: Panel	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
SAS	-6.44**	1.87	4.08*	1.97	1.71	1.64	1.55	1.65
Reading	-4.36*	2.01	6.51**	2.18	4.12*	2.03	3.63	2.05
Math	-7.25**	2.11	0.14	2.23	-0.48	1.76	-0.52	1.77
Science	-5.13	3.15	3.84	3.40	1.68	2.88	1.37	2.95

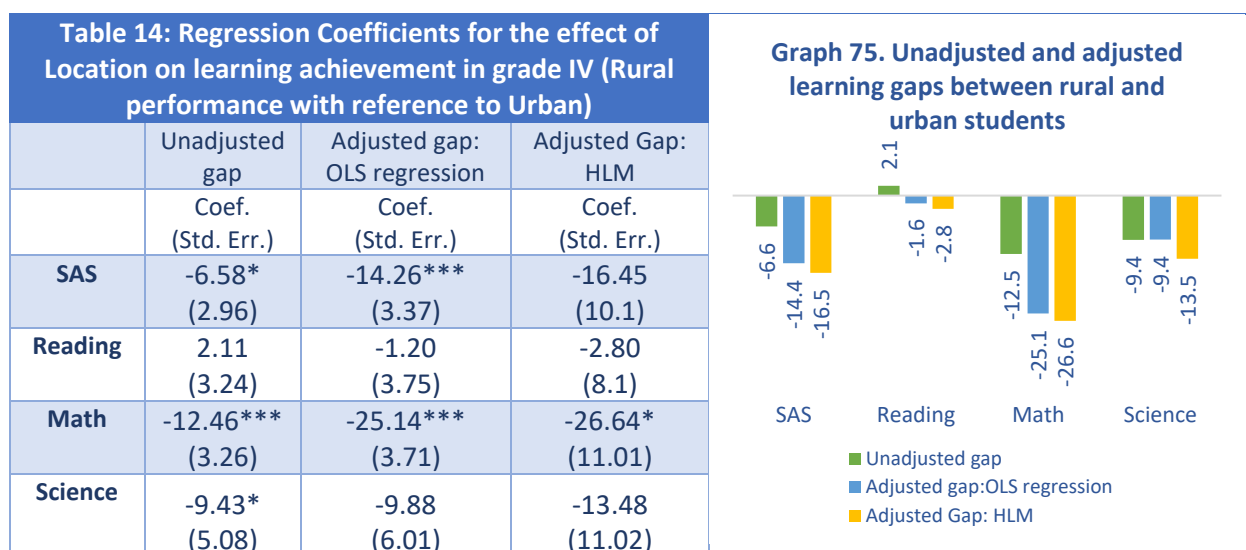
* means $p < .10$; or significant at 10%; ** means $p < .05$, or significant at 5%.

Gender: Multi-variate analysis shows that girls' performance in Reading Comprehension was significantly better than that of boys in Reading Comprehension, while gender differences were negligible in Mathematics and Science tests. The results for Reading Comprehension is significant, showing that even after controlling for other factors, girls are better readers than boys!

Table 13: Regression Coefficients for the effect of gender on learning achievement in grade IV (Girls with reference to boys)								
	Unadjusted gap (girls over boys)		Adjusted gap: Ordinary Least Square (OLS) regression		Adjusted Gap: Hierarchical Linear Model (HLM)		Adjusted gap: Panel	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
SAS	6.79**	2.39	2.38	2.48	3.58*	2.03	3.64*	2.04
Reading	14.58***	2.62	9.96***	2.78	10.24***	2.55	10.22***	2.56
Math	-0.19	2.65	-3.41	2.76	-1.53	2.15	-1.41	2.16
Science	0.80	3.96	-1.63	4.26	0.85	3.55	1.33	3.61

* means $p < .10$; or significant at 10%; ** means $p < .05$, or significant at 5%; and *** means $p < .01$ or significant at 1%

Location: Multi-variate regressions show that urban students performed significantly better than their rural peers in Math and to some extent in Science. However, no such differences were observed in Reading Comprehension.



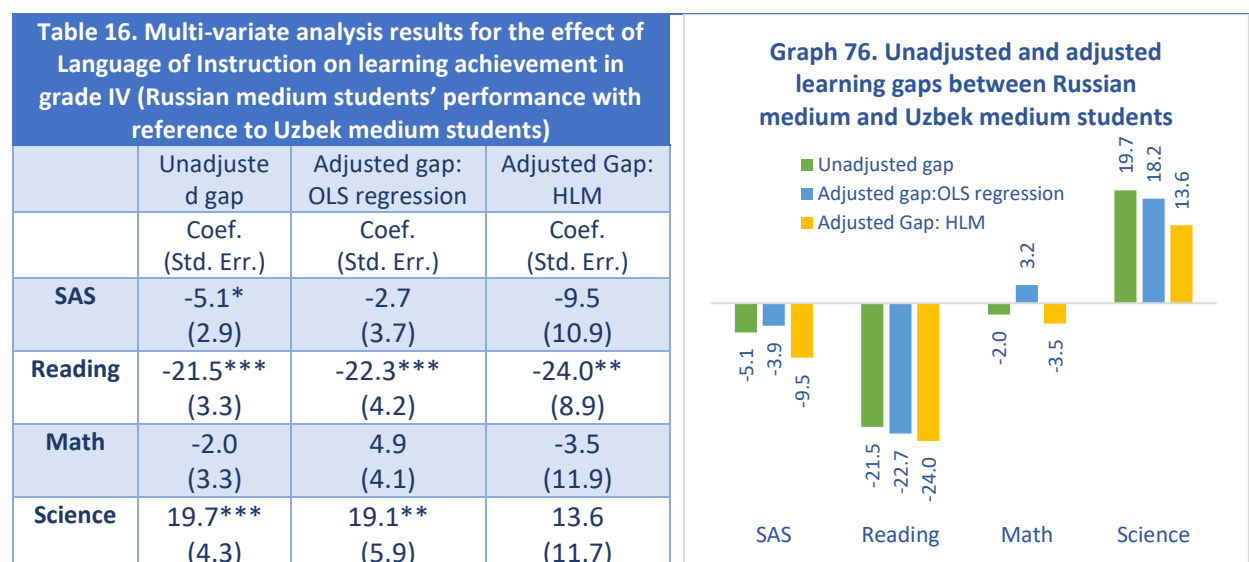
* means $p < .10$; or significant at 10%; ** means $p < .05$, or significant at 5%; and *** means $p < .01$ or significant at 1%

Regional differences: The region-wise dummies were used in the multi-variate analysis (Ordinary Least Square estimates) to understand the regional variations after controlling for other socio-economic variables. Tashkent city was used as the reference point. The regression coefficients show that students in Andijon, Namangan, Navoi and Tashkent region performed significantly better than students in Tashkent city. Students in Bukhara, Fergana, Republic of Karakalpakstan, Khorozm and Surkhadarya were behind the students in Tashkent city in their test scores. Students in Jizzakh, Samarkhand and Syrdaraya had performance like that of students in Tashkent city.

	SAS		Reading		Math		Science	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Andijon	27.15***	4.43	2.76	4.90	43.12***	5.04	29.87***	7.42
Bukhara	-22.48***	6.07	-36.14***	6.42	7.09	6.84	-51.37***	12.05
Fergana	-59.03***	4.17	-59.27***	4.76	-49.77***	4.65	-37.96***	6.82
Jizzakh	-2.12	8.10	4.09	9.26	-15.48*	8.88	19.89	13.76
Karakalpak	-64.45***	9.36	-52.94***	10.87	-56.62***	10.36	-63.37***	15.08
Kashkadarya	6.75	4.66	-5.54	5.28	23.65***	5.12	-10.57	8.04
Khorozam	-23.60***	5.67	-18.02**	6.34	-24.39***	6.32	-15.50	9.71
Namangan	16.55***	4.19	-14.52**	4.78	39.47***	4.68	26.10***	6.85
Navoi	52.90***	11.24	35.54**	12.64	51.57***	12.44	60.62**	19.24
Samarkand	3.47	4.57	-6.93	5.04	10.69*	5.12	6.61	8.08
Surkhadarya	-19.48**	7.36	-24.46**	8.35	-14.05*	8.16	-6.67	12.35
Syrdarya	-10.19	8.20	-1.18	9.22	-22.91*	9.16	7.29	13.78
Tashkent region	32.76***	4.92	26.55***	5.58	27.59***	5.47	35.15***	8.17

* means $p < .10$; or significant at 10%; ** means $p < .05$, or significant at 5%; and *** means $p < .01$ or significant at 1%

Medium of instruction: The analysis shows that Uzbek medium children were doing significantly better than Russian medium students, particularly in Reading. However, though the Russian medium students were doing better than Uzbek medium students in Science, once controlled for “nested” school effects and other correlates (HLM analysis), the difference between the students of the two types of schools turned insignificant.



* means $p < .10$; or significant at 10%; ** means $p < .05$, or significant at 5%; and *** means $p < .01$ or significant at 1%

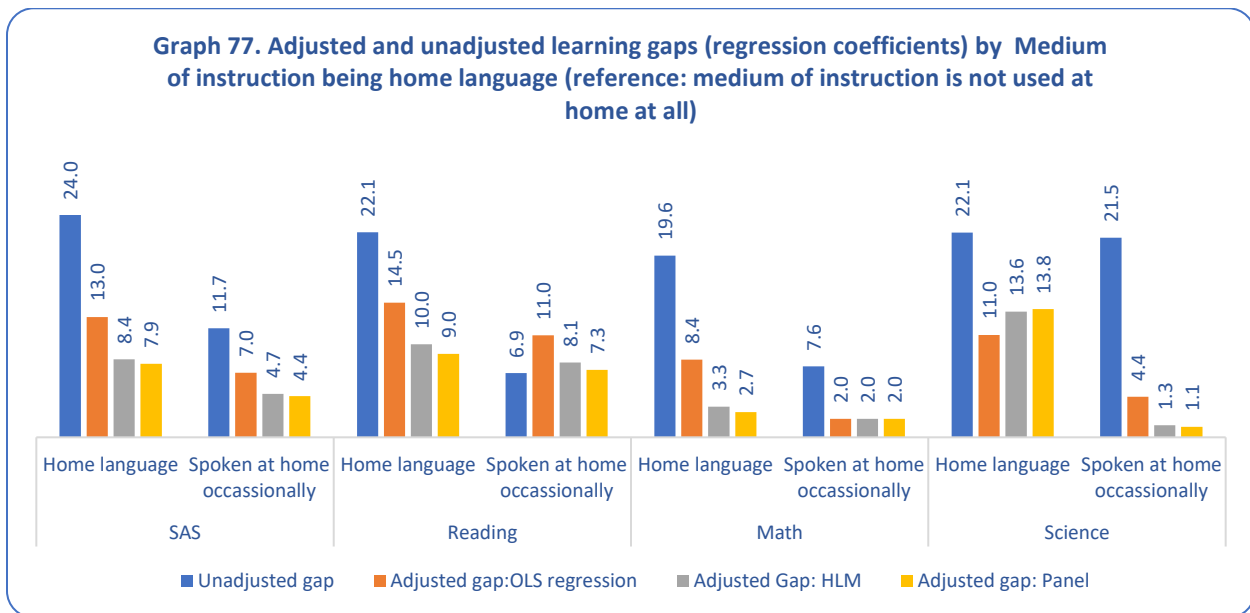
Home language as the school language in comparison to different home and school languages:

The multi-variate analysis shows that children who attended a school with the same language as spoken at home as the medium of instruction scored much better than those students who home language was different from the medium of instruction or school language. Children from families where the language of school instruction was also spoken occasionally also did better, though to a much smaller extent, compared to those who did not speak in that language at all.

		Unadjusted gap	Adjusted gap: OLS regression	Adjusted Gap: HLM	Adjusted gap: Panel
		Coef. (Std. Err.)	Coef. (Std. Err.)	Coef. (Std. Err.)	Coef. (Std. Err.)
SAS	Main home language	23.98*** (3.17)	13.70*** (3.31)	8.39** (2.75)	7.92** (2.76)
	Spoken sometimes	11.75** (3.89)	7.03* (4.26)	4.51 (3.53)	4.43 (3.55)
Reading	Main home language	22.13*** (3.45)	14.63*** (3.68)	10.05** (3.42)	9.02** (3.45)

	Spoken sometimes	6.93 (4.32)	10.34* (4.80)	7.83* (4.45)	7.28 (4.49)
Math	Main home language	19.59*** (3.52)	9.13* (3.69)	3.22 (2.92)	2.73 (2.93)
	Spoken sometimes	7.64* (4.37)	2.56 (4.77)	1.91 (3.75)	1.98 (3.77)
Science	Main home language	22.07*** (5.37)	12.04* (5.79)	13.59** (4.87)	13.82** (4.96)
	Spoken sometimes	21.55** (6.25)	4.44 (7.13)	1.14 (6.03)	1.15 (6.14)

* means $p < .10$; or significant at 10%; ** means $p < .05$, or significant at 5%; and *** means $p < .01$ or significant at 1%



Role of preschool attendance on learning levels: The unadjusted regression coefficients show that children who attended a kindergarten before entering grade 1 performed better than those who never attended a kindergarten in their early childhood stage; those students who had attended even short stay play groups did better than those who did not. The results persisted, though to a lesser degree, even after controlling for various socio-economic status.

Graph 78. Adjusted and unadjusted learning gaps (regression coefficients) by preschool attendance

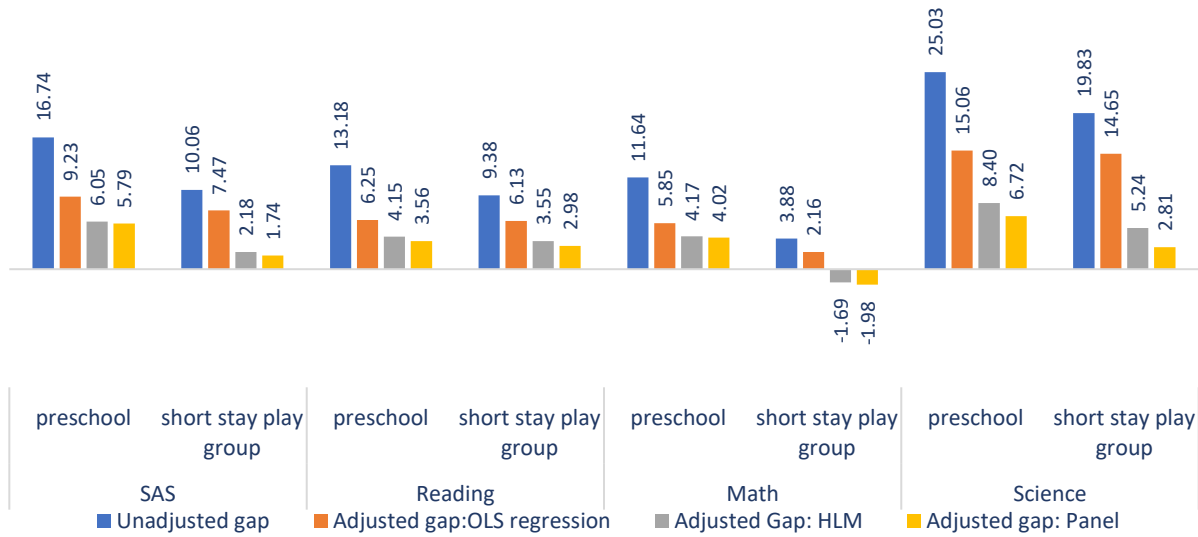


Table 18: Multi-variate analysis results for preschool attendance: Regression Coefficients for the effect of preschool attendance on learning achievement in grade IV (with reference to no preschool attendance)

		Unadjusted gap	Adjusted gap: OLS regression	Adjusted Gap: HLM	Adjusted gap: Panel
		Coef. (Std. Err.)	Coef. (Std. Err.)	Coef. (Std. Err.)	Coef. (Std. Err.)
SAS	preschool	16.74*** (2.80)	9.23** (2.94)	6.05* (2.46)	5.79* (2.47)
	short stay play group	10.06** (3.46)	7.47* (3.56)	2.18 (2.96)	1.74 (2.97)
Reading	preschool	13.18*** (3.08)	6.25* (3.30)	4.15 (3.07)	3.56 (3.11)
	short stay play group	9.38* (3.80)	6.13 (3.99)	3.55 (3.69)	2.98 (3.72)
Math	preschool	11.64*** (3.12)	5.85* (3.27)	4.17 (2.60)	4.02 (2.61)
	short stay play group	3.88 (3.82)	2.16 (3.94)	-1.69 (3.10)	-1.98 (3.12)
Science	preschool	25.03*** (4.62)	15.06** (5.11)	8.40* (4.33)	6.72 (4.42)
	short stay play group	19.83** (5.84)	14.65* (6.28)	5.24 (5.30)	2.81 (5.41)

* means $p < .10$; or significant at 10%; ** means $p < .05$, or significant at 5%; and *** means $p < .01$ or significant at 1%

Home and family attributes

Availability of Reading resources: The multi-variate regression analysis shows that having reading materials like books at home contributes significantly to the learning achievements in Reading Comprehension as well as in Science, but to a smaller extent to Math as well. Even after controlling for several factors, a household with reading-rich resources enables enhance learning scores by around 12 points.

Availability and access to digital materials: Multi-variate analysis in fact point towards the adverse impact of digital access and use on children's learning. However, one should not infer from these results that digital resources are not good for student learning – it simply means that if not used properly, digital access is not beneficial for children. The PIRLS 2011 (Mullis, I.V.S; M.O. Martin, P. Foy, and K. T. Drucker, 2012) had raised questions as to whether “the many competing media activities (e.g., watching TV, social networking, listening to music on phones and computers, and playing video games) supplanted reading in children's lives to the point that reading skills are eroding”.

Table 19: Multi-variate analysis results for Reading resources (books other than textbooks) at home: Regression Coefficients

	Unadjusted gap	Adjusted gap: OLS regression	Adjusted Gap: HLM	Adjusted gap: Panel
	Coef. (Std. Err.)	Coef. (Std. Err.)	Coef. (Std. Err.)	Coef. (Std. Err.)
SAS	34.65*** (4.20)	21.47*** (4.57)	12.32*** (3.49)	11.56** (3.50)
Reading	32.64*** (4.66)	19.73*** (5.27)	11.64** (4.39)	9.59* (4.43)
Math	24.01*** (4.68)	12.18* (5.13)	6.96* (3.70)	6.68* (3.72)
Science	37.36*** (6.86)	27.37*** (7.67)	17.95** (5.86)	16.96** (5.97)

Graph 79. Adjusted and unadjusted learning gaps (regression coefficients) for reading materials at home

Subject	Unadjusted gap	Adjusted gap: OLS regression	Adjusted Gap: HLM	Adjusted gap: Panel
SAS	34.65	21.47	12.32	11.56
Reading	32.64	19.73	11.64	9.59
Math	24.01	12.18	6.96	6.68
Science	37.36	27.37	17.95	16.96

* means $p < .10$; or significant at 10%; ** means $p < .05$, or significant at 5%; and *** means $p < .01$ or significant at 1%

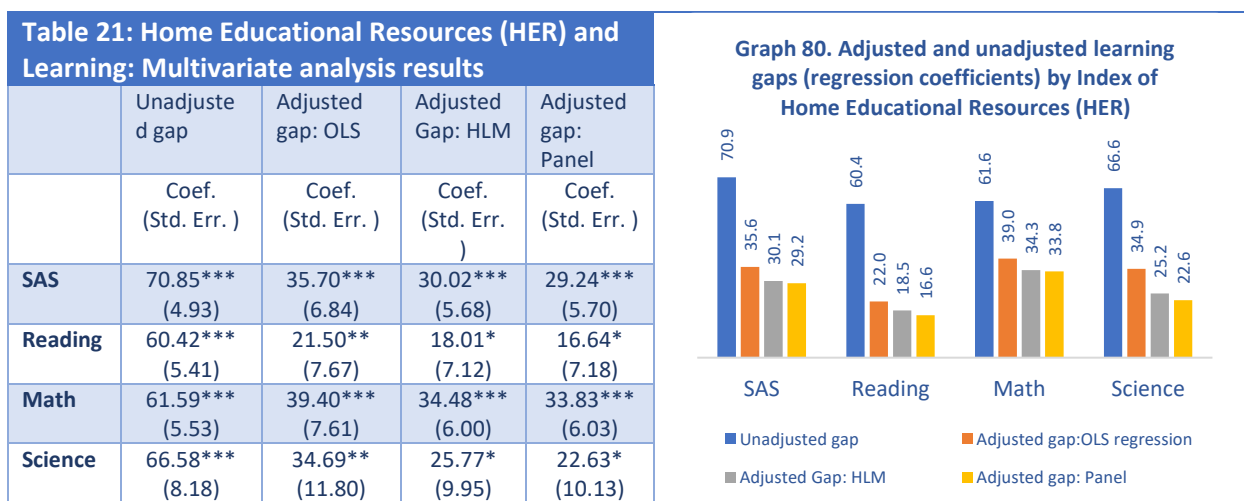
Table 20: Digital access and use: Regression coefficients on Learning

		Unadjusted gap	Adjusted gap: OLS regression	Adjusted Gap: HLM	Adjusted gap: Panel
		Coef. (Std. Err.)	Coef. (Std. Err.)	Coef. (Std. Err.)	Coef. (Std. Err.)
SAS	Digital access	8.34* (3.41)	-0.06 (4.32)	-4.61 (3.99)	-4.19 (4.02)
	Digital use	-8.36 (6.61)	-13.57* (6.99)	-9.77* (5.76)	-9.55* (5.78)
Reading	Digital access	8.92* (3.76)	6.04 (4.87)	0.59 (5.01)	0.29 (5.08)
	Digital use	-16.53* (7.23)	-18.68* (7.79)	-19.88** (7.18)	-20.21** (7.23)

Math	Digital access	3.22 (3.81)	-4.92 (4.81)	-4.89 (4.22)	-4.00 (4.25)
	Digital use	-4.79 (7.31)	-6.57 (7.74)	-2.47 (6.05)	-2.27 (6.08)
Science	Digital access	11.55* (5.57)	-3.33 (7.41)	-12.92* (6.91)	-13.06* (7.07)
	Digital use	13.71 (11.18)	0.24* (12.47)	13.26 (10.44)	16.50 (10.62)

* means $p < .10$; or significant at 10%; ** means $p < .05$, or significant at 5%; and *** means $p < .01$ or significant at 1%

Home Educational Resources: Summary Indicator: The analysis of test scores using the HER index showed that children with the higher HER also scored high on learning assessments while children whose HER was low also lagged in learning. These results were further validated by multi-variate analysis. While the unadjusted learning gap (overall scores -SAS) amounted to 71 points with every higher HER, adjusted learning gap (accounting for other socio-economic characteristics of home and school) is still highly significant, as better HER contributes to better learning for each increment by 29 points.

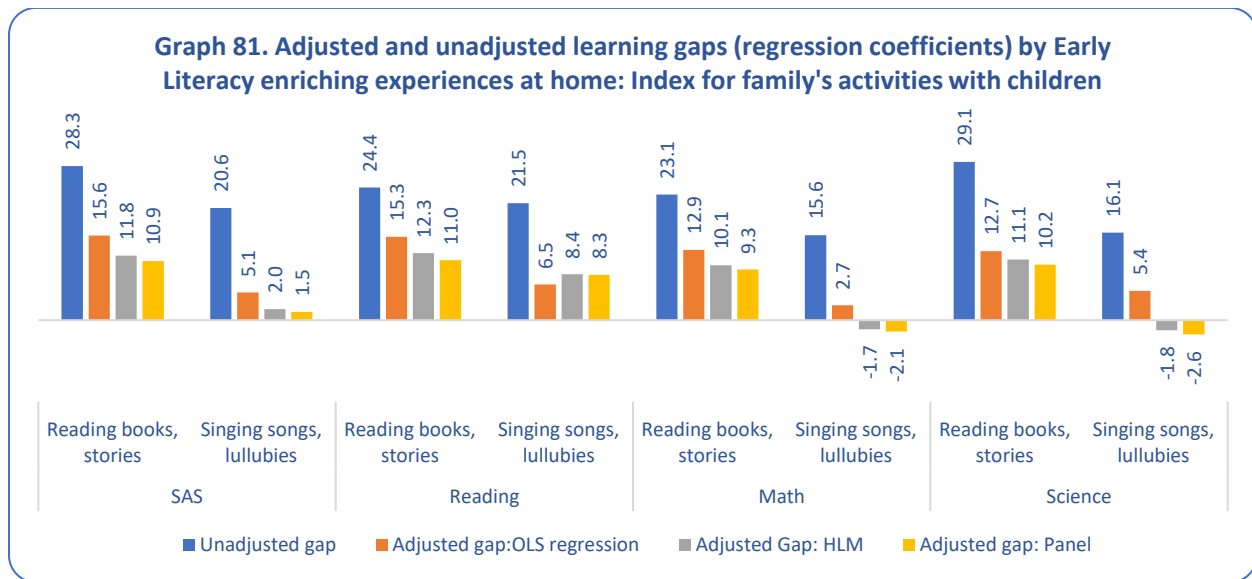


* means $p < .10$; or significant at 10%; ** means $p < .05$, or significant at 5%; and *** means $p < .01$ or significant at 1%

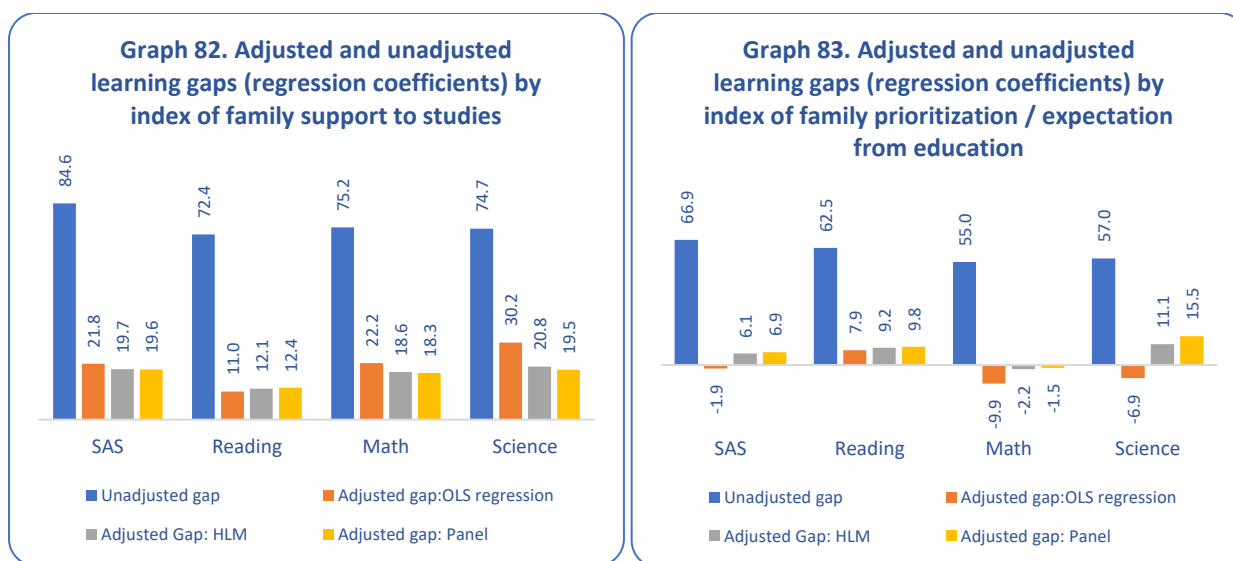
Early interventions by family: The multi-variate analysis also shows that students who reported parents or other family members engaging them during their early childhood days by early literacy activities such as reading books and telling stories, performed better than those children who reported limited or no experience of early literacy engagements with family members. Family members engaging with children in their younger days with songs and lullabies also performed better in reading or literacy related test.

Table 22: Parental/ family's early childhood development engagement and primary grades learning achievement: Results from multi-variate analysis					
		Unadjusted gap	Adjusted gap: OLS regression	Adjusted Gap: HLM	Adjusted gap: Panel
		Coef. (Std. Err.)	Coef. (Std. Err.)	Coef. (Std. Err.)	Coef. (Std. Err.)
SAS	Reading books	28.33*** (3.37)	15.69*** (3.57)	11.31*** (2.94)	10.86*** (2.95)
	Singing songs	20.62*** (3.52)	4.46 (3.74)	1.61 (3.10)	1.48 (3.11)
Reading	Reading books	24.39*** (3.72)	15.07*** (4.02)	11.85** (3.70)	11.00** (3.73)
	Singing songs	21.50*** (3.87)	6.06 (4.19)	7.98 (3.87)	8.35 (3.91)
Math	Reading books	23.09*** (3.76)	13.03** (3.96)	9.66** (3.10)	9.31** (3.11)
	Singing songs	15.63*** (3.94)	2.21 (4.17)	-1.87 (3.27)	-2.08 (3.29)
Science	Reading books	29.07*** (5.60)	13.32* (6.11)	11.08* (5.12)	10.20* (5.21)
	Singing songs	16.05** (5.86)	5.50 (6.42)	-1.66 (5.44)	-2.60 (5.55)

* means $p < .10$; or significant at 10%; ** means $p < .05$, or significant at 5%; and *** means $p < .01$ or significant at 1%



Family Support and expectations: Consistent with the results from PIRLS and other research, the analysis shows that students who felt their parents have higher expectations from them or aspirations about their studies scored more in the test than students who reported lesser parental expectations.



Children who are supported by family with both rewards and reprimands, encouragement to study and constant follow up, performed significantly better than children who were relatively neglected by their families. On the other hand, family's aspirations or expectations regarding children's education had mixed results. While children with high family aspirations / expectations performed relatively better in Science and Reading, the same thing was not reflected in Math test results. Family's expectations are part of encouragement in most cases, however, such expectations can also put un-necessary pressure on children to perform which may in some cases, eventually be counter-productive.

		Unadjusted gap	Adjusted gap: OLS regression	Adjusted Gap: HLM	Adjusted gap: Panel
		Coef. (Std. Err.)	Coef. (Std. Err.)	Coef. (Std. Err.)	Coef. (Std. Err.)
SAS	Family support Index	84.60*** (4.61)	21.83** (6.74)	19.72*** (5.56)	19.57*** (5.58)
	Family expectation index	66.88*** (3.86)	-1.93 (6.39)	6.12 (5.26)	6.86 (5.28)
Reading	Family support Index	72.41 (5.09)	10.99 (7.55)	12.14* (6.96)	12.43* (7.02)
	Family expectation index	62.51*** (4.24)	7.88 (7.13)	9.25 (6.55)	9.84 (6.60)
Math	Family support Index	75.21*** (5.21)	22.16** (7.51)	18.61** (5.91)	18.27** (5.94)
	Family expectation index	55.01*** (4.40)	-9.91 (7.12)	-2.18 (5.57)	-1.47 (5.60)
Science	Family support Index	74.72*** (7.53)	30.17* (11.65)	20.80* (9.76)	19.47* (9.92)
	Family expectation index	57.02*** (6.26)	-6.90 (11.17)	11.13 (9.42)	15.47 (9.61)

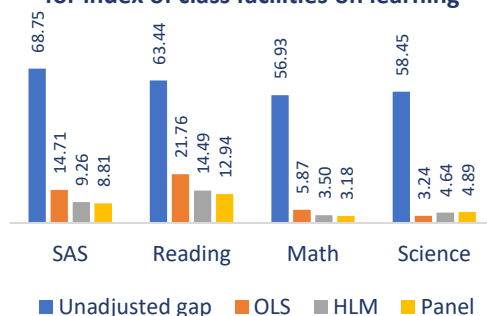
* means $p < .10$; or significant at 10%; ** means $p < .05$, or significant at 5%; and *** means $p < .01$ or significant at 1%

School characteristics

Classroom facilities: The test scores by response category show that the more students felt comfortable physically in classrooms, the better were their test scores. Results of multi-variate analysis confirms that though the extent of the influence of classroom facilities shrink with the introduction of other factors, they are still important in the overall scheme of things for students' learning.

Table 24: Regression Coefficients for the index of classroom facilities on learning achievement in grade IV				
	Unadjusted gap	Adjusted gap: OLS regression	Adjusted Gap: HLM	Adjusted gap: Panel
	Coef. (Std. Err.)	Coef. (Std. Err.)	Coef. (Std. Err.)	Coef.(Std. Err.)
SAS	68.75*** (3.83)	14.71* (6.34)	9.26* (5.23)	8.81* (5.25)
Reading	63.44*** (4.20)	21.76** (7.12)	14.49* (6.54)	12.94* (6.59)
Math	56.93*** (4.32)	5.87 (6.95)	3.50 (5.47)	3.18 (5.50)
Science	58.45*** (6.42)	3.24 (11.28)	4.64 (9.49)	4.89 (9.66)

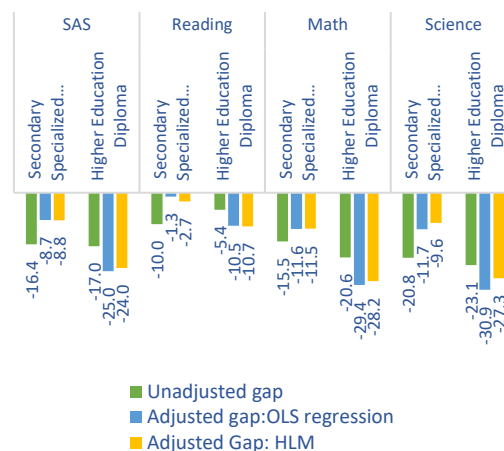
Graph 84. Adjusted and unadjusted learning gaps (regression coefficients) for index of class facilities on learning



* means $p < .10$; or significant at 10%; ** means $p < .05$, or significant at 5%; and *** means $p < .01$ or significant at 1%

Table 25: Regression Coefficients for Teachers by education qualification on learning achievement in grade IV (Reference: Teachers with Bachelors and Masters degree)				
		Unadjusted gap	Adjusted gap: OLS regression	Adjusted Gap: HLM
		Coef. (Std. Err.)	Coef. (Std. Err.)	Coef. (Std. Err.)
SAS	Secondary specialized ed.	-16.42*** (3.21)	-8.70* (4.07)	-8.79 (12.50)
	Higher education	-17.02*** (2.80)	-25.01*** (3.04)	-23.97* (9.52)
Reading	Secondary specialized ed.	-9.97** (3.54)	-1.25 (4.61)	-2.75 (10.19)
	Higher education	-5.41* (3.09)	-10.49** (3.44)	-10.68 (7.74)
Math	Secondary specialized ed.	-15.53*** (3.56)	-11.56* (4.52)	-11.45 (13.63)
	Higher education	-20.58*** (3.11)	-29.43*** (3.39)	-28.20** (10.39)
Science	Secondary specialized ed.	-20.77*** (5.32)	-11.67* (6.97)	-9.57 (13.52)
	Higher education	-23.07*** (4.57)	-30.87*** (5.16)	-27.26** (10.33)

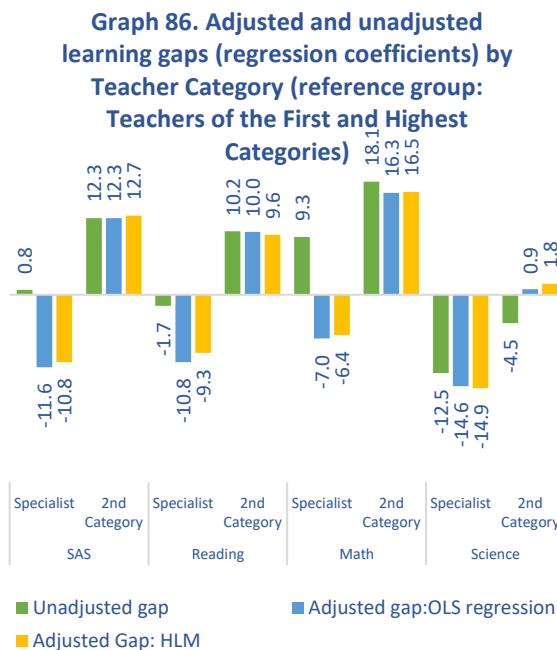
Graph 85. Adjusted and unadjusted learning gaps (regression coefficients) by Teachers' education levels (Reference group: Teachers with Bachelors or Masters Degree)



* means $p < .10$; or significant at 10%; ** means $p < .05$, or significant at 5%; and *** means $p < .01$ or significant at 1%

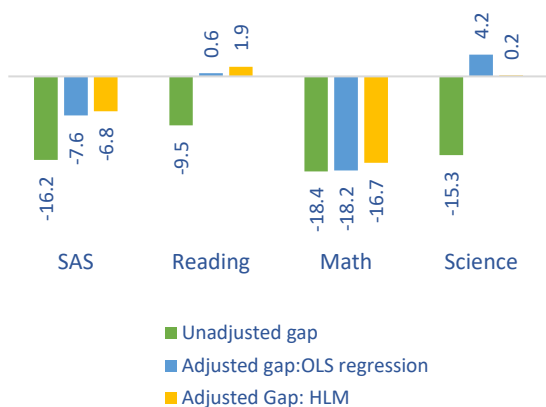
Table 26: Regression Coefficients for Teachers by education category on learning achievement in grade IV (Reference: Teachers of first and highest categories)

		Unadjusted gap	Adjusted gap: OLS regression	Adjusted Gap: HLM
		Coef. (Std. Err.)	Coef. (Std. Err.)	Coef. (Std. Err.)
SAS	Specialist teacher	0.80 (2.98)	-11.63** (4.15)	-10.76 (13.01)
	Teacher 2 nd cat.	12.29*** (3.09)	12.28*** (3.33)	12.68 (10.44)
Reading	Specialist teacher	-1.74 (3.29)	-10.79* (4.71)	-9.31 (10.58)
	Teacher 2 nd cat.	10.17** (3.41)	10.05** (3.76)	9.61 (8.48)
Math	Specialist teacher	9.25** (3.31)	-7.01 (4.61)	-6.43 (14.19)
	Teacher 2 nd cat.	18.08*** (3.44)	16.30*** (3.70)	16.48 (11.39)
Science	Specialist teacher	-12.53* (4.88)	-14.64* (6.98)	-14.92 (14.00)
	Teacher 2 nd cat.	-4.54 (5.08)	0.87 (5.69)	1.79 (11.31)



* means $p < .10$; or significant at 10%; ** means $p < .05$, or significant at 5%; and *** means $p < .01$ or significant at 1%

Graph 87. Adjusted and unadjusted learning gaps (regression coefficients) by Index of student attendance problems (at school levels)



Graph 88. Adjusted and unadjusted learning gaps (regression coefficients) by Index of student violence issues at school level

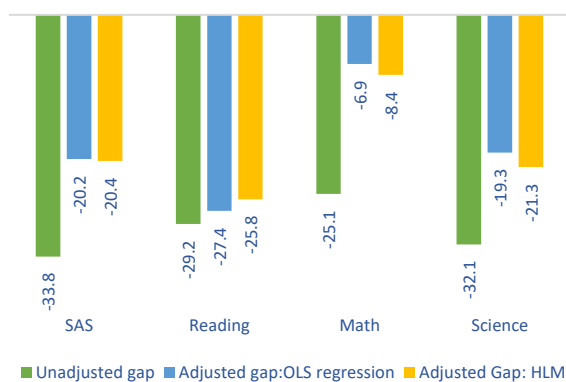


Table 27: Principals' reporting on issues at schools regarding student attendance and student behavioural problems and student test scores

		Unadjusted gap	Adjusted gap: OLS regression	Adjusted Gap: HLM
	Issue of....	Coef. (Std. Err.)	Coef. (Std. Err.)	Coef. (Std. Err.)
SAS	student attendance	-16.18** (5.04)	-7.60 (6.28)	-6.79 (19.02)
	Student behavior issues	-33.81*** (5.27)	-20.17** (6.78)	-20.44 (20.66)
Reading	student attendance	-9.51* (5.56)	0.63 (6.99)	1.85 (15.47)
	Student behavior issues	-29.25*** (5.78)	-27.42*** (7.51)	-25.81 (16.77)
Math	student attendance	-18.40** (5.57)	-18.25** (6.96)	-16.74 (20.75)
	Student behavior issues	-32.12** (5.83)	-6.89 (7.51)	-8.38 (22.54)
Science	student attendance	-15.29* (8.57)	4.24 (11.13)	0.17 (20.80)
	Student behavior issues	-25.06** (9.09)	-19.26 (12.15)	-21.31 (22.74)

* means $p < .10$; or significant at 10%; ** means $p < .05$, or significant at 5%; and *** means $p < .01$ or significant at 1%

Table 28: Principals' reporting on parental involvement and teacher satisfaction and student test scores

		Unadjusted gap	Adjusted gap: OLS regression	Adjusted Gap: HLM
		Coef. (Std. Err.)	Coef. (Std. Err.)	Coef. (Std. Err.)
SAS	Parental involvement	33.26*** (7.26)	13.72* (7.67)	12.02 (23.96)
	Teacher satisfaction	65.93*** (8.48)	53.99*** (9.04)	46.86* (27.84)
Reading	Parental involvement	30.33*** (8.05)	-4.68 (8.64)	-0.04 (19.46)
	Teacher satisfaction	56.67*** (9.53)	28.01** (10.39)	22.31*** (22.73)
Math	Parental involvement	32.57*** (8.06)	25.03** (8.52)	22.48 (26.15)
	Teacher satisfaction	87.83*** (9.47)	92.12*** (10.12)	84.50** (30.40)
Science	Parental involvement	19.75 (12.19)	19.67 (13.16)	13.04 (26.02)
	Teacher satisfaction	3.09 (13.35)	-3.25 (14.66)	-1.47 (29.82)

* means $p < .10$; or significant at 10%; ** means $p < .05$, or significant at 5%; and *** means $p < .01$ or significant at 1%

8. Lessons and Implications for Education Quality Improvement efforts in Uzbekistan

The analysis of the national learning assessment for grade IV students in Uzbekistan provide several insights into the quality of education in Uzbekistan. In this section, first, the summary of all findings is presented and following that, lessons from international experiences relevant for improving Uzbekistan's education quality is discussed.

Summary of Results

The Uzbekistan NAS of grade IV children identifies education quality, manifested as learning outcomes and several household level and school level deprivations as education processes, as the main challenge facing the education system in the country.

In Reading Comprehension, students were good at identifying the more obvious information, while they struggled to accomplish tasks related to more complicated information or to interpret or evaluate the information or text content. In the case of Mathematics, where the task was clearly set out and uncomplicated, students tended to do well while they struggled with complex mathematical problems. In general Science, students were good at simple, straight recall questions. However, students struggled with questions that required application of knowledge and reasoning /problem solving.

Overall, the results reveal significant differences in the average achievement levels of students of various categories/ groups. Some differences are accounted for by contextual factors, but the results suggest that the quality of educational outcomes is far from equal across the schools in the country. The results show great diversity in achievement between the highest and lowest performing schools and within schools, among students. On an average, student attributes and home factors within schools contribute to around 55 percent of the variations in students' learning levels, which comes down to 50 percent or so when regional attributes are introduced in the analysis. School level variations explain around 45 percent of the variations, but in the presence of regional attributes, the influence of school level factors come down to 35-38 percent. Close to 14-15 percent of the results are explained by variations at regional level. Inequity of outcomes suggest that higher achieving students are receiving support while their less achieving peers may not be receiving adequate support and opportunities to reach more acceptable levels of learning.

The analysis shows that girls outperformed boys in Reading Comprehension tasks while in no such differences were observable in other subjects. Students in urban areas performed better than students in rural areas in Mathematics and Science subjects while there were no significant differences in Reading Comprehension across rural and urban students. Students in Russian medium schools performed relatively poorer in Reading Comprehension compared to their Uzbek peers whereas the Russian medium students did significantly better in Science than their Uzbek peers.

The survey used three questionnaires designed for schools, teachers and students to collect information on background factors that could potentially influence learning outcomes. The results from these findings give strong evidence on the direction of influence of these factors on students' learning. However, it is important to treat some of these results with caution and should only be used to indicate where more research and study can be usefully done to help guide educational improvement. They also show only where a certain factor is associated with improved achievement and not that it necessarily causes it. Some factors lie outside the school and educational system, for example, parent's attitude and home resources; both are associated with achievement. But some background factors are under the control of the education system and by looking at how these impact upon achievement it is possible to identify areas where policy makers and academicians can research further to determine what the problems are, what seems to work and how they can best improve performance. The more significant of these factors are considered when determining if other factors have an impact and are used in the analysis as the 'key variables'. For example, home educational resources (HER), language spoken at home and used for instruction in the school.

The results suggest that students who had attended a preschool before entering primary grades did perform better than those who had not attended preschool education. This is significant given the variable quality of preschools in the country when these students were preschoolers. This means that even with average quality, preschool experiences contribute to sustained learning in primary education. Students who could recall family providing them with early learning /literacy experiences also performed better than those who reported a deprivation of such experiences. Indeed, better performing students had an early start in literacy and numeracy.

Other Home factors: High performing students have home environments that support learning. The results suggest that higher the support and involvement from parents/ family and better the home resources, the better the student performance in test outcomes.

School factors: There are several school factors associated with students' learning achievement. High performing students attend well resourced, academically oriented schools. The results show that safe schools contribute to better learning achievements. Students attending schools where behaviour problems were reported as high by school principals, such as late arrivals, absenteeism, skipping classes or violations of school rules, tend to do worse in tests.

Student attributes and perspectives: Student perspective is very important and anything that affects students' ability or desire to attend school and pay attention to various curricular activities could be associated with better learning achievement. Students with positive attitude towards learning also perform better in tests. On the other hand, students who face one or other form of violence or bullying performed poorly in the learning assessment, indicating school atmosphere and safety is extremely important.

Teachers: Teacher has a key role in mediating learning and the study looked at various factors around the teacher and their teaching practices. A teacher with some experience and a modern

higher education contributed to better student performance than a new teacher or a teacher who was a product of the old Soviet education model. Students who had their homework checked by their teacher every day tend to do better.

To summarize, the study shows that learning outcomes (and hence quality of education) is influenced by (i) students' endowments and family factors; (ii) school factors (including teachers) and (iii) system level factors. However, these factors are inter-dependent and mutually influential. Multi-variate analysis results show that half of the explainable variations in learning is attributable to family and home factors, while the rest is attributable to school and location effects. However, the analysis also shows that better performing schools have a higher proportion of children from affluent backgrounds. Children from poorly resourced families also attend resource-poor schools and perform poorly in test scores.

Improving education Quality and achieving better learning outcomes for children: different approaches

The results from learning assessment studies – whether national or international - have prompted wide-spread education sector reforms in several countries. In this process, countries have been supported by international education community as well as local communities. Often, policy makers as well as development partners resort to “single-factor” intervention approach to improve education quality. While there are several cases of single-factor interventions and efforts to isolate the attributable effects of such interventions, with experience, most countries and systems have realized that such efforts were not sufficient. Analysis of such interventions show that while the ‘single-factor’ approach to school quality did result in some improvements, they were frequently compromised by other factors in the education setting (UNICEF, 2009). UNICEF has compiled some examples of the limitations of such single-factor interventions.

Table 29: UNICEF (2009): Examples of the Limitations of the Single-Factor Interventions		
Single-factor approach	Improvements & gains	Compromising factors
Teacher development	<ul style="list-style-type: none"> • Number of qualified teachers increased • Better informed teachers 	<ul style="list-style-type: none"> • Irrelevance of curriculum to local context • Lack of materials and learning/teaching aids
Provision of textbooks	<ul style="list-style-type: none"> • Individual study facilitated • Academic performance boosted 	<ul style="list-style-type: none"> • Not connected to teacher development and culturally irrelevant • Insufficient quantity of textbooks
Hygiene and life skills education	<ul style="list-style-type: none"> • Awareness of health and hygiene raised in children • Children empowered to participate in caring for themselves and others 	<ul style="list-style-type: none"> • Acute lack of sanitary facilities • Acute lack of safe water for drinking and hand washing • Quality of life skills education often not gender-responsive or age-appropriate

School environment and environmental education	<ul style="list-style-type: none"> • More schools provided with access to water and sanitation • Renewable energy sources for electricity found • Trees and gardens planted at schools 	<ul style="list-style-type: none"> • Lack of connection to curriculum • Facilities subject to vandalism and misuse • Lack of capacity for facilities maintenance
School as a community outreach	<ul style="list-style-type: none"> • Partnerships with parent-teacher associations and school governing boards forged • Young people's organizations formed 	<ul style="list-style-type: none"> • Poor capacity development for parents and community leaders • Restricted spaces for young people to participate

Source: UNICEF (2009). *Child Friendly Schools Manual*.

The importance of a set/package of complementary interventions, as against single-factor interventions, for improving quality of education is well recognized globally. To draw lessons for Uzbekistan to improve its education sector quality, this section looks at some existing evidences of the use of such set of education interventions that helped countries to trigger quality improvement.

Lessons from School systems that improved their education systems for better learning outcomes

Countries have been using the results from national and international learning assessment studies and lessons from top performing /improving countries to reform education quality and achieve better learning outcomes. A classic example is from the USA. In 2009, the then US President Barack Obama launched one of the world's most ambitious education reform agendas, titled "Race to the Top", which encouraged US states to adopt internationally benchmarked standards and assessments that prepare students for success in education and in jobs: recruit, develop, reward, retain effective teachers and principals, build data systems that measure student success; and inform teachers and principals how they can improve their practices and turn around their lowest performing schools²⁴. In Obama's words, "Better standards. Better teaching. Better schools." The focus was on breaking down silos that in the past had led to fragmented and isolated educational improvements in favor of making inter-connected improvements simultaneously in four core areas²⁵:

- Establishing high, challenging learning standards aligned with readiness for college and careers and transforming instructional practices to enable students to meet the more challenging expectations.
- Developing and supporting effective teachers and leaders.
- Creating data systems and using technology to inform and enhance instruction.
- Turning around the lowest-performing schools.

²⁴ <https://www2.ed.gov/programs/racetothetop/index.html>

²⁵ Department of Education, Overview Information: Race to the Top Fund: Notice Inviting Applications for New Awards for Fiscal Year (FY) 2010, 74 Fed. Reg. 59836 (Nov. 18, 2009). Department of Education, Overview Information; Race to the Top Fund; Notice Inviting Applications for New Awards for Fiscal Year (FY) 2010, 74 Fed. Reg. 19496 (Apr. 14, 2010).

The OECD (2011) had come up a detailed analysis and report drawing lessons from education systems of selection of top-scoring and rapidly improving countries as measured by the OECD's PISA. This report defined countries as high-performing if: almost all of their students are in high school at the appropriate age, average performance is high and the top quarter of performers place among the countries whose top quarter are among the best performers in the world with respect to their mastery of the kind of complex knowledge and skills needed in advanced economies as well their ability to apply that knowledge and those skills to problems with which they are not familiar (OECD, 2011). The OECD report presented several country examples. Some of the evidences from the report is summarized below.

Ontario, Canada

Consistent application of centrally-driven pressure for higher results, combined with extensive capacity building and a climate of relative trust and mutual respect, have enabled the system to achieve progress on key indicators. The success of Canada in PISA was attributed to factors such as: culture, welfare state's efforts and three policy-specific factors: teacher selectivity, equalized funding and provincial curricula.

Canadian applicants to teachers' colleges are in the "top 30%" of their college cohorts. Canada has established a province-wide curriculum. Education funding is a provincial responsibility and transfer of funds to local governments is generally of three types: (i) block grants based on the student size; (ii) categorical grants which are either used to fund particular programmatic needs or help local governments to meet specific challenges in providing basic services such as remote area transportation grants; and (iii) equalization funding which is used in to support poorer districts.

Shanghai and Hong Kong, China

In China, the improvements in education is attributed to the following factors: (a) continuous curriculum reforms, particularly aimed at moving away from pure knowledge transmission towards fostering learning attitudes and values; (b) enhancing student engagements in classrooms; (c) existence of a "remedial system" of education as well as a "supplementary system of education, promoting participation in extra-curricular activities; (d) reforms in teaching practice/ pedagogy, with more student-centric activities related to teachers' lecturing; (e) enhancing teacher salary scales to bring it up on the ladder or preferred occupations; and (f) redesigning examinations and assessment systems. However, one noteworthy efforts in Shanghai is related to improving the school system by converting "weaker schools" to stronger schools, by (i) introducing school renovations, (ii) financial transfer payment, which is the mobilization of public funding with positive discrimination; (iii) transferring teachers from urban to rural schools and vice versa; (iv) pairing of urban and rural districts in order to promote innovation, cross fertilization of best practices and capacity building; (v) allowing good performing public schools to take over the administration of weaker schools and improve weaker schools; and (vi) establishing a consortium of schools where schools of different performance levels are allowed to work together and plan the improvements.

In **Shanghai, China**, government introduced curricular reforms in 1990s with a view to broadening students' learning experiences and developing capacity rather than mere accumulation of information and knowledge. Shanghai also introduced "neighborhood school attendance" initiatives with the schools and teachers obliged to handle students from diverse backgrounds and different abilities. Shanghai also abolished public examinations at the end of primary schooling, thus reducing the primary education from the pressures of examinations and facilitated more innovative and creative approaches to teaching and learning to flourish. Shanghai also raised the bar for entry to the teaching profession - all primary school teachers must have a diploma and all teachers in secondary schools are degree-holders with professional certification. Shanghai also insisted on continuous professional development programme for teachers - every teacher is expected to engage in 240 hours of professional development within five years.

One of the most ambitious strategies that Shanghai introduced was to get the strong-performing schools to help weaker schools. This was done in various ways, including "pairing" a strong school with a weaker school; or creating a consortium in which a number of schools in a specific area are grouped in a cluster with a strong school at the core. This helped to draw on the strengths of best performing schools as these best performing schools were required to take responsibility and leadership in raising the standards and performance of the paired weaker schools.

Hong Kong's education reforms happened over a long period of time, which benefited from better preparations and good management. The result was a new design for education in Hong Kong, focused on preparing students for a 21st century economy. The exams following primary school were abolished and a new curriculum developed, shifting schools from rote learning designed to enable students to pass exams to curriculum and teaching designed to encourage real learning and active engagement. In Hong Kong, curricular reforms were introduced with the document – "Learning to Learn", which emphasized a shift from rote learning to process of learning as an active construction by learner.

The planners focused on education for understanding rather than the accumulation of facts or the performance of procedures: the goal was to create learning experiences for students that would enable them to acquire and demonstrate understanding by applying what they were learning through the use of real-life situations as part of the instructional process. Reforms to teacher and school leader training have ensured that Hong Kong has educators with the knowledge and skills to prepare students to reach these goals.

Finland

Finland has been one of the world's best performing education systems as per the PISA results since 2000. Finland's education system is also characterized by slow and steady reforms for consistently higher results. Finland has narrow inequities between schools as well as within schools, between students differing family backgrounds. The Finnish story was the result of a long, slow, and steady process, not the result of a single policy, programme, or administrative reforms. Each step in the development of the modern Finnish education system built sensibly

on those that went before, from the creation of a unified comprehensive education structure, to national curriculum guidelines, to a restructuring of teacher education, with responsibility for teacher training moving to Finland's universities.

The possible factors for Finland's success include: political consensus to educate all children together in a common school system; an expectation that all children can achieve at high levels, regardless of family background or regional circumstances, single-minded pursuit of teaching excellence; collective school responsibility for teachers who are struggling, modest financial resources that are tightly focused on the classroom and a climate of trust between educators and community.

Finland has achieved all these by decentralizing the education systems, introducing flexible modular structures, providing teachers the freedom to design their curriculum and choose text books and a high degree of personal responsibility for results. These reforms were complemented by strong community support and interventions, including their approach to accountability, curriculum, instruction and school management.

A particular feature of the Finnish system is the "special teacher." This is a specially trained teacher assigned to each school whose role is to work with class teachers to identify students needing extra help, and then work individually or in small groups with these students to provide the support they need to keep up with their classmates.

Japan

Japan's success is attributed the following factors: (a) shared belief that education is the key to the country's future; (b) a coherent and focused curriculum; (c) efforts and expectations; (d) organization of instruction; (e) a first-rate teaching force, and professional development efforts of teachers; (f) family support for students at home, (g) use of social capital as a powerful accountability mechanism; and (h) the way resources are focused on instruction and the strong incentives the system provides for students to take tough courses and study hard in school. The school curriculum in Japan is very coherent, focusing on core topics with clear goals of fostering deep conceptual understanding. Teachers are provided with considerable autonomy in using curriculum. The system has a great deal of inherent accountability.

Singapore

Education has been central to the building of both the economy and the nation in the country. The country's success in international assessments are often attributed to the following: (a) a clear vision and belief in the centrality of education for students and the nation; (b) persistent political leadership; (c) alignment of the education system to economic development goals; (d) coherence of the education system; (e) a focus on building high quality teacher and leadership to deliver reforms at the school level; (f) clear goals, rigorous standards and assessments; (g) curriculum, instruction and assessment matched with standards; (h) strong central capacity and authority to act; (i) strong accountability mechanism; (j) meritocratic values; and (k) a culture of continuous improvement and future orientation that adapts from proven practices from abroad.

Brazil

The lessons from Brazil's experience of education reforms and improvements post-PISA results could be summarized as follows: (a) strong commitment to education and children; (b) cultural support for universal high achievement; (c) using national and international benchmarking to focus their efforts and establish tools to improve education systems; (d) achieving system coherence and alignments, in spite of being a federal system; (e) reforming teacher education and professional development; (f) reforms in curriculum and instructional practices; (g) strong equity orientation in the distribution of resources; and (h) incentives for learning for students and schools.

The McKinsey & Company (2010)'s report on improved school systems

The McKinsey & Company (2010) examined the trajectory of several countries in quality of education in their report titled "How the World's Most Improved School Systems Keep Getting Better". McKinsey & Company (2010) identified two different types of interventions carried out by improving school systems:

1. Interventions that are appropriate to a specific stage of performance and contextualized;
2. Interventions that apply equally during all stages, but manifests differently in each stage.

The report identified the following performance stages that an education system/ country goes through:

- **"Poor to fair"**: During this stage, countries try to achieve basic literacy and numeracy for its children
- **"Fair to good"**: In this stage, countries focus on getting the foundations in place
- **"Good to great"**: countries focus on shaping their teaching professionals and
- **"Great to excellent"**: This stage involves improving through peer support and many innovations.

The table below shows these journey in detail:

Table 30: How the World's Most Improved Systems Keep getting better (McKinsey& Company, 2010)		
Theme	Description	Examples
<i>"Poor to fair" journeys focus on achieving basic literacy and numeracy</i>		
Providing scaffolding and motivation for low skill teachers and principals	<ul style="list-style-type: none"> • Scripted lessons: The system creates instructional objectives, lesson plans, and learning materials for daily lessons to enable teachers executing lessons rather than devising them • Coaching on curriculum: The system creates a field force of coaches to visit schools and work with teachers in-class on effectively delivering the curriculum 	<ul style="list-style-type: none"> • Prescriptive teaching materials • Technical skill-building • External coaches • School visits by center • Instructional time on task

	<ul style="list-style-type: none"> • Incentives for high performance: The system gives rewards (monetary and prestige) to schools and teachers who achieve high improvement in student outcomes against targets • School visits by center: The system's central leaders/administrators visit schools to observe, meet and motivate staff, and discuss performance • Instructional time on task: The systems increases student instructional time 	
Getting all schools to minimum quality standard	<ul style="list-style-type: none"> • Targets, data, and assessments: The system sets minimum proficiency targets for schools/ students, frequent student learning assessments (linked to lesson objectives, every 3-4 weeks), and data processes to monitor progress • Infrastructure: The system improves school facilities and resources to a minimum threshold adequate for attendance and learning • Textbooks and learning resources: The system provide textbooks and learning resources to every student • Supporting low performing schools: The system funds targeted support for low performing schools 	<ul style="list-style-type: none"> • Outcome targets • Assessments • Data systems • School infrastructure improvement • Provision of textbooks • Additional funding for low performing schools
Getting students in seats	<ul style="list-style-type: none"> • Expand seats: The system increases school seats to achieve universal access • Fulfill students' basic needs: The school provides for student basic needs to ensure that more students attend school and that absenteeism declines 	<ul style="list-style-type: none"> • Meeting basic needs (meals, clothing, transportation, toilets) • Increase student seats
"Fair to good" journeys emphasize getting the system foundations in place		
Data and accountability foundation	<ul style="list-style-type: none"> • Transparency and accountability: The system establishes student assessments and school inspections to create reliable data on performance and to hold schools accountable for improvement • Improvement areas: The system uses this data to identify and tackle specific areas (e.g., subjects, grades, gender) with lagging performance 	<ul style="list-style-type: none"> • Student assessments • Transparency to schools and/or public on school performance • School inspections and inspections institutions
Financial and organizational foundation	<ul style="list-style-type: none"> • Organization structure: The system takes steps to make the school network shape 	<ul style="list-style-type: none"> • Optimization of number of schools or teachers

	<p>and governance manageable, and to delineate decision rights accordingly</p> <ul style="list-style-type: none"> • Financial structure: The system establishes an efficient and equitable funding allocation mechanism for schools 	<ul style="list-style-type: none"> • Decentralizing financial and administrative rights • Increasing funding and changing allocation model • Organizational restructuring
Pedagogical foundation	<ul style="list-style-type: none"> • Learning model: The system selects a learning model consistent with raising student capabilities, and designs the necessary supporting materials for this new model (e.g., standards, curriculum, textbooks) 	<ul style="list-style-type: none"> • School model (number of years students spend at each education level) • Streams/tracks based on student outcomes and academic focus • Language of instruction
<i>“Good to great” journeys emphasize shaping the professional</i>		
Raising caliber of entering teachers and principals	<ul style="list-style-type: none"> • Recruiting: The system raises the entry bar for new teacher candidates • Preparation and induction: The system raises pre-service training quality and certification requirements 	<ul style="list-style-type: none"> • Recruiting programs • Pre-service training • Certification requirements
Raising caliber of existing teachers and principals	<ul style="list-style-type: none"> • Professional development: The system raises professional development requirements and provides more opportunities for self-, peer-, and center-led learning and development. • Coaching on practice: Instructional coaches work with teachers to strengthen their skills in areas such as lesson planning, student data analysis, and in-class pedagogy • Career pathways: The system creates teacher and leadership specializations through career pathways, raising expectations with each successive pathway rung and increasing pay accordingly 	<ul style="list-style-type: none"> • In-service training programs • School-based coaching • Career tracks • Teacher community forums
School-based decision making	<ul style="list-style-type: none"> • Self-evaluation: The systems cultivates ownership in schools for improvement through introducing self-evaluation for schools and making performance data more available • Flexibility: The system gives schools the flexibility to pursue specialized programs appropriate to their students, and increasingly decentralizes pedagogical rights 	<ul style="list-style-type: none"> • Self-evaluation • Data systems • Independent and specialized schools
<i>“Great to excellent” journeys emphasize learning through peers and innovation</i>		
Raising caliber of entering teachers and principals	<ul style="list-style-type: none"> • Learning communities: The system facilitates school-based learning communities to create peer-led support and accountability to each other 	<ul style="list-style-type: none"> • Collaborative practice amongst educators • Decentralizing pedagogical rights to schools and teachers

	<ul style="list-style-type: none"> • Flexibility: The system provides effective educators with greater pedagogical autonomy • Rotations: The system rotates educators throughout the system in order to spread learning and varied styles of mentorship 	<ul style="list-style-type: none"> • Creating rotation and secondment programs across schools, and between the center and schools
Creating additional Support mechanisms for professionals	<ul style="list-style-type: none"> • Leverage: The system provides administrative staff in schools so that teachers and principals can focus on pedagogy and leadership rather than administrative tasks 	<ul style="list-style-type: none"> • Providing additional administrative staff
System-sponsored innovation across schools	<ul style="list-style-type: none"> • Stakeholder innovation: The system sponsors and identifies examples of innovative practices in schools (teaching and learning practice, parent/community involvement practices, etc.) and then develops mechanisms to shares these innovations across all schools 	<ul style="list-style-type: none"> • Sharing innovation from the front-line • Funding for innovation

Source: McKinsey & Company (2010)

The cross-stage interventions that McKinsey & Company (2010)'s analysis identified comprise a group of six actions that occur with equal frequency across all performance stages, but manifest differently in each one. These six interventions are:

- **Technical skill building:** Strengthening professional development for new and tenured teachers and principals.
- **Student assessment:** assessing students at the regional or national level for various grades and subjects.
- **Data systems:** gathering, analyzing, and sharing data on system performance (schools, students, educators, geographic areas), and using data as a tool to direct the allocation of system support.
- **Revised standards and curriculum:** defining what students should know, understand, and be able to do, and creating the accompanying teaching content.
- **Teacher and principal compensation:** introducing a reward schemes for high performance, and structuring teacher and principal compensation in accordance with the role they play.
- **Policy documents and education laws:** facilitating the improvement journey by articulating the aspirations, objectives, and priorities of the reform program.

Importance of reviving a holistic approach to school quality and children's development outcomes

The lessons from OECD study (2011) of “strong performers and successful reformers” as well as the McKinsey study (2010) tells how countries focused on a “production function” as well as “learning outcome” approach. However, an important approach that focused on holistic development of children with a right to quality education and learning needs to be discussed for its relevance for low or lower middle-income countries where education quality cannot be isolated from school and family context. UNICEF’s child-friendly school (CFS) models as comprehensive ways of dealing with all factors affecting quality assumes relevance in this context.

The CFS framework is for rights-based, child-friendly education systems and schools that are characterized as "inclusive, healthy and protective for all children, effective with children, and involved with families and communities - and children" (Shaeffer, 1999). They represent pragmatic pathways towards quality in education that have evolved (and are still evolving), from the principle of education as a human right to a child-centered ideology that regards the best interest of the child as paramount at all times. This makes the child central to the educational process and the main beneficiary of key decisions in education. As for scope, CFS models embrace a concept of quality that goes well beyond pedagogic excellence and performance outcomes. The focus is on the needs of the child as a whole, not just on the ‘school bits’ that educators traditionally feel responsible for. The scope of a CFS model includes multidimensional coverage of quality and a holistic concern for the child’s needs.

Within the CFS framework:

- The school is a significant personal and social environment in the lives of its students. A child-friendly school ensures every child an environment that is physically safe, emotionally secure and psychologically enabling.
- Teachers are the single most important factor in creating an effective and inclusive classroom.
- Children are natural learners, but this capacity to learn can be undermined and sometimes destroyed. A child-friendly school recognizes, encourages and supports children's growing capacities as learners by providing a school culture, teaching behaviour and curriculum content that are focused on learning and the learner.
- The ability of a school to be and to call itself child-friendly is directly linked to the support, participation and collaboration it receives from families.
- Child-friendly schools aim to develop a learning environment in which children are motivated and able to learn. Staff members are friendly and welcoming to children and attend to all their health and safety needs.

In pursuit of quality, therefore, CFS models cut across sectors to address the child's needs comprehensively. Within this intersectoral and holistic framework, CFS models are concerned as much with the health, safety, security, nutritional status and psychological well-being of the child as they are with teacher training and the appropriateness of the teaching methods and learning resources used for schooling. They have as much to do with promoting child participation and creating space for children to express their views and opinions as they do with helping children learn to follow rules and regulations or show deference to school authorities. Quality in these models comes not only from the efficiency of setting the school apart in a special place as a community that pursues learning, but also from the effectiveness of linking the school to a wider community from which it derives its sense of engagement with reality and confirms the relevance of its curriculum.

Uzbekistan: Way Forward

The results from the study point towards the challenges, yet the opportunities for Uzbekistan to further improve quality of education in the country. Based on the lessons from the achievements of several countries in reforming different aspects of education, Uzbekistan may identify the right reforms suited for the country. Some of the non-negotiable reforms the country should focus on include:

- Reforming the curriculum, pedagogy and instructional time.
- Reforming National Assessment Surveys (NAS) to check the health of the education system quality
- Reforming various aspects of teacher workforce development.
- Creating a friendly and enabling environment in school for learning through initiatives like the “Child Friendly Schools”
- Focus on school community, including parents and family of students in creating more awareness and accountability about school outcomes
- Focus on improving the “poor schools” – both resource-wise as well as performance-wise.
- Most importantly, strengthen the monitoring and evaluation system of the sector – both by strengthening the administrative data collection as well as carrying out continuous and comprehensive studies and evaluations on various aspects of education so that planning and programming is more evidence-based. “What gets measured, gets done” – systematic, standardized assessment and data keep you focused – because the information helps to have more evidence-based decision making. Uzbekistan needs to transform its Education Management Information System (EMIS) from its rudimentary stage to a more robust one to facilitate this.

This study also points out several gaps in empirical evidence in the country regarding quality of education. There is a need to explore and understand some of these issues in detail. This include:

Study on instructional time and quality: Learning effectiveness depends on what tasks students and teachers do in classrooms, how they do them and how much time is spent doing them. Research shows that at the primary level, effective learning time, class organization and management, teaching strategies and instruction, assessments and teacher expectations are significant factors in improving student performance (Stallings, 1985).

Exploring Teacher Quality Further: Teacher quality is difficult to define and measure. It depends not only on observable characteristics – education, training and experience, but also on the behavior of teachers and the nature of their interaction with children inside classrooms. Teacher training, pedagogical support system, recruitment standards and pay relative to equivalent professional groups determine both the kinds of people who become teachers and their incentives and motivation to perform within the system. Policy makers will have to think about and initiate changes along these dimensions to improve teacher effectiveness to attain acceptable learning outcomes. (Goyal, 2009). As a monitoring and evaluation strategy, impact evaluations of innovations in these areas can be useful in knowing which strategies are effective and cost-efficient.

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