DECEMBER 2020

DISCUSSION PAPER SERIES NO. 2020-57

Correlates of Test Performance of 15-year-old Students in the Philippines: Evidence from PISA

Aniceto C. Orbeta Jr., Kris Ann M. Melad, and Maropsil Potestad

CONTACT US:

RESEARCH INFORMATION DEPARTMENT
Philippine Institute for Development Studies

18th Floor, Three Cyberpod Centris - North Tower
EDSA corner Quezon Avenue, Quezon City, Philippines

publications@mail.pids.gov.ph
(+632) 8877-4000

https://www.pids.gov.ph

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Aniceto C. Orbeta Jr.
Kris Ann M. Melad
Maropsil Potestad

PHILIPPINE INSTITUTE FOR DEVELOPMENT STUDIES

December 2020
(Updated January 2021)

Abstract

To provide evidence on the drivers of the quality of education in the country, this study focuses on the correlates of test performance of 15-year-old students in the Philippines. It aims to quantitatively measure the roles of individual, family, and school characteristics in test performance. It uses the 2018 Program for International Student Assessment (PISA) which include a rich set of student, family, and school characteristics. In addition to the average relationship between the variables provided by ordinary least squares, it also provides an analysis for high and low performing students using quantile regressions. The estimation results show that, in terms of individual characteristics, there is consistent negative correlation between grade repetition, age at start of primary schooling and incidence of bullying and test scores across mathematics, science and reading. For household characteristics, parental occupation and emotional support are positively correlated with test scores. For school characteristics, disciplinary climate provided a consistent positive correlation with test scores. In addition, to these results the paper also found puzzling results that require in-depth studies. The paper also provided recommendations in the light of the estimation results.

Keywords: test scores, PISA, basic education, correlates, K to 12, test performance, junior high school

Table of Contents

1. Introduction 5

2. Literature review 7

2.1. Global strategies to measure learning outcomes 7
2.2. National assessments in the Philippines 7
2.3. International and regional large-scale assessments 8
2.4. 2018 PISA Results: Philippines 9
2.5. Estimation methods 12

3. Methodology and data 14

3.1. Conceptual considerations 14
3.2. Estimation method 15
3.3. Data source 15
3.4. Measures of outcomes 16
3.5. Variables 16

4. Results and findings 17

4.1. Descriptive statistics 17
4.2. Estimation results 19

5. Summary and recommendations 24

5.1. Summary 24
5.2. Recommendations 25

6. Bibliography 26

Appendix A. Definition of Variables 29

List of Tables

Table 1. Education 2030 target 4.1 and indicator 4.1.1. under SDG 4 7
Table 2. Comparison of international and regional assessments, as of 2015 8
Table 3. Descriptions of international and regional assessments, as of 2015 9
Table 4. Estimation variables 16
Table 5. Descriptive statistics 17
Table 6. OLS, and quantile and estimation results; Output: Mathematics 20
Table 7. OLS, and quantile and estimation results; Output: Science 22
Table 8. OLS, and quantile and estimation results; Output: Reading 23

List of Figures

Figure 1. Mean scores of the participating ASEAN countries and OECD in Overall Reading Literacy 10
Figure 2. Percentage distribution Filipino students in Overall Reading Literacy by proficiency level 10
Figure 3. Mean scores of the participating ASEAN countries and OECD in Mathematical Literacy 11
Figure 4. Percentage distribution Filipino students in Overall Mathematical Literacy by proficiency level 11
Figure 5. Mean scores of the participating ASEAN countries and OECD in Scientific Literacy 12
Figure 6. Percentage distribution Filipino students in Overall Scientific Literacy by proficiency level 12

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1. Introduction

High quality education is an immensely popular objective of global and national educational systems. The Philippine constitution explicitly talks about quality and access to education. Article XIV, Section 1 of the 1987 Constitution of the Republic of the Philippines stipulates that "the State shall protect and promote the right of all citizens to quality education at all levels and shall take appropriate steps to make such education accessible to all." Quality education is also at the heart of the Sustainable Development Goal (SDG) 4. The United Nations (2019) aptly highlighted that on a global scale, "despite the considerable progress on education access and participation over the past years, 262 million children and youth aged 6 to 17 were still out of school in 2017" (p. 33), and "more than half[1] of children and adolescents are not meeting minimum proficiency standards in reading and mathematics" (p. 32). It also argued that despite the promise of the SDG 4 to provide 12 years of quality education for all, "many are not learning at the appropriate grade level" (UNESCO 2016).

The Philippines' vision of inclusive growth and development that encourages focus on inclusive education has seen notable gains in the education access and participation particularly for basic education over the past decades. Interestingly, the Education for All 2015 National Review Report: Philippines (UNESCO, 2015) highlighted that the country's basic education quality "has been improving". It is important to note, however, that this trend of improving mean percentage scores based on the National Achievement Test (NAT) results from School Year (SY) 2005-2006 to SY 2012-2013 continued to stay a few percentage points behind the 75 percent mastery target over the eight-year period.

There has been numerous pieces of research on the country's education system tackling pertinent policy issues including out-of-school youth, universal access to primary education, alternative learning system, early childhood care and development among many others. But there is a glaring lack of research that directly addresses a recurring theme on basic education: *Where are we in terms of the quality of education? What do we do to improve the education quality?*

In a long-standing call for reforms to improve the quality of basic education, the K to 12 Program was officially introduced through Enhanced Basic Education Act of 2013 (RA 10533) which codified the proposed reforms at the time with the promise of a more relevant and responsive curriculum. Interestingly since 2018, the Senate has been quite resolute in pushing for a comprehensive performance review of the education system across all levels in the country. Since March of 2019, the Senate Committee on Basic Education, Arts and Culture has

* Senior Research Fellow, Supervising Research Specialist and Research Analyst, respectively, at the Philippine Institute for Development Studies. Opinions expressed here are of the authors and not necessarily of the Institute.

[1] At 617 million, and with 750 million adults still remain illiterate of which two-thirds are women based on SDG Report 2019 (https://unstats.un.org/sdgs/report/2019/).

put forward inquiries[2] on the state of the country's basic education, underscoring the status of the quality of the education system. One pressing concern is the impression that the country continues to do poorly in basic education despite the surge in the allocated budget of which spending has been primarily focused in addressing challenges in access and lack of resources over the years.

This concern was heightened by the release last December 2019 of the results of the 2018 Programme for International Student Assessment (PISA) of the Organisation for Economic Co-operation and Development (OECD)[3]. The performance of the country in the recent PISA confirms the unexpressed suspicion that there is a long-standing problem of quality of education in the country. Among 79 high- and middle-income countries, the country was last in reading, and second to the last in Mathematics and in Science.

In a subsequent statement[4] released by the Department of Education (DepEd), it recognized the gaps in the status of the country's basic education and highlighted Sulong Edukalidad, a national effort aggressively towards a quality basic education. The strategy consists of four components, namely, (1) K to 12 curriculum review and update, (2) improving learning environment, (3) teacher upskilling and reskilling, and (4) engagement of stakeholders for support and collaboration.[5]

Literature tells us that the quality of any education system is indeed an interplay of several factors including individual and household factors; school inputs such as curriculum, learning environment, teachers; and community support. As a modest attempt to contribute to better understanding what drives test performance of Filipino students, this study focuses on the correlates on student performance measured by test scores. It aims to (i) quantitatively measure the importance of select individual, family and school characteristics in the test performance of students, and (ii) compare correlates of test scores for high and low performing students.

An important limitation of the study is the unavailability of data on performance by level as PISA assesses only 15-year-old students, equivalently junior high school students in the country. Another limitation is that the study also focuses on contemporaneous correlation of test scores and its correlates rather than estimating causal relationships.

The paper is organized as follows. Section 2 describes global and local assessments. Section 3 details the methodology and data. Section 4 provides the results and findings. Finally, Section 5 provides the summary and recommendations.

[2] Full video coverage of the March 6, 2019 session is accessible at https://www.youtube.com/watch?v=zBZUJ6mEl44.
[3] More recently, the 2019 Trends in International Mathematics and Science Study (TIMSS) results where the Philippines participated for Grade 4 Students was also released. The results are similar with the Philippines the last among 64 participating countries in mathematics and science. The raw data for this test, however, has not yet been released as of the writing of this paper.
[4] https://www.deped.gov.ph/2019/12/04/statement-on-the-philippines-ranking-in-the-2018-pisa-results/
[5] https://www.deped.gov.ph/2020/02/14/sulong-edukalidad-a-move-to-innovate-ph-education-says-briones/

2. Literature review

2.1. Global strategies to measure learning outcomes

In terms of global indicator framework, of the five out of ten education targets focusing on learning outcomes under the SDG 4, target 4.1 focuses on the measures of quality of learning in primary and secondary education. Indicator 4.1.1 particularly requires a tracking of the proportion of the children and young people at three points in the basic education, as detailed in Table 1. This indicator is ideally tracked in the Philippines through ELLNA, NAT, and BEEA, respectively, which are described in section 2.2.

Table 1. Education 2030 target 4.1 and indicator 4.1.1. under SDG 4

TARGETS		INDICATORS	
4.1	By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes	4.1.1	Proportion of children and young people: (a) in grades 2/3; (b) at the end of primary; and (c) at the end of lower secondary achieving at least a minimum proficiency level in (i) reading and (ii) mathematics, by sex

Source: United Nations Statistics Division (n.d.)

The UNESCO Institute of Statistics (UIS) (2016), nonetheless, acknowledges that despite many countries conducting learning assessments, there is still "no way to compare results on a global scale". Key to the many challenges in measuring quality education is the variability in education data sources having different sets of criteria and classifications.

In terms of country participation in international and regional assessments, data show that American, Russia and Europe have the most experience while Africa and Asia have the least (UNESCO 2016).

In terms of a global status of quality learning, what is known so far from the progress data of the SDG 4 (UNESCO 2016) is that several children leave school without basic grasp of reading and mathematics.

2.2. National assessments in the Philippines[6]

The national assessments on basic education, as listed below, is administered by the Bureau of Education Assessment (BEA) of the DepEd. These are said to determine if the learners are meeting the standards of education in each of the four key stages[7] in the K to 12 program, or as deemed required by special cases[8].

[6] See also DO 55, s. 2016 or Policy Guidelines on the National Assessment of Student Learning for the K to 12 Basic Education Program, accessible at https://www.deped.gov.ph/wp-content/uploads/2016/06/DO_s2016_55-3.pdf.
[7] Stage 1: kindergarten to grade 3; Stage 2: grade 4 to grade 6; Stage 3: grade 7 to grade 10; Stage 4: grade 11 to grade 12.
[8] See items d to f.

a. the **Early Language Literacy and Numeracy Assessment (ELLNA)** for Grade 3 students. This has replaced the Language Assessment for Primary Grades (LAPG);

b. the **National Achievement Test (NAT)** for Grade 6 and Grade 10 students;

c. the **Basic Education Exit Assessment (BEEA)** for Grade 12 students;

d. the **National Career Assessment Examination (NCAE)** for Grade 9 or Grade 10 students;

e. the **Accreditation and Equivalency (A&E) Tests** for learners in the alternative learning system and the non-formal education programs, Grade 6 and Grade 10;

f. the **Philippine Education Placement Test (PEPT)** for learners in special circumstances in any grade level.

It is important to note, however, that with K to 12 basic education reform, these tests have been redesigned to specifically assess if the students are indeed acquiring the 21st century skills, except for BEEA which was only administered nationwide starting 2017 and is not a requirement for graduation.

In the Philippines, the DepEd Bureau of Curriculum Development (BCD) is mandated to create National Curriculum Framework and Standards Development, and Curriculum Policy Formulation. Its 2022 goals include a range activities and enhancements from review and enhancement of the existing K to 12 curriculum to establishing of new centers of excellence for special programs in foreign language, among many others. The bureau alone aims to release 12 new policies within the fiscal year 2019, and is still finalizing at least 18 policies more for their 2022 targets.[9] These are all in hope to adapt to the fourth industrial revolution, while "continuing" to monitor the quality of education adhering to the three senior high school curriculum exits. As to the discussion on the specific indicators of this "quality" of education, however, no concrete measurement is yet in place.

2.3. International and regional large-scale assessments

Table 2 presents a general comparison of international and regional assessments while Table 3 presents the comparison in the analysis and reporting of these assessments.

Table 2. Comparison of international and regional assessments, as of 2015

Assesment	Classification	Countries	Target Population	Frequency	Content	Coverage	Format	MCQ or CRQ
PISA	International	70	15 year olds	3-year cycle (6)	Not Curriculum-based	Reading and Math	Computer and Paper	Both
TIMSS	International	77	Grades 4, 8	4-year cycle (6)	Curriculum-based	Math and Science	Paper	Both

[9] As discussed during the March 6, 2019 Senate Committee on Basic Education, Arts and Culture hearing.

Assesment	Classification	Countries	Target Population	Frequency	Content	Coverage	Format	MCQ or CRQ
PIRLS	International	49	Grade 4	5-year cycle (3)	Curriculum-based	Reading	Paper	Both
LLECE	Regional	15	Grades 3, 6	No fixed cycle (3)	Curriculum-based	Reading and Math	Paper	Both
SACMEQ	Regional	15	Grade 6	No fixed cycle (4)	Curriculum-based	Reading and Math	Paper	MCQ
PASEC	Regional	10	Grades 2, 6	No fixed cycle (4/5)	Curriculum-based	Reading and Math	Paper / Oral	MCQ

Source: Adapted from Crosswell et al. (2015) as presented in the SDG 4 Data Webinar Series-Part II (UNESCO 2016).

Table 3. Descriptions of international and regional assessments, as of 2015

Assessment	Analytical approach	Proficiency levels	Background data on learning, language, home	Comparable across systems, trends
PISA	IRT (1)	6	Yes	Both
TIMSS	IRT (3)	4	Yes	Both
PIRLS	IRT (3)	4	Yes	Both
LLECE	IRT (R)	4	Yes	Partially
SACMEQ	IRT (R)	8	Yes	Both
PASEC	IRT (2014 onwards)	4 to 5 (2014 onwards)	Yes	2014 onwards

Source: Adapted from Crosswell et al. (2015) as presented in the SDG 4 Data Webinar Series-Part II (UNESCO 2016).
* Item response theory

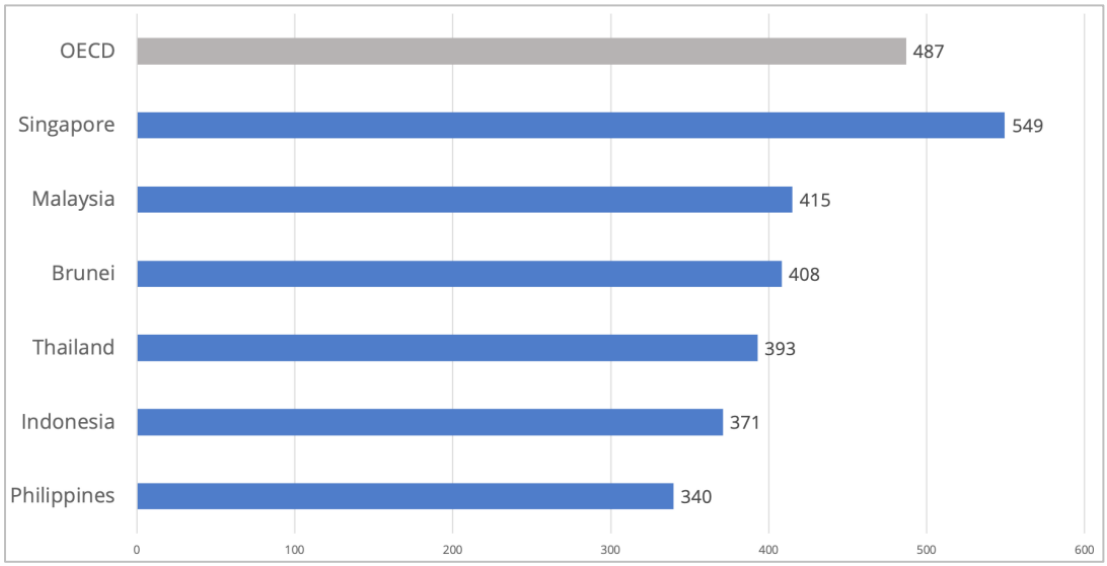
Among all these international large-scale assessments, as of date, the DepEd has participated in PISA in 2018, TIMSS in 2019, and SEA-PLM in 2019. Results were released in December 2019 for PISA, and December 2020 for TIMSS and SEA-PLM.

2.4. 2018 PISA Results: Philippines

A recall of the results of the 2018 PISA released in December 2019 will tell us that overall, the country ranks second to the last in each of the Mathematical and Scientific literacies, and last in Reading literacy among the 79 high- and middle-income countries that participated.

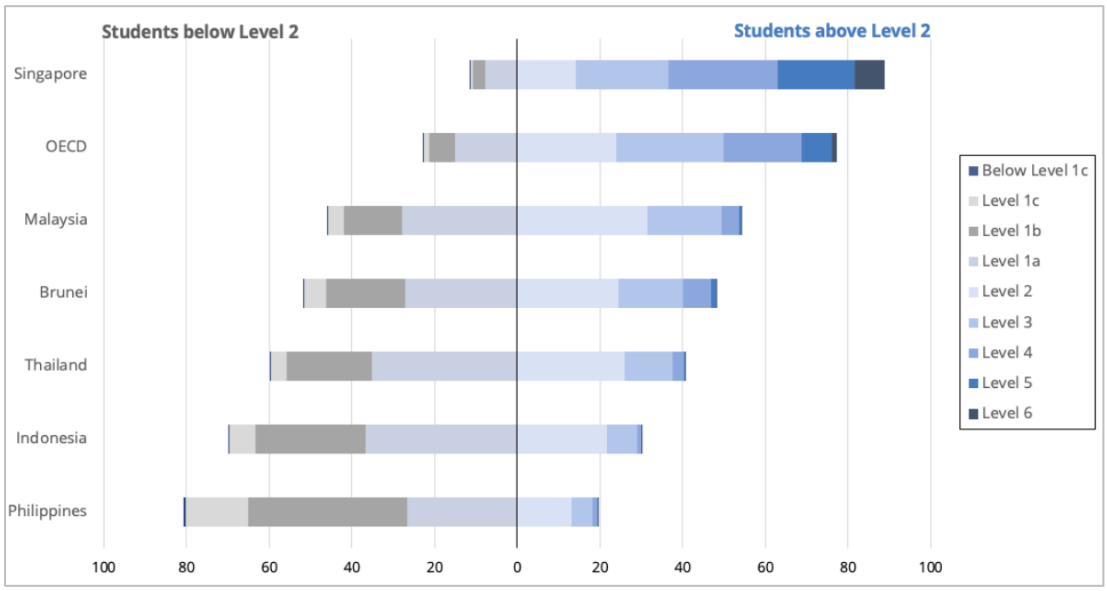
The illustrations in Figures 1 to 6 describes the overall performance of the Philippines in the 2018 PISA in comparison with neighboring countries and the OECD average, as reported by the Department of Education (2019). Figures 1, 3, and 5 tell the story in terms of mean scores while Figures 2, 4 and 6 tells the story in terms of proportion achieving the different levels of proficiency. In terms of mean scores the country scored 340, 353, and 357, in Reading, Mathematics, and Science, respectively. OECD average, on the other hand is 487, 489, and 489, respectively. Zooming into proportions by levels of proficiency the figures 2, 4, and 6 show that 80%, 81%, and 78%, respectively, of the 15-year-old or junior high school Filipino students are below level 2 proficiency.

Figure 1. Mean scores of the participating ASEAN countries and OECD in Overall Reading Literacy



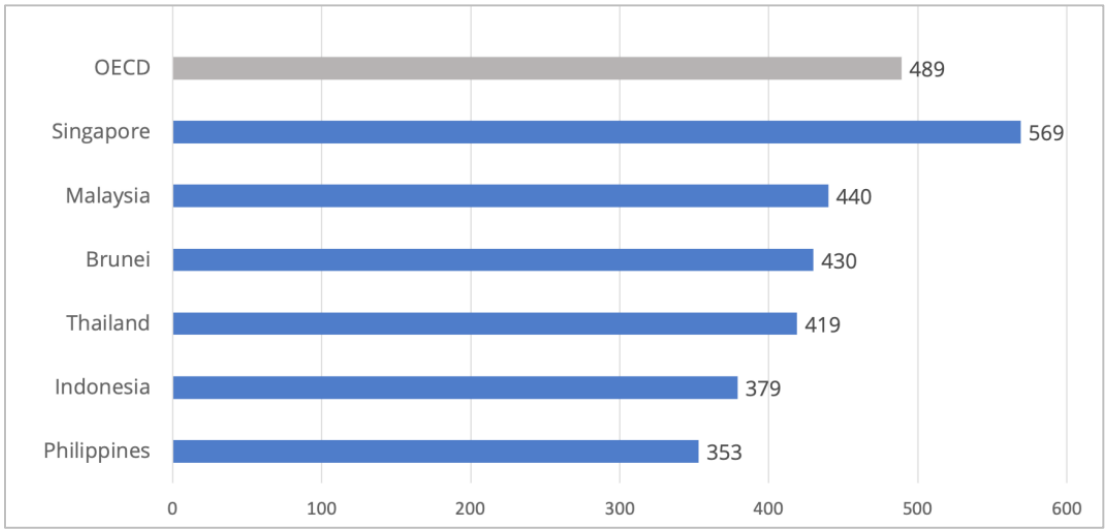
Source: 2018 PISA Results National Report of the Philippines (DepEd, 2019), Figure 4

Figure 2. Percentage distribution Filipino students in Overall Reading Literacy by proficiency level



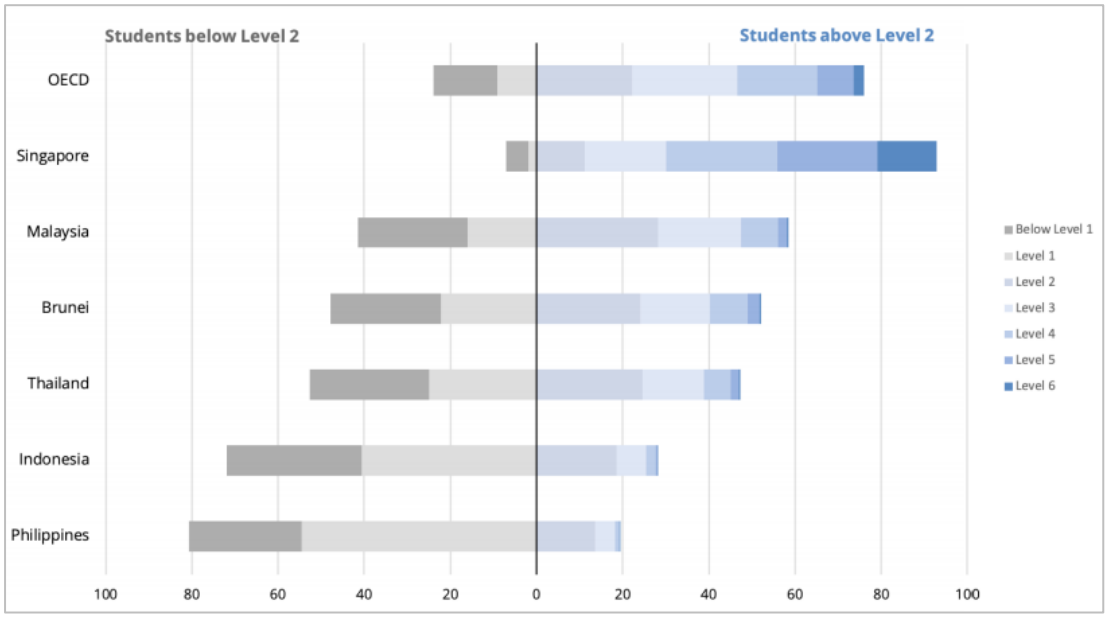
Source: 2018 PISA Results National Report of the Philippines (DepEd, 2019), Figure 5

Figure 3. Mean scores of the participating ASEAN countries and OECD in Mathematical Literacy



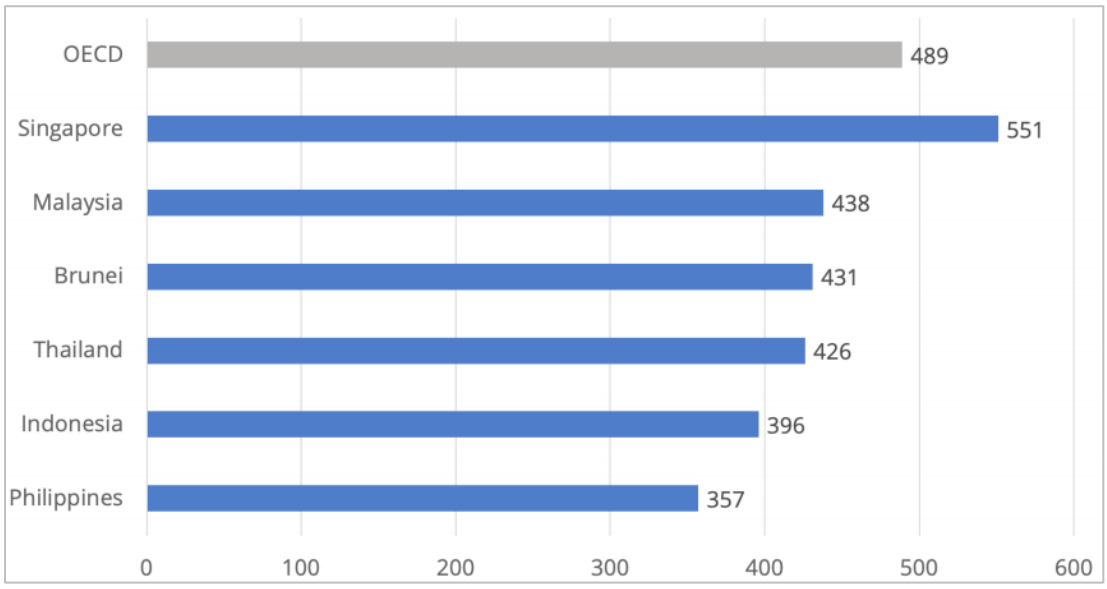
Source: 2018 PISA Results National Report of the Philippines (DepEd, 2019), Figure 17

Figure 4. Percentage distribution Filipino students in Overall Mathematical Literacy by proficiency level



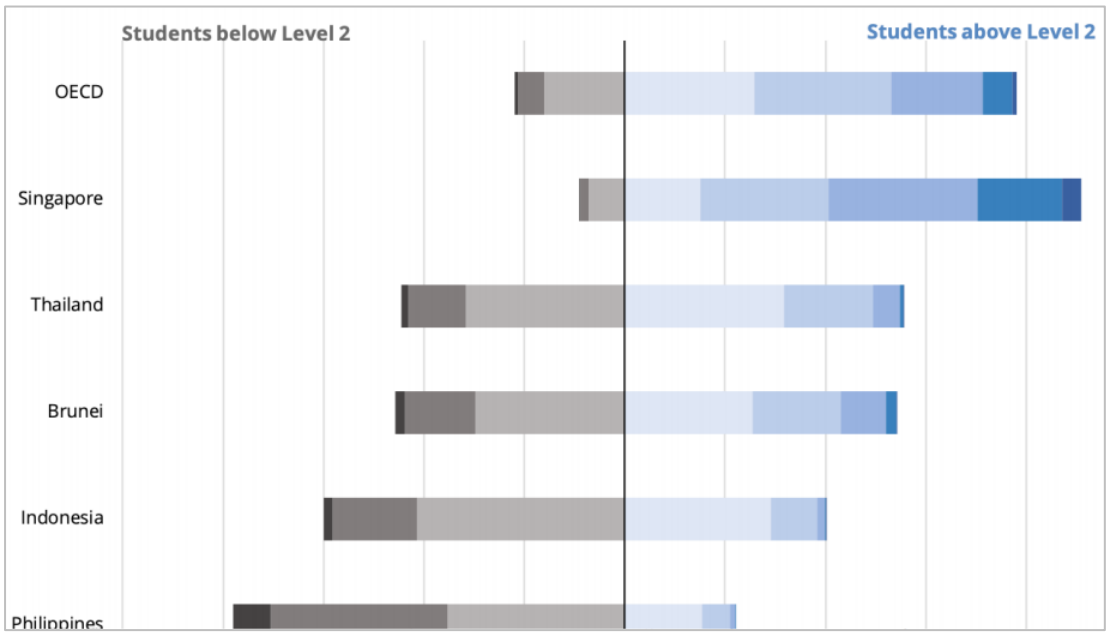
Source: 2018 PISA Results National Report of the Philippines (DepEd, 2019), Figure 18

Figure 5. Mean scores of the participating ASEAN countries and OECD in Scientific Literacy



Source: 2018 PISA Results National Report of the Philippines (DepEd, 2019), Figure 25

Figure 6. Percentage distribution Filipino students in Overall Scientific Literacy by proficiency level



Source: 2018 PISA Results National Report of the Philippines (DepEd, 2019), Figure 26

2.5. Estimation methods[10]

The focus of this study is to study the role of student performance on education quality. In this study we limit measure of education quality to PISA test scores. It should, however, be mentioned that outcomes beyond test scores, such as labor market outcomes and non-labor

[10] Draws heavily from Orbeta (2010).

market outcomes, are recognized in the literature (e.g., Blau, 1996). In fact, measuring impact of education on labor market outcomes is the topic of numerous papers (e.g., Duflo,1999; Card and Krueger, 1992). Non-market outcomes such as better personal health, expanded capacity to enjoy leisure, increased efficiency in job search and other personal choices, are also recognized (Haveman and Wolfe, 1984).

The determinants of test scores include individual, home, school and community level characteristics. One common adage state that "it takes a community to educate a child." The landmark study of Coleman (1966) even reported that once family background of the student is controlled for, there will be little effect of school resources on student test scores. This has been generally supported by several subsequent studies such as Hanushek (1986, 1996, 2003). This assessment, however, is not unanimously accepted (see Hedges et al., 1994 for example). They find significant impact of resource inputs on test scores. Card and Krueger (1992) find that better educated teachers and higher proportion of female teachers are associated with higher rates of returns to education.

On the estimation side, there are several issues in measuring the impact of school inputs on test scores. Hanushek (1979) provides an early discussion of the issues. One issue is the unit of analysis. Ideally analysis should be at the student level. However, student level data is not always available. Other studies aggregate up from the school level all the way to the economy level. There are consequences to aggregation. Hanushek et al. (1996) first brought up the issue of the tendency to have positive impact of school factors at higher levels of aggregation. This, however, comes with the difficulty of interpreting the results especially in the cases where lower-level units have independent choices on resource allocations.

Another important issue is the appropriateness of using levels. It has been argued by many (e.g., Hanushek, 1979) that using levels will disregard the pre-existing differences in achievements when students enter schools and include the same to what one gains while in school. They recommended that a better approach is to relate the gains in achievement to school resources. This is now known as the "value-added" approach. However, the value-added approach has been criticized recently for instance by Bacolod and Tobias (2006) arguing that it presumes that it is equally easy to gain 10 percentage points for low performing as it is for high performing schools. Ultimately the availability of the data decides what estimation method will be adopted.

Still another issue is that students are not randomly assigned into school but rather self-select into schools. Highly motivated parents will likely send their children to schools with smaller class sizes and spend more in the education of their children than low motivated parents (Webbink, 2005). This further complicates the determination of the effects of inputs.

Finally, while the average estimates one gets from a regression on test scores on school, household and community characteristics is informative, researchers have asked the question whether there are heterogeneities in the responses of top and low performing observation units. Among the early attempt at answering this question is done by Eide and Showalter (1998). Using quantile regressions, they find significant differences in responses between low performing and high performing schools based on math scores. The length of school year was

found to be negative and insignificant low performing schools but positive and significant for higher performing schools. Expenditure per pupil was also found to be significant for low performing school but not for high performing schools. School enrollment are significantly positive except for top performing schools. Pupil-teacher ratio and fraction of teachers with advanced degrees have little effect on test scores. Basset, Tam and Knight (2002) analyzing the ACT scores using quantile analysis had similar results on expenditure per pupil and enrollment. In addition, they find that pupil-teacher ratio hurt low performing schools but help high performing schools.

3. Methodology and data

3.1. Conceptual considerations

The underlying framework commonly used in estimating the determinants of education outcomes is the "education production function." It relates education outcomes, such as test scores, with school inputs, individual and household characteristics, as well as community characteristics. There are several challenges to estimating education production function. A recent[11] summary of the issues is provided in Todd and Wolpin (2003). They argued that an achievement production function ca be expressed as

$$T_{ija} = T(X_{ij}^{f}(a), X_{ij}^{e}(a), X_{ij}^{c}(a), \mu_{ij0}, \varepsilon_{ija})$$

where

T_{ija} = achievement of child I in household j at age a

X_{ija}^{f} = vector of parent-chosen input histories at a given age a

$X_{ij}^{e}(a)$ = vector of exogenous inputs histories

$X_{ij}^{c}(a)$ = vector of community factors histories

μ_{ij0} = child endowed mental capacity

ϵ_{ija} = error

The basic idea of the function is that achievement is a cumulative process and is the result of history of family, school and community inputs and innate personal ability. There are at least three challenges in estimating the function, namely: (a) data on inputs are incomplete, (b) μ_{ij0} is not observable, and (c) currently inputs maybe chosen endogenously in response to prior realizations of achievements.

The estimation of the function can be grouped into three: (a) contemporaneous where all historical data are not considered; (b) value-added, the most common, uses the contemporaneous and baseline achievement measure as a proxy for the history of inputs, and

[11] An earlier review of the issues is provided in Hanushek (1978).

(c) cumulative which relates the full history of inputs and unobserved endowment. The final specification is always determined by available data at the time of estimation.

Assuming additive separability and parameters that are non-age varying will yield the following estimable specification:

$$T_{ija} = \boldsymbol{X}_{ija}\boldsymbol{\alpha} + \gamma T_{ija-1} + \eta_{ija}$$

where $\boldsymbol{X}$ is the vector of family, school, and community inputs. Since in the current case there is no lagged test scores, the following will be estimated:

$$T_{ij} = \boldsymbol{X}_{ij}\boldsymbol{\alpha} + \eta_{ij}.$$

This specification boils down to the contemporaneous version of the education production function. Hence, what will be estimated are correlations rather than a causal relationship between test scores and personal, household and community characteristics.

3.2. Estimation method

The study estimates the average relationships of personal, household and school characteristics and test scores using ordinary least squares (OLS). In addition, it also estimates quantiles regressions to generate indications of the differential relationships across different levels of test scores. While the estimate of the average relationship given by OLS estimate is highly informative already, knowing differential relationships for high and low performers enriches the analyses some more. In particular, the OLS estimate gives estimates of the correlation of covariates **X** at the average value of the outcome y, i.e., E(y|**X**). The quantile regressions, on the other hand, estimates the correlation of X across the range of values of y, i.e., for each quantile $\theta, Q(\theta|X) = \alpha(\theta) + X'\beta(\theta)$. Basset et al. (2003) provides an interesting description of the relationship of the OLS and quantile regression estimates. They pointed out that the OLS estimate can be viewed as a summary of all quantile effects, i.e., $\int Q(\theta|X)d\theta = E(y|X)$. This view gives rise to a more nuanced interpretation of the average correlation of y and X. For instance, when one observes that the coefficient of the OLS regression is not significant, this can mean two things, namely: (a) the coefficient is not significant across all values of the dependent variable, or (b) the effects are offsetting across the values of the dependent variable.

3.3. Data source

The study uses the data from the Program for International Student Assessment (PISA) 2018 round where the Philippine participated for the first time. The assessment aims to get a representative sample of in-school 15-year-olds. To be eligible, the student must have enrolled at grade 7 or higher (Schleicher, 2019). The test is in English and was delivered in a two-hour computer based assessment. The sampling was done in two stages with the first stage involved

selecting 187[12] schools from 17 regions proportional to the number of 15-year-old students and the second stage requires selecting 42[13] PISA-eligible students for each school (DepEd, 2019). The Philippine dataset has information at the student level and school level. The teacher module was not implemented in the Philippines for the 2018 round. The data set includes 7,233 students. It has data on personal and household characteristics provided by the student and school characteristics provided by the school principal. The outcomes of interest for this paper are test scores in Math, Science and Reading.

The PISA test has a complex psychometric design. It covers numerous subject areas that would require several hours to complete if all questions are asked of every student. To keep the test into two hours, several test booklets with limited number of test questions are developed. Students are then randomly assigned to complete a test booklet. It then computes 10 imputed values (plausible values) using an item-response-theory (IRT) model based on answers to questions in the test booklet assigned and the background characteristics of the student (Jerrim, et al., 2017)[14]. To consider these features of the survey, the estimation in the paper uses the user contributed Stata routine *repest* (Avvisati & Keslais, 2014) which is a wrapper of native Stata commands that considers the complex nature of the PISA dataset.

3.4. Measures of outcomes

The outcomes of interest of the study are test scores in Mathematics, Science, and Reading. To account for measurement error, data uses ten plausible values for each of the outcomes. Survey weights are used for point estimation, and 80 replicate weights for error estimation. Estimation uses *repest*, which is a wrapper for estimation commands that uses plausible values and replicate weights.

3.5. Variables

Table 4 lists the variables used. Most of the indices are standardized with mean zero centered at the OECD average. Appendix A provides the detailed description of the covariates.

Table 4. Estimation variables

Individual Characteristics	Family Background	School Characteristics
• Age at test • Sex • Grade repetition • Age when started schooling (Grade 1) • Self-rated reading ability • Joy/Like reading	• Highest parental education in years • Highest occupational status of parents • Parental emotional support for student's education	• Student-Teacher ratio • Number of available computers per student • Proportion of available computers that are connected to the Internet • Index proportion of all teachers fully certified

[12] It started with 188 schools. One school was dropped because it did not have PISA-eligible students.
[13] Not all schools are able to make 42 students participate. For instance, one school had as low as 4 students who participated.
[14] Jerrim et at. (2017) provides a good discussion of the of the PISA survey and test design and its implication to estimation.

Individual Characteristics	Family Background	School Characteristics
• Outlook about completion of schooling (college) • Tardiness • Experience of bullying		• Index proportion of all teachers ISCED LEVEL 5A Master • Class Size • Learning time (Math, Science, Reading) • Admission requirement based on academic performance • Disciplinary climate

Source: Authors' compilation.

4. Results and findings

4.1. Descriptive statistics

Table 5 shows the descriptive statistics of the determinants used in the analysis. The full description of the variables is provided in Appendix A.

Individual Characteristics. The age of the responding students ranges from 15.25 years to 16.25 years. Forty-six percent of the respondents are male. Twenty-one percent have repeated at least a grade. The average age of starting primary grade (ISCED 1) is 4.3 ranging from 2[15] to 7. Self-rated reading ability indicates lower that the OECD average while Joy/like reading indicates a bit higher than the OECD average. Thirty-five percent expects to finish college. Seventy percent have been late or skipped class in the last two weeks.

Household Characteristics. The highest educational attainment in years of schooling is almost 13 years. The index values for occupational status ranges from 11.6 to 88.7 with an average 33.9 and the index value for parental emotional support is a little less than the OECD average.

School Characteristics. The student-teacher ratio is 26 and ranges from 1 to 46 while the number of available computers per student ranges from 0 to a little over 2 per student with an average of 0.3. It is also shown that 50% of these computers are connected to the internet. A high 91% of the teachers are certified while about 16% of the teachers have master's degrees. The class size ranges from 13 to 53 with an average of 44. The average minutes learning in math, science and reading is 314 minutes which go as high as 2,400 minutes. Eighty three percent of schools based their admission requirements on academic performance. The disciplinary climate is on average is less than the average for OECD countries.

Table 5. Descriptive statistics

[15] The distribution of the variable has small number with age 2 and modal class of age 4.

Variables	Obs	Mean	Std. Dev.	Min	Max
Individual characteristics					
Age	7,233	15.688	0.288	15.25	16.25
Male	7,233	0.465	0.499	0	1
Grade repetition	7,153	0.210	0.408	0	1
Age when started schooling (Grade 1)	6,932	4.344	0.883	2	7
Self-rated reading ability	6,943	-0.060	0.787	-2.440	1.884
Joy/like reading	7,105	0.537	0.778	-3.210	4.013
Outlook about completion of schooling (college)	7,185	0.351	0.477	0	1
Tardiness	6,442	0.696	0.460	0	1
Experience bullying	6,145	1.272	1.160	-0.782	3.859
Family characteristics					
Highest parental educ in year	7,184	12.995	3.072	3	16
Highest occup status of parents	6,785	33.873	19.803	11.560	88.700
Parental emotional support for student's education	6,547	-0.091	1.004	-2.447	1.035
School Characteristics					
Student-teacher ratio	7,233	25.913	7.382	1.397	46.000
No. of available computer per student	7,201	0.296	0.297	0.000	2.069
Prop. of available computer connected to internet	6,960	0.524	0.432	0	1
Prop. of teachers fully certified	7,197	0.912	0.198	0	1
Prop. of teachers ISCED Level 5A Master	7,222	0.165	0.174	0	1
Class size	7,233	44.434	7.358	13	53
Learning time math, mins	5,494	314.388	293.232	0	2400
Learning time science, mins	5,489	314.102	290.716	0	2400
Learning time reading, mins	5,509	314.837	298.967	0	2400
Admission requirement based on academic performance	7,233	0.829	0.377	0	1
Disciplinary climate	7,057	-0.208	0.885	-2.712	2.035

Source: Authors' computation using 2018 PISA Philippine Dataset

4.2. Estimation results

In this sub-section the estimation results are described consisting of the OLS as well as quantile regression to get differential impact for high and low performers as described in the methodology section. We do so by subject area.

4.2.1 Mathematics

The summary of the estimation results for mathematics is provided in Table 6.

Individual Characteristics. The age of the student is shown to be positively associated with test scores with each year associated with 8.5 points increase in test score. This relationship is higher for low performing students than high performing students. Being male is not significantly related to test scores on average. But this is significantly negative for low performers (at 0.1 and 0.25) and not significantly different in the middle quantiles (at 0.5 and 0.75) and significantly positive for very high performers (at 0.9). Repeating a grade is associated with lower test scores by 46.7 points on average. The relationship is higher in magnitude for low performers compared to high performers. The age of starting primary education has a negative relationship with test scores, i.e., students who started older have lower test scores, with an average of -5.4 points less on average per year of delay. This relationship is less negative for low performers compared to high performers. The prospects of completing college has a positive relationship with test scores contributing 8 points on average. This is significant higher for low performers and significant for all quantiles except for 0.9. Tardiness is not significantly correlated with test scores on average and for all quantiles. Experience in bullying is negatively correlated with test scores. This correlation become more negative for the top performers.

Household characteristics. Parents education is not correlated with test scores on average and for all quantiles. Parental occupation is positively correlated with test cost on average. This positive relationship increases with high performers. Parental emotional support is positive correlated with test scores. This relationship is higher for low performers compared to high performers.

School characteristics. Student to teacher ratio is not significantly correlated with test scores on average and all the quantiles. The number of computers per students is positively related with number of computers available per student with an average coefficient of 29.2 points. This relationship increases in magnitude with higher performers. The proportion of computers connected to the internet if positively related with test scores with an average coefficient of 19.4 points. This variable matters more for high performers. The proportion of teachers that are certified is not correlated with test scores on average and for all quantiles. The proportion of teachers with master's degrees is not correlated with test scores on average and for all quantiles. Class size is not correlated with test scores on average and for low performers. This, however, is negatively correlated with top performers. Learning time in Math is not related to test scores on average and for low performers but curiously negatively correlated with top performers. Admission requirements base on academic performance is not correlated with test

scores on average and for all quantiles. Disciplinary climate is positively correlated with test scores on average and the relationship increases with top performers.

Table 6. OLS, and quantile and estimation results; Output: Mathematics

	OLS			Quantile Regression													
				Q = 0.10			Q = 0.25			Q = 0.50			Q = 0.75			Q = 0.90	
Variable	*Coef*		*t stat*	*Coef*		*z stat*	*Coef*		*z stat*	*Coef*		*z stat*	*Coef*		*z stat*	*Coef*	*z stat*
Age at test	8.52	**	2.22	9.47	**	2.31	9.38	***	2.75	8.59	**	2.5	7.22	**	2.16	6.61	*	1.76
Sex = male	-1.41		-0.44	-5.30	*	-1.73	-4.82	*	-1.71	-2.81		-1.3	1.35		0.4	6.76	**	2.13
Grade repetition	-46.72	***	-11.79	-44.91	***	-17.63	-43.16	***	-18.3	-44.45	***	-24.82	-44.61	***	-17.28	-43.87	***	-14.31
Age when started schooling	-5.36	***	-2.77	-3.93	***	-3.44	-4.68	***	-3.61	-5.36	***	-3.77	-6.55	***	-2.88	-9.18	***	-3.07
Outlook about college	8.01	***	3.1	14.65	***	6.03	11.39	***	4.22	8.23	***	4.37	5.53	***	3.94	2.79		1.26
Tardiness	-0.78		-0.29	-3.44		-1.54	-2.16		-1.31	-1.18		-0.54	0.76		0.45	4.25		1.1
Experience of bullying	-8.47	***	-6.38	-6.97	***	-3.98	-7.39	***	-6.38	-8.39	***	-7.04	-9.84	***	-7.54	-10.44	***	-7.47
Parents' education	0.37		0.6	0.42		0.57	0.29		0.5	0.35		0.83	0.25		0.46	-0.09		-0.15
Parents' occupation	0.83	***	10.83	0.62	***	7.62	0.74	***	14.96	0.81	***	17.03	0.93	***	15.89	1.00	***	16.87
Parental emotional support for student's education	9.48	***	5.44	13.04	***	7.6	11.96	***	9.94	9.89	***	7.35	7.13	***	5.61	5.53	***	2.88
Student-Teacher ratio	0.15		0.42	0.26		1.49	0.16		0.76	0.08		0.44	0.01		0.08	0.14		0.54
Number of available computers per student	29.17	**	2.49	22.95	***	3.94	22.16	***	4.15	23.31	***	3.76	22.92	***	5.54	23.40	***	3.66
Proportion of available computers that are connected to the Internet	19.41	***	2.8	12.15	***	3.33	14.85	***	4.25	17.34	***	5.05	21.70	***	7.46	23.50	***	8.27
Index proportion of all teachers fully certified	7.58		0.57	-2.74		-0.34	4.95		0.9	8.58		1.28	13.18		1.31	17.93		1.59
Index proportion of all teachers ISCED LEVEL 5A Master	-3.75		-0.21	-8.65		-0.78	-8.50		-1.24	-5.12		-1.04	-0.17		-0.03	14.03		1.06
Class Size	-0.12		-0.2	0.02		0.06	-0.12		-0.68	-0.31		-1.34	-0.60	**	-2.43	-0.92	**	-1.98
Learning time in Math	0.00		-1.32	0.00		-0.03	0.00		-0.11	0.00		-1.44	-0.01	***	-3.57	-0.02	***	-3.56
Admission requirement based on academic performance	1.62		0.25	2.31		0.98	2.10		1.09	3.20		1.04	0.84		0.33	0.41		0.15
Disciplinary climate	10.36	***	5.82	8.47	***	5.46	9.87	***	4.68	11.71	***	8.33	11.57	***	8.82	11.05	***	5.66
Constant	217.72	***	3.18	127.39	**	2.1	167.05	***	3.15	226.92	***	4.27	305.97	***	5.21	371.24	***	5.46

*p<0.1,** p<0.05, ***p<0.01

Source: Authors' computation using 2018 PISA Philippine Dataset

4.2.2 Science

Table 7 provides the summary of the estimation results for science.

Individual characteristics. Age at the time of the test does appear correlated with test scores on average and in all quartiles. The same is true for gender. The incidence of grade repetition is negatively correlated with test scores reducing average test scores by 39.5 points. This correlation increases with high performers with low performers at 0.1 reducing by -27.7 while top performers at 0.0 reducing by -46.4. Age at which the student started primary schooling is negatively correlated with test scores with one-year increase associated with a decline in test score by 4.8 points. This negative relationship becomes more bigger with high performers. The prospects of completing college is not correlated with test scores on the average and has a complex relationship across the quantiles. It is positively correlated for low performers and the relationship becomes negative for high performers. Tardiness has a perverse than expected relationship with test scores showing positive correlation and this relationship increases in magnitude as one goes up the performance quintiles. Experience with bulling is negatively correlated with test scores and this increases from a low negative to a high negative as on goes up the performance quintile.

Household characteristics. Parents education is not correlated with the test scores but for high performers, starting with the median, the relationship become significantly positive. Parents' occupation is positively correlated with test scores. This correlation increases as one goes up the performance quantiles. Parents emotional support is positively correlated with test scores. This relationship is stronger for low performers compared to high performers.

School characteristics. Student teacher ratio is not significantly correlated with test scores on average but turns out having negative correlation with high performers starting at quantile 0.25. The proportion of certified teachers is not significantly correlated with test scores on average and in all performance quantiles. Proportion of teachers is not significantly related with test scores and in most quintiles except to the top performers at 0.9 quantile where a positive relationship is found increasing science test score by 16.6 points. Class size is not significantly correlated with test scores on the average and low performers but turns up negatively correlated starting from median quantile. Learning time in science is curiously negatively correlated with test scores. This is not significant for low performers but gradually become increasingly negative as one goes up the performance quantile. Admission based on academic performance is not significantly correlated with test score on the average and all throughout the performance quantiles. Disciplinary climate is positively correlated with test scores. This positive relationship increases are one goes up the education ladder.

Table 7. OLS, and quantile and estimation results; Output: Science

	OLS			Quantile Regression													
				Q = 0.10			Q = 0.25			Q = 0.50			Q = 0.75			Q = 0.90		
Variable	*Coef*		*t stat*	*Coef*		*z stat*	*Coef*		*z stat*	*Coef*		*z stat*	*Coef*		*z stat*	*Coef*		*z stat*
Age at test	2.79		0.7	5.08		1.04	4.17		1.23	2.82		1.44	2.81		0.88	-1.70		-0.6
Sex = male	4.47		1.21	3.93		1.09	3.33		1.16	3.20		1.09	2.67		0.91	8.40		1.62
Grade repetition	-39.52	***	-10.08	-27.71	***	-9.19	-31.39	***	-15.24	-35.28	***	-18.37	-42.04	***	-12.96	-46.40	***	-15.3
Age when started schooling	-4.84	***	-3.19	-3.35	**	-2.38	-2.95	**	-2.04	-3.29	***	-2.93	-5.74	***	-5.05	-10.48	***	-4.16
Outlook about college	0.83		0.28	5.98	***	4.12	5.14	***	2.78	3.99	*	1.65	-0.45		-0.21	-6.41	**	-2.07
Tardiness	5.68	**	2.12	5.70	**	2.05	6.56	***	3.35	6.07	***	3.08	5.83	***	3.23	7.02	**	2.37
Experience of bullying	-11.77	***	-9.75	-8.68	***	-7.67	-10.01	***	-8.95	-12.11	***	-15.18	-12.88	***	-7.51	-13.30	***	-10.81
Parents' education	0.71		1.46	0.06		0.23	0.35		1.37	0.77	*	1.9	0.92	*	1.66	1.00	*	1.86
Parents' occupation	1.03	***	11.79	0.61	***	12.14	0.78	***	22.73	1.00	***	17.69	1.29	***	27.07	1.41	***	20.88
Parental emotional support for student's education	7.20	***	4.55	10.46	***	6.96	9.64	***	11.06	8.27	***	6.22	5.55	***	4.25	4.56	***	3.46
Student-Teacher ratio	-0.41		-1.13	-0.13		-1.36	-0.21	**	-2.23	-0.16	**	-2.2	-0.37	**	-2.15	-0.51	**	-2.32
Index proportion of all teachers fully certified	-4.25		-0.38	-8.45		-1.22	-5.98		-0.98	-3.05		-0.78	1.23		0.2	3.31		0.47
Index proportion of all teachers ISCED LEVEL 5A Master	1.93		0.12	-6.55		-1.18	-2.15		-0.49	0.11		0.02	9.89		1.43	16.60	*	1.79
Class Size	-0.24		-0.54	0.14		0.81	0.04		0.23	-0.23	*	-1.68	-0.52	***	-3.08	-0.76	***	-3.37
Learning time in Science	-0.01	**	-2.21	0.00		-0.33	0.00		-1.49	-0.01	**	-2.05	-0.01	***	-3.74	-0.02	***	-4.17
Admission requirement based on academic performance	3.38		0.58	1.97		0.56	2.13		0.73	2.42		0.94	2.49		0.99	4.45		1.2
Disciplinary climate	10.04	***	5.6	8.04	***	6.33	9.78	***	5.94	11.19	***	8.36	11.34	***	6.66	10.61	***	4.53
Constant	343.76	***	5.12	219.91	***	2.63	261.30	***	4.27	323.40	***	10.02	386.36	***	8.65	529.98	***	11.54

*p<0.1,** p<0.05, ***p<0.01

Source: Authors' computation using 2018 PISA Philippine Dataset

4.2.3 Reading

The summary of the estimation results for reading is provided in Table 8.

Individual characteristics. Age at test is positively correlated with test score on average increasing test score by 9 points per additional year and this is higher for low performers compared to high performers. Being male is negatively correlated with test score on average reducing test scores by -9.2 points. This is again higher for low performers and become insignificant for quantile 0.9. Grade repetition is negatively correlated with test score on average reducing test score by -45.2 points for those who repeated a grade and this is larger negative for high performers. Starting age of primary schooling is negatively correlated with test score on average reducing test score by -5.1 points and this become more negative for high performers. Higher self-rated reading ability is positively correlated with test score on average by 9.6 points and this becomes more positive for high performers. Joy and liking reading is positively correlated with test score on average increasing test score by 16.3 pints and this more positive for low performers. The prospect of completing college is not correlated with test scores on average but this is positively correlated for low performers and negatively correlated with high performers. Incidence of tardiness has a perverse than expected relationship with test score yielding a positive correlation with test cost and this becomes bigger positive with high performers. Experiencing bullying is negatively correlated with test scores on average and this become bigger negative with high performers.

Household characteristics. Parents education is positive correlated with test scores on average increase test scores by 1.1 points and this increases with high performers. Parents' occupation

is positively correlated with test scores on average and this increases with high performers. Parents' emotional support is positively correlated with test scores. This is bigger for low performers.

School characteristics. Student-teacher ratio is not significantly correlated with test score on average but is negatively correlated for high performers (quantile 0.75 and 0.9). The proportion of teachers certified is not significantly correlated with test scores. This is negatively correlated with test scores for low performers (quantile 0.1 and 0.25) but not significantly correlated for high performers. Similarly, proportion of teachers who had master's degrees is not significantly correlated with test scores and negatively correlated for low performers (quantile 0.1 and 0.25) but not significant for high performers. Class size is not significantly correlated with test scores on average, but this is negatively correlated starting with quantile 0.25 up to the higher quantiles. Learning time in English is negatively correlated with test scores on average but this is not significant for low performers and negatively correlated with higher performers. Admission based on academic performance is not significantly correlated with test score on average. It is not significantly correlated for low performers and positively correlated in the middle quantiles (quantile 0.25 to 0.75) but also not significantly correlated with top performers. Disciplinary climate is positively correlated with test scores. This increases as one goes up the performance level.

Table 8. OLS, and quantile and estimation results; Output: Reading

	OLS			Quantile Regression													
				Q = 0.10			Q = 0.25			Q = 0.50			Q = 0.75			Q = 0.90		
Variable	*Coef*		*t stat*	*Coef*		*z stat*	*Coef*		*z stat*	*Coef*		*z stat*	*Coef*		*z stat*	*Coef*		*z stat*
Age at test	9.04	***	2.6	9.73	***	4.4	8.87	***	2.98	10.38	***	4.37	8.35	***	3.12	7.07	*	1.96
Sex = male	-9.20	***	-3.82	-11.68	***	-6.72	-11.63	***	-7	-10.48	***	-10.02	-7.90	***	-3.99	-3.47		-1.39
Grade repetition	-45.20	***	-13.45	-33.28	***	-11.58	-35.01	***	-15.39	-40.61	***	-23.95	-47.36	***	-17.13	-52.13	***	-14.74
Age when started schooling	-5.15	***	-3.73	-3.42	***	-2.65	-3.89	***	-3.46	-4.55	***	-6.89	-6.31	***	-4.94	-8.19	***	-4.64
Self-rated reading ability	9.59	***	5.43	4.96	***	3.93	7.32	***	9	8.44	***	9.53	10.81	***	7.94	14.32	***	9.2
Joy/Like reading (WLE)	16.33	***	9.45	17.22	***	13.53	17.36	***	14.29	17.76	***	15.34	15.74	***	12.16	12.72	***	10.48
Outlook about college	-0.12		-0.05	4.64	**	2.45	3.63	***	3.11	2.47		1.61	-0.14		-0.07	-5.47	***	-2.65
Tardiness	5.59	**	2.15	3.92	**	2.14	6.81	***	4.23	6.58	***	4.37	4.91	**	2.58	7.09	***	2.99
Experience of bullying	-13.08	***	-14.99	-8.60	***	-15.09	-10.57	***	-11.08	-12.80	***	-31.87	-14.47	***	-20.4	-15.62	***	-24.43
Parents' education	1.15	***	2.75	0.65	***	4.2	0.90	***	3.87	0.91	***	3.27	1.13	***	4.33	1.83	***	10.84
Parents' occupation	1.10	***	12.19	0.63	***	15.17	0.83	***	21.47	1.11	***	27.38	1.38	***	39.28	1.37	***	27.44
Parental emotional support for student's education	6.04	***	4.73	9.00	***	8.54	8.98	***	9.54	7.30	***	12.84	4.62	***	5.69	2.09	***	2.63
Student-Teacher ratio	-0.29		-0.76	0.08		1.21	0.04		0.53	-0.05		-0.42	-0.28	***	-3.12	-0.50	***	-4.16
Index proportion of all teachers fully certified	-1.62		-0.15	-6.90	**	-2.28	-7.08	**	-2.44	1.25		0.34	5.95		1.43	7.29		1.32
Index proportion of all teachers ISCED LEVEL 5A Master	-6.51		-0.41	-15.64	***	-2.68	-11.96	***	-3.37	-2.76		-0.54	3.76		0.76	4.27		0.7
Class Size	-0.57		-1.16	-0.02		-0.24	-0.21	*	-1.8	-0.49	***	-4.16	-0.94	***	-10.17	-1.35	***	-7.38
Learning time in English	-0.01	***	-2.96	0.00		-0.57	0.00	**	-2	-0.01	***	-3.08	-0.01	***	-7.64	-0.02	***	-4.66
Admission requirement based on academic performance	4.63		0.81	3.07		0.92	4.18	***	3.05	2.26	*	1.8	2.92	*	1.95	3.55		1.38
Disciplinary climate	9.49	***	5.78	7.84	***	9.75	9.75	***	13.1	11.30	***	8.11	10.12	***	9.54	10.47	***	6.21
Constant	233.03	***	3.88	126.75	***	3.63	171.72	***	3.69	192.20	***	4.81	291.31	***	6.21	380.25	***	7.12

*p<0.1,** p<0.05, ***p<0.01

Source: Authors' computation using 2018 PISA Philippine Dataset

5. Summary and recommendations

5.1. Summary

Taking que from literature that education quality is a product of the interplay of individual, household, school and community factors, this study estimates the correlation of test scores with select personal, household and community characteristics using the 2018 PISA dataset where the Philippines participated for the first time. The result is expected to inform policy on improving achievement in schools in the country. This is highly relevant given the results of the PISA and TIMSS where the country placed at the bottom of participating countries. This is also useful given the current policy thrust of DepEd dubbed as Sulong Edukalidad which aggressively pursues quality basic education. It is important to remind the reader that the estimates are correlations rather than causal relationships.

Estimation results shows that among the individual characteristics considered in the study, repeating a grade, age of start in primary education and bullying have consistent negative correlation across subject areas. In terms of family background, parental occupation and parental emotional support have positive correlation with test scores. For school characteristics, only disciplinary climate has a consistent positive correlation with test scores. These results highlight the roles of factors beyond the confines of the school. The role of the household is highlighted here. While a large factor of disciplinary climate is in enforcement in classrooms, there is also the societal role of appreciating the value of order and discipline in learning environments.

Another important policy question is what factors help low performers better. Estimation results show that prospects of completing college help low performers more even if on average the correlation is not statistically significant. Parents' emotional support also helps more low performers. Admission requirements based on academic performance is associated with higher scores for low performers in reading.

The correlation of school characteristics with test scores is mixed. The number of computers per student and the proportion of computers connected with the internet is associated with higher scores in math. Student teacher ratio is associated with lower scores for high performers even if not significantly correlated on average. Similarly, class size is also correlated with lower test scores for high performers.

In terms of gender, only in reading is there evidence of lower test scores for males compared to females.

There are also puzzling estimation results that requires closer scrutiny. One is the negative association of test scores and learning time. Given that we are estimating correlations, this may also mean that it may not be a puzzle after all as it can also imply that smarter students learn fast and hence require less time to learn. Teacher qualification (being certified and having master's degrees) are either insignificantly related with test scores or even negatively correlated with it (e.g., reading). This highlights the reality that better qualification does not always

translate into better pedagogy. In addition, this can be a reflection of either (a) the quality of graduate training, or (b) the way better qualified teachers are utilized in instruction or both. Finally, there is a curious result of tardiness being positively correlated with test scores.

5.2. Recommendations

Given the results, the study identifies the following recommendations and areas for further study in the quest for finding levers to improve achievement in schools.

1. **Address grade repetition**. The estimation results are showing that repeating a grade has a double-whammy effect. It not only waste investments for the school year, it is also associated with lowers test scores reflecting possible scarring effect. Obviously, this should not be taken to mean mass promotion but a call for addressing the issues why students lagged compared to their classmates and finding measures to improve performance of those who are behind.

2. **Start children at an early age**. Starting primary school at a later age is associated with lower test scores. This means promoting early entry into primary education.

3. **Promote parental support**. The estimation result says parental support is consistently positively correlated with test scores. This means greater involvement and support of parents with their children's education should be promoted, in general, and for lagging students, in particular, where this also has greater impact.

4. **Address bullying in schools**. The PISA reports that 64.9% of students in the Philippines reported being bullied a least a few times in a month putting the county among those having the highest incidence of bullying among the participating countries (OECD, 2019). Besides the fact that bullying is inherently unacceptable, it is also negatively correlated with test scores. This result should provide an additional impetus to stop bullying in schools.

5. **Promote better disciplinary climate in schools**. Disciplinary climate in classrooms is consistently a positive correlate of test scores. This result puts explicit value to promoting and instilling discipline in classrooms. This does not only mean demanding discipline in classroom situations but also asks the society at large to put value to order and discipline in the classroom.

6. **Promote reading for boys**. The only time gender is significantly correlated with test scores is in reading where males are lagging females. This calls for promoting reading among males.

7. **Look more closely why learning time is negatively correlated with test scores**. This perverse than expected relationship is worth examining more closely. While this can be also interpreted to mean that smart students learn faster given that we are estimating correlations, it should also encourage us to examine how our education system use instruction time.

8. **An in-depth study why teacher qualifications are not correlated with test scores.** The estimation results show that teacher qualifications (being certified and proportion with master's degrees) are not correlated with math and science test scores and is even perversely correlated with reading test scores for low performers. This calls for an in-depth study why teacher qualifications are not correlated with test scores. On the one hand, this can include review of how high qualified teachers are utilized in learning. On the other hand, this can also mean examining the effectiveness of our teacher certification systems as well as the quality of graduate education for teachers.

9. **Continued participation in international benchmarking tests and learning from the results**. This study was made possible because our policy makers decided to participate in PISA. The test has given us solid information on where we are in terms of education quality. This has also served as wake-up call for the country to take a hard look and begin to take steps in understanding how we ended up at the bottom of participating countries and how we can improve education quality in the country. We need to continue to participate in these benchmarking tests to provide us a good measure of our performance and provide us with progress indicators of the effectiveness the reforms we introduce to our educational system. We should make it part of protocol that every reform must be measured in terms of its effectiveness in achieving their stated objectives.

10. **Wider dissemination and generation of public use files of national test score results**. DepEd regularly undertakes standardized tests at various levels of the basic education system as mentioned in Section 2.2. The results should be used to inform policy decisions of the department. In addition, the results should be widely disseminated so that the public may know and be properly guided on the state of education quality in the country. Finally, like many survey data produced by the Philippine Statistics Authority, public use files should be produced from those tests results so that analysts can provide supplementary analyses and contribute to a better understanding of the state and determinants of education quality.

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Appendix A. Definition of Variables

VARIABLES	Remarks on Definitions	Estimation Equation Used		
		Math	Science	Reading
PISA Test scores in Math/Science/ Reading	Plausible values			
Age at test	Age in years (e.g. 15.25)	x	x	x
Sex	Male = 1, Female = 0	x	x	x
Grade repetition	"1" if the student had repeated a grade in at least one ISCED level and the value of "0" if "no, never" was chosen at least once, provided that the student had not repeated a grade in any of the other ISCED levels. The index was assigned a missing value if none of the three categories were ticked for any of the three ISCED levels.	x	x	x
Age when started schooling	Age started primary education (ISCED 1), in years	x	x	x
Self-rated reading ability	Perception of competence index from questions: Agree or disagree "I am a good reader", "I read fluently"			x
Joy/Like reading (WLE)	Index for student's enjoyment in reading (reading for leisure). Positive values on this scale mean that the student enjoyed reading to a greater extent than the average student across OECD countries.			x
Outlook about completion of schooling (College)	Dummy indicator whether they think they can complete college or higher (5A, 6)	x	x	x
Tardiness	Late for class or skipped class in the last two weeks (whole day or some classes) 1= tardy, 0 otherwise **created from two variables*	x	x	x
Experience of bullying	1 = experienced bullying in school 0 = never experienced bullying in school During the 12-month period prior to the test. Positive values indicate that the student was more exposed to bullying at school than the average student in OECD countries; negative values on this scale indicate that the student was less exposed to bullying at school than the average student across OECD countries.	x	x	x

VARIABLES	Remarks on Definitions	Estimation Equation Used		
		Math	Science	Reading
Highest parental education in years	Index highest parental education in estimated years of schooling; taken from higher of the highest education level of either parents	x	x	x
Highest occupational status of parents	Index is the higher than either parent levels of occupational status; higher values indicate high levels of occupational status	x	x	x
Parental emotional support for student's education	Parents' emotional support is an index derived from perception of students in response to the following questions (a) "My parents support me when I am facing difficulties at school," and (b) "My parents encouraged me to be confident". Positive values indicate greater levels of emotional support from their parents than did the average students across OECD countries.	x	x	x
Student-Teacher ratio	Ratio	x	x	x
Number of available computers per student	Ratio	x		
Proportion of available computers that are connected to the Internet	Ratio	x		
Index proportion of all teachers fully certified	Proportion of teacher fully certified	x	x	x
Index proportion of all teachers ISCED LEVEL 5A Master	Proportion of teacher with ISCED LEVEL 5A (Master)	x	x	x
Class Size	Class size	x	x	x
Learning time - Math - Science - Reading	Length of class period total and per subject per week in minutes Computed from the length of class sessions	mmins	smins	Lmins
Admission requirement based on	Admission to school is based on academic performance of students	x	x	x

VARIABLES	Remarks on Definitions	Estimation Equation Used		
		Math	Science	Reading
academic performance	1 = true, 0 = false			
Disciplinary climate	Disciplinary climate is an index constructed from student responses to questions covering (a) listening to what teacher says, (b) noise and disorder, (c) time it takes for students to quiet down, (d) students cannot work well, and (e) time it takes students to be working after lesson begin. Positive values on this scale mean that the student enjoyed a better disciplinary climate in language-of-instruction lessons than the average student across OECD countries.	x	x	x

Source: Authors' compilation

Note: For a description of the indices see reference for PISA indices see: https://www.oecd-ilibrary.org/sites/0a428b07-en/index.html?itemId=/content/component/0a428b07-en