SCIENCE AND MATHEMATICS CURRICULUM PROJECT

PROGRESS OF STUDENTS THROUGH THE CURRICULUM: A FOCUS ON ELEMENTARY SCIENCE AND MATHEMATICS

PRE-GRADE 4 AND PRE-GRADE 6 REPORT

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EXECUTIVE SUMMARY

A previous study that investigated the progress of students in Junior High School Chemistry curriculum found that there is a trend of decreasing levels of readiness of students for the K-12 Science Curriculum from Grade 7 to Grade 10 (Ferido et al., 2017). The findings of that study provided an impetus to further investigate the progress of students in Science and Mathematics curricula in the elementary grade levels.

Participants recruited for this study were Grade 4 and Grade 6 students from selected schools from the National Capital Region (NCR), Region VI (Western Visayas) and Region VII (Central Visayas). Assessment of readiness of students for the topics in Science and Mathematics were conducted to investigate the progress of students in the elementary Science and Mathematics curricula. Through the assessment, levels of proficiency of the students were determined and compared against the prerequisite knowledge and skills implicitly required by the Science and Mathematics curricula at the beginning of the school year.

The results revealed that Grade 6 students were generally at higher proficiency levels than their Grade 4 counterparts in skills and conceptual understandings in both Science and Mathematics. However, a smaller proportion of Grade 6 students were found to be ready compared to their Grade 4 counterparts. For Mathematics, 96% of Grade 4 students were assessed as ready for the curriculum compared to only 41% for Grade 6. For Science, 80% of Grade 4 students were ready and only 47% of Grade 6 students. Teacher report data corroborates these findings with between 80% and 90% of teachers, depending on subject, indicating that more than a quarter of their students had difficulties learning the curriculum. For some classes, more than three quarters of students were reported as having difficulties.

The presence of considerable proportion of students who were not ready for their respective topics were taken to suggest two possible issues in the curriculum: (1) that there was a mismatch in the expected pacing of the curriculum and the actual rate of learning of students, and (2) that the topics may not be developmentally appropriate for the students. Teacher questionnaires indicate that between a quarter and a half of teachers were unable to cover the curriculum in the previous school year, adding weight to these presuppositions.

A detailed examination of the teacher and class information revealed some issues with learning delivery also need to be taken into consideration. Access to teacher and student materials remains lacking for a considerable number of participants in the study and at least a third of teachers in each subject had not received training in the K-12 Curriculum. These conditions were seen as aggravating factors faced by the students who enter the grade level with low levels of readiness.

Strategies such as the use of assessment results to determine levels of readiness of students (and decide whether to proceed to the next topic) and the conduct of remedial/enhancement classes, were found to be practiced by some of the teacher participants. These were deemed worth promoting and provide a viable ground for teacher support from the instructional leaders.

An adequate response to these findings has two aspects: one concerns the curriculum and the other concerns learning delivery. The findings suggest the

need to revisit the assumptions of the curriculum in terms of the rate of learning and the developmental appropriateness of the topics for the students. At the same time, access to teacher and learner materials needs to be improved as problems in access are expected to affect student learning. Current good practices reported by the teacher participants such as the use of formative assessment and the conduct of remedial lessons may also be supported to help address the low levels of readiness of students already entering a grade level. Training on proper use of formative assessment as well as provision of interventions such as remedial lesson modules/plans designed to provide students with essential prerequisite skills are opportunities for instructional leaders to support the teachers in this area.

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PROJECT INTRODUCTION

In School Years 2015-2017, the Assessment Curriculum and Technology Research Centre (ACTRC) conducted the Science Curriculum Study investigating the progress of Junior High School students within the K–12 Science curriculum. That project focused on the chemistry (Matter) strand and included assessments of readiness for the chemistry topics among samples of students from the National Capital Region (NCR), Region VI and Region VII. The design was cross-sectional and the grade levels tested were Grades 7 to 10.

The findings of the Science Curriculum Study revealed a trend of decreasing readiness for the chemistry topics that the students will tackle at the beginning of their respective quarters in chemistry (Ferido et al., 2017). Figure 1 shows the percentages of students ready/not ready for the chemistry topics at the beginning of the quarter. This result served as the impetus to investigate the conditions that led to this trend in readiness levels of students as they move up the grade levels in secondary schools. One question asked was whether such a trend began at the elementary grade levels.

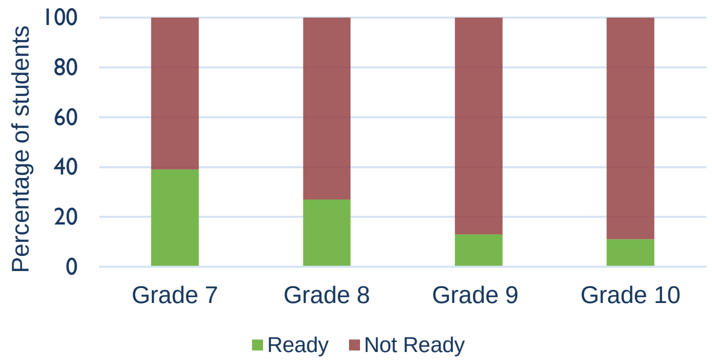

Figure 1. Percentage of students ready/not ready for the Chemistry curriculum

In School Year 2017-18 a new study at Grades 4 and 6 provided unique opportunities for assessing and describing the levels of ability of the students in the elementary grades. Since Science is formally introduced into the curriculum at Grade 3, it is at Grade 4 where students are first expected to already have prerequisite concepts and skills to draw from. At Grade 6, students are already in the final year of their elementary education, and the level of prerequisite concepts and skills they have acquired to that point largely determines performance towards the end of their elementary education. It was also necessary to investigate the students' progress in mathematics ability in the elementary level because the science skills in the secondary level require some prerequisite skills from elementary level Mathematics. Determining what students know and can do at these stages can be used to inform subsequent teaching and assist with future reviews of the Science curriculum domains and learner modules.

This project was designed to investigate how students' knowledge of the science and mathematics content, as well as their enquiry and problem-solving skills, develop. It sought to investigate the progress of students' knowledge and skills as they complete the spiral elementary school Science and Mathematics curriculum, with an emphasis on whether students have developed the pre-requisite knowledge for the current year of study.

PROJECT METHOD

PARTICIPANTS

A total of six Department of Education (DepEd) elementary schools from the NCR, Western Visayas (Region VI) and Eastern Visayas (Region VII) participated in this study. Two schools were recruited from each of these regions. These regions were selected due to their inclusion within the Basic Education Sector Transformation (BEST) initiative. The schools were selected primarily because of their large population and also because of their proximity to the participating schools in the previous study on the Science Curriculum for Grades 7-10.

RESEARCH DESIGN

For the main study, elementary students were tested in June 2017, at the beginning of the school year. The assessment was conducted early in the school year to ensure that no significant amount of instruction for the current grade level was delivered to the students. The rationale for this approach is a focus on depth of student learning in the form of retention from the previous year. The approach provides an indication of the skill level of students prior to each relevant grade level, including the level of skill retained from the previous grade level. Following a particular component of the curriculum and tracking students' progress over the elementary school years was expected to give a more accurate and detailed understanding of the way students' knowledge increases over each year and the exact prerequisite understanding students possess prior to entering each grade level. Although it may well be the case that delivery of the new curriculum will become more seamless over the next five years or so, it was hypothesised that, within the duration of the study, little difference would be found across cohorts. Accordingly, a cross-sectional design was implemented. The primary reason for this choice of design was to produce results and information useful to the Department of Education in as timely a manner as possible.

The main variable explored throughout the study was that of student outcomes, as measured through tests of science and mathematics knowledge and skills developed in alignment with the curriculum. Other variables explored include content delivered, teacher, teacher training, teacher specialisation, access to materials, and class size. Confounding variables include homogeneous/ heterogeneous student grouping, socio-economic status (SES), language background, and metro/regional/rural location.

INSTRUMENT DEVELOPMENT

Activities for the development of each test comprise:

a. Curriculum audit: analysis and identification of major themes/skills for analysis
b. Selection from an item bank for final test form, item writing and item review
c. Finalisation of grade level test.

Curriculum Audit

The curriculum audit was conducted in a workshop on May 9-10, 2017. Participants comprised four science education specialists and three mathematics education specialists from the UP National Institute for Science and Mathematics Education Development (UP NISMED), two science teachers and two mathematics teachers from the UP Integrated School (UPIS), four ACTRC staff members, and ACTRC's Program Leader for Curriculum. The curriculum audit involved curriculum analysis and identification of concepts and skills required for the Grade 4 and Grade 6 Science and Mathematics curricula. Attention was also given to the spiralling of topics in these subjects as it determines the focus of the curriculum in each quarter, thus allowing for consideration of the relevant educational context in the design of the tests. Table 1 shows the different topics tackled in the quarters across the school year.

Table 1. Curriculum Focus by Quarter Across Grades 4 and 6

	Grade 4		Grade 6	
	Science	Mathematics	Science	Mathematics
1st Quarter	Matter	Numbers and Number Sense	Matter	Numbers and Number Sense
2nd Quarter	Living Things and Their Environment	Numbers and Number Sense	Living Things and Their Environment	Numbers and Number Sense
3rd Quarter	Force, Motion & Energy	Geometry, Patterns and Algebra, Measurement	Force, Motion & Energy	Geometry, Patterns and Algebra, Measurement
4th Quarter	Earth & Space	Measurement, Statistics and Probability	Earth & Space	Measurement, Statistics and Probability

A test blueprint was drafted for each of the four tests, Grades 4 and 6 Mathematics and Grades 4 and 6 Science, using the information derived from the curriculum audit. The following questions were considered in the drafting of the blueprint:

- What strands run through the different grades?
- What is the most communicative terminology to use for each of these strands?
- Do strands appear only at one grade or at some grades?
- What is the relative importance of the strands at each grade level?

To articulate the skills integral to each grade level in the curriculum, specific behaviours that a student could demonstrate were identified. Descriptions of behaviours that could be demonstrated in a pen and paper test were written for each statement. Where the same behaviours appeared at multiple grade levels, these were noted at each relevant level. The behaviours were also classified as 'essential' or 'advantageous.' 'Essential' behaviours were defined as those that indicate the presence of a prerequisite concept or skill that is absolutely necessary for the students to be able to access the topics presented in the Science curriculum for their respective grade levels. 'Advantageous' behaviours, on the other hand, were defined as those that indicate the presence of a related concept or skill that facilitates understanding of the topics.

Item Selection

In the same workshop as the curriculum audit, the experts selected from a pool of pre-existing items those that could be used to assess the skills specified in the test blueprint. In cases where there were no items that could assess specific skills in the blueprint, new items were written and included in the tests. Content experts from UPIS, UP NISMED and staff from ACTRC contributed to the writing of items. The items were written in the English language because this is the language of instruction for Science. A multiple-choice test format was used as this method is easy to mark (Withers, 2012) and therefore an efficient method of assessing at large scale. Newly written items were quality assured by workshop participants through a panelling process. This process ensured adherence to guidelines for best practice in objective item writing and the use of language and scenarios that were appropriate both culturally and contextually for the participating students. The distribution of items across strands in the resulting test forms are presented in Table 2 and Table 3 for Science and Mathematics, respectively.

Table 2. Blueprint for Science Tests

Strand	Grade 4		Grade 6	
	Number of Items	Percentage	Number of Items	Percentage
Matter	21	35%	17	27%
Living Things and Their Environment	17	28%	20	32%
Force, Motion and Energy	11	18%	14	23%
Earth and Space	11	18%	11	18%
Total	60	100%	62	100%

Note: due to rounding, percentages may not total 100.

Table 3. Blueprint for Mathematics Tests

Strand	Grade 4		Grade 6	
	Number of Items	Percentage	Number of Items	Percentage
Numbers and Number Sense	34	63%	37	62%
Geometry	5	9%	7	12%
Patterns and Algebra	4	7%	3	5%
Measurement	7	13%	7	12%
Statistics and Probability	4	7%	6	10%
Total	54	100%	60	100%

Note: due to rounding, percentages may not total 100.

Instruments

A total of four tests were developed in this project to assess student learning. Separate tests, for each grade level, were constructed for both Science and Mathematics. For each subject, items common to both grade level tests were included for the linking of tests. This was in order to construct a single scale for each subject that would apply across the grade levels.

The tests were designed to cover prerequisite knowledge and skills for the relevant grade level. For science, these knowledge and skills cover the four domains of science in the curriculum, namely, Matter, Living Things and

Environment, Force, Motion and Energy, and Earth and Space. For mathematics, these knowledge and skills cover five strands: Numbers and Number Sense, Geometry, Patterns and Algebra, Measurement, and Statistics and Probability.

A teacher questionnaire was also developed to capture information about both the teacher and the class of the assessed students. The purpose of the teacher questionnaire was to provide background information about the context in which these students were expected to learn for the coming year.

Procedures

The main procedures were:

- liaising with DepEd Central and in NCR, Regions VI and VII for the purposes of recruitment
- recruitment within the NCR for the tests
- fieldwork associated with research data collection from students and schools
- analysis and reporting.

Data Collection

Data was collected with clearance from the University of Melbourne's Human Ethics Advisory Group (HEAG project number: 1748910.1). Permission for the conduct of the research was granted by DepEd through DepEd Memorandum (DM-PFO-2017-0346).

The primary activity in each school comprised student assessment. Data was collected via pencil and paper tests, with student responses provided on scannable forms. Each participant was requested to take both the Science and Mathematics tests for his/her grade level. The subject teachers of the participating students were also asked to provide teacher and class information through a teacher questionnaire.

DATA ANALYSIS

A free calibration of each test was conducted and then the two tests within each learning area were linked psychometrically in order to place them on a single scale so the results across grades could be compared.

Free Calibration of Individual Tests

Individual tests were calibrated using the one-parameter simple logistic model (Rasch, 1960) within the modelling software ConQuest (Wu et al., 2010). Estimates of item difficulty, measures of item separation reliability, person separation reliability, item-total correlations, MNSQ and fit statistics were examined to determine acceptability of items for the linking and the final estimation of student abilities. The acceptable reliability for both item and person separation was set at .80 for this project. Items with low discrimination (i.e., Item-Total Correlation < .20) were flagged to be performing poorly, and were examined for possible causes (e.g., mis-keyed, confusing stem or options, etc.). Flagged items were either deleted or retained depending on the nature of the issue. In particular, difficult items with poor discrimination were retained. Mis-keyed items were simply supplied with corrected keys and retained in the subsequent calibrations. Items with confusing stem or other issues that could not be addressed adequately were deleted in the next iteration of calibrations.

Test Linking

For both Science and Mathematics tests, the Grade 4 and Grade 6 tests were linked via an anchoring procedure using common items. Stability of difficulties of the common items was examined so as to ensure consistency of the scale. In doing the linking procedure, the difficulty estimates for the common items were obtained from the calibration using the Grade 4 sample. Then, holding those difficulty estimates fixed, the Grade 6 tests were recalibrated, using the Grade 6 sample to obtain linked estimates of item difficulties of the unique Grade 6 items. This yielded estimates that were anchored to the same scale as the Grade 4 item difficulty estimates. Hence, direct comparison of the difficulty estimates of all items on the tests across grade levels were made possible.

Estimation of Student Abilities and Scoring

The estimates of student abilities were obtained using the Weighted Least Estimate (WLE) of person ability against the linked tests. For the Grade 4 sample, the WLEs were obtained from the final calibration, from which any items that did not perform well were excluded. For the Grade 6 sample, the WLEs were estimated while fixing item parameters of the anchor items to those obtained from the calibration using the Grade 4 sample.

The Rasch scores (estimates of student abilities) were transformed to a scale (M = 50, SD = 10) to facilitate interpretation. The formulae for computing the transformed scores are given below:

$$Score_{i,Math} = \frac{10(\delta_{i,Math} - \bar{\delta}_{ALL,Math})}{SD_{ALL,Math}} + 50$$

$$Score_{i,Sci} = \frac{10(\delta_{i,Sci} - \bar{\delta}_{ALL,Sci})}{SD_{ALL,Sci}} + 50$$

where,

$Score_{i,Math}$	is the transformed score for mathematics
$\delta_{i,Math}$	is the WLE of mathematics ability of student *i*
$\bar{\delta}_{ALL,Math}$	is the average WLE of mathematics ability of all participants
$SD_{ALL,Math}$	is the standard deviation of the WLEs of mathematics ability of all participants
$Score_{i,Sci}$	is the transformed score for science
$\delta_{i,Sci}$	is the WLE of science ability of student *i*
$\bar{\delta}_{ALL,Sci}$	is the average WLE of science ability of all participants
$SD_{ALL,Sci}$	is the standard deviation of the WLEs of science ability of all participants.

Writing of Level Description

The items were sorted using the linked item difficulty estimates. With the use of the skills audit (i.e., descriptions of the underpinning skill required by each item), the sorted items were then examined to identify clusters of items that suggest the presence of a common substantive skill. Whether the clusters illustrate a unique substantive skill that could help explain the change in difficulty level of the items was also checked. The descriptions of the underlying skills of the item clusters were then used as criterion-reference for the interpretation of the student scores (Griffin, 2007).

Validation of Level Descriptions

The drafted level descriptions were presented to a group of Elementary Level Science and Mathematics content experts for validation. Validation was done to ensure the sound theoretical grounding and the usability of the level descriptions for the teachers at the classroom level. This was done in collaboration with experts from NISMED.

REPORTING

Results in aggregated form for each class were provided to participating schools in order to supply teachers with relevant information about student learning levels. For school use, student results across descriptive skill levels were provided. At no point in the study were any individual student scores or grades reported.

RESULTS AND DISCUSSION

Testing of Grade 4 and Grade 6 students in Science and Mathematics was carried out at the beginning of the 2017-2018 school year.

PARTICIPANTS

A total of 1478 and 1466 respondents participated in the Mathematics and Science tests respectively. Table 4 shows the distribution of respondents by gender across grade levels and regions. It should be noted that the respondents for both tests came from the same particular classes but the number of students varied because the assessments for each subject were done on different days. Some of the participants were absent on the first day of assessment but joined in the following day, while there were also students who were present during the first day but did not come the following day for the assessment on the second subject.

Table 4. Distribution of Test Takers by Grade, Region and Gender

Grade Level	Region	Science Participants			Mathematics Participants		
		Female Count (Row %)	Male Count (Row %)	Total Count (Row %)	Female Count (Row %)	Male Count (Row %)	Total Count (Row %)
Grade 4	Region VI	133 (56.8%)	101 (43.2%)	234 (100%)	135 (57.9%)	98 (42.1%)	233 (100.0%)
	Region VII	122 (50.0%)	122 (50.0%)	244 (100%)	118 (48.4%)	126 (51.6%)	244 (100.0%)
	NCR	131 (54.4%)	110 (45.6%)	241 (100%)	125 (53.6%)	108 (46.4%)	233 (100.0%)
	Total	386 (53.7%)	333 (46.3%)	719 (100%)	378 (53.2%)	332 (46.8%)	710 (100.0%)
Grade 6	Region VI	133 (55.2%)	108 (44.8%)	241 (100%)	130 (54.4%)	109 (45.6%)	239 (100.0%)
	Region VII	134 (53.0%)	119 (47.0%)	253 (100%)	132 (53.0%)	117 (47.0%)	249 (100.0%)
	NCR	127 (48.7%)	134 (51.3%)	261 (100%)	127 (48.5%)	135 (51.5%)	262 (100.0%)
	Total	394 (52.2%)	361 (47.8%)	755 (100%)	389 (51.9%)	361 (48.1%)	750 (100.0%)

DATA ANALYSIS

The data collected from the Science and Mathematics tests were scanned and cleaned prior to analysis.

Free Calibration Results

The test data were calibrated using the previously described method. Item statistics were examined for evidence of acceptable psychometric properties of the items used. The initial results of the free calibrations allowed for the flagging of items that performed poorly. In the final iteration of the free calibration, three items from G4 Science, six items from G6 Science, six items from G4 Mathematics, and 11 items from G6 Mathematics were deleted.

To check the suitability of the tests for use to determine the prerequisite knowledge and skills of students, the distribution of item difficulties for each test was compared to the distribution of the estimates of student ability. This can be visually examined by the use of a Wright map, in which the estimates of student ability and item difficulties are plotted on adjacent panels using a common scale. Figure 2 shows the Wright map for Grade 4 Mathematics. The student abilities are plotted on the left panel and the item difficulties on the right panel. In this example, the distribution of student ability roughly matches that of item difficulties, indicating that the test is suitable for use in determining the prerequisite knowledge and skills in Mathematics of the Grade 4 students. Similar observations were made of the Wright maps for the other tests.

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Each 'X' represents 1.1 cases
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Figure 2. Wright Map for Grade 4 Mathematics

Linking Results

In order for the scales to be directly comparable across grade levels, the tests were linked using common items. The common items were found to have acceptable psychometric properties in the initial calibration and the estimates of difficulties of these items from the initial calibrations were found to be highly correlated. These indicate the consistency in the ordering of the difficulty of items across samples and, therefore, the suitability of the use of a single scale within each learning area. The estimates of item difficulties and student abilities from the single scale were used for in the subsequent analyses of the results.

The estimates of student abilities using the linked scales were then transformed to scores with an overall mean of 50 and a standard deviation of 10 for easy comparison.

Level Cutpoints and Descriptions

In order to provide for interpretable reporting, the scaled scores were divided into discrete levels of proficiency, which are characterised by qualitatively different underlying concepts/skills in terms of levels of complexity and sophistication. Each level of proficiency was described based on the underpinning concepts/skills required by the cluster of linked items that are within the proficiency level. The proficiency levels are defined by a set of cutpoints for item difficulty/scores.

Science

The cutpoints for levels on the Science proficiency scale are shown in Table 5. The values in the table are scaled scores on the single scale.

Table 5. Cutpoints for Science Proficiency Levels

Level	Cutpoints (Scaled score)	
	Lower bound	Upper bound
E	> 62.69	Highest
D	> 53.78	62.69
C	> 44.38	53.78
B	> 36.58	44.38
A	Lowest	36.58

Descriptions were written for each level using the process described in the Method section. The final Science level descriptions are given in Table 6.

Table 6. Science Proficiency Level Descriptions

Level	Science Level Description
E	Students at this level have mastered the skills in levels A to D.
D	Students at this level are learning to identify interactions among basic components of a system. They are beginning to identify the interactions within an ecosystem. They are starting to identify factors affecting interactions between forces and objects. They are also beginning to understand how heat is transferred and sound propagated and apply this in identifying objects in which heat and sound can travel through.
C	Students at this level are starting to recognize causal relationships. They are learning to identify the effects of forces on objects. They are learning to recognize the effect of temperature on objects undergoing phase change, and identify sources of force acting on an object. They are beginning to apply their understanding of the properties of matter to identify potentially harmful wastes. They are beginning to understand that body parts help animals adapt in a particular habitat. They are learning to classify plants as flowering and non-flowering. They are beginning to identify ways to protect oneself from harmful effects of the weather and pollution.
B	Students at this level are learning to use characteristics of living things and properties of objects to predict behaviors and functions. They are learning to identify sources of heat and sound. They are learning the body parts of plants and animals and their functions, and the developmental stages of common plant or animal. They are learning to describe natural objects that are seen in the sky.
A	Students at this level are beginning to learn scientific terminology for observable characteristics of living things and properties of objects and to classify according to these characteristics/properties. They are starting to recognize basic parts of a plant and identify natural habitats of animals.

Shown in Table 6 are the descriptions of levels of proficiency in elementary Science. Upon examination of the underlying skills and the required topics in the curriculum, in consultation with content experts in elementary Science, it was found that the students at level B and above may be considered "ready" for the topics to be taught in Grade 4 Science. For Grade 6, it is those at levels D and E who may be considered "ready".

Students were assigned their corresponding proficiency levels based on their scores. In interpreting the results, it should be noted that the students assigned to higher ability levels are deemed to have mastered the skills described at the lower levels (i.e., they have a greater than 50% chance of giving the correct answer for items on lower level difficulty). Conversely, those at the lower levels are deemed not yet ready to learn the skills/topics at the higher levels (i.e., they have less than a 50% chance of giving the correct answer for items on higher levels of difficulty).

Mathematics

The results for Mathematics were treated the same way as those for Science so as to allow a similar interpretation. The cutpoints for Mathematics proficiency levels are given in Table 7.

Table 7. Cutpoints for Mathematics Proficiency Levels

Level	Cutpoints (Scaled score)	
	Lower bound	Upper bound
E	> 61.94	Highest
D	> 52.42	61.94
C	> 43.95	52.42
B	> 33.37	43.95
A	Lowest	33.37

The Mathematics proficiency level descriptions are shown in Table 8.

Table 8. Mathematics Level Descriptions

Level	Mathematics Level Description
E	Students at this level are starting to exhibit the ability to determine prime factors of a given number and also use factors in reducing fractions to their lowest term. They are also learning to perform addition of dissimilar fractions. They are beginning to apply an understanding of parallel, intersecting and perpendicular lines in solving word problems involving lines and shapes.
D	Students at this level are learning to understand division to be the inverse of multiplication and apply this understanding in solving word problems. They are starting to perform division with remainder and convert fraction to decimal or percentage. They are beginning to apply their understanding of parallel lines and symmetry in distinguishing between different shapes and different solids (3-D figures). They are also learning to calculate the area and volume of regular shapes, and read and interpret bar graphs.
C	Students at this level are starting to use multiplication of decimal numbers in solving word problems. They are beginning to interpret multiplication as repeated addition and division as repeated subtraction. They are also learning to perform division operation without remainder. They are beginning to identify common solids (3-D figures) and recognize parallel lines and symmetrical shapes. They are gaining an understanding of measurements as additive and are starting to exhibit ability to read and interpret count data in tabular form.
B	Students at this level are learning arithmetic operation. They are beginning to use place value with numbers greater than 1000 and to apply addition and subtraction operation with decimal numbers in solving word problems. They are starting to perform addition of similar fractions and multiplication with decimal numbers.
A	There was not enough evidence collected to describe the skills the students at this level are ready to learn.

Checking the description of the proficiency levels for Mathematics against the required topics in the curriculum revealed that the lowest level of understanding that can be considered ready for Grade 4 is level B and for Grade 6 is level D.

STUDENT PROFICIENCY AND READINESS

To compare the proficiency of students in Grades 4 and 6, the scaled scores, distribution of students across the levels, and readiness of students were examined for both Science and Mathematics.

Scores Distribution

To compare the abilities of students in Grades 4 and 6, the scaled scores were examined. Table 9 shows the mean and SD of the distribution student ability in both tests grouped by grade levels.

Table 9. Mean and Standard Distribution of Ability Estimates on Single Scale

Test	Grade Level	N	Mean Ability	SD
Science	4	723	45.98	9.63
	6	755	53.85	8.76
Mathematics	4	716	47.29	9.81
	6	750	52.59	9.49

Tests of statistical significance were used to determine whether the differences between grade levels and gender were significant at 95% confidence level. Mann-Whitney U tests of significance of differences across groups of interest were used because the distribution deviated significantly from the normal distribution (see Figures 5, 6, 7 & 8 in the Appendix). A statistically significant difference is indicated by a p-value less than .05.

Comparing across grade levels, it was found that the Grade 6 students performed significantly better than Grade 4 students in Science (U = 148925.0, p-value = .000) and in Mathematics (U = 182179.0, p-value = 0.000). This suggests that students typically experience considerable growth in ability levels in Science and Mathematics when they progress from Grade 4 to Grade 6. While this result is expected, it is reassuring to have confirmation that students improve significantly in both Science and Mathematics as they move up the grades.

Comparing the performance between sexes, female students generally perform significantly better than male students for both the Science (U = 242097.5, p-value = 0.000) and Mathematics (U = 238462.0, p-value = 0.001) tests.

Science

The distribution of students across levels of proficiency in Science is shown in Figure 3. The distribution for Grade 4 students is shown in blue and Grade 6 in brown. The distribution for the Grade 6 participants peaked at a higher level (Level C) than that for Grade 4 participants (Level B). It is also noteworthy that there were very few Grade 6 students still in Level A, the lowest level of proficiency. It should be remembered that this graph shows the distribution of two different cohorts of students, not longitudinal data. However, the size shift between the two grades is sufficient to suggest that students typically make considerable progress between the beginning of Grade 4 and the beginning of Grade 6.

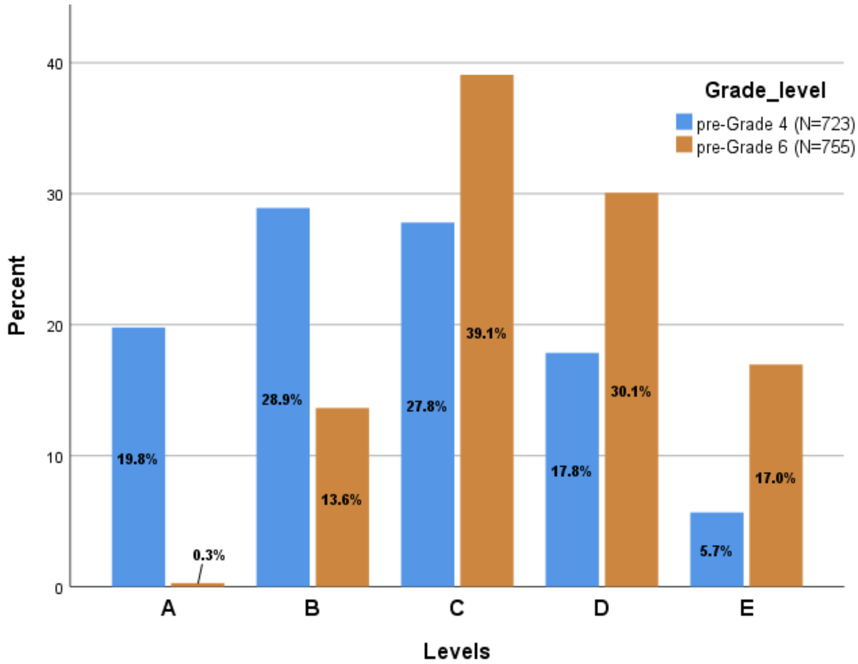

Figure 3. Distribution of students across science ability levels by grade level (A = lowest, E = highest)

Mathematics

The distribution of students across the Mathematics proficiency levels, shown in Figure 4, was similar to that for Science.

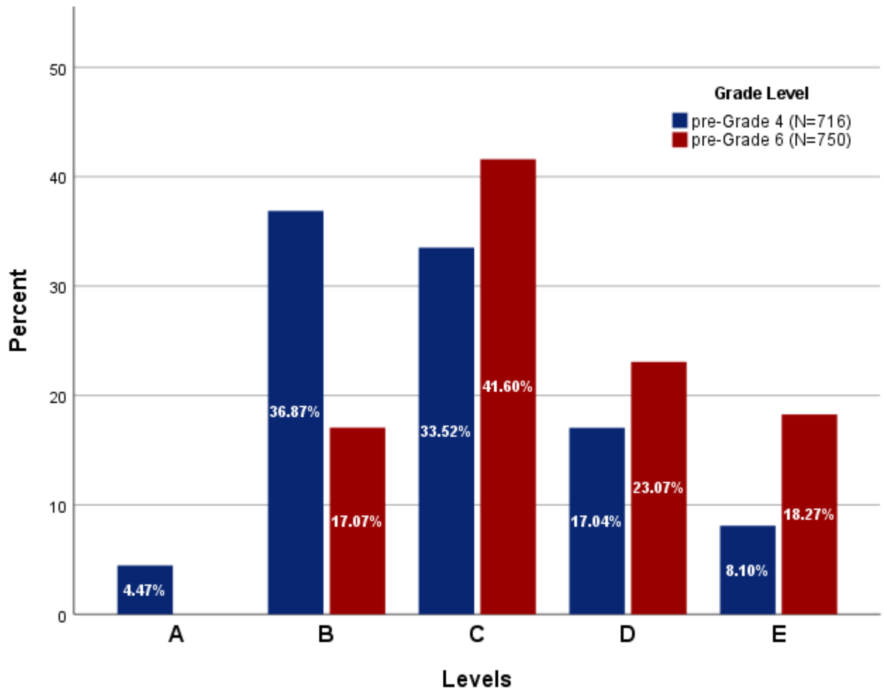

Figure 4. Distribution of students across mathematics ability levels by grade level (A = lowest, E = highest)

The distribution of students shown in Figure 4 was shifted in a similar way to the Science data. The peak for each grade was at different levels: Level B and Level C for Grade 4 and Grade 6, respectively. The differences were most obvious at lower proficiency levels, with few Grade 6 students being placed in Levels A or B.

Readiness

The readiness of students for the curriculum they were about to undertake is shown in Table 10.

Table 10. Readiness of Students for the Curriculum

Grade	Ready	Not ready
Pre-Grade 4 Science	80%	20%
Pre-Grade 6 Science	47%	53%
Pre-Grade 4 Mathematics	96%	4%
Pre-Grade 6 Mathematics	41%	59%

These results indicate that although a high percentage of students enter Grade 4 with the prerequisite skills, this is not the situation by the time students enter Grade 6, where approximately half the students lack the skills and conceptual understandings needed to be ready for the Grade 6 curriculum.

The high level of readiness of students for Grade 4 Mathematics indicates a good matching of the expectations of the curriculum with the level of ability of the students. For Science, the presence of a fifth of students who are not ready for the Grade 4 topics suggests poor matching of the expectation of the curriculum with the ability level of the students. It should be noted, however, that the Grade 4 participants were only introduced to science concepts at grade 3. This means that the students may not have been able to learn or retain the concepts and skills taught to them in the previous grade level.

The low percentage of Grade 6 participants who were ready is worth noting. The percentages of Grade 6 students who were ready for their respective topics on both subjects is a considerable drop from that of Grade 4 students. This suggests that the trend of decreasing levels of readiness found in a similar study for Junior High School (Ferido et al., 2017) also happens in the elementary grade levels.

This study was not designed to investigate the factors contributing to student readiness, but the results suggest it would be beneficial for these to be explored in the future. The results could be partly due to factors related to the curriculum and delivery of instruction. In terms of the curriculum, it has been suggested that the pacing of student learning expected in the curriculum is not realistic and that the contents are probably not developmentally appropriate. The difference in the pacing expected by the curriculum and rate of student learning could explain the drop in the percentage of the students who were ready. This is assuming perfect implementation of the curriculum. The mismatch in terms of developmental appropriateness to the students of the contents could potentially explain why at Grade 4, though with minimal exposure to the curriculum, a considerable percentage of students are not ready for the topics. In this, the assumption of perfect implementation may be relaxed, thus making the mismatch in terms of developmental appropriateness more tenable. Both arguments, however, deserve careful consideration.

On the other hand, it may also be argued that the problem is in the delivery, which includes factors related to materials, school, teachers and students. While these factors are indeed worth investigating, the study has not been designed to determine their effects. In fact, the purposive selection of large schools located in city centres tended to minimize the conditions within the implementation that could adversely affect the student performance because the schools selected through the process are more likely to have greater access and receive more support compared to the smaller ones outside the city centres.

A more comprehensive view is that the results may be due to an ensemble of factors from both the curriculum and the delivery of instruction. As to which and to what extent the possible factors affected the results is beyond what can be inferred from results of this study. Notwithstanding the limitations of the interpretive value of the results, it is clear that the low percentage of students who are ready for their respective topics to be covered is a problem to be addressed and the suggestions concerning areas in the curriculum that could contribute to this problem cannot be readily dismissed.

TEACHER AND CLASS INFORMATION

This section presents pertinent features of the context in which the results were obtained. Specifically, summarised information collected through the teacher questionnaires is presented here to provide background on the conditions faced by the students who participated in this study. It should be noted that no causal relation may be established between the assessment results presented and the background information.

Teacher Information

Summary information from the science teachers and the mathematics teachers, is shown in Table 12 and Table 13 respectively (See Appendix). Based on these summaries, most of the teachers for both subjects were experienced (mean= 16 years) and female. Most of the science teachers and all of the mathematics teachers taught the same subject for at least a year by the time of data collection. For Grade 4 teachers, this means they were not only experienced with the subject, but also with this specific curriculum. The situation for Grade 6 teachers was different; while they had experience with the subject, they were inexperienced with this specific curriculum as, at the time of data collection, it was the first year of the implementation of the new Grade 6 curriculum.

Responses on items that asked Grade 4 teachers about the extent to which they were able to cover the Grade 4 the curriculum in the previous school year reveal that half for mathematics were not able to cover all material, with the Quarter 4 content being the most frequently incomplete. The problem was less extreme for Grade 4 Science teachers with just under a quarter of these teachers reporting they were unable to cover the curriculum. One limitation of the questionnaire design was that it did not ask teachers if they needed to cut corners in order to complete the curriculum. It is possible that the extent of the problem is greater than indicated by these results, as teachers who did not report incomplete quarters may have reduced the depth of curriculum coverage in order to finish. Incomplete or reduced depth would contribute to students being unable to develop the skills and conceptual understandings required for subsequent grades.

In terms of training, most of the teachers graduated with a degree in education (83% for Science and 89% for Mathematics) and a small percentage (12% for Science and 11% Mathematics) with non-education degrees. Among those with education-related degrees, more majored in elementary than in secondary education. For their in-service training, it is worth noting that almost half of the teachers for both subjects have attended the National Training of Trainers in the new curriculum, the first level of the 'train the trainer' model used to roll out professional development, while roughly a quarter of them have attended training at the regional level. Overall, 9 out of 24 science teachers and 12 out of 27 mathematics teachers neither received national level training nor the regional level training in the new curriculum. Two mathematics teachers also reported having availed themselves of training offered by private institutions, specifically Metrobank.

Responses on items asking about the availability of teaching materials are also worth examining. The Teacher's Guide (TG), according to the responses of the teachers, is available to roughly half of the teachers only. This therefore limited the extent of the use of the TG. To address this lack of access, some resorted to using other materials.

Class information

Class information is summarized in Table 14 and Table 15 (see Appendix) for Science and Mathematics, respectively. As each group of students were tested for both Science and Mathematics, the data is very similar for each subject, with variations in entries mainly due to the differences specific to the subject. The difference in the total number of responses presented here is due to the inability to collect responses from the subject teachers who were not in school during the administration of the test. It should also be noted that some of the teachers provided multiple answers to the items asking them about what they do when they have difficulty moving to the next topic; hence the number of total responses exceeds the total number of teachers interviewed.

The average class size of the participants is well within the acceptable size determined by DepEd, which is within 15 to 65 (Department of Education, 2004). The usual attendance rate, which appears to be within a two-unit difference from the average class size, suggests a low level of absenteeism in the participating classes. The rate of use of DepEd Learners' Materials (LM) was high for the participating classes (75% for Science and 59% for Mathematics). Workspace, equipment and storage of materials for experiments appear to be available or somewhat available for more than half of the classes. While these reveal acceptable levels of access to the resources for students in those classes, there are still about half the students in the sample without access.

Teachers reported that their students experienced difficulties understanding the topics taught to them. This is in alignment with the assessment data gathered in this project. When asked about their estimates of the percentage of students who have difficulty in understanding the topics being taught by them, for 89% (for Science) and 83% (for Mathematics) of the classes the teachers indicated percentages higher than 25% of their students. This means that the teachers already recognize the lack of readiness of the students for the topics at the beginning of the school year. This recognition of the lack of readiness was also apparent when teachers were asked if they had difficulty deciding when to move to the next topic. There were two types of responses that teachers take when faced with this problem: (1) some teachers resolve to ignore this and proceed to the next topic in order to keep up with the budget of work and (2) others re-teach, give remedial lessons and enrichments for the students having difficulty in order for them to catch up. These responses point to the need to take into account time allotment, in addition to student readiness, as a factor that affects the teachers' decision-making.

Implications

Aside from corroborating with the results of the assessment of student readiness for Science and Mathematics done in this study, the background information given by the teachers provide a picture of how they determine the readiness of students and how they approach classes depending on their own findings. It also revealed that aside from student readiness for the topics, teachers also consider time allotment in deciding when to move to the next topic. It has been found that already some of the teachers use assessment results to guide their decision. This practice needs to be encouraged and be improved upon through proper training in formative assessment. The conduct of remedial/enrichment lesson for students also presents a viable ground for teacher support through provision of remedial lessons designed to take up less time while covering the essential concepts and skills that will equip the students for the topics to be covered.

The findings based on the teacher and class information point to possible areas for further improvement in the area of implementation. However, they cannot be used to explain the performance of the students in the assessment of their readiness. While it can be argued that they may have been affected by similar circumstances given that they studied in the same school in the previous year levels, it still cannot be safely assumed that they have had similar access to materials and that their teachers had similar background. At best, these findings show the context in which the participants of this study are situated. Despite that, it is clear that the conditions surrounding implementation of the curriculum are in some instances unfavorable for students, especially for those who are not ready for the topics.

To improve the implementation of the reform, two aspects have to be addressed adequately. One concerns the curriculum. It has been argued that the mismatch of the readiness of students to their studies could be due to unrealistic expectations embedded in the curriculum. It is yet to be determined whether the expected pacing, the degree of developmental appropriateness or a combination of both is the cause of this mismatch. Further research in this area could shed more light into this problem. These findings, therefore, can also be understood to invite curriculum designers to revisit the sequencing of the topics in the Science and Mathematics curriculum because such problems may also be due to inadequate coverage of prerequisite concepts and skills for the subsequent years of study and/or that the gap between teaching of prerequisite concepts and skills and their latter application may have been too long that the students were not able to retain their mastery of the concepts and skills. Addressing these will certainly require adjustments in the curriculum itself that will render it more developmentally appropriate and ensure adequate coverage of essential concepts and skills at the lower grade levels.

The other aspect concerns delivery of the curriculum. This includes access to instructional materials: the Teacher's Guide and appropriate training for the teachers, and the provision of Learner's Materials to students. While this study did not establish a causal link between these background issues and the assessment results, there is sufficient cause for concern in this aspect of curriculum implementation since it showed that the low levels of readiness of the students in some schools are met with an aggravating condition of inadequate access to educational resources. Some good practices in addressing the lack of readiness of students were also uncovered and found to be worth promoting. The use of assessment results in determining readiness of students and the conduct of remedial/enrichment lessons for students and are suggested as good starting points to assist teachers in their work.

Given the design of the study and its accompanying limitations, several recommendations for future research are suggested. While the assessment results provide evidence that certain prerequisite concepts and skills in the K-12 Science and Mathematics curriculum have not been retained by the students, it is possible that the performance of the Grade 6 participants (the first cohort to undergo the full K-12 curriculum) have been affected negatively because the schools and the teachers are still adjusting to the new curriculum. A replication of this study after a few years into the implementation could help rule out this possible confounding effect. An experimental (or quasi-experimental) design that could uncover the relationships among curriculum, delivery variables and student outcomes would be a study that could also further the understanding of the issues found in this study. A detailed look at the topics taught and an inventory of prerequisite concepts and skills could also help implementers. Studies designed to determine the essential concepts and skills required by the Science and Mathematics curriculum for each grade level could provide helpful information for the design of interventions for students who are found to be not equipped with prerequisite skills.

CONCLUSION

The progress of students in the elementary Science and Mathematics curricula was investigated in this study. The results showed that Grade 6 students were typically more proficient in both Science and Mathematics than their Grade 4 counterparts. This finding is reassuring as it suggests that students make progress in their skills and conceptual understandings over those two years of schooling, although this study has not tracked students longitudinally.

The study generated descriptions of proficiency levels which allowed for a qualitative interpretation of the performance of the Grade 4 and Grade 6 students at the beginning of the school year 2017-2018. The proficiency levels were also used to determine grade-specific levels of readiness. The percentage of students who are ready for the topics to be covered is lower for Grade 6 than for Grade 4. This is similar to the findings of the previous project in which there was a trend of decreasing readiness for the Chemistry curriculum from Grade 7 to Grade 10 (Ferido et al., 2017). The presence of considerable proportion of students who were not ready for their respective topics were taken to suggest two possible issues in the curriculum i.e., that there was a mismatch in the expected pacing of the curriculum and the actual rate of learning of students, and that the topics may not be developmentally appropriate for the students.

A detailed examination of the teacher and class information revealed findings that provide insight into the context in which these results were gathered. Access to teacher and student materials was a challenge for a considerable number of participants in the study. The in-service training made use of by the teachers also appeared to be limited. While the low levels of student readiness cannot be directly attributed to these, it is still worth noting that in addition to the low readiness for the topics covered, the students also face the challenges brought about by these unfavourable conditions. With these challenges, some teacher practices, specifically the use of assessment results to determine levels of readiness of students (and decide whether to proceed to the next topic) and the conduct of remedial/enhancement classes, were found to be worth promoting and provide a viable ground for teacher support from the instructional leaders to address problems of student readiness.

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Appendix

Figure 5. Distribution of Scaled Scores for Pre-Grade 4 Science

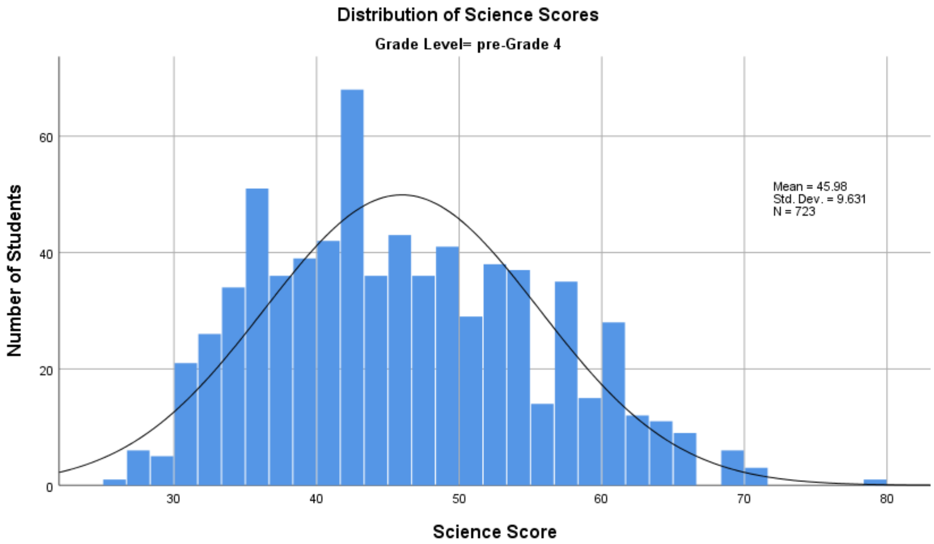

Figure 6. Distribution of Scaled Scores for Pre-Grade 6 Science

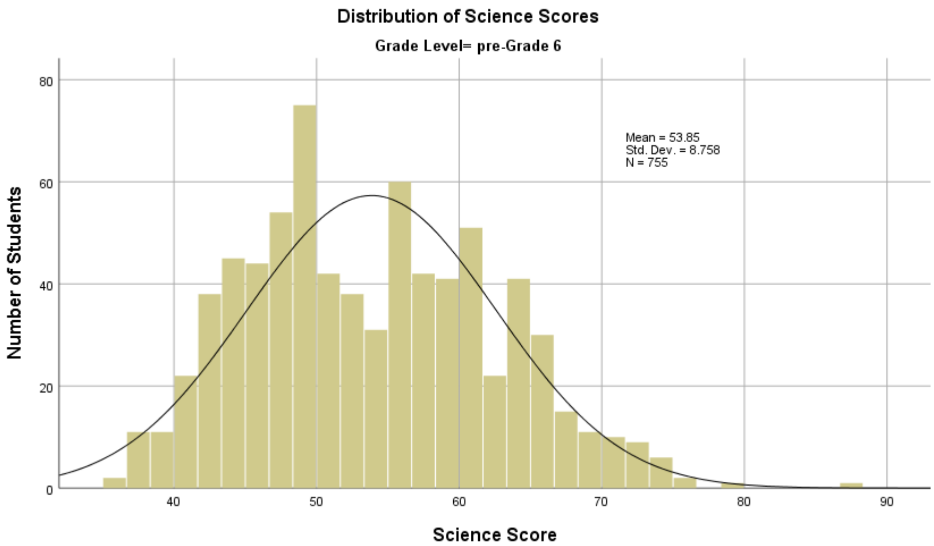

Figure . Distribution of Scaled Scores for Pre-Grade 4 Mathematics

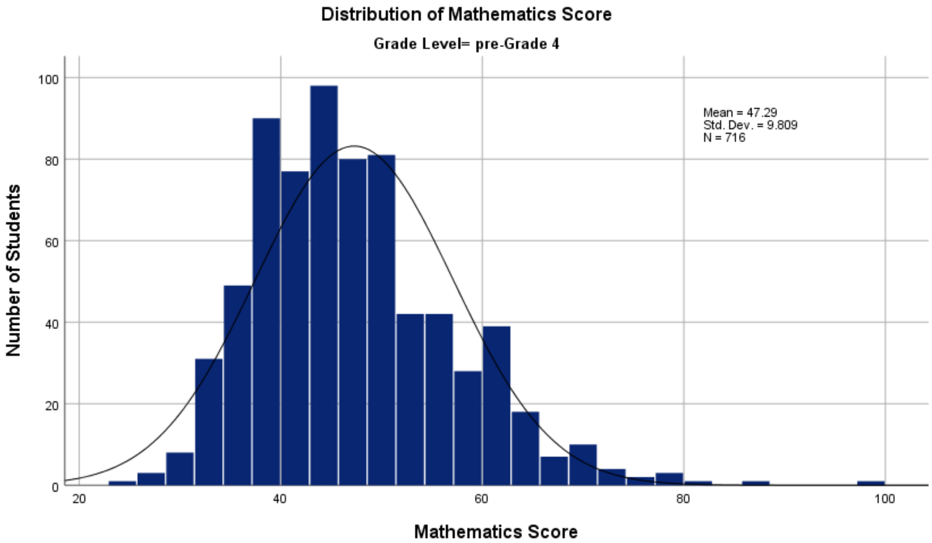

Figure . Distribution of Scaled Scores for Pre-Grade 6 Mathematics

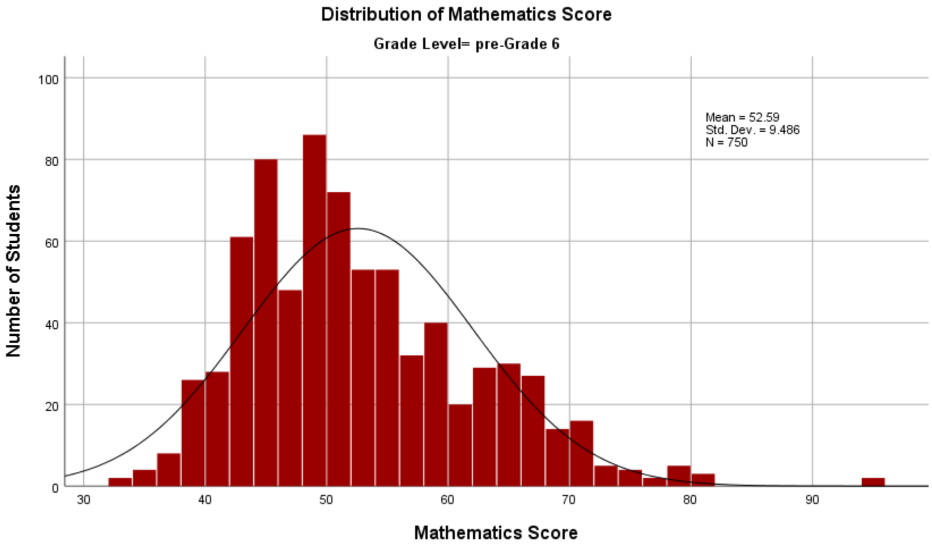

Table 11. Mean ability estimates and reliabilities of the tests based on free calibration

Test	N	Mean Ability	SD	Item Separation Reliability	Person Separation Reliability
Grade 4 Science	723	.2743	1.081	.989	.910
Grade 6 Science	755	.2940	.9891	.992	.895
Grade 4 Mathematics	716	-.0849	.9269	.992	.860
Grade 6 Mathematics	755	-.1749	9.49	.990	.862

Figure 7. Teacher Questionnaire (Science)

Teacher Information

1. Gender: ◻ Male ◻ Female

2. How many years have you been teaching at the elementary school level? ____________________

3. What grade level/s are you presently teaching?

	Subjects *(Write "all" if applicable)*
◻ Grade 1	____________
◻ Grade 2	____________
◻ Grade 3	____________
◻ Grade 4	____________
◻ Grade 5	____________
◻ Grade 6	____________

4. Did you teach Science in SY 2016-2017?
   ◻ Yes ◻ No If **yes**, for grade________

5. Which quarter/s were you not able to finish? In the space provided, please specify the part/s of the quarter not covered.
   ◻ Quarter 1 (Matter) ____________________
   ◻ Quarter 2 (Living Things and their Environment) ____________________
   ◻ Quarter 3 (Force, Motion and Energy) ____________________
   ◻ Quarter 4 (Earth and Space) ____________________

6. What is your undergraduate degree?____________________
   ◻ Bachelor of Elementary Education
   ◻ Bachelor of Elementary Education Major in ____________________
   ◻ Others *(Please specify)* ____________________

7. Did you attend the national training for K to 12 Science?
   ◻ Yes ◻ No If yes, for grade________

8. Did you attend any regional training for K to 12 Science?
   ◻ Yes ◻ No If yes, for grade________

9. Do you have a copy of the DepEd Science Teacher's Guide (TG)?
   ◻ Yes ◻ No
   If **yes**, specify for what grade level/s is the TG ____________________

10. Do you use the TG accompanying the DepEd Learning Materials?
    ◻ Yes ◻ No ◻ Somewhat

    If **no** or **somewhat**, please provide reason ______________________________

11. Based on your initial interaction with your pupils, what percent of your pupils are having difficulty in understanding the Science lessons?

    ◻ 0 – 25% ◻ 26 – 50% ◻ 51 – 75% ◻ 76 – 100%

12. Do you have difficulty deciding whether to move to the next topic when there are pupils who have not yet understood the previous topic?
    ◻ Yes ◻ No

    If **yes**, how do you decide or what do you do? ______________________________

    ____

    If **no**, what is your usual basis for moving to the next topic? ______________________________

    ____

Class Information

13. How many pupils are enrolled in this class? ___________

14. How many pupils usually attend this class? ___________

15. Are you using the DepEd Learner's Material to teach this class?
    ◻ Yes ◻ No
    If **yes**, how often
    ◻ Sometimes ◻ Most of the time

16. Does each pupil in this class have a copy of the DepEd Learner's Material?
    ◻ Yes ◻ No ◻ Photocopy

17. Do you have an appropriate workspace to conduct Science experiments in this class?
    ◻ Yes ◻ No ◻ Somewhat

18. Do you have the required equipment to conduct experiments in your Science class?
    ◻ Yes ◻ No ◻ Somewhat

19. Do you have a place to store Science materials or math manipulatives?
    ◻ Yes ◻ No ◻ Somewhat

Table 12. Summary of Information from Science Teacher Questionnaire (N=24)

SCIENCE TEACHER INFORMATION (N = 24)			
Sex			
	Male	3	12.5%
	Female	20	83.3%
	Missing	1	4.2%
Years of Experience			
	Mean	16.0	
	SD	8.0	
	Max	34	
	Min	3	
	Range	31	
Grade Levels Presently Teaching			
	Grade 4	11	45.8%
	Grade 6	11	45.8%
	Grade 4 and 6	1	4.2%
	Missing	1	4.2%
Taught Science in the previous school year			
	Yes	21	87.5%
	No	2	8.3%
	Missing	1	4.2%

Grade Level Taught Science in SY 16-17			
	Grade 4	8	33.3%
	Grade 6	7	29.2%
	Grade 4, 5 and 6	2	8.3%
	NA	2	8.3%
	Missing	5	20.8%
Quarters not completed			
	Q4	6	25.0%
	Q1	1	4.2%
	Q2	1	4.2%
	NA	2	8.3%
	Missing	14	58.3%
Parts not Covered			
	Ecosystem	1	4.2%
	Universe	1	4.2%
	First implementation	2	8.3%
	Not specified	4	16.7%
	NA	2	8.3%
	Missing	14	58.3%
Undergraduate degree			
	Elementary Education	19	79.2%
	Secondary Education	1	4.2%
	Non-education	3	12.5%
	Missing	1	4.2%
Attended National Training			
	Yes	13	54.2%
	No	9	37.5%
	Missing	2	8.3%
Grade Level National Training attended			
	Grade 4	5	20.8%
	Grade 6	4	16.7%
	NA	10	41.7%
	Missing	5	20.8%
Regional Training			
	Yes	6	25.0%
	No	16	66.7%
	Missing	2	8.3%
Grade Level Regional Training attended			
	Grade 4	2	8.3%
	Grade 6	2	8.3%
	NA	16	66.7%
	Missing	4	16.7%
Copy of Teacher Guide (TG)			
	Yes	14	58.3%
	No	10	41.7%
Teacher Guide Grade Level			
	Grade 4	9	37.5%
	Grade 6	1	4.2%
	NA	10	41.7%
	Missing	4	16.7%
Use of Teacher Guide			
	Yes	11	45.8%
	No	11	45.8%
	Somewhat	2	8.3%
Reason for "No" & "Somewhat"			
	Not available	7	29.2%
	Uses other materials	3	12.5%

NA	11	45.8%
Missing	3	12.5%

Figure 8. Teacher Questionnaire (Mathematics)

Teacher Information

1. Gender: ☐ Male ☐ Female

2. How many years have you been teaching at the elementary school level? ____________

3. What grade level/s are you presently teaching?

   Subjects *(Write "all" if applicable)*

   ☐ Grade 1 ____________
   ☐ Grade 2 ____________
   ☐ Grade 3 ____________
   ☐ Grade 4 ____________
   ☐ Grade 5 ____________
   ☐ Grade 6 ____________

4. Did you teach math in SY 2016-2017?

   ☐ Yes ☐ No If **yes**, for grade________

5. Which quarter/s were you not able to finish? In the space provided, please specify the part/s of the quarter not covered.

   ☐ Quarter 1 (Numbers and Number Sense)____________
   ☐ Quarter 2 (Numbers and Number Sense) ____________
   ☐ Quarter 3 (Geometry, Patterns and Algebra, Measurement) ____________
   ☐ Quarter 4 (Measurement, Statistics and Probability) ____________

6. What is your undergraduate degree?____________

   ☐ Bachelor of Elementary Education
   ☐ Bachelor of Elementary Education Major in ____________
   ☐ Others (Please specify)____________

7. Did you attend the national training for K to 12 Math?

   ☐ Yes ☐ No If yes, for grade________

8. Did you attend any regional training for K to 12 Math?

   ☐ Yes ☐ No If yes, for grade________

9. Do you have a copy of the DepEd Math Teacher's Guide (TG)?

   ☐ Yes ☐ No

   If **yes**, specify for what grade level/s is the TG ____________

10. Do you use the TG accompanying the DepEd Learning Materials?
    □ Yes □ No □ Somewhat

    If **no** or **somewhat**, please provide reason ______________________

11. Based on your initial interaction with your pupils, what percent of your pupils are having difficulty in understanding the science/math lessons?

    □ 0 – 25% □ 26 – 50% □ 51 – 75% □ 76 – 100%

12. Do you have difficulty deciding whether to move to the next topic when there are pupils who have not yet understood the previous topic?
    □ Yes □ No

    If **yes**, how do you decide or what do you do? ______________________

    ____

    If **no**, what is your usual basis for moving to the next topic? ______________________

    ____

<u>**Class Information**</u>

13. How many pupils are enrolled in this class? ____________

14. How many pupils usually attend this class? ____________

15. Are you using the DepEd Learner's Material to teach this class?
    □ Yes □ No
    If **yes**, how often
    □ Sometimes □ Most of the time

16. Does each pupil in this class have a copy of the DepEd Learner's Material?
    □ Yes □ No □ Photocopy

17. Do you have an appropriate workspace where pupils can use Math manipulatives in this class?
    □ Yes □ No □ Somewhat

18. Do you have the required manipulatives for your math class?
    □ Yes □ No □ Somewhat

19. Do you have a place to store science materials or math manipulatives?
    □ Yes □ No □ Somewhat

Table 13. Summary of Information from Mathematics Teacher Participants (N = 27)

MATHEMATICS TEACHER INFORMATION (N=27)			
Sex			
	Male	3	11.1%
	Female	24	88.9%
Years of Experience			
	Mean	16.19	
	Median	17	
	Mode	17	
	Max	27	
	Min	2	
	Range	25	
Grade Level Presently Teaching			
	Grade 4	12	44.4%
	Grade 6	13	48.1%
	Grade 4 and 6	2	7.4%
Taught Math in SY 16-17		27	100.0%
Grade Level Taught in SY 16-17			
	Grade 4	10	37.0%
	Grade 6	10	37.0%
	Others	2	7.4%

	Missing	5	18.5%
Quarters not completed			
	Q4	10	37.0%
	Q1	2	7.4%
	Missing	15	55.6%
Parts not Covered			
	Statistics	5	38.5%
	Probability	4	30.8%
	Division	2	15.4%
	Multiplication	1	7.7%
	Volume	1	7.7%
	Missing	18	
Undergraduate Degree			
	Elementary Education	21	77.8%
	Secondary Education	3	11.1%
	Non-education	3	11.1%
National Training			
	Yes	13	48.1%
	No	14	51.9%
Grade Level National Training attended			
	Grade 4	6	22.2%
	Grade 6	3	11.1%
	Grade 2	1	3.7%
	NA	14	51.9%
	Missing	3	11.1%
Regional Training			
	Yes	8	29.6%
	No	19	70.4%
Grade Level Regional Training attended			
	Grade 4	1	3.7%
	Grade 6	3	11.1%
	Grade 2	1	3.7%
	Unspecified (MTAP)	3	11.1%
	NA	19	70.4%
Copy of Teacher Guide			
	Yes	17	60.7%
	No	11	39.3%
Teacher Guide Grade Level			
	Grade 4	11	39.3%
	Grade 6	3	10.7%
	NA	11	39.3%
	Missing	3	10.7%
Use of Teacher Guide			
	Yes	19	67.9%
	Somewhat	2	7.1%
	No	7	25.0%
Reason for "No" & "Somewhat"			
	Not available	6	21.4%
	NA	19	67.9%
	Missing	3	10.7%

Table 14. Class Information for Science (N = 36)

Class Size			

	Mean	43.6	
	SD	4.4	
	Max	52	
	Min	33	
	Range	19	
Usual Attendance			
	Mean	42.1	
	SD	3.9	
	Max	49	
	Min	33	
	Range	16	
Use of DepEd Learner Materials			
	Yes	27	75.0%
	No	8	22.2%
	Missing	1	2.8%
Frequency			
	Most of the time	20	55.6%
	Sometimes	0	0.0%
	NA	8	22.2%
	Missing	8	22.2%
Copy of Learner Materials per student			
	Yes	17	47.2%
	Photocopy	3	8.3%
	No	15	41.7%
	Missing	1	2.8%
Workspace for experiment			
	Yes	14	38.9%
	Somewhat	8	22.2%
	No	13	36.1%
	Missing	1	2.8%
Equipment for experiment			
	Yes	15	41.7%
	Somewhat	7	19.4%
	No	13	36.1%
	Missing	1	2.8%
Storage Area for Science			
	Yes	17	47.2%
	Somewhat	6	16.7%
	No	12	33.3%
	Missing	1	2.8%
% of Students with Difficulty			
	0-25%	6	16.7%
	26-50%	10	27.8%
	51-75%	8	22.2%
	76-100%	10	27.8%
	Missing	2	5.6%
Difficulty moving to the next topic			
	Yes	16	44.4%
	No	19	52.8%
	Missing	1	2.8%
If yes, what do you do?			
	Remedial	8	22.2%
	Reteach	6	16.7%
	Assessment	1	2.8%
	NA	19	52.8%
	Missing	2	5.6%
If no, basis			

	Test or Assessment	11	30.6%
	Time constraint	2	5.6%
	Remedial/Enrichment	3	8.3%
	NA	16	44.4%
	Missing	4	11.1%

Table 15. Class information for Mathematics (N = 34)

Class size			
	Mean	43.2	
	SD	4.7	
	Min	30	
	Max	52	
	Range	19	
Usual attendance			
	Mean	41.9	
	SD	4.3	
	Min	30	
	Max	49	
	Range	19	
Use of DepEd Learner Materials			
	Yes	20	58.8%
	No	14	41.2%
Frequency			
	Most of the time	17	50.0%
	Sometimes	2	11.8%
	Missing	1	6.7%
	NA	14	45.2%
Copy of Learner Materials per student			
	Most of the time	17	50.0%
	No	17	50.0%
Workspace for math manipulatives			
	Yes	20	58.8%
	Somewhat	7	20.6%
	No	6	17.6%
	Missing	1	2.9%
Equipment for manipulatives			
	Yes	15	44.1%
	Somewhat	12	35.3%
	No	7	20.6%
Storage area for mathematics			
	Yes	21	61.8%
	Somewhat	7	20.6%
	No	6	17.6%
% of Students with Difficulty			
	0-25%	4	10.0%
	26-50%	20	50.0%
	51-75%	9	22.5%
	76-100%	3	7.5%
Difficulty moving to the next topic			
	Yes	28	76.5%
	No	8	23.5%
If yes, what do you do?			
	Remedial	21	43.8%

	Enrichment	9	18.8%
	Reteach	9	18.8%
	NA	8	16.7%
	Missing	1	2.1%
If no, basis			
	Test or assessment	7	80.0%
	Missing	1	20.0%
	NA	28	

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