

PROFILING OF GRADUATING ELEMENTARY STUDENTS: DETECTING POSSIBLE LEARNING LOSS

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Abstract

This study investigates the performance of Filipino graduating elementary students to determine the extent of the effect induced by the Covid-19 pandemic on the students' learning continuity. It specifically looks into the students' performance in the K to 12 Achievement Test in English, Mathematics, and Science Grade 6 – assessment tools developed by the pioneer testing and research institution in the Philippines, the Center for Educational Measurement, Inc. (CEM). Taking into account estimates derived using the One Parameter Logistic Model (OPLM), graduating elementary students' achievement levels acquired in SY 2020-2021 and SY 2021-2022 are compared with those obtained prior to the pandemic by learning areas as well as their respective content areas and cognitive skills. Subgroup analysis in terms of geographic location is conducted as well. Results of the study are deemed imperative in providing a roadmap for learning recovery plans.

Keywords: Learning Continuity, Learning Recovery, Learning Loss, K to 12, Basic Education

INTRODUCTION

The COVID-19 pandemic has brought adverse impacts not only on the global health system but extends to the education system. The Education Development Trust (2021) reported that school closure due to the pandemic and subsequently, the limited to no access to formal education caused by lack of online connectivity during the closure, thereby resulted to learning losses worldwide. Learning loss is defined as *“any loss of knowledge or skills and/or deceleration of or interruption to academic progress, most commonly due to extended gaps or discontinuities in a student's education”* (UNESCO, UNICEF, and World Bank, 2021). With the limited available data during the pandemic, most of the prior studies on learning loss are measured through predictions and simulations. Compilations of these studies are available in the reports of the Education Development Trust (2021) and UNICEF (Alban Conto, et. al., 2020).

At present, evidences of substantial learning losses highlighting the numerical and reading literacies of students are increasing in literature. Such researches on learning losses include that of Hevia, et. al (2022) revealing that in Mexico, learning loss was estimated to range from 0.34 to 0.45 SD in reading and 0.62 to 0.82 SD in numeracy. In the UK, Juniper Education (2021) reported that due to the pandemic, students struggled to reach related expectations with the youngest children having the most significant drop. In particular, age-related expectations of Year 1 pupils had dropped from 82% to 60% in reading, from 79% to 54% in writing and from 83% to 59% in maths by the summer term of 2020.

Even in countries such as the Netherlands where a relatively short lockdown was experienced, learning loss (Engzell, Per, Arun Frey, and Mark D. Verhagen., 2021) was reported to approximate about 3 percentile points or 0.08 standard deviation, equivalent to a fifth of their school year. The same study also revealed that there was up to a 60% larger loss among students from less-educated homes. The study of Schuurman, Henrichs, Schuurman, Polderdijk, & Hornstra (2021) further revealed that an average learning loss of 2.47 months in mathematics and 2.35 in reading comprehension had been caused by school closure on students' achievement growth on national standardized tests in the Netherlands.

In Switzerland where schools transitioned swiftly to online learning, learning slows down and at the same time interindividual variances in learning gains increase for primary school pupils although secondary school pupils remain largely unaffected by the school closures (Tomasik, Helbling and Moser, 2020)

In the Philippines, despite the Department of Education (DepEd) coming up with the Basic Education Learning Continuity Plan in the Time of COVID-19 (BE-LCP; Department of Education, 2020) as an immediate response to the disruption of students' learning, there has been no study on the amount of learning loss incurred by the Filipino learners during the pandemic.

In light of this, a series of research is initiated by the Center for Educational Measurement, Inc. (CEM), the pioneer testing and research institution in the Philippines, to document students' learning at the Basic Education level during the pandemic and at the start of post-pandemic, and thus, help in preparing for learning recovery plan. This study specifically investigates the performance of graduating elementary students in SY 2020-2021 and SY 2021-2022 in the CEM K to 12 Achievement Test in English, Mathematics, and Science for Grade 6. Subgroup analysis considering students' geographical location is conducted as well to determine the varying effect in terms of location.

METHOD

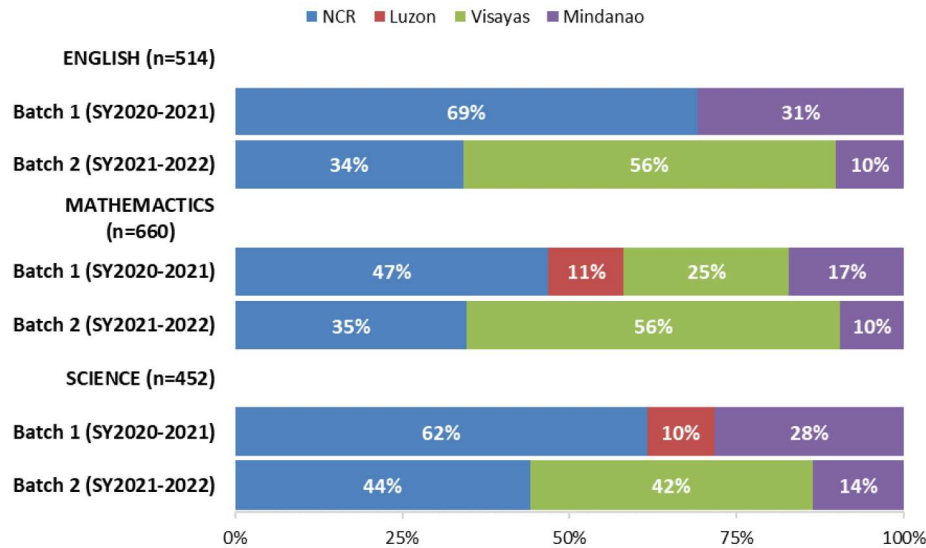
Elementary Students' Profile

A total of 514 test takers for English, 660 test takers for Mathematics, and 452 test takers for Science were included in this study. They were graduating elementary students who took the CEM K to 12 Achievement Test in English, Mathematics, and Science for Grade 6 as a posttest in School Year 2020-2021 and School Year 2021-2022. The distribution of the students in terms of the school year and geographic location is presented in Figure 1. Samples in School Year 2020-2021 and School Year 2021-2022 are referred to as Batch 1 and Batch 2, respectively.

Taking into account that these samples were gathered at the height of the pandemic (School Year 2020-2021) and the start of post-pandemic phase in the Philippines (School Year 2021-2022), this study was delimited with the available data based on actual test service subscriptions. As shown in Figure 1, the majority of the samples were from NCR and Visayas where access to online learning are more prominent while there were very few shares coming from Luzon.

Figure 1

Profile of Elementary Students by School Year and Geographic Location



CEM K to 12 Achievement Test in English, Mathematics, and Science for Grade 6

The CEM K to 12 Achievement Test in English, Mathematics, and Science for Grade 6 are highly reliable and valid assessment instruments developed by CEM and are designed to provide stakeholders with valuable information on students' achievement levels in core subject areas of the K to 12 Curriculum.

The tests cover learning competencies included in the K to 12 Curriculum and are classified according to the major content areas and cognitive skills assessed. The specific contents of the said tests are presented in Table 1.

Table 1

Test Contents of K to 12 Achievement Tests for Grade 6

English	Mathematics	Science
Content Area		
1. Grammar	1. Numbers and Number Sense	1. Living Things and Their Environment
2. Reading Comprehension	2. Geometry	2. Matter
	3. Patterns and Algebra	3. Force, Motion, and Energy
	4. Measurement	4. Earth and Space
	5. Statistics and Probability	
Cognitive Skill		
	1. Remembering	
	2. Understanding	
	3. Applying	
	4. Analyzing	

Analyzing the Student Performance

Estimating the Student Performance

Students' performances in each of the content areas, the cognitive skills and the entire test are estimated using the One Parameter Logistic Model (OPLM). OPLM is generally an Item Response Model (IRT) and a software application developed by Cito. OPLM combines the statistical virtues of the 1-Parameter Logistic Model (1PL) with greater flexibility of the 2-Parameter Logistic Model (2PL) by imputing integer values for the slope parameter rather than the statistical estimation of these parameters (Sijtsma, K., & Hemker, B. T., 2000). The OPLM produces estimate of each student's ability which is used as indicator of student's performance or achievement level. The ability estimates usually range from -4.00 to 4.00 with higher values corresponding to higher performance or achievement level.

Reporting Student Performance

Students' performances are reported in terms of Scaled Score (ScS). ScS is a mathematical transformation of the raw score, and subsequently the ability estimates, taking into account the difficulty of test items (i.e., extra points are given to more difficult items). It ranges from 100 to 500.

The CEM K to 12 Achievement Test Results also reports statistics (i.e., mean) derived from a reference group called Population. Population refers to all CEM test takers nationwide. They generally came from private schools and have participated in the K to 12 testing programs offered by CEM in the previous school year for a specific grade level. Particularly, the mean ScS of the Population is reported for each content area and cognitive skill, and the entire test, serving as a performance benchmark.

Estimating Learning Loss

Performances of Batches 1 and 2 as well as the geographical groups are compared with the Population statistics by measuring the difference from the mean and reported in terms of standard deviation. The disparity below and/or above the Population mean in each of the content areas, cognitive skills and the entire test, subjected to statistical testing, are referred to as learning loss and/or learning gain, respectively.

The Populations in this study are composed of test takers from School Year 2018-2019 wherein the statistics such as mean and standard deviation in each of the content areas, cognitive skills, and the entire tests were obtained and served as the benchmarks in measuring learning losses or learning gains. These statistics are shown in Appendix A.

The reporting of learning losses and/or gains in this study adapts the technique described by Storey and Zhang (2021) as effect size, which is derived from the difference between the adjusted posttest scores for treatment (cohort 2020/2021) and control (cohort 2019) students, divided by the unadjusted standard deviation of the control group. Meanwhile, the one-sample T-test was employed to test the statistical significance of difference from the Population obtained by the batches of test takers as well as the geographical groups.

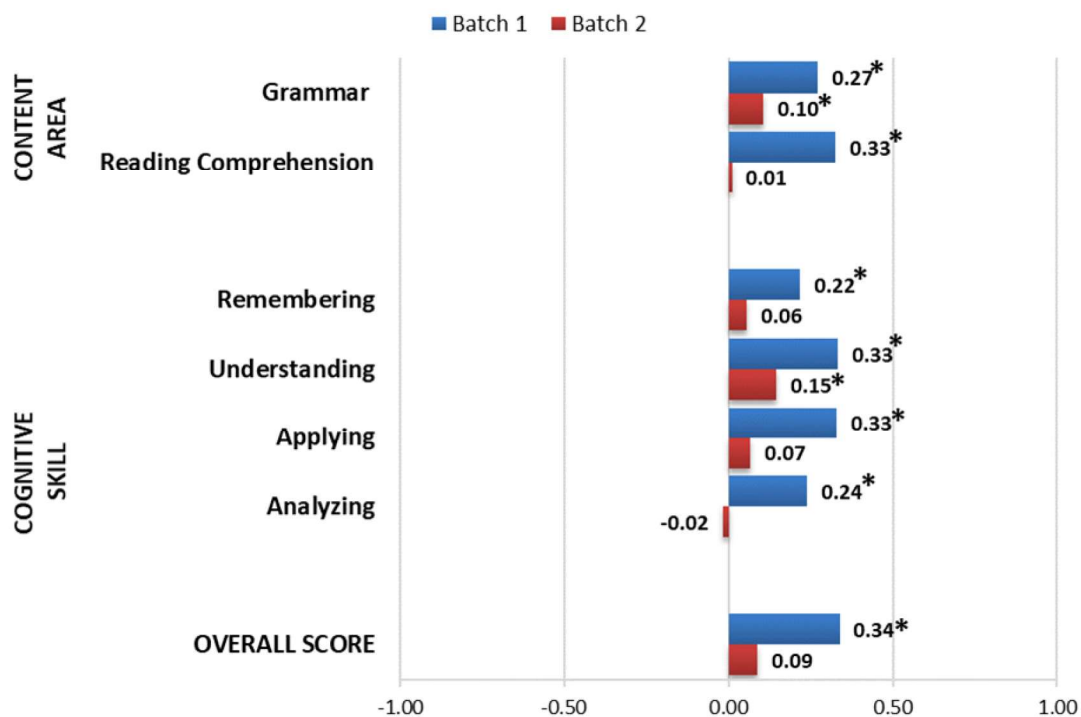
RESULTS

Performance in English

The summary of results for English Grade 6 is presented in Figure 2. Results show that for Batch 1, all of the significant disparities from the Population lean above the mean in

all the content areas, cognitive skills, and as a whole, indicating better performance than what was expected if the global pandemic did not strike. Such disparities range from 0.27 SD to 0.33SD for the content areas, 0.22 SD to 0.33 SD for the cognitive skills, and 0.34 SD for the entire English test. As for Batch 2, the content area *Grammar* was found to be significantly higher than the expected performance by 0.10 SD, and the cognitive skill *Understanding* was significantly higher by 0.15 SD. The overall English score for Batch 2 yields not significant difference from expectation. With these and as reflected in Figure 2, Batch 1 appears to have performed better than Batch 2 in almost all the content areas and cognitive skills of the English test as well as in the entire test, indicating that in reference to the performance of the Population, those who took the test during the pandemic year outperformed those who took the test at the start of post-pandemic phase.

Figure 2.
Students' Performance in English test by School Year/Batch



*Significant at 0.05 alpha level

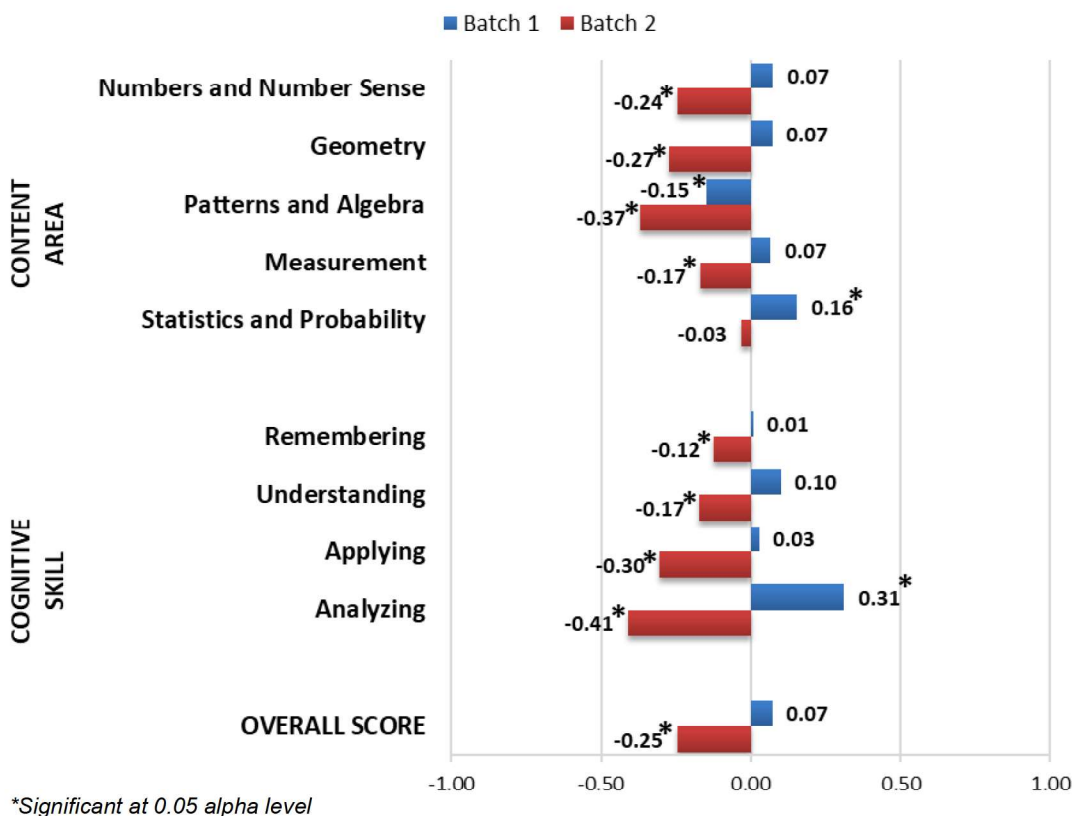
Performance in Mathematics

Students' performances across the batches in Mathematics are shown in Figure 3. Based on the figure, Batch 1 performed as expected except in the content area *Statistics and Probability and Statistics* and the cognitive skill *Analyzing* yielding higher values of approximately 0.16 SD and 0.31 SD, respectively, whereas a significantly lower mean was recorded in *Patterns and Algebra* with -0.15 SD. For Batch 2, significantly lower performances were observed in all content areas except in *Statistics and Probability*, in all cognitive skills, and the entire test. In terms of the content area, significant deviation below the Population mean were observed ranging from the absolute value of 0.17 SD to 0.37 SD in *Patterns and Algebra* and *Geometry*, respectively. All the cognitive skills were also found to be substantially lower than expected, varying from -0.12 SD to -0.41 for *Remembering* and *Analyzing*, respectively. The overall score for Batch 2 was found to significantly deviate from the Population mean by as much as -0.25 SD.

Furthermore, Figure 3 shows that in relation to the performance of the Population, Batch 1 performed better than Batch 2 indicating that possible learning loss became more evident at the start of the post-pandemic phase. The possibility of learning losses as observed in the performance of Batch 2 was consistent in all the content areas and cognitive skills. There was also persistent significant performance below the Population mean in *Patterns and Algebra* across the two batches and was recorded to be the greatest deviation among all the content areas. This implies that students' difficulty is evident in this content area across batches.

Figure 3.

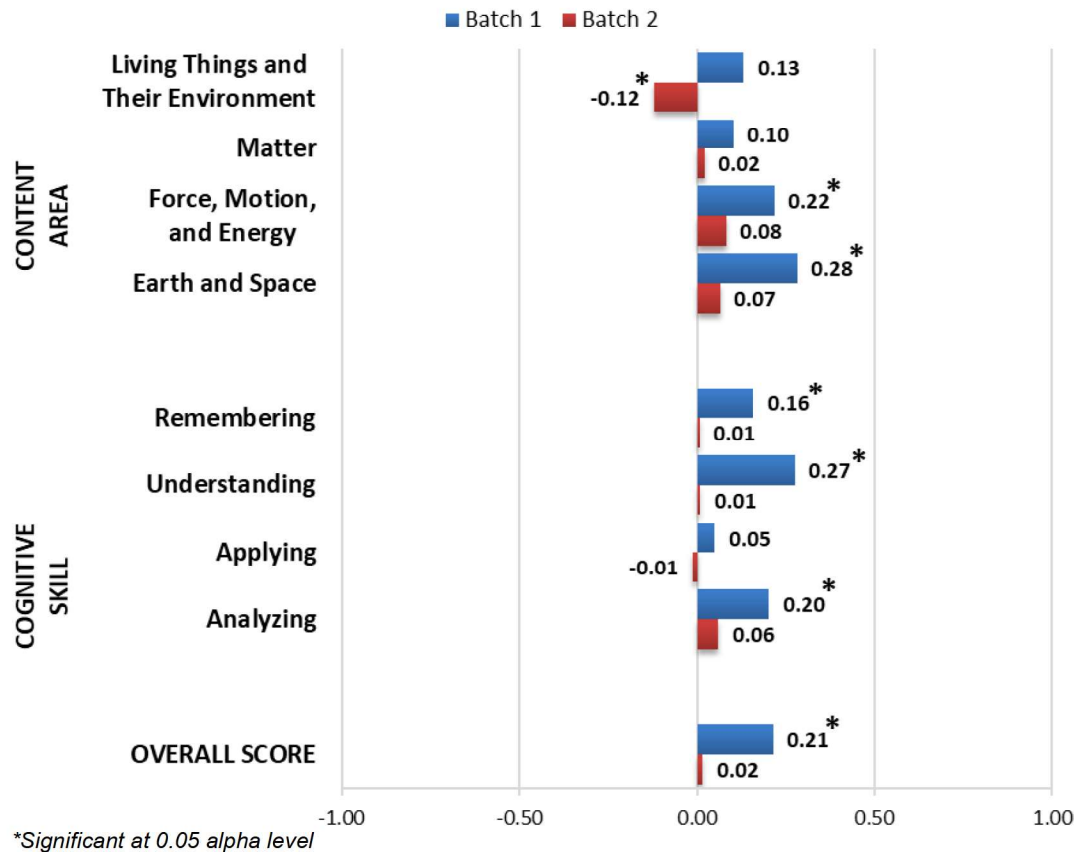
Students' Performance in Mathematics test by School Year/Batch



Performance in Science

For the subject area of Science, students' performances are summarized in Figure 4. Batch 1 appears to have performed as expected in almost all the content areas except in *Force, Motion and Energy* and *Earth and Space* in which significant disparity from the Population mean was recorded amounting to 0.08 SD and 0.28 SD, respectively. In terms of cognitive skill, significant disparities from the Population mean ranging from 0.16 SD to 0.27 SD were observed in *Remembering* and *Understanding*, respectively. Overall, the performance of Batch 1 was found to be significantly higher than expected by 0.21 SD. For Batch 2, although the overall performance yields nonsignificant result from expectations, significantly lower performances were recorded in the content area *Living Things and Their Environment* with a corresponding standard deviation of -0.12. It appears that in comparison to the Population, Batch 1 performed better than Batch 2, indicating in reference to the performance of the Population, those who took the test at the start of post-pandemic phase lagged behind outperformed those who took the test during the pandemic year.

Figure 4.
Students' Performance in Science test by School Year/Batch

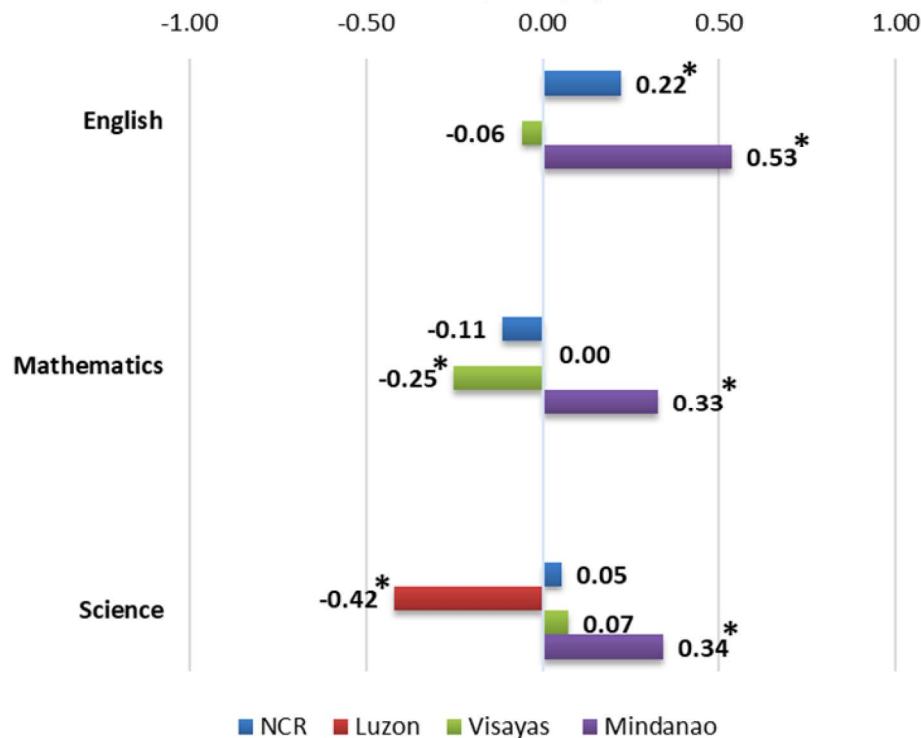


Subgroup Analysis by Geographical Location

The subgroup analysis in terms of geographical location, shown in Figure 5, reveals that there is indeed a differential result in the performance of the graduating elementary students across the country in the past two school years. Performance of the *NCR group* was found to be significantly different from what was expected in the English test whereas there was no significant difference in the other subject areas. The performance was found to be 0.22 SD higher than what was expected. For the *Luzon group*, there was no record of testing for English whereas significantly lower performance was observed in Science. The *Visayas group* appeared to have lower performance in Mathematics with about -0.25 SD, yet no significant disparities in both English and Science tests were noted. Lastly, the *Mindanao group* was found to perform significantly higher than what was expected in all the three subject areas with varying standard deviations from 0.33 to 0.53. These statistics were found to be the highest amount of positive disparity in all the subject areas examined with the respect to the other geographical groups.

Figure 5.

Grade 6 Students' Test Performance by Geographic Location



*Significant at 0.05 alpha level

DISCUSSION

Concurring with the ADB Brief report (2022) that the key initial step in addressing learning loss is to identify how much learning was lost or forgone, this study tried to illustrate how learning loss and/or gain can be quantified. In Newton (2021)'s review of 10 researches on learning during the pandemic in the UK, he noted that most studies compare the overall performance of the last cohort group to take their exam prior to the pandemic with the overall performance of the COVID and post-COVID cohorts on the same exams taken at the same point in time. In this study, learning loss and/or gain are identified by quantifying and subjecting to statistical testing the disparity between the Population's mean performance and the mean performance of Batch 1 or Batch 2, with Population being the pre-COVID data, Batch 1 as the COVID data and Batch 2 as the post-COVID data. These data are all post-test performance in the same assessment instruments, the K to 12 Achievement Tests for Grade 6 taken towards the end of the school year.

Results of the analyses in the three subject areas across phases of the global pandemic showed that:

- With respect to the English test, the performances of the test takers during the COVID were significantly higher than expectation whereas the performances of test takers in the post-COVID yielded no significant results, indicating that the pandemic did not cause much adverse effect on student learning in this subject area.
- In terms of the subject area of Mathematics, the performance of test takers during the pandemic appears to be not significantly different from the expectation whereas substantially lower performances of the post-pandemic test takers were recorded not only in the entire test but also in all the content areas and cognitive skills, supporting

literature on the learning losses in this subject area. Moreover, the consistent result of significantly lower performance than the expectation was observed for the content area *Patterns and Algebra*, indicating that this content area should be given more attention and emphasis when attending to learning loss.

- Lastly, for the Science test, significantly higher performance than what is expected was observed for the during-the-pandemic test takers whereas the post-pandemic test takers performed as expected if the global health crisis did not occur, implying that there was no substantial evidence of learning loss in this subject area.

With these findings, an initial recovery plan can be drafted focusing on those area/s with substantial lower performance than what is expected, most especially in the subject area of Mathematics, as well as conducting research on how the delivery of instruction was carried out in those areas with nonsignificant results to substantially higher than expected performance. There are already a number of whitepapers published (Alban Conto, et.al., 2020; Schleicher, 2020; UNESCO, UNICEF and World Bank, 2021; ADB, 2021) by authorities in education which identified specific strategies on how learning losses due to the pandemic can be mitigated and recovered. These strategies include establishing programs for teaching at the right level, providing individualized self-learning programs, extending instruction time, establishing tutoring programs, and training teachers for recovery. Gearing towards recovery, as inspired by Former Usec. Malaluan (2022) in one of his keynote speeches, should also look into the learning gains and learn from those factors such as parental involvement which contributed to the attainment. These investigations on both the learning losses and learning gains must go hand-in-hand in crafting the plans for learning recovery in every institution.

Cognizant of the occurrence that there might be a varying impact of the pandemic across the country, this study included subgroup analysis in terms of geographic location. The analysis provided evidences namely, substantially lower performance was observed in Mathematics for the Visayas group and in Science for the Luzon group; significantly higher performance was recorded in English for the NCR group; and lastly, the Mindanao tended to perform significantly higher than expected in all the three subject areas. These imply that among the group of test takers, Mindanao was the least affected in terms of student learning. This may be due to the location of Mindanao being the farthest from the main gateway to and from the country, which is located in the NCR. Although, this warrants further investigation since the country went through the same length of school closure.

To further substantiate the findings of this study, an analysis of the characteristics of the included sample schools would be beneficial, investigating how these schools performed individually prior to the pandemic and validating the measured learning losses or gains.

In spite of this study shedding light on student learning in the Philippines, the results of this study are just a glimpse of the nation's current education status. Findings are merely valid for the test takers included in this study. Leveraging the analyses into a national context entails the application of more sophisticated statistical techniques such as adding weights to responses to ensure representativeness of the findings and strengthening comparability across time points. Analysis of even the transition points in the Basic Education level (i.e., Grades 3, 6, 10, and 12) would likewise provide a better picture of the students' learning in the country. Lastly, posttest data to be gathered this School Year 2022-2023 would also supply valuable input and a better understanding of the students' performance in the post-pandemic state as school reopening is being mandated by the Department of Education (2022) under the DepEd Order 034, series 2022 in the said school year.

Detecting and quantifying possible learning losses through the use of established assessments, identifying specific focus areas, and addressing them are deemed imperative now that schools start to reopen to ensure that this generation of students is free of unwanted disadvantages compared to the past and future generations (World Bank, 2021) and to mitigate the threats of diminished lifetime economic prospects (ADB Brief, 2022).

REFERENCES

- Asian Development Bank. (2021). Learning and earning losses from COVID-19 school closures in developing Asia: special topic of the Asian Development Outlook 2021. Asian Development Bank.
<https://www.adb.org/sites/default/files/publication/692111/ado2021-special-topic.pdf>
- Asian Development Bank. (2022). How to Recover Learning Losses from COVID-19 School Closures in Asia and the Pacific. <http://dx.doi.org/10.22617/BRF220301-2>
- Alban Conto, C., Akseer, S., Dreesen, T., Kamei, A., Mizunoya, S. and Rigole, A. (2020). COVID-19: Effects of School Closures on Foundational Skills and Promising Practices for Monitoring and Mitigating Learning Loss, Innocenti Working Paper 2020-13, UNICEF Office of Research – Innocenti, Florence.
- Department of Education (2022). School Calendar and Activities for the School Year 2022-2023. https://www.deped.gov.ph/wp-content/uploads/2022/07/DO_s2022_034.pdf
- Department of Education (2020). Basic Education Learning Continuity Plan in the Time of COVID-19. https://www.deped.gov.ph/wp-content/uploads/2020/07/DepEd_LCP_July3.pdf
- Education Development Trust. (2021). Learning loss, learning gains and wellbeing: a review of policy and grey literature.
<https://www.educationdevelopmenttrust.com/EducationDevelopmentTrust/files/20/201258b4-98ab-415a-b0da-f33d5cf8688d.pdf>
- Engzell, Per, Arun Frey, and Mark D. Verhagen. (2021). Learning loss due to school closures during the COVID-19 pandemic. Proceedings of the National Academy of Sciences of the United States of America, 118(17).
<https://www.pnas.org/content/118/17/e2022376118>
- Hevia, F. J., Vergara-Lope, S., Velásquez-Durán, A., & Calderón, D. (2022). Estimation of the fundamental learning loss and learning poverty related to COVID-19 pandemic in Mexico, International Journal of Educational Development, Volume 88,
<https://doi.org/10.1016/j.ijedudev.2021.102515>
- Juniper Education (2021). Juniper Education National Dataset Report. February 2021. The impact of the Covid-19 pandemic on primary school children's learning. Essex: Juniper Education. <https://junipereducation.org/resource/press-releases/youngest-pupils-learning-worst-affected-by-covid-19-pandemic-new-report-reveals/>
- Malaluan, N.A. (2022, August 25). DepEd's Response to Philippines' Performance in International Large-Scale Assessments (i.e., PISA, TIMSS, SEA-PLM). Philippine Educational Measurement and Evaluation Association.
<https://www.pemea.org/nceme2022>
- Newton, P. (2021). Learning during the pandemic: quantifying lost learning.
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1000351/6803-2_Learning_during_the_pandemic-quantifying_lost_time.pdf
- Schleicher, A. (2020) The Impact of COVID-19 on Education: Insights from Education at a Glance 2020. <https://www.oecd.org/education/the-impact-of-covid-19-on-education-insights-education-at-a-glance-2020.pdf>

Schuurman, T. M., Henrichs, L. F., Schuurman, N. K., Polderdijk, S. & Hornstra, L. (2021). Learning Loss in Vulnerable Student Populations After the First Covid-19 School Closure in the Netherlands, *Scandinavian Journal of Educational Research*. DOI: 10.1080/00313831.2021.2006307

Sijtsma, K., & Hemker, B. T. (2000). A Taxonomy of IRT Models for Ordering Persons and Items Using Simple Sum Scores. *Journal of Educational and Behavioral Statistics*, 25(4), 391. doi:10.2307/1165222

Storey, N., & Zhang, Q. (2021, September 10). A Meta-analysis of COVID Learning Loss. <https://doi.org/10.35542/osf.io/qekw2>

Tomasik, Martin J., Laura A. Helbling and Urs Moser. (2020). Education gains of in-person vs. distance learning in primary and secondary schools: A natural experiment during the COVID-19 pandemic school closures in Switzerland. *International Journal of Psychology*, 56(4): 566-676. <https://onlinelibrary.wiley.com/doi/10.1002/ijop.12728>

UNESCO; UNICEF; World Bank. 2021. The State of the Global Education Crisis : A Path to Recovery. UNESCO, Paris, UNICEF, New York, and World Bank, Washington, DC. © UNESCO, UNICEF, and World Bank. <https://openknowledge.worldbank.org/handle/10986/36744> License: CC BY-SA 3.0 IGO

World Bank (2021). Accelerating Learning Recovery. <https://thedocs.worldbank.org/en/doc/75bdb5f2c03f19f0642db1c941193f8d-0140042021/related/Recovery-updated-09-27-2021.pdf>

Appendix A
Population Statistics
 SY 2018 - 2019

English (n=7,049)			Mathematics (n=6,992)		Science (n=5,836)	
Content Area	Mean	SD		Mean	SD	
Grammar	329.23	53.12	Numbers and Number Sense	310.98	45.67	Living Things and Their Environment
Reading Comprehension	301.57	45.62	Geometry	323.58	93.41	Matter
			Patterns and Algebra	303.18	98.83	Force, Motion, and Energy
			Measurement	327.51	106.41	Earth and Space
			Probability and Statistics	312.76	95.86	
Cognitive Skill						
Remembering	300.16	73.99	Remembering	324.65	105.48	Remembering
Understanding	338.38	59.40	Understanding	336.98	73.02	Understanding
Applying	306.52	50.27	Applying	306.52	54.45	Applying
Analyzing	301.91	123.17	Analyzing	302.19	55.42	Analyzing
Overall	308.49	36.31		306.60	39.70	