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Performance Management in Basic Education: A Strategic Analysis of Mathematics and Science Learning Outcomes at University of Baguio Laboratory Elementary School

Johann Ben A. Bautista

University of Baguio

Abstract

This report investigates and proposes improvements for the mathematics and science performance of Grade 4 students at the University of Baguio Laboratory Elementary School (UB-LES), contextualized within the broader Philippine educational landscape and its performance in international assessments. The methodology involved literature research on international and national assessments, interviews with the UB-LES Principal, and a detailed analysis of Center for Educational Measurement (CEM) data for UB-LES Grade 4 students from 2017-2019, augmented by a strategic SWOT analysis. Key findings reveal the Philippines' consistently low rankings in PISA and TIMSS, signaling a pervasive national educational challenge. Furthermore, UB-LES Grade 4 students consistently performed below national CEM averages, with specific content areas and cognitive skills identified as areas of pronounced weakness in both mathematics and science. A notable finding was an unexpected decline in science post-test results for 2018. These findings hold significant implications for UB-LES curriculum development, teacher professional development, and broader national educational policy. Recommendations are presented to enhance student outcomes and foster alignment between local educational practices and global standards.

Keywords: UB-LES Grade 4, International Assessments, Center for Educational Measurement (CEM), Educational Performance, Curriculum Alignment.

1. INTRODUCTION

1.1 Global and National Context of Educational Performance

The landscape of global education is increasingly characterized by the use of international standardized assessments to benchmark the performance of national educational systems. Among the most prominent of these are the Programme for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMSS). PISA, administered by the Organisation for Economic Co-operation and Development (OECD), evaluates the ability of 15-year-olds to apply their reading, mathematics, and science knowledge and skills to real-life challenges. Concurrently, TIMSS, conducted by the International Association for the Evaluation of Educational Achievement (IEA), assesses student achievement in mathematics and science at the fourth and eighth grades, providing insights into curricular reforms and their effectiveness over time.

The Philippines' participation in these assessments has yielded consistently alarming results, highlighting

significant challenges within its basic education system. In the PISA 2018 assessment, the Philippines ranked last in reading and second to last in science and mathematics among 79 participating countries. This was followed by equally concerning outcomes in the TIMSS 2019 global assessment for Grade 4 students, where the Philippines ranked last among 58 participating countries in both mathematics and science. Specifically, Filipino Grade 4 students scored 297 in mathematics and 249 in science, representing the lowest scores among all participating nations. A deeper examination of these results reveals that a substantial majority of students did not meet even the "low benchmark" level: 81% in mathematics and 87% in science, indicating a limited grasp of foundational concepts in these critical subjects.

At the national level, the Center for Educational Measurement (CEM) aptitude tests serve as a key assessment tool for many private schools in the Philippines, including the University of Baguio Laboratory Elementary School (UB-LES). These tests are designed to provide feedback, identify specific strengths and areas for improvement, facilitate the development of intervention programs, and monitor student progress in Mathematics, English, and Science. The scenario contrast between national assessment practices and international benchmarking results underscores a prevalent educational challenge. The repeated last or near-last rankings in global assessments are not merely an indication of underperformance but rather a clear signal of a systemic educational crisis within the Philippines. This situation demands a critical examination of the underlying issues and a concerted effort to bridge the widening gap between national educational outcomes and global competencies.

1.2 Problem Statement: The Philippine Educational Crisis and Assessment Gaps

The persistent underperformance of Filipino students in international assessments points to a fundamental issue: a significant misalignment between the Department of Education's (DepEd) K to 12 curriculum and international educational standards. This suggests that the content being taught and the skills being assessed nationally may not adequately prepare students for the demands of global competencies. Despite the implementation of comprehensive educational reforms such as the K to 12 Basic Education Program in 2013, which aimed to create a functional system for holistic citizen development, and subsequent initiatives like "Sulong EduKalidad" and the "MATATAG" agenda, the international assessment results have not shown commensurate improvement. This continuous disparity between national educational efforts and global outcomes suggests a profound disconnect. It implies that while national policies and curricula are in place, they may not be effectively fostering the higher-order thinking skills and conceptual understanding necessary for international competitiveness. This situation extends beyond mere funding issues, potentially encompassing challenges in curriculum design, teacher training, and the very philosophy underpinning national assessment.

Compounding this national challenge is a notable scarcity of dedicated research studies focusing specifically on what Filipino Grade 4 students genuinely comprehend or struggle with in science and mathematics, particularly when viewed through the lens of international benchmarks. This research void makes it difficult to pinpoint the precise learning gaps at this critical foundational stage and to develop targeted interventions.

1.3 Objectives of the Study

The primary objective of this study is to improve the performance of UB Grade 4 students in mathematics and science.

To achieve this overarching goal, the study sets forth the following specific objectives:

- To analyze the performance of UB-LES Grade 4 students in mathematics and science based on CEM assessment data from 2017-2019.

- To identify specific strengths and weaknesses in mathematics and science content areas and cognitive skills among UB-LES Grade 4 students, as revealed by CEM data.
- To understand the broader factors contributing to the overall educational performance challenges in the Philippines, drawing from international assessment findings and local insights.
- To propose actionable recommendations for UB-LES to enhance mathematics and science education, aiming for improved student outcomes and greater alignment with international standards.

1.4 Significance of the Study

This study holds significant implications for various stakeholders within the Philippine educational system. For UB-LES, the findings will provide specific, data-driven insights crucial for enhancing their curriculum, developing targeted teacher professional development programs, and designing effective intervention strategies to improve student performance in mathematics and science. The analysis of student strengths and weaknesses from the CEM data offers a precise roadmap for instructional adjustments.

For the Department of Education (DepEd) and national policy-makers, this report contributes to the ongoing national discourse surrounding the Philippine educational crisis. By offering practical evidence from a local school within the context of international assessment failures, it provides valuable insights for aligning national curricula and assessment practices with global benchmarks. The strategic framework derived from a school management perspective, specifically the SWOT analysis, offers a structured approach to identifying internal capabilities and external factors impacting educational outcomes, thereby providing a school-oriented lens for problem-solving in education.

For the broader educational research community, this study adds to the limited body of existing research on Filipino Grade 4 students' performance in mathematics and science. It particularly addresses the critical gap in understanding how national assessment results relate to international performance, thereby contributing to a more comprehensive understanding of educational challenges and opportunities in the Philippines.

2. Methodology

2.1 Research Design

This study employs a descriptive-analytical research design, integrating both qualitative and quantitative approaches to comprehensively understand and address the performance of Grade 4 students in mathematics and science. The initial phases of data gathering, involving literature reviews and interviews, are qualitative in nature, providing contextual understanding and perceptions. The subsequent analysis of CEM assessment data, however, is quantitative, allowing for statistical comparisons and the identification of specific learning trends and gaps. The overarching rationale for this design is to systematically uncover the root causes of observed performance issues and to identify actionable solutions, progressing from a broad national educational context to a detailed, school-specific analysis.

2.2 Population and Locale of the Study

The primary participants of this study were the Grade 4 students of the University of Baguio Laboratory Elementary School (UB-LES) who participated in the CEM achievement tests during the School Years 2017-2019. It is important to note that no direct participation from these students was involved beyond the analysis of their existing, anonymized test data.

A crucial qualitative component of the study involved an interview with the UB-LES Principal, who served as a key informant. The setting for this study is the University of Baguio Laboratory Elementary

School, a private educational institution situated in Baguio City, Philippines.

2.3 Data Sources and Collection Procedures

Data for this study were systematically collected from multiple sources to ensure a comprehensive understanding of the research problem.

Literature Analysis: The initiation of this research was prompted by compelling news reports from CNN Philippines in December 2019, highlighting the Philippines' low rankings in the PISA 2018 assessment. This served as a catalyst for extensive literature analysis, which involved a thorough review of published news articles, academic papers, and official documents. The focus of this review included detailed reports on PISA 2018 and TIMSS 2019 results, analyses of DepEd policies such as the K to 12 Basic Education Program, the "Sulong EduKalidad" initiative, and the "MATATAG" agenda, as well as broader insights into the Philippine education system. A specific aspect of this research involved examining the content of the TIMSS context questionnaires (student, early learning/home, teacher, school, and curriculum questionnaires) to gain an understanding of the comprehensive factors that influence student achievement in an international context. Initially, the research encompassed both PISA and TIMSS. However, to maintain a focused scope and to ensure greater comparability with the UB-LES student population (Grade 4), the research subsequently narrowed its focus to the TIMSS (Grade 4) results, thereby excluding the PISA results which primarily concerned 15-year-olds.

Interviews: A key qualitative data collection method involved a semi-structured interview with the UB-LES Principal. To facilitate a thoughtful and comprehensive response, the interview questions were provided to the principal in advance. These questions were designed to elicit insights into various aspects of educational performance, including: the principal's perspectives on the reasons behind the Philippines' poor performance in TIMSS and PISA exams; a hypothetical assessment of how UB students might perform if they took these international tests; the perceived effectiveness of CEM tests for UB students; the mechanisms through which CEM provides analysis and feedback; instances of the school's non-participation in CEM tests since 2018 and the reasons; potential strategies DepEd could employ to improve student performance; and the implications of a school not adhering to DepEd's prescribed curriculum. It was noted that the principal had also solicited input from his faculty members via a Google poll, incorporating some of their collective responses into his own answers.

CEM Data Acquisition: Following the interview, it was ascertained that data pertaining to CEM results could be obtained from UB's Center for Counselling and Student Development (CCSD). The researcher proceeded to acquire the CEM pre-test and post-test results for UB-LES Grade 4 students in mathematics and science for the year 2018. Additionally, pre-test results for 2017 and 2019 were obtained. A notable limitation in the available data was the absence of post-test results for 2017 and 2019, which restricted the ability to conduct consistent within-year progress tracking across all three academic years.

2.4 Assessment Instruments

The primary quantitative assessment instrument utilized in this study was the Center for Educational Measurement (CEM) Achievement Tests. These tests provided the foundational data for evaluating the performance of UB-LES Grade 4 students in mathematics and science. The CEM tests are designed to offer detailed feedback on student proficiency across various content areas and cognitive skills, thereby serving as a crucial tool for identifying specific learning strengths and areas requiring improvement within the school.

Complementing this, the TIMSS 2019 Context Questionnaires were reviewed. Although these questionnaires were not directly administered to UB-LES students, their content was examined to provide

a comprehensive understanding of the broader factors that influence student achievement in an international context. Analyzing the scope of these international questionnaires provided a valuable framework for contextualizing UB-LES's performance and identifying potential areas of influence that extend beyond direct academic instruction.

2.5 Data Analysis Techniques

A multi-faceted approach was employed for data analysis to ensure a comprehensive understanding of the research problem.

Comparative Analysis of CEM Results: This involved a detailed quantitative examination of the CEM data for UB-LES Grade 4 students. Comparisons were made across several dimensions:

- Year-on-year trends: Pre-test results from 2017, 2018, and 2019 were compared to identify patterns of performance over time.
- Within-year progress: The 2018 pre-test and post-test results were analyzed to assess student improvement or regression over a single academic year.
- Benchmarking against national averages: UB-LES scaled scores were rigorously compared against the national average scaled scores of all CEM Grade 4 test-takers in the Philippines. This comparison was conducted for overall performance, specific mathematics content areas (Numbers and Number Sense, Geometry, Patterns and Algebra, Measurement, Statistics and Probability), and science content areas (Living Things and Their Environment, Matter, Force and Motion, Earth and Space), as well as across various cognitive skills (Remembering, Understanding, Applying, Analyzing, Evaluating).
- Item-level analysis: An analysis was performed on the CEM data to identify specific strengths (items where more than 50% of students answered correctly) and weaknesses (items where more than 50% of students answered incorrectly) within each content area for both mathematics and science. This detailed breakdown provides actionable insights for curriculum and instruction.

Qualitative Content Analysis: Transcripts from the interview with the UB-LES Principal and the content gathered from the literature research were subjected to qualitative content analysis. This involved systematically reviewing the textual data to identify recurring themes, perceptions, policy implications, and contextual factors related to educational performance at both the school and national levels.

SWOT Analysis: To provide a strategic perspective, particularly relevant given the researcher's background in business administration, a SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis was conducted. This framework was applied to synthesize the internal capabilities and limitations of UB-LES, alongside external factors (opportunities and threats) within the broader educational landscape. This analysis aimed to identify key strategic areas for intervention and improvement within the school's operational context.

3. Results

3.1 Philippines Performance in International Assessments (PISA & TIMSS)

The performance of the Philippines in recent international assessments has consistently placed the nation at the lower end of global rankings, signaling a significant challenge in its educational system. In the PISA 2018 assessment, the Philippines was ranked last in reading proficiency and second to last in both science and mathematics among 79 participating countries. This trend continued in the TIMSS 2019 global assessment for Grade 4 students, where the Philippines again ranked last among 58 countries in both mathematics and science, with average scores of 297 and 249 respectively.

A detailed breakdown of the TIMSS 2019 results for Grade 4 students reveals the extent of the proficiency

gap:

- Mathematics: Only 1% of Filipino students reached the high benchmark, 6% reached the intermediate benchmark, and 19% reached the low benchmark. Crucially, 81% of students fell below the low benchmark, indicating a severe lack of basic mathematical knowledge and problem-solving skills.
- Science: Similarly, only 1% of students achieved the high benchmark, 5% reached the intermediate benchmark, and 13% reached the low benchmark. A staggering 87% of students did not meet the low benchmark, demonstrating limited understanding of scientific concepts and foundational science facts.

These findings are further corroborated and contextualized by a World Bank report, which highlighted several critical issues contributing to the Philippines' educational challenges, based on data from PISA, TIMSS, and SEA-PLM (Southeast Asia Primary Learning Metrics).

Key issues identified by the World Bank report include:

- Minimum Learning Standards: A vast majority of students fail to meet minimum learning standards. For instance, 81% of Grade 4 students could not perform simple math operations or solve basic word problems, and 87% lacked understanding of basic science concepts.
- Socioeconomic Disparity: A significant achievement gap exists between wealthier and poorer students. In PISA 2018, socio-economically advantaged students scored 88 points higher than disadvantaged students, a disparity comparable to averages in rich countries.
- Lack of Nutrition and Home Support: Student well-being and home environment play a critical role. TIMSS 2019 reported that one-third of Grade 4 students frequently arrived at school feeling tired, and 29% were often hungry. Furthermore, over half of PISA 2018 students had 10 or fewer books at home, and a third of TIMSS 2019 students reported few home resources, including internet access. Parental engagement in schooling was also noted to be significantly lower in the Philippines compared to other nations.
- Prevalence of Bullying: Bullying is alarmingly widespread in Philippine schools. Nearly half (45%) of Grade 4 students reported weekly bullying in TIMSS 2019, and 40% of 15-year-olds in PISA 2018 reported frequent bullying. This high incidence of bullying is associated with lower test scores.
- Insufficient Government Investment: The Philippines' government investment in education falls short of international recommendations. As of 2019, only 3.2% of the GDP was allocated to education, below the UN's recommended 4%. Cumulative spending per student also ranked last in PISA 2018.
- Classroom Time vs. Scores Paradox: Counter-intuitively, spending more time in the classroom does not correlate with improved scores. The Philippines dedicated more instructional hours to Grade 4 students than any other country (1,225 hours per year, with 158 hours in science compared to an international average of 73 hours), yet still ranked last in TIMSS 2019 science.
- Lack of Growth Mindset: Only 31% of Filipino students in PISA 2018 exhibited a "growth mindset," which is the belief that one's abilities can be developed through dedication and hard work. Nurturing such a mindset is crucial for improving student learning.

3.2 UB-LES Grade 4 CEM Performance: Overall Trends (2017-2019)

The performance of UB-LES Grade 4 students in the Center for Educational Measurement (CEM) tests from 2017 to 2019 reveals specific trends and a consistent pattern when compared to national averages. It is important to note a shift in CEM's reporting categories: in 2017, performance was described across nine categories (Very Poor to Excellent), while from 2018 onwards, it shifted to five categories (Needs

Improvement to Excellent). This change limits direct year-on-year comparisons of specific category counts.

Table 1: UB-LES Grade 4 CEM Pre-Test Performance Trends (2017-2019) - Mathematics & Science

Year	Subject	Total Examinees	% Average or Higher	% Below Average
2017	Mathematics	120	19.17%	80.83%
2017	Science	120	32.26%	67.74%
2018	Mathematics	96	50.00%	50.00%
2018	Science	95	58.94%	41.05%
2019	Mathematics	86	54.65%	45.34%
2019	Science	86	51.15%	48.83%

In mathematics, the pre-test results for UB-LES Grade 4 students showed an improving trend in the percentage of students performing at "average or higher" levels: from 19.17% in 2017 to 50% in 2018, and further to 54.65% in 2019. This indicates a positive progression in the proportion of students meeting or exceeding proficiency benchmarks in mathematics over these years.

For science, the pre-test trends were more varied. The percentage of students performing at "average or higher" increased from 32.26% in 2017 to 58.94% in 2018, but then experienced a slight decline to 51.15% in 2019.

Despite these internal trends, a consistent finding across all years and subjects is that UB-LES Grade 4 students' overall scaled scores remained lower than the national average scaled scores of all CEM Grade 4 test-takers in the Philippines. In mathematics, UB's average scaled score was 263 compared to the national CEM average of 274. In science, UB's average scaled score was 284, while the national CEM average stood at 308. This consistent underperformance relative to national CEM averages suggests that while UB-LES students may show some internal improvements, their overall proficiency levels still lag behind their peers in other schools taking the same national assessment.

3.3 Detailed Analysis of UB-LES Grade 4 CEM Mathematics Performance (Strengths and Weaknesses)

A comprehensive analysis of the UB-LES Grade 4 CEM mathematics results for 2018, comparing pre-test and post-test outcomes, provides specific insights into student learning progression and areas requiring attention.

Table 2: Comparison of UB-LES Grade 4 CEM Pre-Test vs. Post-Test Results (2018) - Mathematics & Science

Performance Category	Mathematics Pre-Test (Count)	Mathematics Post-Test (Count)	Science Pre-Test (Count)	Science Post-Test (Count)
Needs Improvement	15	7	7	10
Moving Towards Average	33	23	32	33

Average	46	55	51	41
Approaching Excellence	2	10	5	10
Excellent	0	1	0	1
Total Examinees	96	96	95	95
% Average or Higher	50.00%	68.75%	58.94%	54.74%

In mathematics, there was a notable overall improvement from the pre-test to the post-test in 2018. The percentage of students performing at "average or higher" increased from 50% in the pre-test to 68.75% in the post-test. This improvement was reflected in a decline in students categorized as "Needs Improvement" (from 15 to 7) and "Moving Towards Average" (from 33 to 23), coupled with an increase in those achieving "Average" (from 46 to 55), "Approaching Excellence" (from 2 to 10), and "Excellent" (from 0 to 1).

Table 3: UB-LES Grade 4 CEM Scaled Scores vs. National Average (2018) - Mathematics (Overall, Content Areas, Cognitive Skills)

Category	UB-LES Pre-Test Scaled Score	UB-LES Post-Test Scaled Score	National Average Scaled Score (Philippines)
Overall Mathematics	263	274	274
Content Areas			
Numbers and Number Sense	244	271	274
Geometry	252	286	301
Patterns and Algebra	250	288	322
Measurement	214	225	246
Statistics and Probability	214	250	277
Cognitive Skills			
Remembering	223	249	281
Understanding	255	285	290
Applying	226	239	255
Analyzing	240	258	277
Evaluating	253	268	291

Across all mathematics content areas and cognitive skills, UB-LES students demonstrated consistent improvement from their pre-test to post-test scores in 2018, although their post-test scores generally remained below the national CEM averages. For instance, in "Numbers and Number Sense," the UB-LES

pre-test score was 244, improving to 271 in the post-test, nearing the national average of 274. In "Patterns and Algebra," UB's score increased from 250 to 288, still below the national average of 322.
A detailed item-level analysis identifies specific strengths and weaknesses:

Table 4: Key Strengths and Weaknesses of UB-LES Grade 4 Students in Mathematics (CEM 2018)

Category	Strengths (Skills where >50% of students answered correctly)	Weaknesses (Skills where >50% of students answered incorrectly)
Numbers and Number Sense	Represents addition of dissimilar fractions (70%); Arranging numbers up to 100,000 (64%); Performs a series of operations (59%); Represents subtraction of a fraction from a whole number (59%); Identifies subtraction equation (56%); Identifies factors (56%); Finds GCF using prime factorization (53%); Divides 2- to 3-digit numbers by 1-digit (51%); Solves word problems involving multiplication (51%); Finds GCF using listing method (51%)	Multiplies numbers up to 3-digit by 2-digit (80%); Estimates product (79%); Changes numbers to lowest forms (73%); Identifies prime numbers (72%, 71%); Performs addition of dissimilar fractions (71%, 64%); Reads/writes decimal numbers (68%); Estimates quotient (68%); Rounds decimal numbers (67%); Finds LCM using prime factorization (65%); Compares numbers up to 100,000 (65%); Multiplies 2-digit numbers (64%); Changes improper fraction to mixed number (60%); Solves division word problems (59%, 54%); Divides 3- to 4-digit numbers by hundreds (58%); Identifies decimal number by grid (58%); Identifies multiples (58%); Finds LCM using listing method (57%); Rounds numbers to nearest hundred thousand (57%); Solves multi-step word problems (56%, 54%); Identifies multiplication equation (55%)
Geometry	Identifies parallel lines (76%); Identifies and describes triangles (71%); Describes attributes of quadrilaterals (72%); Identifies intersecting lines (56%); Recognizes an obtuse angle (54%)	Describes a rectangle (76%); Identifies and describes trapezoid (70%); Identifies a parallelogram (68%); Recognizes a right angle (56%); Identifies a rhombus (56%); Recognizes an obtuse angle (55%); Describes parallel lines (54%); Identifies and describes square (54%)

Patterns and Algebra	Determines missing term in odd numbers (64%); Determines missing term in even numbers (51%)	Finds missing number in equation (68%); Determines missing term in multiples (65%); Determines missing term in factors (57%)
Measurement	Determines formulas for perimeter (57%); Finds elapsed time in minutes (53%); Solves word problems involving squares (52%)	Solves word problems involving perimeter of triangles (76%); Solves problems involving area of rectangles (74%); Solves word problems involving parallelograms (74%); Finds perimeter of a square (66%); Finds area of triangles (65%); Solves problems involving elapsed time (59%); Measures perimeter (55%)
Statistics and Probability	Interprets data in tabular form (55%)	Solves problems using double-bar graph (72%, 59%, 51%); Expresses outcome in experiment (66%); Draws inferences from double-bar graph (59%); Solves word problems involving simple experiment (57%, 52%); Organizes data in bar graph (52%)

The detailed breakdown shows that while students demonstrate proficiency in basic operations and identification of shapes, significant weaknesses persist in more complex tasks such as multi-digit multiplication, estimation, understanding fractions beyond basic representation, and solving multi-step word problems. In geometry, while they can identify basic lines and shapes, describing their properties or recognizing specific types like parallelograms and rhombuses remains challenging. Similarly, in patterns and algebra, and statistics and probability, students struggle with higher-order tasks like finding missing numbers in equations or interpreting and solving problems from graphs.

3.4 Detailed Analysis of UB-LES Grade 4 CEM Science Performance (Strengths & Weaknesses)

The analysis of UB-LES Grade 4 CEM science results for 2018, comparing pre-test and post-test outcomes, presents a more complex picture than mathematics, with an unexpected decline in overall performance.

Referring back to Table 2, the percentage of UB-LES students performing at "average or higher" in science *declined* from 58.94% in the pre-test to 54.74% in the post-test. This is an unusual finding, as post-test results are typically expected to show improvement. While there was an increase in students categorized as "Needs Improvement" (from 7 to 10) and "Approaching Excellence" (from 5 to 10), there was a notable decline in the "Average" category (from 51 to 41).

Table 5: UB-LES Grade 4 CEM Scaled Scores vs. National Average (2018) – Science (Overall, Content Areas, Cognitive Skills)

Category	UB-LES Pre-Test Scaled Score	UB-LES Post-Test Scaled Score	National Average Scaled Score (Philippines)
Overall Science	284	284	308
Content Areas			
Living Things and Their Environment	202	297	-
Matter	291	268	-
Force and Motion	277	272	-
Earth and Space	268	266	-
Cognitive Skills			
Remembering	303	290	335
Understanding	281	282	321
Applying	278	277	314
Analyzing	280	284	311

On an overall scaled score basis for science, UB-LES Grade 4 students showed no improvement between the pre-test and post-test, maintaining a score of 284, which remained below the national CEM average of 308. When examining specific content areas, there was an improvement in "Living Things and Their Environment" (from 202 to 297). However, declines were observed in "Matter" (from 291 to 268), "Force and Motion" (from 277 to 272), and "Earth and Space" (from 268 to 266). Similarly, in cognitive skills, while "Understanding" and "Analyzing" showed slight inclines, "Remembering" and "Applying" experienced declines.

A detailed item-level analysis reveals specific strengths and weaknesses in science:

Table 6: Key Strengths and Weaknesses of UB-LES Grade 4 Students in Science (CEM 2018)

Category	Strengths (Skills where >50% of students answered correctly)	Weaknesses (Skills where >50% of students answered incorrectly)
Living Things and Their Environment	Chooses which animals to raise in a particular habitat (91%); Describes how animals adapt and survive (59%); Compares body movements of animals (59%); Selects which plants to grow (58%); Identifies animals in community and habitats (58%); Explains major organs work together (57%); Identifies plants in community and habitats (56%); Describes effect of environment on life cycle (51%)	Makes inferences from investigations on specialized structures of plants (74%); Identifies predation (61%); Identifies characteristics of plants (60%); Identifies causes of diseases of major organs (59%); Identifies specialized structures of aquatic plants (57%); Describes effects of interactions among organisms (57%); Describes harmful interactions (56%); Describes

		investigation on specialized structures of plants (55%); Describes main function of heart (54%); Describes habits to maintain healthy body (52%); Identifies stages in life cycle (51%)
Matter	Classifies materials based on ability to absorb water (67%); Identifies changes in solid materials that can be pressed (61%); Describes changes in solid materials when they are cut (52%)	Classifies waste materials (68%); Identifies changes in materials harmful to environment (68%); Identifies changes in properties when mixed (63%); Identifies effects of decaying materials (58%); Describes changes in properties with temperature (58%); Describes changes in solid materials when bent (55%); Classifies materials based on decay (53%); Identifies proper disposal of waste (53%); Classifies materials based on float/sink (53%)
Force and Motion	Describes characteristics of light (73%); Describes ways to protect from excessive sound (64%); Describes how light travels (56%); Illustrates how heat travels (54%); Describes ways to protect from excessive light (51%)	Identifies safety measures in physical activities (75%); Explains safety measures in handling materials (71%); Describes force exerted by magnets (66%, 51%); Describes properties of light (66%, 55%); Describes ways to protect from excessive heat (65%); Explains effects of force applied to an object (65%)
Earth and Space	Identifies weather instruments (58%); Describes the effects of the Sun (50%)	Infers importance of water (68%, 51%); Makes inferences from weather chart (66%); Identifies weather condition in chart (66%); Interprets weather in chart (63%); Illustrates changes in shadows (61%); Identifies characteristics of soil (59%); Identifies safety precautions during weather (56%); Identifies use of water from different sources (56%)

The science results indicate that while students have some understanding of basic biological concepts and environmental adaptations, they struggle significantly with more analytical and inferential tasks, particularly in areas like plant structures, disease causes, and the effects of material interactions. In physical sciences, despite some understanding of light and sound, applying safety measures and comprehending the properties of forces remain challenging. Similarly, in earth and space science, interpreting data from charts and understanding the implications of environmental phenomena are areas of weakness.

3.5 Insights from UB-LES Principal Interview

An interview with the Principal of UB-LES, provided valuable qualitative perspectives on the school's educational context and the broader challenges facing Philippine education. It was noted that the principal had shared the interview questions with his faculty, incorporating their collective responses into his answers, suggesting a broader school perspective.

Regarding the reasons for the Philippines' poor performance in TIMSS and PISA, the principal attributed it to a misalignment of competencies with DepEd's minimum standards and a general lack of exposure to international test assessments among Filipino students, coupled with insufficient preparation time. He opined that schools should be granted greater autonomy to innovate and be exempt from excessive regulations, advocating for more time for students and schools to prepare for such international assessments.

When asked about how UB students might perform if they took the TIMSS or PISA tests, the principal expressed an optimistic view, stating that UB students would likely perform "average" or "beyond average". His basis for this assessment included a high academic compliance rate among students (over ninety percent) and the success of many UB students in various math, science, and English competitions.

On the effectiveness of CEM tests for UB students, the principal affirmed their utility. He explained that the results of the CEM pre-assessment, particularly from 2019, served as a foundation for enhancing the teachers' syllabi, helping them align content and identify specific student weaknesses. This identification of weaknesses, he noted, enabled the design of targeted intervention programs. He also highlighted an "age appropriateness" issue, where students in higher grades might be taught subjects typically covered in lower grades, indicating potential curriculum pacing challenges. The principal confirmed that CEM provides accurate analysis and feedback, assisting the school in identifying students needing further assistance and enabling teachers to provide appropriate interventions.

The interview also shed light on some unique school practices at UB-LES. Students have half-day classes, allowing them time for rest or independent study. Unlike many public schools, UB-LES permits the use of digital devices such as laptops, tablets, and smartphones inside the classroom for educational purposes. The principal also mentioned that the school halves the number of subjects taught per month (four or five subjects in one month, with the remainder in the next) to alleviate the burden on both teachers and young learners, contrasting with the nine subjects a day often found in other grade schools.

A significant observation arises from the principal's optimistic assessment of UB students' potential performance ("average" or "beyond average") in TIMSS/PISA. This perception stands in contrast to the empirical CEM data, which consistently shows UB students performing below the national CEM average. Considering that the national CEM average itself is far below international benchmarks (as evidenced by the Philippines' last-place rankings in TIMSS), this discrepancy suggests a potential gap between internal perceptions of student readiness and external, objective assessment data. This situation indicates that

internal metrics or anecdotal successes, such as competition wins, might be providing a misleading picture of true academic readiness when compared to the broader, standardized assessment landscape.

3.6 Strategic Analysis: SWOT for UB-LES

A comprehensive SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis was conducted to provide a strategic overview of UB-LES's position within the educational landscape, particularly from a business administration perspective.

Table 7: SWOT Analysis of UB-LES in the Context of Educational Performance

Category	Description
Strengths	Participation in CEM assessment tests; Autonomous status as a private Higher Education Institution (HEI); Ability to implement curriculum changes more easily than public schools; Strong, harmonious relationship with the Parents-Teachers Association (PTA); Equipped with modern computer laboratories and other school facilities; Adaptation to online and hybrid learning during the pandemic; Allowance of digital device use in classrooms for educational purposes; Long tradition of integrity and untarnished reputation (founded 1948), with a large university student body (19,000 in SY 2022-23) and a small elementary school student body; History of employing qualified teachers; Reasonable school fees compared with schools in Manila; Conveniently located and highly accessible; Conducts several extracurricular activities for a holistic approach to learning.
Weaknesses	Non-participation in TIMSS and PISA exams; Majority of Grade 4 students still fall below minimum proficiency among CEM test-takers in mathematics and science; Specific weaknesses in mathematics content areas (e.g., 24/34 items in Numbering and Number Sense, 8/13 in Geometry, 3/5 in Patterns and Algebra, 7/10 in Measurement, and 7/9 in Statistics and Probability where majority get answers wrong); Specific weaknesses in science content areas (e.g., 11/19 items in Living Things and Their Environment, 9/12 in Matter, 8/13 in Force and Motion, and 9/11 in Earth and Space where majority get answers wrong); UB-LES teachers do not fully utilize CEM assessment and feedback to make necessary adjustments in teaching mathematics and science; Limited admission capacity (maximum two sections per grade level); Traffic within the Central Business District can be time-consuming; Insufficient professional development training for teachers, specifically for reskilling with Direct and Explicit Instruction on mathematics, science, and reading comprehension; UB's curriculum is aligned with DepEd's outdated national curriculum for Basic Education.
Opportunities	Potential for improvement in international assessment test scores over time; Continued participation in TIMSS and PISA by the Philippine government and DepEd to gather reliable feedback; Assumption that UB Grade 4 students' weaknesses are similar to TIMSS test-takers, providing a basis for

	re-evaluation; Education Secretary acknowledges problems in the Basic Education sector and seeks national commitment for improvement (MATATAG agenda); Access to national and international assessments provides useful data for administrators and policymakers; UN ranks the Philippines as the most literate country in Southeast Asia; DepEd (and UB-LES) may emphasize focus on Mathematics, Science, and Reading/Literacy Skills; Intervention programs may be implemented based on assessment feedback; UB Administration can adopt "best practices" from top 10 performing countries; Increased government investment in education (DepEd receives largest national budget); DepEd can identify important learning content over easy-to-test content; DepEd can identify industry employment needs; Irrelevant subjects may be removed from basic education; Better planning can improve understanding of allocation requirements; Schools can be given greater authority in planning and resource management; DepEd can improve transparency of fund allocation; All stakeholders must recognize education as a means to alleviate poverty; Shift to online learning during the pandemic; Allowance of digital devices for learning in the classroom; Reconsidering shorter school hours as long hours do not guarantee higher scores.
Threats	Philippines ranked last (or near last) in TIMSS and PISA; Huge percentage of number of students do not meet minimum learning standards; Quality of DepEd's K to 12 Basic Education Program is not at par with international educational standards; Many Filipino students do not speak the language of the tests (English); Students' higher-order thinking skills are untapped, and DepEd curricula do not fully recognize this; Spending more time in the classroom does not improve scores; Richer students perform better than poorer ones; Lack of proper nutrition and support at home; High prevalence of bullying in Philippine schools (45% weekly for Grade 4); Most students do not have a growth mindset; Insufficient government investment in education; The Philippine education system is too huge to monitor and control effectively; DepEd has not identified industry skills needed in today's workforce; Overcrowded classrooms in public sector making full face-to-face classes difficult, with insufficient classrooms and teachers; Many schools still prohibit digital device use for learning; Risk of digital devices being a distraction or used for non-educational purposes; Majority of teachers are not well-equipped for teaching vis-à-vis international standards; Poor teacher performance on content knowledge assessments and inadequate professional systems; Only about 20% of K to 12 graduates enter the workforce; COVID-19 pandemic worsening conditions; Declining interest in mathematics and science among older students; Poverty and financial stress are major contributors to high dropout rates.

The SWOT analysis highlights UB-LES's internal strengths, such as its autonomy and modern facilities, which could be leveraged for educational improvements. However, it also underscores significant internal weaknesses, particularly the underutilization of CEM feedback by teachers and the alignment with an outdated national curriculum. Externally, the opportunities are vast, driven by national policy shifts and the availability of international assessment data for benchmarking. Conversely, the threats are substantial, emanating from the systemic failures of the broader Philippine education system, including issues of curriculum quality, teacher preparedness, and socioeconomic factors that impede learning.

4. Discussion

4.1 Interpretation of UB-LES Performance in Relation to National and International Benchmarks

The analysis of UB-LES Grade 4 student performance in CEM tests reveals a consistent pattern of underperformance when compared to the national average of CEM test-takers in both mathematics and science. This finding confirms that, within the national assessment framework, UB-LES does not outperform most other schools taking the same test. While CEM tests appear to be aligned with DepEd's national curriculum, a crucial distinction emerges: DepEd's K to 12 curriculum itself is not aligned with international assessments such as TIMSS or PISA. This lack of alignment is significant, as the Philippines has consistently ranked at the bottom of these international assessments.

This situation illustrates a concerning effect of systemic misalignment. If the national curriculum, which CEM assessments reflect, is not adequately preparing students for international standards, then even schools performing at or slightly below the national CEM average, like UB-LES, are inherently significantly underprepared on a global scale. This implies that efforts to improve UB-LES performance cannot be confined solely to internal school-level interventions. A fundamental re-evaluation and recalibration of the national curriculum's alignment with global competencies are necessary to truly elevate student performance to international standards. Without this broader systemic change, local improvements, while valuable, will remain limited in their ability to bridge the international achievement gap.

4.2 Implications for Curriculum and Instruction at UB-LES

The detailed CEM data, particularly the item-level analysis of strengths and weaknesses (Tables 4 and 5), provides a clear and actionable roadmap for targeted curriculum adjustments and instructional focus within UB-LES. For instance, in mathematics, specific attention is needed for multi-digit multiplication, estimation, understanding and performing operations with dissimilar fractions, and solving complex multi-step word problems. In science, instructional efforts should be intensified in areas such as making inferences from plant investigations, understanding harmful interactions among living things, and comprehending changes in material properties.

A particularly critical finding is the "odd decline" observed in the science post-test performance for 2018, where overall proficiency decreased from pre-test levels. This observation warrants further investigation. Such a decline could suggest that the post-test measured different skills, or, more concerningly, that the instructional methods employed between the pre-test and post-test were ineffective, or perhaps even led to a regression in understanding within certain science domains. This outcome contradicts the fundamental expectation of learning progression and highlights a potential flaw in pedagogical approaches or curriculum pacing specific to science instruction at UB-LES.

The finding that UB-LES teachers do not fully utilize the feedback provided by CEM assessments points to a critical need for enhanced professional development. Recommendations for UB-LES must therefore

emphasize reskilling teachers in effective pedagogical approaches, such as "Direct and Explicit Instruction," particularly in mathematics, science, and reading comprehension. This method guides the teacher-learner through a step-by-step process, which could be particularly beneficial for addressing specific learning gaps identified by the CEM data. Furthermore, it is imperative to establish a robust feedback loop where CEM results are systematically reviewed and utilized by teachers, administrators, and shared with the Parents-Teachers Association (PTA) to collectively inform instructional decisions and the design of targeted intervention programs.

4.3 Broader Implications for the Philippines Basic Education System

The consistent and dismal performance of the Philippines in international assessments like TIMSS and PISA strongly indicates that the DepEd K to 12 curriculum requires substantial reform. The current curriculum appears to be primarily focused on meeting minimum national standards, which are evidently insufficient for preparing students to compete globally. A shift towards aligning the curriculum with international educational standards and fostering higher-order thinking skills is imperative.

Furthermore, the approach to national assessment needs rethinking. Philippine test providers, such as CEM, should consider aligning their assessments more closely with the frameworks of international tests like TIMSS and PISA. This alignment would provide more realistic and globally relevant benchmarks for schools and students, offering a clearer picture of their preparedness for international academic and professional environments.

The findings from TIMSS and PISA, as highlighted by the World Bank report , underscore that the educational crisis in the Philippines extends beyond mere curriculum or pedagogical issues. It is a multifaceted challenge rooted in broader societal, economic, and psychological factors. These broader findings collectively indicate that the educational crisis in the Philippines is not solely an educational problem but rather a complex, holistic ecosystem challenge. Addressing it effectively will require concerted efforts and multi-sectoral collaboration involving not only DepEd but also other government agencies, local communities, and families.

4.4 Alignment with Existing Literature and Policy Initiatives (e.g. MATATAG Agenda)

The findings and recommendations of this study align closely with current national policy initiatives, particularly Vice President Sara Duterte's "MATATAG" agenda for basic education. This agenda, launched in January 2023, outlines a roadmap for addressing the multifaceted challenges in the basic education sector. The study's emphasis on curriculum reform directly supports the "Make the curriculum relevant to produce job-ready, active and responsible citizens" pillar of MATATAG. The need to update DepEd's curriculum to align with international standards is a crucial step towards achieving this relevance.

Furthermore, the study's call for addressing student well-being, nutrition, and bullying directly resonates with the "Take good care of learners by promoting learner well-being, inclusive education and a positive learning environment" pillar. The identified lack of proper nutrition, home support, and the prevalence of bullying are significant barriers to learning that require holistic interventions.

Finally, the recommendations for enhanced teacher professional development and addressing non-teaching tasks for educators are in direct consonance with the "Give support for teachers to teach better" pillar of the MATATAG agenda. The recognition that teachers are the "lifeblood" of the Department of Education underscores the importance of investing in their professional growth and welfare to improve educational outcomes.

The explicit acknowledgement of an "educational crisis" by DepEd and the subsequent launch of the "MATATAG" agenda create a significant policy window. This study's findings, supported by specific data and detailed analysis, can directly inform and strengthen the implementation of these national initiatives. By providing empirical evidence and actionable recommendations, this research has the potential to contribute meaningfully to real-world policy and practice, thereby increasing its impact and relevance for publication in journals that prioritize policy-oriented educational research.

4.5 Limitations of the Study

Several limitations are inherent in this study, which should be considered when interpreting its findings.

- Scope of Data: The primary data source for UB-LES student performance was limited to CEM test results. As UB-LES students did not participate in TIMSS or PISA, direct comparisons of their performance against international benchmarks could not be made. This necessitates inferential analysis regarding their international readiness based on national assessment data.
- CEM Data Gaps: The absence of post-test results for the 2017 and 2019 CEM assessments restricted the ability to consistently track within-year student progress across all three academic years studied. This limited the scope of analyzing the impact of school-year interventions in those specific years.
- Qualitative Data Depth: The qualitative component relied on an interview with a single key informant (the UB-LES Principal). While valuable, the insights gathered may reflect a singular perspective, and the use of pre-provided questions, though ensuring structure, might have limited the spontaneity and depth of certain qualitative insights.
- Generalizability: The study focused on a single private laboratory elementary school (UB-LES). Therefore, the findings and specific recommendations may not be fully generalizable to the entire Philippine basic education system, particularly to public schools, which often face different resource constraints and operational challenges.
- Causality: While the study identifies correlations between various factors (e.g., classroom hours and test scores, socioeconomic status and achievement), it does not establish direct causality for all observed relationships. Further experimental or longitudinal studies would be required to determine definitive causal links.

4.6 Directions for Future Research

Building upon the findings and limitations of this study, several avenues for future research emerge as critical for a more comprehensive understanding and effective intervention in Philippine education.

- Curriculum Alignment Study: A detailed comparative analysis of the DepEd and UB-LES curriculum content against the specific frameworks and learning objectives of international assessments like TIMSS and PISA is needed. Such a study could pinpoint precise misalignments and inform targeted curriculum revisions.
- Comprehensive Training Needs Analysis for Teachers: A thorough assessment of UB-LES teachers' professional development needs, particularly focusing on their proficiency in specific pedagogical approaches such as Direct and Explicit Instruction, would be highly beneficial. This could lead to more effective and targeted teacher training programs.
- Longitudinal Performance Tracking: Continued and consistent monitoring of UB-LES Grade 4 student performance in CEM tests post-pandemic is essential to assess current trends, evaluate the long-term impact of any implemented interventions, and understand the recovery from pandemic-related learning disruptions.

- Impact of Digital Devices: Research on the actual impact of allowing digital devices in classrooms on learning outcomes, student engagement, and potential distractions would provide valuable evidence for technology integration policies.

5. Conclusion

The performance of UB-LES Grade 4 students in CEM tests consistently indicates an underperformance relative to the overall national CEM test-takers in both mathematics and science. The overall scaled average of all schools taking CEM tests consistently surpasses UB-LES's average performance across all assessed categories in both subjects. While CEM tests appear to be aligned with DepEd's curriculum, a critical disconnect exists: DepEd's K to 12 Basic Education Program is not aligned with the international assessments of TIMSS or PISA. This misalignment is a significant factor contributing to the Philippines' dismal international rankings.

Despite the concerning nature of the Philippines' performance in TIMSS and PISA, these results are not entirely negative. Rather, they represent a crucial starting point for positive change. Had DepEd not participated in these international assessments, the wealth of diagnostic data now available would be inaccessible, and the true extent of the educational gap would remain unknown. Improving educational outcomes for Grade 4 students—and indeed for all grade levels—remains a formidable challenge for the Philippine basic education system. However, the identified deficiencies in reading comprehension, mathematics, and science are not insurmountable and can be effectively addressed and resolved over time through concerted and strategic interventions.

6. Recommendations

Based on the findings and discussions of this study, the following actionable recommendations are proposed for various stakeholders to improve mathematics and science performance among Grade 4 students and the broader educational system.

6.1 Recommendations for UB-LES

- Continue and Enhance Assessment Utilization: UB-LES should maintain its participation in CEM or other credible third-party assessments to ensure continuous acquisition of accurate feedback on student performance. The school should also explore opportunities to participate in pilot international assessments if available.
- Implement Data-Driven Curriculum and Instruction: The detailed CEM feedback on specific strengths and weaknesses (Tables 4 and 5) must be systematically utilized to refine the mathematics and science curriculum. Instructional efforts should be intensified in identified areas of weakness, moving beyond general improvements to targeted interventions.
- Prioritize Targeted Teacher Professional Development: It is crucial to implement professional development programs specifically focused on "Direct and Explicit Instruction" in mathematics, science, and reading comprehension. These programs should guide teachers through step-by-step pedagogical processes to address specific learning gaps and enhance their content knowledge, directly addressing the finding that teachers are not fully utilizing CEM feedback.
- Strengthen Feedback Loops and Collaboration: Ensure that CEM results are regularly disseminated and thoroughly discussed among administrators, teachers, and the Parents-Teachers Association (PTA). This fosters a collaborative problem-solving environment and facilitates the co-creation of effective intervention programs.

- Proactive Curriculum Alignment Review: UB-LES should proactively review and adjust its curriculum to align more closely with international standards, anticipating and preparing for future DepEd reforms. This strategic foresight can position UB-LES as a leader in educational quality.
- Foster Holistic Student Support: Leverage the school's existing strengths, such as a strong PTA and modern facilities, to implement comprehensive student well-being initiatives. This includes addressing issues like nutrition, creating a positive learning environment, and potentially adopting "best practices" observed in high-performing educational systems globally.

Recommendations for DepEd and National Policy

- Sustained International Assessment Participation: The Department of Education (DepEd) should continue its active participation in TIMSS and PISA assessments. This sustained engagement is vital for ongoing international benchmarking and provides invaluable diagnostic data to identify systemic weaknesses and track progress over time.
- National Assessment Alignment with International Benchmarks: Philippine test providers, including CEM, should be encouraged to align their assessments more closely with the frameworks and competencies measured by international benchmarks rather than solely with the current DepEd curriculum. This would provide more realistic indicators of students' global readiness and help bridge the gap between national and international educational standards.
- Comprehensive Curriculum Reform for Global Competence: A top priority for DepEd must be a comprehensive review and reform of the K to 12 Basic Education Program. This reform should focus on ensuring alignment with international educational standards, fostering critical thinking, problem-solving, and other higher-order thinking skills, and moving beyond mere minimum national standards. This directly supports the "Make the curriculum relevant" pillar of the "MATATAG" agenda.
- Enhanced Teacher Support and Professional Development: Significant investment is required in nationwide professional development programs for teachers, with a strong emphasis on improving content knowledge and effective pedagogical strategies, particularly in mathematics and science. Furthermore, addressing teacher welfare and removing non-teaching tasks are crucial steps to empower educators to teach more effectively, aligning with the "Give support for teachers to teach better" pillar of MATATAG.
- Address Systemic Barriers to Learning: DepEd, in collaboration with other government agencies and community stakeholders, must implement multi-sectoral approaches to address non-academic factors that significantly impede learning. These include improving student nutrition, enhancing home learning support, and implementing robust anti-bullying programs, as highlighted by the World Bank report. This supports the "Take good care of learners" pillar of MATATAG.
- Strategic Resource Allocation and Transparency: The government should ensure increased and transparent investment in education, with a focus on optimizing resource utilization to address critical gaps, particularly in public schools, such as classroom size and teacher-student ratios. Empowering schools with greater authority in planning and resource management, while simplifying reporting requirements, can also improve efficiency.
- Rethink Instructional Time: Given the finding that longer classroom hours do not necessarily translate to higher test scores, DepEd should reconsider the length of school hours. Exploring evidence-based approaches that prioritize the quality and engagement of instruction over mere quantity of instructional time could lead to more effective and less stressful learning environments.

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6. JOHANN BEN A. BAUTISTA
7. Baguio City
8. EDUCATION
9. Graduate Studies Doctor of Business Administration
10. University of Baguio
11. October 2025
12. Master in Business Administration
13. University of Baguio
14. October 2006
15. Tertiary Bachelor of Science in Commerce, Major in Management
16. University of Baguio
17. May 1999
18. Certificate Language and Culture Exchange Student
19. Nagasaki Wesleyan University
20. Isahaya, Nagasaki, Japan
21. July 1992
22. Secondary University of Baguio Science High School
23. Baguio City
24. March 1988
25. Elementary Special Education Center
26. Baguio City
27. March 1984
28. PROFESSIONAL EXPERIENCE
29. Vice President for Finance University of Baguio
30. Baguio City
31. June 2018 – present
32. Board Member Center for Educational Measurement
33. Makati City
34. August 2019 - present
35. Board Chairman Altus Holdings
36. Baguio City
37. March 2016 - present
38. Corporate Treasurer University of Baguio

39. Baguio City
40. June 2015 – May 2018
41. University President University of Baguio
42. Baguio City
43. June 2009 – May 2015
44. Board Chairman Rural Bank of Sagada
45. Sagada, Mountain Province
46. February 2011
47. Vice President for Finance University of Baguio
48. Baguio City
49. June 2001 – May 2009
50. Bank Employee Rural Bank of Itogon
51. Baguio City
52. 1997 - 2001