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Revitalizing and amplifying (REVAMP) numeracy skills of learners through error analysis

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Abstract
In the realm of education, numeracy skills are fundamental, serving as a cornerstone for academic success and everyday problem-solving. This study, titled "Revitalizing and Amplifying (REVAMP) Numeracy Skills of Learners through Error Analysis," delves into innovative strategies aimed at enhancing these critical skills. The research employs a novel approach centered on error analysis, recognizing that errors offer valuable insights into a student's thought processes and misconceptions. The study investigates five key areas: error identification, error categorization, error interpretation, targeted interventions, and progress assessment. Through a combination of data-driven methodologies and tailored interventions, educators can address individual learning gaps more effectively. This research presents a framework for revitalizing and amplifying numeracy skills by harnessing the power of error analysis, ultimately promoting deeper understanding and confidence among learners.

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Keywords: Numeracy skills, error analysis, education, learners, revitalization

Introduction

Maintaining a high standard of living requires efficient economic practices. This includes the ability to use mathematics in decision-making. In this age of technology, numeracy skills are especially vital. People must be able to use the latest tools, and understand the mathematics that govern them. Hence, it is crucial to identify and address impediments to mathematical understanding and skill acquisition early in life.

A modern economy relies on numerical calculation and data analysis. As such, numerical skills are crucial to its success. Employers seek employees with good mathematical skills because those with lower scores often receive higher pay. Furthermore, employers use sophisticated mathematical models to manage their businesses efficiently. Governments use mathematical models to plan their economies and direct fiscal resources where they are most needed. Understanding how math helps people succeed in today's world is crucial. As such, it is crucial that at the very young age, learners need to develop their numeracy skills in their full potentials. Despite this dream, everything halted when the Corona Virus, also known as COVID-19, became a pandemic. Its prowess suppressed many to go outside their homes and soon enabled the shutting down of educational institutions across the globe. However, schools did not stop to continue educating learners. Online and modular modalities were adapted. Having these modalities benefited some yet destroyed desires of many in learning. Thus, learning gaps emerged. Yang (2022) [8] revealed that learning loss has been aggravated by remote learning and has been a constant topic of Department of Education just before they were able to launch the in-person classes in the country after two years of online learning. Learning losses were associated with the results from large-scale assessments, including the PISA (Programme of International Student Assessment) and TIMSS (Trends in International Mathematics and Science Study) which signified that Philippines lags other countries in numeracy skills even before the pandemic. The Schools Division Office of Mandaluyong City initiated a test called Strengthening the Comprehensive Assessment of Commitment to Learning (SCALE) abiding the SOLO Framework as part of the Division Learning Continuity and Recovery Plan that seeks to measure learners' literacy and numeracy skills across subject areas. This test uncovered the learning gaps specifically on reading and numeracy skills of learners.

In Highway Hills Integrated School, only about 39% of learners in junior high school are proficient in terms of numeracy skills indicating that majority of them failed to be at their "supposed" level of numeracy given their age.

Meanwhile, to answer for this issue, the Department of Education issued DepEd Order No. 012 S. 2020 that stipulated the adoption of Basic Education Learning Continuity Plan in schools. This in turn required the regions, divisions, and schools to craft a Learning Continuity and Recovery Plan (LCRP) to address the learning gaps incurred during the pandemic.

In line with this, Highway Hills Integrated School crafted the School LCRP which focused on recovering literacy and numeracy skills gaps. Various programs were initiated by teachers and administrators. Project RevAmp which means Revitalizing and Amplifying Numeracy Skills of Learners Through Error Analysis, were proposed as part of JHS mathematics departments' Project FOCUS in the year 2022. With this, it is the desire of the researcher to conduct a quasi-experimental action research in incorporating Error Analysis in the mathematics classes. This research were called Project RevAmp and were conducted for a span of 3 months for the academic year 2022-2023 at Highway Hills Integrated School.

Research Methods

Mathematics has been constantly included in basic education curriculum for it involved basic and necessary skills that a learner can use in his daily life. Thus, numeracy skills must be honed to an extent where learners enjoy and awed.

However, COVID-19 pandemic came and hit the public not just physically but mentally. Performances of learners both in literacy and numeracy dropped as the modalities of learning shift from in-person to online and modular approach. Came 2022, in-person classes began to resume. Evidently, learning gaps emerged as the digital learning became less meaningful for most of learners.

Through constant efforts of educators, interventions on getting back what was lost has begun. Projects on literacy and numeracy including revitalizing problem-solving skills commenced.

As cited by Abdul (2015), Newman and Polya suggested that there are five stages of mathematical problem solving namely (a) reading errors (b) comprehension errors, (c) transformation errors, (d) process skill errors, and (e) encoding errors that is student ability to write encoding errors.

Project RevAmp which means Revitalizing and Amplifying Numeracy Skills of Learners Through Error Analysis, is a coined term from the initials of the words "revitalizing" and "amplifying" which suggests improvement and enhancement. "Rev" and "Amp" both signify positivity therefore the coined term "RevAmp" was established. This project will utilize the theory of Newman and Polya regarding the use of error analysis in improving the numeracy skills of learners.

RevAmp was done by embedding error analysis in illustrating lesson examples in Mathematics 9 instead of simply giving out sample problems to the learners. They are to spot errors and correct such errors which exist in the given problem. This were done on a daily basis for a span of three months. By posing problems with errors among learners, they may be able to critically-develop their skills in numeracy.

The research design employed in the study is descriptive in nature. A descriptive research design seeks to systematically gather, analyze, and interpret data to provide a detailed account of a particular phenomenon or subject. In this case, the research aims to comprehensively describe the process of enhancing numeracy skills among learners through the application of error analysis. Key elements of the descriptive research design used in this study include data collection through various means, such as observations, surveys, tests, and interviews. The study focuses on providing an objective and factual description of the error analysis process, capturing the nuances of error identification, categorization, and interpretation without manipulating variables or testing hypotheses. It employs a cross-sectional approach, collecting data at a specific point in time to gain insights into the current state of learners' numeracy skills and the impact of error analysis interventions**.**

The participants of the study are the 200 purposively selected grade 9 students in Mathematics subject in Highway Hills Integrated School for the academic year 2022 to 2023. Data on school learning continuity plan were also utilized as inputs of the learners' numeracy skills.

Respondents were given a test before and after the conduct of Project RevAmp to measure their numeracy skills level. Also, a survey in determining the challenges encountered by learners in mathematics were conducted to serve as inputs on the strategy to be used. Weekly performances among students were monitored and recorded for three months during the implementation of the said intervention. The study will utilize the quasi-experimental design using one-shot pre-test post test design to ascertain the numeracy skills of the respondents before and after the use of the intervention.

Results were statistically analyzed at 0.05 level of significance using t-test to determine if there is a significant difference in the pretest and post test score among respondents. Tools in descriptive statistics such as mean, frequency and percentage were also utilized to provide the level of numeracy skills of the respondents.

Numeracy skills level of the Grade 9 students was classified as follows:

Table 1: Numeracy Skills level of the Grade 9 students

Level	Level of Ability
Satisfactory	86%-100%
Good	71%-85%
Poor	70% below

Results

Table 2: Pre-Test Results (50-items)

Section	Mean	Level of Academic Performance
Dagohoy	23.20	Poor
Spj	32.80	Poor
Aquino	30.10	Poor
Malvar	35.10	Good
Del pilar	34.60	Poor
Jaena	21.20	Poor
Weighted Mean	29.50	Poor

Table 2 presents the pre-test results for 50 items, displaying the mean scores and corresponding levels of academic performance for different sections or groups of students. Specifically, the DAGOHOY section obtained a mean score of 23.20, categorizing its performance as "Poor." Similarly,

the SPJ section achieved a mean score of 32.80, also classified as poor performance. The AQUINO section showed a mean of 30.10, placing it in the poor performance category as well. In contrast, the MALVAR section stood out with a mean score of 35.10, indicating "Good" academic performance. The DEL PILAR section, while scoring 34.60, still fell into the poor category. Notably, the JAENA section had the lowest mean score of 21.20, solidifying its place in the poor performance category. The weighted mean for all sections combined was calculated at 29.50, reinforcing the overall categorization as "Poor" performance.

These findings align with existing literature on academic performance disparities among student groups. Research by Smith and Johnson (2019) [7] emphasized the impact of instructional strategies on students' academic performance, highlighting the need for tailored interventions to address poor performance. Furthermore, the study by Anderson et al. (2020) [1] explored the influence of teacher-student relationships on academic outcomes, indicating that a supportive learning environment can significantly impact student performance. In this context, the results underscore the importance of implementing targeted interventions and fostering a conducive learning atmosphere to improve academic outcomes among the sections displaying poor performance.

Table 3: Post-Test Results (50-items)

Section	Mean	Level of Academic Performance
Dagohoy	37.22	Good
Spj	45.63	Satisfactory
Aquino	39.12	Good
Malvar	43.32	Satisfactory
Del pilar	40.17	Good
Jaena	38.20	Good
Weighted Mean	40.61	Good

Table 3 presents the post-test results for 50 items, displaying the mean scores and corresponding levels of academic performance for different sections or groups of students. Specifically, the DAGOHOY section achieved a mean score of 37.22, categorizing its performance as "Good." The SPJ section scored 45.63, which falls into the "Satisfactory" performance category. The AQUINO section obtained a mean score of 39.12, also classified as "Good" performance. Similarly, the MALVAR section achieved a mean score of 43.32, indicating "Satisfactory" academic performance. The DEL PILAR section scored 40.17, categorizing its performance as "Good." The JAENA section obtained a mean score of 38.20, also falling into the "Good" performance category. The weighted mean for all sections combined was calculated at 40.61, reinforcing the overall categorization as "Good" performance.

These findings align with existing literature on the effectiveness of targeted interventions in improving academic performance. Smith and Johnson (2019) [7] emphasized the importance of tailored strategies for academic improvement, showing that such interventions can lead to significant enhancements in students' performance levels. Additionally, Brown (2021) [2] conducted a study highlighting the positive impact of supportive learning environments on student achievement, further supporting the observed improvements in academic performance across various sections in this study.

Table 4: Difference Between the Pre-Test and Post Test Results in Research

Category	Mean Score	Degrees of Freedom	Computed t-value	p-value	Interpretation
Pre-Test	29.50	5	6.43	0.00135	Significant
Post-Test	40.61				

Table 4 displays the difference between the pre-test and post-test results in research, providing essential statistical information for understanding the impact of interventions or educational strategies.

The table illustrates the mean scores, degrees of freedom, computed t-value, and p-value for both the pre-test and post-test. The pre-test results, with a mean score of 29.50, were subject to statistical analysis, resulting in a computed t-value of 6.43 and a p-value of 0.00135, signifying statistical significance. However, the post-test results, which show a mean score of 40.61, await further interpretation and analysis. These findings support the notion that the implemented interventions or strategies have had a substantial impact on academic performance, as evidenced by the significant difference between the pre-test and post-test results.

The interpretation of these results aligns with established literature on the effectiveness of educational interventions in improving student outcomes. For example, a study by Johnson and Smith (2020) [5] emphasized the importance of analyzing pre-test and post-test data to evaluate the effectiveness of instructional strategies, highlighting the significance of positive changes in post-test scores. This research supports the observed significant improvement in academic performance between the pre-test and post-test results in this study.

Discussion

In retrospect, the researcher observed significant variations in academic performance among different sections in the pre-test results. While the MALVAR section exhibited "Good" performance, most sections were categorized as "Poor." This initial assessment highlighted the need for targeted interventions to address the identified gaps in numeracy skills among students.

Moving forward, the researcher noted encouraging improvements after the implementation of interventions or strategies. Several sections, including DAGOHOY, AQUINO, and DEL PILAR, transitioned from the "Poor" category to "Good." This transformation indicated the potential effectiveness of tailored interventions in enhancing academic outcomes.

Furthermore, statistical analysis affirmed the significance of the improvements observed in the post-test results. The computed t-value and low p-value (0.00135) for the pre-test results underscored that the interventions had a meaningful impact on student performance. These findings collectively suggest that the implemented strategies successfully addressed the initial performance gaps identified among the student sections.

Conclusions

Based on the results and discussions, the following conclusions were drawn

1. Before the use of error analysis as intervention, students' numeracy skills are generally poor.
2. After the use of error analysis as intervention, students'

numeracy improved to a good level.
3. There is a significant difference between the pretest and post test results of numeracy skills among students at 0.05 alpha level of significance.
4. Error analysis aid in improving one's numeracy skills.

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