International Journal of Research (IJR)
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Vol. 11 Issue 05
May 2024

Learning Gaps and Proficiency Levels in Science Specialized Subjects of Senior High School Students in Surigao City, Philippines

[1]Joey S. Simbajon, [2]Mauricio S. Adlaon

[1] Student, Surigao del Norte State University, [2]Faculty, Surigao del Norte State University

[1]ORCID: 0000-0002-0876-0624

[2]ORCID: 0000-0002-3546-0774

Abstract – *This study examines the learning gaps and proficiency levels in science-specialized subjects among grade 12 Senior High School STEM students at St. Paul University Surigao. The goal is to identify areas of weakness and develop targeted interventions to enhance students' understanding and academic achievement. A cross-sectional design and purposive sampling technique are employed to assess multiple subjects simultaneously. Diagnostic and post-tests are conducted, and statistical measures are used for analysis. The findings indicate varying levels of mastery and learning gaps in specific topics, highlighting the need for targeted interventions. The study emphasizes the importance of effective instructional strategies, considering factors like gender and learning approaches, and utilizing interventions such as the Mastery Learning Approach and Learning Management Systems. The results provide valuable insights for educators, curriculum developers, and policymakers to enhance science education at St. Paul University Surigao. Recommendations include establishing support programs, providing professional development for educators, and allocating resources for a comprehensive science curriculum integrating technology. Implementation of these recommendations can create a supportive and inclusive learning environment, ultimately improving the quality of science education at the institution.*

Keywords: *Learning gaps, Proficiency level, Science specialized subjects*

I. Introduction

In the field of education, it is crucial to continuously monitor and evaluate students' learning progress to ensure effective instruction and meaningful educational experiences. According to the findings from the PISA 2022 assessment, the examination of Filipino students' performance in science has elucidated that a predominant proportion of students have demonstrated attainment levels primarily within Levels 1 (indicative of performance below proficiency) and Level 2 (reflective of basic proficiency), with a relatively limited representation in Levels 3 (characterized by intermediate proficiency) and Level 4 (embodying advanced proficiency).

Received: *25 April 2024*
Revised: *7 May 2024*
Accepted: *15 May 2024*

DOI: https://doi.org/10.5281/zenodo.11195269

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Vol. 11 Issue 05
May 2024

In the context of senior high school education, particularly in science-specialized subjects, it is essential to identify and address learning gaps that students may encounter. By conducting a comprehensive assessment of these learning gaps, educators can gain valuable insights into the specific areas where students struggle the most, enabling the development of targeted interventions and instructional strategies to enhance their conceptual understanding and academic achievement.

According to Pajares (2012), individuals' self-efficacy beliefs significantly influence their motivation, effort, and perseverance in learning. When students face challenges or encounter difficulties in their science education, it can negatively impact their self-efficacy and overall engagement in the subject matter (Flores, 2015). Hence, it becomes imperative for educators to identify and address these learning gaps to foster students' confidence and competence in science.

St. Paul University Surigao, a reputable educational institution committed to providing quality education, recognizes the importance of assessing learning gaps in science-specialized subjects among its senior high school students. This assessment aims to uncover specific topics or concepts where students may struggle, providing educators with critical insights to design targeted interventions and instructional strategies that effectively address these gaps (Monroe et al., 2019).

By assessing learning gaps and proficiency levels in science-specialized subjects, educators at St. Paul University Surigao can create a supportive and inclusive learning environment that caters to the diverse needs of their students. This assessment will contribute to the ongoing improvement of science education practices within the institution and promote equitable education (Windschitl et al., 2019). Moreover, addressing these learning gaps will empower students to develop a strong conceptual foundation in science and enhance their academic achievement, preparing them for future academic pursuits and careers in scientific fields (Kpolovie, Joe, & Okoto, 2014).

The purpose of this study is to conduct a comprehensive assessment of learning gaps and proficiency levels in science-specialized subjects among grade 12 STEM students at St. Paul University Surigao. Through this assessment, the specific areas of weaknesses and challenges that students may be facing in their science education will be identified. This research endeavor aims to provide insights that will inform the development of targeted interventions and instructional strategies to bridge these gaps effectively.

By undertaking this study, St. Paul University Surigao reaffirms its commitment to providing quality science education and ensuring the academic success of its senior high school students. The findings of this assessment will contribute to evidence-based decision-making, inform curriculum development, and guide instructional practices, ultimately improving the overall quality of science education at the institution.

Furthermore, this study holds immense significance for various stakeholders. Senior high school students will benefit from the identification and addressing of specific gaps, receiving targeted support to enhance understanding and academic achievement, ultimately improving their self-efficacy and engagement. Educators can utilize the findings to design effective instructional

Received: *25 April 2024*
Revised: *7 May 2024*
Accepted: *15 May 2024*

DOI: https://doi.org/10.5281/zenodo.11195269

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Vol. 11 Issue 05
May 2024

strategies and interventions, improving teaching practices and learning outcomes. The institution itself can contribute to science education improvement, informed by evidence-based decision-making, curriculum development, and tailored instruction. Additionally, the broader field of education can benefit from insights into effective practices, fostering equitable education and enhancing science education quality.

II. Statement of the Problem

In this study, the researchers aim to assess the learning gaps and proficiency levels in science-specialized subjects in senior high school students of St. Paul University Surigao. Specifically, it sought to answer the following:

1. What are the specific learning gaps and proficiency levels in science-specialized subjects among senior high school students at St. Paul University Surigao in terms of:
   1.1 Learning Competency; and
   1.2 Percentage of Correct Responses per Competency?
2. Based on the findings, what recommendations may be proposed?

III. Assumptions

There is a significant learning gap in science-specialized subjects of the Grade 12 STEM Students.

IV. Methodology

This study will employ a cross-sectional design which is appropriate for this study as it allows for an overview of the learning gaps and proficiency levels in science-specialized subjects of grade 12 STEM students at St. Paul University Surigao. It efficiently assesses multiple subjects simultaneously and provides practical data collection within a specific timeframe, making it a cost-effective approach for examining the current state of knowledge in the selected subjects. Additionally, the subjects of focus are General Chemistry 2, General Physics 1, and General Biology 1.

A purposive sampling technique will be used to select participants, ensuring representation from each STEM section. The data collection process will include a diagnostic and post-test to gauge students' initial knowledge and mastery of the subjects. The results will be analyzed to identify specific areas of learning gaps, supplemented by data mining to gather quantitative data on students' difficulties with specific learning competencies.

Quantitative analysis of the diagnostic and post-test results will be conducted using statistical measures, while interpretations are based on the percentage of correct responses per competency. The findings will be presented, highlighting the identified learning gaps in each subject.

In addition, to facilitate the interpretation of the assessment results, a legend was used to categorize the percentage of correct responses per competency into different levels of mastery.

Received: *25 April 2024*
Revised: *7 May 2024*
Accepted: *15 May 2024*

DOI: https://doi.org/10.5281/zenodo.11195269

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Vol. 11 Issue 05
May 2024

This legend provides a clear framework for understanding the students' proficiency based on their performance. This legend allows for a straightforward interpretation of the student's level of understanding in each competency.

Legend

Percentage of Correct Responses per Competency	Interpretation
0%	Absolute No Mastery
5%	Very Low Mastery
15%	Low Mastery
35%	Average Mastery
66%	Moving Towards Mastery
86%	Closely Approximating Mastery
96%	Mastery

Furthermore, this study utilizes a four-point Likert scale with clear verbal descriptions such as Needs Improvement, Proficient, Moderately Proficient, and Highly Proficient which enables researchers to assess and communicate participants' proficiency levels in a concise and easily understandable manner. With this, it facilitates the identification of areas that require improvement as well as areas where participants demonstrate higher levels of proficiency.

Likert Scale

Interval	Verbal Description
3.59% - 20.40%	Needs Improvement
20.41% - 37.22%	Proficient
37.23% - 54.04%	Moderately Proficient
54.05% - 70.85%	Highly Proficient

V. Results and Discussions

Overview of the assessment of learning gaps and proficiency level in Science-specialized Subjects

Received: *25 April 2024*
Revised: *7 May 2024*
Accepted: *15 May 2024*

DOI: https://doi.org/10.5281/zenodo.11195269

Table 1 presents the overview of learning gaps and proficiency level in General Chemistry 2 for the First Quarter of School Year 2022-2023.

Table 1. Overview of the assessment of learning gaps and proficiency level on General Chemistry 2.

Learning Competencies	**Diagnostic Test**		**Post-Test**		**Difference**	**Post intervention result**
	%	**I**	**%**	**I**		
Use the kinetic molecular model to explain properties of liquids and solids. ***STEM_GC11IMFIIIa-c-99***	47.09%	Average Mastery	87.71%	Moving Towards Mastery	40.62%	Moderately Proficient
Describe and differentiate the types of intermolecular forces. ***STEM_GC11IMFIIIa-c-100***	41.45%	Average Mastery	83.56%	Moving Towards Mastery	42.11%	Moderately Proficient
Describe the following properties of liquids, and explain the effect of intermolecular forces on these properties: surface tension, viscosity, vapor pressure, boiling point, and molar heat of vaporization. ***STEM_GC11IMFIIIa-c-102***	28.55%	Low Mastery	64.13%	Average Mastery	35.58%	Proficient
Explain the properties of water with its molecular structure and intermolecular forces. ***STEM_GC11IMFIIIa-c-102***	27.80%	Low Mastery	55.61%	Average Mastery	27.81%	Proficient

Received: *25 April 2024*
Revised: *7 May 2024*
Accepted: *15 May 2024*

DOI: https://doi.org/10.5281/zenodo.11195269

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Vol. 11 Issue 05
May 2024

Describe the difference in structure of crystalline and amorphous solids. ***STEM_GC11IMFIIIa-c-104***	23.77%	Low Mastery	55.16%	Average Mastery	31.39%	Proficient
Interpret the phase diagram of water and carbon dioxide. ***STEM_GC11IMFIIIa-c-104***	22.57%	Low Mastery	45.14%	Average Mastery	22.57%	Proficient
Determine and explain the heating and cooling curve of substance. ***STEM_GC11IMFIIIa-c-109***	20.03%	Low Mastery	43.65%	Average Mastery	23.62%	Proficient
Use different ways of expressing concentration of solutions: percent by mass, mole fraction, molarity, molality, percent by volume, percent by mass, ppm. ***STEM_GC11PPIIId-f-111***	31.09%	Low Mastery	48.43%	Average Mastery	17.34%	Needs Improvement
Perform stoichiometric calculations for reactions in solution. ***STEM_GC11PPIIId-f-112***	30.64%	Low Mastery	58.00%	Average Mastery	27.36%	Proficient
Describe the effect of concentration on the colligative properties of solutions. ***STEM_GC11PPIIId-f-115***	32.14%	Low Mastery	69.66%	Moving Towards Mastery	37.52%	Moderately Proficient

Received: *25 April 2024*
Revised: *7 May 2024*
Accepted: *15 May 2024*

DOI: https://doi.org/10.5281/zenodo.11195269

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Vol. 11 Issue 05
May 2024

Differentiate the colligative properties of nonelectrolyte solutions and of electrolyte solutions. ***STEM_GC11PPIIId-f-115***	31.54%	Low Mastery	65.32%	Average Mastery	33.78%	Moderately Proficient
Calculate boiling point elevation and freezing point depression from the concentration of a solute in a solution. ***STEM_GC11PPIIId-f-117***	33.63%	Low Mastery	55.61%	Average Mastery	21.98%	Proficient
Calculate molar mass from colligative property data. ***STEM_GC11PPIIId-f-117***	26.16%	Low Mastery	45.59%	Average Mastery	19.43%	Needs Improvement
Describe laboratory procedures in determining concentration of solutions. ***STEM_GC11PPIIId-f-117***	28.70%	Low Mastery	84.45%	Moving Towards Mastery	55.75%	Highly Proficient
Explain the first law of thermodynamics. ***STEM_GC11PPIIId-f-117***	34.53%	Low Mastery	76.08%	Moving Towards Mastery	41.55%	Moderately Proficient
Explain enthalpy of a reaction. ***STEM_GC11PPIIId-f-117***	34.98%	Low Mastery	69.06%	Moving Towards Mastery	34.08%	Proficient
Calculate the change in enthalpy of a given reaction using Hess Law.	21.97%	Low Mastery	44.84%	Average Mastery	22.87%	Proficient

Received: *25 April 2024*
Revised: *7 May 2024*
Accepted: *15 May 2024*

DOI: https://doi.org/10.5281/zenodo.11195269

STEM_GC11TCIIIg-i-127						
Describe how various factors influence the rate of reaction. ***STEM_GC11TCIIIg-i-127***	25.56%	Low Mastery	41.70%	Average Mastery	16.14%	Needs Improvement
Differentiate zero, first-, and second-order reactions. ***STEM_GC11CKIIIi-j-132***	34.38%	Low Mastery	37.97%	Average Mastery	3.59%	Needs Improvement
Explain reactions qualitatively in terms of molecular collisions. ***STEM_GC11CKIIIi-j-136***	19.58%	Low Mastery	37.22%	Average Mastery	17.64%	Needs Improvement
Explain activation energy and how a catalyst affects the reaction rate. ***STEM_GC11CKIIIi-j-137***	23.02%	Low Mastery	42.15%	Average Mastery	19.13%	Needs Improvement
Cite and differentiate the types of catalysts. ***STEM_GC11CKIIIi-j-137***	41.41%	Average Mastery	59.34%	Average Mastery	17.93%	Needs Improvement

The findings of the study reveal varying levels of mastery and learning gaps in science-specialized subjects among senior high school students at St. Paul University Surigao. The diagnostic test scores provide a baseline measure of students' initial knowledge, while the post-test scores indicate their performance after the intervention. The difference between the diagnostic and post-test scores reflects the improvement achieved. The post-intervention result represents the final level of proficiency attained.

Among the specific learning competencies assessed, it is evident that students made significant progress in some areas. For example, in the topic of using the kinetic molecular model to explain properties of liquids and solids, the students demonstrated *average mastery initially* (47.09%) and *moved towards mastery* (87.71%) after the intervention, resulting in a *moderate level*

Received: *25 April 2024*
Revised: *7 May 2024*
Accepted: *15 May 2024*

DOI: https://doi.org/10.5281/zenodo.11195269

of proficiency. Similar progress was observed in differentiating types of intermolecular forces and understanding the properties of water with its molecular structure and intermolecular forces.

However, several learning gaps persist in certain areas. For instance, in topics such as describing the properties of liquids and explaining the effect of intermolecular forces on these properties, students started with *low mastery* (28.55%) and achieved only *average mastery* (64.13%) after the intervention, indicating a *moderate level of proficiency* (35.58%). Similarly, in topics related to stoichiometric calculations, colligative properties of solutions, and reaction kinetics, students showed *low mastery* and made limited progress towards achieving *average mastery*.

Moreover, in terms Describing laboratory procedures in determining concentration of solutions, students made a huge progress having 84.45% (Moving towards mastery) from 28.70% (Low mastery), which indicates Highly Proficient. Meanwhile, it can be gleaned that seven out of twenty-two competencies Needs Improvements in particular differentiating zero, first-, and second-order reactions which has 37.97% (Average mastery) from 34.38% (Low mastery).

In this regard, a study conducted by Canac & Kermen (2016), stated that Students struggle greatly to comprehend concepts that are taught in the first two years of chemistry instruction. The pupils don't appear to be using the scientific name as opposed to a popular name as a useful classification tool for chemical species and mixtures. They have trouble decoding chemical formulas when they are not considered in the context of a chemical equation. Both macroscopic (a pure material or a combination) and microscopic (an atom or a molecule) requirements are difficult for the students in the survey to appropriately associate with a name or a formula.

Table 2 presents the overview of learning gaps and proficiency level in General Biology 1 for the First Quarter of School Year 2022-2023.

Table 2. Assessment of the learning gap and proficiency level in General Biology 1.

Learning Competencies	**Diagnostic Test**		**Post-Test**		**Difference**	**Post intervention result**
	%	**I**	**%**	**I**		
Explain the postulates of the cell theory ***STEM_BIO11/12-Ia-c-1***	43.05 %	Average Mastery	87.89 %	Closely Approximating Mastery	44.84%	Moderately Proficient
Describe the structure and function of major and subcellular	36.77 %	Average Mastery	78.92 %	Moving Towards Mastery	42.15%	Moderately Proficient

Received: *25 April 2024*
Revised: *7 May 2024*
Accepted: *15 May 2024*

DOI: https://doi.org/10.5281/zenodo.11195269

organelles ***STEM_BIO11/12-Ia-c-2*** Distinguish prokaryotic and eukaryotic cells according to their distinguishing features	36.02 %	Average Mastery	84.01 %	Moving Towards Mastery	47.99%	Moderately Proficient
STEM_BIO11/12-Ia-c-3 Classify different cell types (plant/animal tissues) and specify each of the function(s)	32.88 %	Low Mastery	78.62 %	Moving Towards Mastery	45.74%	Moderately Proficient
STEM_BIO11/12-Ia-c-4 Describe some cell modifications that lead to adaptation to carry out specialized functions (e.g., microvilli, root hair)	40.06 %	Average Mastery	84.75 %	Moving Towards Mastery	44.69%	Moderately Proficient
STEM_BIO11/12-Ia-c-5 Characterize the phases of the cell cycle and their control points	44.84 %	Average Mastery	86.85 %	Closely Approximating Mastery	42.01%	Moderately Proficient
STEM_BIO11/12-Id-f-6 Describe the stages of mitosis/meiosis	27.65 %	Low Mastery	71.90 %	Moving Towards Mastery	44.25%	Moderately Proficient

Received: *25 April 2024*
Revised: *7 May 2024*
Accepted: *15 May 2024*

DOI: https://doi.org/10.5281/zenodo.11195269

given 2n=6 ***STEM_BIO11/12 -Id-f-7***						
Discuss crossing over and recombination in meiosis ***STEM_BIO11/12 -Id-f-8***	48.58 %	Average Mastery	91.78 %	Closely Approximating Mastery	43.20%	Moderately Proficient
Explain the significance or applications of mitosis/meiosis ***STEM_BIO11/12 -Id-f-9***	41.41 %	Average Mastery	93.12 %	Closely Approximating Mastery	51.71%	Moderately Proficient
Identify disorders and diseases that result from the malfunction of the cell during the cell cycle ***STEM_BIO11/12 -Id-f-10***	54.86 %	Average Mastery	87.74 %	Closely Approximating Mastery	32.88%	Proficient
Describe the structural components of the cell membrane ***STEM_BIO11/12 -Ig-h-11***	34.38 %	Low Mastery	70.10 %	Moving Towards Mastery	35.72%	Proficient
Relate the structure and composition of the cell membrane to its function ***STEM_BIO11/12 -Ig-h-12***	39.01 %	Average Mastery	86.40 %	Closely Approximating Mastery	47.39%	Moderately Proficient

Received: *25 April 2024*
Revised: *7 May 2024*
Accepted: *15 May 2024*

DOI: https://doi.org/10.5281/zenodo.11195269

Explain transport mechanisms in cells (diffusion, osmosis, facilitated transport, active transport) ***STEM_BIO11/12 -Ig-h-13***	23.17 %	Low Mastery	62.63 %	Average Mastery	39.46%	Moderately Proficient
Differentiate exocytosis and endocytosis ***STEM_BIO11/12 -Ig-h-14***	14.35 %	Very Low Mastery	60.84 %	Average Mastery	46.49%	Moderately Proficient
Categorize the biological molecules (lipids, carbohydrates, proteins, and nucleic acids) according to their structure and function ***STEM_BIO11/12 - Ii-j-15***	35.13 %	Average Mastery	84.30 %	Moving Towards Mastery	49.17%	Moderately Proficient

The findings from the pre- and post-assessments of learning competencies in science subjects among senior high school students provide valuable insights into the student's performance and the effectiveness of the intervention. The results indicate the percentage of correct responses (mastery level) for each learning competency and the difference in performance before and after the intervention. Additionally, the post-intervention results are provided as an indication of the student's proficiency level.

In terms of the specific learning competencies assessed, it is evident that there were varying levels of mastery observed. For example, in the topic "Explain the postulates of the cell theory," the students exhibited an *average mastery* level of 43.05% in the pre-test, which significantly improved to 87.89% in the post-test. This indicates a substantial increase in understanding and knowledge after the intervention. Similarly, in the topic "Identify disorders and diseases that result from the malfunction of the cell during the cell cycle," the students demonstrated an *average*

Received: *25 April 2024*
Revised: *7 May 2024*
Accepted: *15 May 2024*

DOI: https://doi.org/10.5281/zenodo.11195269

mastery level of 54.86% in the pre-test, which remained relatively high at 87.74% in the post-test and indicated as *Highly proficient*.

However, there were also areas where the students showed lower levels of mastery. For instance, in the topic "Differentiate exocytosis and endocytosis," the students had a *very low mastery* level of 14.35% in the pre-test, which improved to an *average mastery level* of 60.84% in the post-test indicated as *Moderately proficient*. Although there was an improvement, the level of understanding remained relatively low.

Thirteen (13) out of fifteen (15) competencies in General Biology 1 showed remarkable progress having *moderately proficient* by incorporating LMS. The study conducted by Hidayat (2018), suggests that the utilization of a Learning Management System (LMS) such as Quipperschool supports the effectiveness of students' learning to improve learning outcomes and concept mastery in Biology.

Table 3 presents the overview of learning gaps and proficiency level in General Physics 1 for the First Quarter of School Year 2022-2023.

Table 3. Assessment of learning gap and proficiency level in General Physics 1.

Learning Competencies	Diagnostic Test		Post-Test		Difference	Post intervention result
	%	I	%	I		
Solve measurement problems involving conversion of units, expression of measurements in scientific notation. ***STEM_GP12EU-Ia-1***	42.75%	Average Mastery	48.58%	Average Mastery	5.83%	Needs Improvement
Differentiate accuracy from precision. ***STEM_GP12EU-Ia-2***	37.67%	Average Mastery	79.07%	Moving Towards Mastery	41.41%	Moderately Proficient
Differentiate random errors from systematic errors. ***STEM_GP12EU-Ia-3***	21.67%	Low Mastery	65.02%	Average Mastery	43.35%	Moderately Proficient
Estimate errors from multiple measurements of a physical quantity using variance. ***STEM_GP12EU-Ia-5***	41.85%	Average Mastery	68.01%	Moving Towards Mastery	26.16%	Proficient

Received: *25 April 2024*
Revised: *7 May 2024*
Accepted: *15 May 2024*

DOI: https://doi.org/10.5281/zenodo.11195269

Differentiate vector and scalar quantities. ***STEM_GP12EU-Ia-8***	40.96%	Average Mastery	54.56%	Average Mastery	13.60%	Needs Improvement
Perform addition of vectors. ***STEM_GP12EU-Ia-9***	19.13%	Low Mastery	46.34%	Average Mastery	27.20%	Proficient
Rewrite a vector in component form. ***STEM_GP12EU-Ia-10***	19.58%	Low Mastery	45.44%	Average Mastery	25.86%	Proficient
Convert a verbal description of a physical situation involving uniform acceleration in one dimension into a mathematical description. ***STEM_GP12EU-Ia-12***	46.64%	Average Mastery	68.01%	Moving Towards Mastery	21.38%	Proficient
Interpret displacement and velocity, respectively, as areas under velocity vs. time and acceleration vs. time curves. ***STEM_GP12EU-Ia-14***	42.75%	Average Mastery	61.29%	Average Mastery	18.54%	Needs Improvement
Interpret velocity and acceleration, respectively, as slopes of position vs. time and velocity vs. time curves. ***STEM_GP12EU-Ia-15***	40.51%	Average Mastery	59.34%	Average Mastery	18.83%	Needs Improvement
Construct velocity vs. time and acceleration vs. time graphs, respectively, corresponding to a given position vs. time-graph and velocity vs. time graph and vice versa. ***STEM_GP12EU-Ia-16***	24.22%	Low Mastery	68.16%	Moving Towards Mastery	43.95%	Moderately Proficient

Received: *25 April 2024*
Revised: *7 May 2024*
Accepted: *15 May 2024*

DOI: https://doi.org/10.5281/zenodo.11195269

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Vol. 11 Issue 05
May 2024

Solve for unknown quantities in equations involving one-dimensional uniformly accelerated motion, including free-fall motion. ***STEM_GP12EU-Ia-17***	14.05%	Very Low Mastery	49.63%	Average Mastery	35.58%	Proficient
Solve problems involving one-dimensional motion with constant acceleration in contexts such as, but not limited to, the "tail-gating phenomenon", pursuit, rocket launch, and free-fall problems. ***STEM_GP12EU-Ia-19***	11.96%	Very Low Mastery	46.04%	Average Mastery	34.08%	Proficient
Describe motion using the concept of relative velocities in 1D and 2D. ***STEM_GP12EU-Ia-20***	29.75%	Low Mastery	74.29%	Moving Towards Mastery	44.54%	Moderately Proficient
Deduce the consequences of the independence of vertical and horizontal components of projectile motion. ***STEM_GP12EU-Ia-22***	36.92%	Average Mastery	64.87%	Average Mastery	27.95%	Proficient
Calculate range, time of flight, and maximum heights of projectiles. ***STEM_GP12EU-Ia-23***	17.79%	Low Mastery	65.47%	Average Mastery	47.68%	Moderately Proficient
Infer quantities associated with circular motion such as tangential velocity, centripetal acceleration, tangential acceleration, radius of curvature. ***STEM_GP12EU-Ia-25***	30.34%	Low Mastery	51.57%	Average Mastery	21.23%	Proficient

Received: *25 April 2024*
Revised: *7 May 2024*
Accepted: *15 May 2024*

DOI: https://doi.org/10.5281/zenodo.11195269

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Vol. 11 Issue 05
May 2024

Solve problems involving two-dimensional motion in contexts such as, but not limited to ledge jumping, movie stunts, basketball, safe locations during firework displays, and Ferris wheels.	32.29%	Low Mastery	70.70%	Moving Towards Mastery	38.42%	Moderately Proficient
STEM_GP12EU-Ia-26 Define inertial frames of reference.	34.08%	Low Mastery	78.03%	Moving Towards Mastery	43.95%	Moderately Proficient
STEM_GP12EU-Ia-28 Identify action-reaction pairs.	37.37%	Average Mastery	81.46%	Moving Towards Mastery	44.10%	Moderately Proficient
STEM_GP12EU-Ia-31 Draw free-body diagrams.	20.93%	Low Mastery	70.10%	Moving Towards Mastery	49.18%	Moderately Proficient
STEM_GP12EU-Ia-32 Apply Newton's 1st law to obtain quantitative and qualitative conclusions about the contact and noncontact forces acting on a body in equilibrium.	41.11%	Average Mastery	77.28%	Moving Towards Mastery	36.17%	Proficient
STEM_GP12EU-Ia-33 Differentiate the properties of static friction and kinetic friction.	24.22%	Low Mastery	80.72%	Moving Towards Mastery	56.50%	Highly Proficient
STEM_GP12EU-Ia-34 Apply Newton's 2nd law and kinematics to obtain quantitative and qualitative conclusions about the velocity and acceleration of one or more bodies, and the contact and noncontact forces acting on one or	14.05%	Very Low Mastery	84.90%	Moving Towards Mastery	70.85%	Highly Proficient

Received: *25 April 2024*
Revised: *7 May 2024*
Accepted: *15 May 2024*

DOI: https://doi.org/10.5281/zenodo.11195269

more bodies.						
STEM_GP12EU-Ia-36 Solve problems using Newton's Laws of motion in contexts such as, but not limited to, ropes and pulleys, the design of mobile sculptures, transport of loads on conveyor belts, force needed to move stalled vehicles, determination of safe driving speeds on banked curved roads.	11.96%	Very Low Mastery	57.40%	Average Mastery	45.44%	Proficient
STEM_GP12EU-Ia-38 Calculate the dot or scalar product of vectors.	42.00%	Average Mastery	60.54%	Average Mastery	18.54%	Needs Improvement
STEM_GP12EU-Ia-40 Determine the work done by a force acting on a system.	36.92%	Average Mastery	63.23%	Average Mastery	26.31%	Proficient
STEM_GP12EU-Ia-41 Define work as a scalar or dot product of force and displacement.	16.14%	Low Mastery	51.57%	Average Mastery	35.43%	Proficient
STEM_GP12EU-Ia-42 Interpret the work done by a force in one - dimension as an area under a Force vs. Position curve.	43.65%	Average Mastery	70.70%	Moving Towards Mastery	27.06%	Proficient
STEM_GP12EU-Ia-43 Relate the gravitational potential energy of a system or object to the configuration of the system.	42.15%	Average Mastery	81.46%	Moving Towards Mastery	39.31%	Moderately Proficient
STEM_GP12EU-Ia-48 Relate the elastic potential energy of a system or object to the configuration of the	42.45%	Average Mastery	71.90%	Moving Towards Mastery	29.45%	Proficient

Received: *25 April 2024*
Revised: *7 May 2024*
Accepted: *15 May 2024*

DOI: https://doi.org/10.5281/zenodo.11195269

system.						
STEM_GP12EU-Ia-49 Explain the properties and the effects of conservative forces.	40.96%	Average Mastery	54.71%	Average Mastery	13.75%	Needs Improvement
STEM_GP12EU-Ia-50 Use potential energy diagrams to infer force; stable, unstable, and neutral equilibria; and turning points.	25.56%	Low Mastery	48.58%	Average Mastery	23.02%	Proficient
STEM_GP12EU-Ia-53 Solve problems involving work, energy, and power in contexts such as, but not limited to, bungee jumping, design of roller -coasters, number of people required to build structures such as the Great Pyramids and the rice terraces; power and energy requirements of human activities such as sleeping vs. sitting vs. standing, running vs. walking.	40.06%	Average Mastery	58.00%	Average Mastery	17.94%	Needs Improvement
STEM_GP12EU-Ia-55 Differentiate center of mass and geometric center.	28.40%	Low Mastery	69.96%	Moving Towards Mastery	41.55%	Moderately Proficient
STEM_GP12EU-Ia-56. Relate the motion of center of mass of a system to the momentum and net external force acting on the system.	20.48%	Low Mastery	67.71%	Moving Towards Mastery	47.23%	Moderately Proficient
STEM_GP12EU-Ia-57 Relate the momentum, impulse, force, and	37.37%	Average Mastery	63.83%	Average Mastery	26.46%	Proficient

Received: *25 April 2024*
Revised: *7 May 2024*
Accepted: *15 May 2024*

DOI: https://doi.org/10.5281/zenodo.11195269

time of contact in a system. ***STEM_GP12EU-Ia-58*** Compare and contrast elastic and inelastic collisions. ***STEM_GP12EU-Ia-60***	19.13%	Low Mastery	77.28%	Moving Towards Mastery	58.15%	Highly Proficient
Apply the concept of restitution coefficient in collisions. ***STEM_GP12EU-Ia-61***	20.93%	Low Mastery	49.78%	Average Mastery	28.85%	Proficient
Solve problems involving center of mass, impulse, and momentum in contexts such as, but not limited to, rocket motion, vehicle collisions, and ping-pong. ***STEM_GP12EU-Ia-63***	10.01%	Very Low Mastery	60.99%	Average Mastery	50.97%	Moderately Proficient

Analyzing the results, it is evident that there are variations in the mastery levels of different learning competencies. For instance, in the topic of "Solve measurement problems involving conversion of units, expression of measurements in scientific notation," the average mastery level increased from 42.75% in the pre-test to 48.58% in the post-test, indicating a *moderately proficient*.

In contrast, some topics showed higher levels of mastery. For example, in the topic "Differentiate accuracy from precision," the average mastery level improved significantly from 37.67% in the pre-test to 79.07% in the post-test. This indicates a substantial increase in understanding and knowledge after the intervention which is through Mastery Learning Approach.

However, there were also areas where the students exhibited lower levels of mastery. For instance, in the topic "Solve problems involving one-dimensional motion with constant acceleration," the average mastery level remained relatively low at 11.96% in the pre-test, which increased to 46.04% in the post-test, indicating progress but still below average proficiency.

It is important to note that these results provide a snapshot of the student's performance in specific learning competencies and do not represent their overall proficiency in science subjects. The data suggests that further attention and targeted interventions may be required in certain areas to enhance students' understanding and mastery. Moreover, the findings highlight the varying levels of mastery among the senior high school students in different science topics.

This study agreed with that of Wambugu & Changeiywo (2008) that Mastery Learning Approach (MLA) teaching method resulted in higher achievement, but gender had no significant influence on their achievement. Additionally, Nggadas (2019) further stated that the score of students' mastery of the physic concept of students are treated with ICT-based learning was higher than students are treated with laboratory experiment –based learning.

Received: *25 April 2024*
Revised: *7 May 2024*
Accepted: *15 May 2024*

DOI: https://doi.org/10.5281/zenodo.11195269

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Vol. 11 Issue 05
May 2024

VI. Conclusions

In conclusion, this study aimed to assess the learning gaps and proficiency levels in science specialized subjects among senior high school students at St. Paul University Surigao. The findings revealed varying levels of proficiency and learning gaps in different topics within the subjects of General Chemistry 2, General Physics 1, and General Biology 1. While some areas showed significant progress and improvement, there were persistent gaps in certain topics. The use of interventions, such as the Mastery Learning Approach and Learning Management Systems, demonstrated positive effects on students' understanding and knowledge. However, targeted attention and further interventions may be needed in specific areas to enhance students' mastery. The results also highlight the importance of effective instructional strategies and the potential impact of factors such as gender and learning approaches on students' achievement. This study provides valuable insights for educators, curriculum developers, and policymakers in designing interventions and instructional practices that address the identified learning gaps, enhance student learning outcomes, and improve the overall quality of science education at St. Paul University Surigao.

VII. Recommendation

Based on the findings and significance of this study, several recommendations are proposed to enhance science education at St. Paul University Surigao. These include establishing targeted support programs for students, focusing on areas of lower mastery to bridge learning gaps and promote academic achievement. Providing professional development opportunities for educators is crucial, enabling them to enhance instructional strategies and create engaging learning environments. Allocating resources for the development of a comprehensive science curriculum, aligned with standards and incorporating evidence-based practices, is essential. Integration of technology and digital resources can enhance student engagement and facilitate interactive and immersive learning experiences. By implementing these recommendations, St. Paul University Surigao can foster a supportive and inclusive environment, positively impacting science education.

VIII. References

Flores, I. M. (2015). Developing Preservice Teachers' Self-Efficacy through Field-Based Science Teaching Practice with Elementary Students. *Research in Higher Education Journal*, *27*.

Kpolovie, P. J., Joe, A. I., & Okoto, T. (2014). Academic achievement prediction: Role of interest in learning and attitude towards school. *International Journal of Humanities Social Sciences and Education (IJHSSE)*, *1*(11), 73-100.

Received: *25 April 2024*
Revised: *7 May 2024*
Accepted: *15 May 2024*

DOI: https://doi.org/10.5281/zenodo.11195269

Monroe, M. C., Plate, R. R., Oxarart, A., Bowers, A., & Chaves, W. A. (2019). Identifying effective climate change education strategies: A systematic review of the research. *Environmental Education Research*, *25*(6), 791-812.

Pajares, F. (2012). Motivational role of self-efficacy beliefs in self-regulated learning. In Motivation and self-regulated learning (pp. 111-139). Routledge.

Wambugu, P. W., & Changeiywo, J. M. (2008). Effects of mastery learning approach on secondary school students' physics achievement. *Eurasia Journal of Mathematics, Science and Technology Education*, *4*(3), 293-302.

Windschitl, M., Thompson, J., Braaten, M., & Stroupe, D. (2012). Proposing a core set of instructional practices and tools for teachers of science. *Science education*, *96*(5), 878-903.

Yammine, K., Violato, C. The effectiveness of physical models in teaching anatomy: a meta-analysis of comparative studies. *Adv in Health Sci Educ* **21**, 883–895 (2016). https://doi.org/10.1007/s10459-015-9644-7

Received: *25 April 2024*
Revised: *7 May 2024*
Accepted: *15 May 2024*

DOI: https://doi.org/10.5281/zenodo.11195269