

Chemistry Self-Efficacy, Anxiety, and Learning Motivation as Predictors of Chemistry Achievement among Nursing Student in One University in Bulacan

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ABSTRACT

Chemistry is an essential subject for nursing students as this includes concepts involved in the work process of nurses. However, chemistry remained to be a challenging subject for nursing students due to several factors. Thus, this study aimed to assess the level of chemistry self-efficacy, anxiety, and motivation as predictors of chemistry achievement. Employing a descriptive-quantitative research design, 102 nursing students were the respondents of this study identified through purposive and stratified sampling from a population of 135. This study utilized questionnaire and tests as the instruments of this study. Weighted mean and multiple regression were used to analyze and interpret the data. The results revealed that nursing students have slight self-efficacy, moderate anxiety, and great motivation. The chemistry achievement of the students was relatively satisfactory. When taken as a whole, these variables predict chemistry achievement while when solely, only self-efficacy predicts chemistry achievement. This study recommends the crafting of suitable interventions to improve chemistry achievement by providing programs to increase self-efficacy and motivation while minimizing anxiety

INTRODUCTION

In nursing education, chemistry is an important subject since it tackles scientific knowledge to understand topics such as medications, nutrition, and other health-related processes. However, chemistry is a challenging subject because it entails conceptual understanding, problem-solving, mathematical competence, and scientific logic. While chemistry requires cognitive skills, it can be noted that affective factors can also influence chemistry learning (Flaherty, 2020). Among the factors which influence achievement in chemistry are self-efficacy, anxiety (Sakiz et al., 2021), and motivation (Kadum & Karpudewan, 2025).

Chemistry self-efficacy is the belief of the students to perform tasks related to the subject and overcome challenges while learning. Research has consistently shown how self-efficacy affected learning in chemistry. Moreno et al. (2021) and Naibert et al. (2024) found out that the self-efficacy of students affect achievement in chemistry. In Indonesia, Rahmawati et al. (2024) found out that significant positive relationship exists between self-efficacy and chemistry achievement. In the same way, Sailaubay et al. (2024) mentioned that laboratory self-efficacy and achievement have significant relationship. In Israel, Easa and Blonder (2024) have found out that tailored approaches were related to higher self-efficacy and chemistry achievement. These findings suggest that the confidence of the students is associated to the extent to the learning and achievement in chemistry.

Chemistry anxiety is the feeling of fear and discomfort when learning chemistry. Ramli (2020) found out that students face anxiety in chemistry especially because of the complexity of chemistry topics. In Nigeria, Oladejo et al. (2023) mentioned that anxiety can be addressed through appropriate strategies. On the other hand, Ghimire (2023) stated that anxiety in chemistry is linked to approaches and personal perception. More recently, Rozgonjuk et al. (2024) anxiety in chemistry is less likely to translate to academic performance. Also, Maulid and Ikhsan (2025) listed the factors contributing to anxiety such as fear of making mistakes, fear of failure, and negative perception on the subject.

Pratt et al. (2022) found the relationship between intrinsic motivation in chemistry and academic achievement. Boro et al. (2021) expressed that both motivation and self-discipline affect chemistry learning outcomes. Tuminah et al. (2021) similarly found out the positive relationship. In Malaysia, Kadum and Karpudewan (2025) self-efficacy predicted chemistry motivation. In the Philippines, Reyes (2025) stated that connecting chemistry application to real life improve motivation and achievement.

In many countries, chemistry performance has proven to be affected by several affective factors. In Bhutan, chemistry achievement is influenced by anxiety (Chhetri et al., 2022). On the other hand, in the United States, the students' apprehension affects chemistry learning (Mahaffey, 2024). In the

Philippines, students demonstrated low proficiency level in chemistry subject (Bete, 2020). These findings highlight the need to determine possible effects of self-efficacy, anxiety, and motivation to chemistry achievement.

Despite the growing body of literature on chemistry self-efficacy, anxiety, and motivation, these variables are often studied separately. This poses a need to determine how these aspects affect chemistry learning. Finding out relationship between these variables can inform the development of suitable strategies, initiatives, and programs that can address both cognitive and affective domains surrounding the attainment of chemistry competence.

In the Philippines, nursing education requires thorough understanding of chemistry. Nursing students learn concepts in chemistry, which is required to understand subjects such as pharmacology, nutrition, pathophysiology, among others. However, academic achievement may vary among students. The differences may not be based only on intellectual abilities but also on affective aspects. The examination of self-efficacy, anxiety, and motivation can give a broader lens in understanding chemistry.

Thus, this study seeks to determine the extent to which self-efficacy, anxiety, and motivation impact achievement in chemistry. This study will focus on the first-year nursing students of Bulacan State University San Rafael Campus.

Research Questions

This study aims to assess self-efficacy, anxiety, and motivation in chemistry learning. Specifically, the study aims to address the questions:

1. What is the level of self-efficacy among nursing students enrolled in Chemistry?
2. What is the level of anxiety among nursing students enrolled in Chemistry?
3. What is the level of learning motivation of nursing students enrolled in Chemistry?
4. What is the level of chemistry achievement among nursing students?
5. Do chemistry self-efficacy, chemistry anxiety, and learning motivation predict chemistry achievement among nursing students?

THEORITICAL REVIEW

Recent literature indicates that students' affective characteristics are closely connected with their experiences and performance in chemistry learning. Self-efficacy is generally associated with students' confidence in performing chemistry-related tasks and has been linked to chemistry achievement, laboratory performance, and academic motivation (Moreno et al., 2021; Naibert et al., 2024; Sailaubay et al., 2024). Chemistry anxiety, in contrast, may emerge from the perceived complexity of chemistry concepts, fear of failure, and difficulties in understanding new topics, potentially influencing students' engagement and academic performance (Ramli, 2020; Chhetri et al., 2022;

Maulida & Ikhsan, 2025). Learning motivation also plays an important role because students who perceive chemistry as relevant and meaningful tend to demonstrate greater engagement and persistence in learning (Pratt et al., 2023; Reyes, 2025). However, the existing literature has largely examined these affective factors independently or among general chemistry and science students, while comparatively limited attention has been given to their combined predictive relationship with chemistry achievement among nursing students. This gap is particularly relevant because nursing students encounter chemistry as a supporting discipline for subsequent professional subjects and clinical applications. Examining self-efficacy, anxiety, and motivation simultaneously may therefore provide a more comprehensive understanding of the affective factors associated with chemistry achievement in nursing education.

METHODOLOGY

The study was conducted at Bulacan State University San Rafael Campus located at Maguinao, San Rafael, Bulacan, Philippines. The school offers college level of education. The respondents were first year nursing students enrolled in the school year 2026-2027.

The study employed purposive and stratified sampling. Purposive sampling was used to select the target school which is Bulacan State University specifically the nursing students. Stratified sampling ensured proper representation of the three sections. The total population is 135 students. Through the Raosoft sample size calculator, the identified sample is 102. Each section was participated by 34 nursing students.

This study employed a descriptive-quantitative research design to assess chemistry self-efficacy, anxiety, motivation, and achievement. According to Hassan (2024) descriptive research design is a structured method for describing the traits, distribution, frequency, or evolution of a population, phenomenon, or experience without changing the conditions under study is called descriptive research design. This design is appropriate for this study as it examines the relationship between chemistry self-efficacy, anxiety, motivation, and achievement. The goal is to enhance instruction at Bulacan State University San Rafael Campus in relation with chemistry teaching among nursing students.

The researcher first secured an approved letter from the campus dean, which served as authorization to conduct the study. The researcher talked with the students regarding the purpose of the study. Only students who were willing and able to participate were included. The researcher employed a researcher-made survey questionnaire for students which was framed based on literature. Part I comprised the items on chemistry self-efficacy taken from the study of Moreno et al. (2021). Part II and III are composed of chemistry anxiety and motivation respectively taken from the work of Burns et al. (2021) and de Soza et

al. (2022). The items were all rated using Likert scale (4-Great Extent, 3-Moderate Extent, 2-Slight Extent, 1-Least Extent). The students' scores in chemistry tests were gathered as well. The statistical tools used were mean and standard deviation for the level of chemistry self-efficacy, anxiety, and motivation and multiple regression to determine predictive power.

The students' free time was used to administer the questionnaire, and they were given easy-to-follow instructions in advance. Concerns and questions were promptly addressed to guaranty accuracy. Prior to the survey, all participants gave their informed consent, with a focus on voluntary participation and confidentiality. The survey was conducted in person to offer support and direction when required. This was conducted with the permission of the campus dean and with the voluntary agreement of the respondents, in accordance with the Data Privacy Act of 2012.

RESEARCH RESULTS AND DISCUSSION

This section presents the findings of the study. The results are based on research questions.

Chemistry Self-efficacy

The results revealed that the students have slight self-efficacy in chemistry clearly evident in the grand mean of 2.46. This means that the students have less confidence in their own ability to comprehend and apply chemistry-related tasks. Although the level is not extremely low, the level of self-efficacy is not strong enough to generalize that the students can assess themselves as capable in chemistry. The standard deviation of 0.50 indicates that the responses have little variation. This indicates that the responses are consistent with one another. This means that the low self-efficacy is a common view rather than a reflection of small group of respondents.

The highest rated indicator is using the periodic table to figure out or explain the properties of elements with a mean of 2.91 and standard deviation of 0.72. This indicates that the students have more confidence in using the periodic table. This may be attributed to the fact that the periodic table gives students a proper reference that helped students identify elements and its properties. Compared with abstract theories, the use of periodic table seemed to be easier for students.

On the other hand, the lowest rated indicator is explaining chemical laws and theories with a mean of 2.13. This means that the students have least confidence when it comes to abstract concepts. This is because these concepts urged students to memorize, understand relationship, and articulate facts correctly. This shows the struggle of students from simply recognizing concepts to understanding principles and theories.

Table 1. Chemistry Self-Efficacy

Indicator	Mean	Std. Dev.	Interpretation
1. I have confidence in myself to comprehend the basic principles introduced in Chemistry.	2.64	.66	Moderate Extent
2. I can explain chemical laws and theories.	2.13	.63	Slight Extent
3. I have confidence in myself to be able to explain important chemistry principles using my own words.	2.23	.62	Slight Extent
4. I can select a suitable formula or method to solve a chemistry problem.	2.15	.72	Slight Extent
5. I can solve numerical problems related to chemistry principles and equations.	2.28	.73	Slight Extent
6. I can interpret chemical formulas, symbols, and equations appropriately.	2.40	.73	Slight Extent
7. I can use the periodic table to figure out or explain the properties of elements.	2.91	.72	Moderate Extent
8. I can interpret chemistry information represented in graphs, tables, and other forms.	2.44	.70	Slight Extent
9. I can apply the knowledge I have gained from Chemistry into nursing situations.	2.66	.66	Moderate Extent
10. I can conduct chemistry laboratory activities following the right procedures.	2.80	.75	Moderate Extent
11. I have confidence in myself to do well in chemistry examinations and activities.	2.44	.73	Slight Extent
OVERALL	2.46	.50	Slight Extent

Legend: 3.26-4.00 (Great Extent); 2.51-3.25 (Moderate Extent); 1.76-2.50 (Slight Extent); 1.00-1.75 (Least Extent)

Several factors may be associated to these findings. Students may perceive chemistry as difficult and abstract. Chemistry may not be the central area of specialization of nursing students so their view to the subject is that it is highly challenging. While this subject is necessary for their work as nurse, the practical applications may be focusing on the procedural aspect of nursing rather than the chemical composition and explanation pertaining to this matter.

In relation, Moreno et al. (2021) and Naibert et al. (2024) found out that the self-efficacy of students affect achievement in chemistry. In the same way, Sailaubay et al. (2024) mentioned that laboratory self-efficacy and achievement have significant relationship.

Chemistry Anxiety

The results show that nursing students have a moderate extent of anxiety with a mean of 2.99 and standard deviation of 0.61. This means that the students are not totally overwhelmed by chemistry, but the level is enough to potentially affect the way the students can participate and learn in the subject. The standard deviation of 0.61 indicates moderate variability which shows that chemistry anxiety is common rather than being true only to a few students.

Table 2. Chemistry Anxiety

Indicator	Mean	Std. Dev.	Interpretation
1. I get scared whenever I am called to respond to a Chemistry question in class.	2.94	.79	Moderate Extent
2. I become apprehensive whenever I have difficulty answering Chemistry questions.	2.84	.74	Moderate Extent
3. I get worried whenever I prepare for a Chemistry exam.	3.07	.73	Moderate Extent
4. I get tense whenever I am waiting to receive my exam result in Chemistry.	3.11	.76	Moderate Extent
5. I get uneasy whenever I fail to understand a Chemistry topic right away.	3.20	.76	Moderate Extent
6. I get worried whenever I perform Chemistry lab activities.	2.75	.81	Moderate Extent
7. I get worried that I might fail Chemistry.	3.09	.80	Moderate Extent
8. I get overwhelmed whenever several Chemistry topics or questions are introduced at the same time.	3.17	.79	Moderate Extent
9. I get worried when I navigate a new topic in Chemistry.	2.87	.77	Moderate Extent
10. I feel uneasy whenever the discussion in Chemistry became too long.	2.85	.81	Moderate Extent
OVERALL	2.99	.61	Moderate Extent

Legend: 3.26-4.00 (*Great Extent*); 2.51-3.25 (*Moderate Extent*); 1.76-2.50 (*Slight Extent*); 1.00-1.75 (*Least Extent*)

The highest rated indicator is getting uneasy when failing to understand Chemistry topic right away with a mean of 3.20. This means that students are particularly worried when they do not understand the topic precisely because when they do not understand one topic, the students will find it difficult to

comprehend succeeding topics. The anxiety may be attributed to the fear of failing and being stagnant because of not understanding the topic. In consonance, Ramli (2020) found out that students face anxiety in chemistry especially because of the complexity of chemistry topics.

On the other hand, the lowest rated indicator lands when the students are conducting laboratory activities. This means that the students feel a certain level of anxiety but is less than the other tasks. This may be because laboratory procedures often have a detailed procedure making tasks predictable. Also, Maulid and Ikhsan (2025) listed the factors contributing to anxiety such as fear of making mistakes, fear of failure, and negative perception on the subject.

Chemistry Motivation

The result shows that the students have great motivation in learning chemistry with a grand mean of 3.34. This means that the nursing students have sufficient motivation and showed willingness and drive to learn better. This may be because the students recognize the importance of chemistry in nursing particularly in medications, body processes, electrolytes, and other related areas.

Table 3. Chemistry Motivation

Indicator	Mean	Std. Dev.	Interpretation
I would like to gain new insights into Chemistry.	3.69	.54	Great Extent
I find it interesting to know how Chemistry helps us understand the world around us.	3.57	.60	Great Extent
I try to learn Chemistry despite its complexity.	3.35	.66	Great Extent
I allocate enough time for Chemistry studies outside the class.	2.72	.83	Moderate Extent
I have motivation to enhance my performance in Chemistry.	3.12	.72	Moderate Extent
I think that it is important for me to study Chemistry in order to become a good nurse.	3.53	.60	Great Extent
I think that I will benefit from Chemistry in my future nursing practice.	3.54	.64	Great Extent
It motivates me when I am able to grasp or solve Chemistry tasks.	3.50	.62	Great Extent
I persist in my efforts to study Chemistry despite difficulties.	3.20	.67	Moderate Extent
I set up my own goals to be successful in Chemistry.	3.13	.78	Moderate Extent
OVERALL	3.34	.52	Great Extent

Legend: 3.26-4.00 (Great Extent); 2.51-3.25 (Moderate Extent); 1.76-2.50 (Slight Extent); 1.00-1.75 (Least Extent)

The highest rated indicator is the desire to gain new insights with a mean of 3.65. This means that the students were strongly driven to grasp new knowledge and improve understanding in chemistry. This suggests that desire curiosity fuel motivation. This may be because the students feel that they need to dig deeper into the subject as this is necessary for the understanding of their work. Pratt et al. (2022) found the relationship between intrinsic motivation in chemistry and academic achievement.

On the other hand, the lowest rated indicator is allocating enough time for chemistry studies outside class with a mean of 2.72 interpreted as moderate extent. This reveals that although students have the motivation to learn, finding enough time is their challenge. While students may have the motivation to learn, the demands of learning and the time that they need to allocate are not aligned. While the desire is there, when students are given several tasks, they cannot simply prioritize the subject. Reyes (2025) stated that connecting chemistry application to real life improve motivation and achievement.

Chemistry Achievement

The overall grade of students in their test scores is 78.06 signifying that the students have a relatively satisfactory performance. This means that the students are performing just slightly above the lower boundary of the grade categories. The standard deviation of 12.55 means that the spread of students' grades is wide. This means that the individual performance of students greatly varied. Some students perform well while some students perform very low. This may be because students have varied abilities, backgrounds, and interests.

Table 4. Chemistry Achievement

Grades	Frequency	Percent (%)
45-55	13	10.2
56-66	6	4.7
67-77	27	21.3
78-88	57	44.9
88-97	24	18.9
TOTAL	127	100.0
Average Grade = 78.06		
Std. Deviation = 12.55		

It is also evident from the distribution that the performance level was not evenly distributed among the respondents. Of the 127 students, 57 (44.9%) scored grades ranging from 78 to 88, forming the largest group. Following this were 27 (21.3%) students who scored grades ranging from 67 to 77, and 24 (18.9%) scoring grades ranging from 88 to 97. However, 13 (10.2%) scored grades ranging from

45 to 55. Similarly, Bete (2020) found out that students demonstrated low proficiency level in chemistry subject.

There may be various reasons for poor performance in students belonging to this group such as lack of basic knowledge, problem solving abilities in numbers, lack of confidence and fear of chemistry. This is proved from the previous findings that the students have very little confidence in choosing right formula, solving Chemistry problems and understanding Chemistry theories

Predictors of Chemistry Achievement

The result of the multiple linear regression analysis shows that the overall regression model is statistically significant in explaining Chemistry Achievement. The output revealed a computed value of 4.185 and a p-value of .007, which is less than .05 level of significance. This means that collectively, the three independent variables explain the differences in Chemistry Achievement of the students. Individual assessment reveals which factor has the significant association.

Table 5. Predictive Power

Variables	B	p-value	R ²	Computed Value	Decision	Conclusion
(Constant)	58.510		.093			
Chemistry Self-Efficacy	.298	.002		3.153	Reject H ₀	Significant
Chemistry Anxiety	-.002	.983		-.021	Fail to Reject H ₀	Not significant
Learning Motivation	.016	.862		.174	Fail to Reject H ₀	Not significant

Dependent Variable: Chemistry Achievement

Indicator	p-value	Computed Value	Decision	Conclusion
Regression Model	.007	4.185	Reject H ₀	Significant

$$\text{Chemistry Achievement} = 58.510 + .298(\text{Chemistry Self – Efficacy}) - .002(\text{Chemistry Anxiety}) + .016(\text{Learning Motivation})$$

The regression result shows that chemistry self-efficacy is the only significant predictor of chemistry achievement with a regression coefficient of 0.298 and a p-value of 0.002. This means that the null hypothesis is rejected. Therefore, holding chemistry anxiety and learning motivation constant, an increase in one unit in chemistry self-efficacy is associated with an estimated 0.298-unit increase. This suggests that students who have greater self-efficacy have higher achievement scores. This may be because students with higher confidence tend to persist more in studying thereby increasing their

performance. Rahmawati et al. (2024) found out that significant positive relationship exists between self-efficacy and chemistry achievement.

In contrast, chemistry anxiety did not significantly predict chemistry achievement as shown by $B = -0.002$ and p -value of 0.983. This means that after considering self-efficacy and learning motivation on hold, chemistry anxiety did not predict achievement. This is in contrast with the findings that chemistry achievement is influenced by anxiety (Chhetri et al., 2022). In the same way, learning motivation has no predicted power to achievement ($B = 0.016$, $p = 0.862$). This means that learning motivation did not predict achievement. In contrast, Boro et al. (2021) expressed that both motivation and self-discipline affect chemistry learning outcomes.

The R^2 for the whole regression equation was calculated to be .093, meaning that the total variance of Chemistry Achievement accounted for by the three predictor variables was around 9.3%. However, the unaccounted-for variance of 90.7% can possibly be attributed to other possible influences such as chemistry background knowledge, study methods, other factors, teaching techniques, attendance, practical work, intellectual ability, among many others. All in all, from the results obtained, one can deduce that while Chemistry Self-Efficacy, Chemistry Anxiety, and Learning Motivation were tested, only Chemistry Self-Efficacy appeared to significantly predict Chemistry Achievement.

Table 6. Mediation Analysis

Relationship	B	P-value	R ²	95% Confidence Interval	Decision	Conclusion
Self-Efficacy → Learning Motivation	0.3732	.000	.1294	[0.2019, 0.5445]	Reject H ₀	Significant
Learning Motivation → Chemistry Achievement	0.3848	.8621	.0926	[-3.9917, 4.7613]	Fail to Reject H ₀	Not Significant
Self-Efficacy → Achievement	7.6047	.0005	.0924	[3.3857, 11.8238]	Reject H ₀	Significant
Self-Efficacy → Achievement (with mediator)	7.4611	.0015		[2.9214, 12.0009]	Reject H ₀	Significant
Indirect effect	BootSE		BootLLCI		BootULCI	
0.1436	0.8711		-1.8787		1.6494	

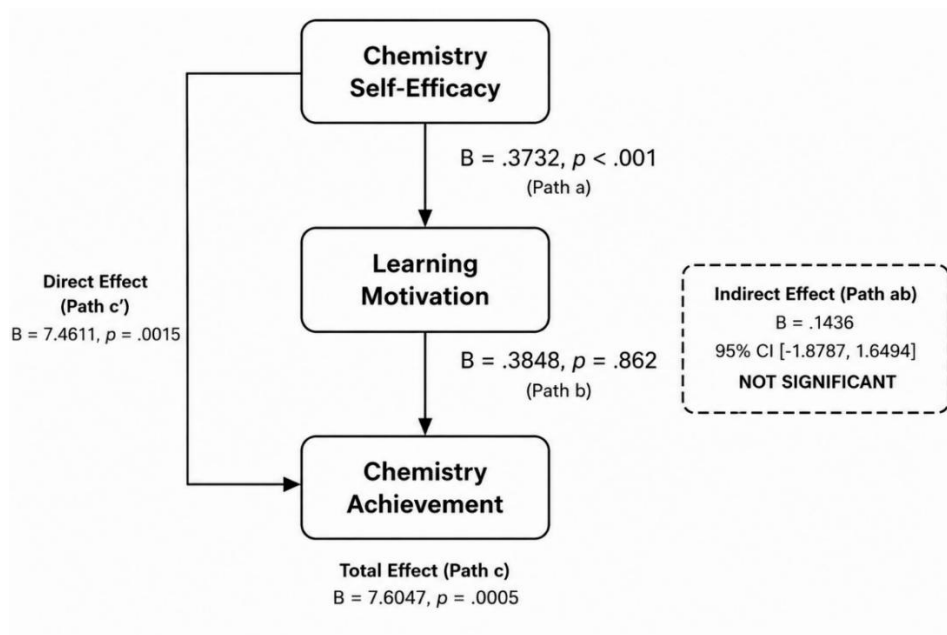


Figure 1. Mediation Model

A mediation analysis using PROCESS Model 4 with 5,000 bootstrap samples was conducted to determine whether Learning Motivation mediates the relationship between Chemistry Self-Efficacy and Chemistry Achievement among nursing students ($N = 127$). The results showed that Chemistry Self-Efficacy significantly predicted Learning Motivation ($B = 0.3732, p < .001$), accounting for 12.94% of its variance. Chemistry Self-Efficacy also significantly predicted Chemistry Achievement (total effect: $B = 7.6047, p = .0005$). When Learning Motivation was included in the model, the direct effect of Chemistry Self-Efficacy on Chemistry Achievement remained significant ($B = 7.4611, p = .0015$). However, the indirect effect through Learning Motivation was not statistically significant ($B = 0.1436$, BootSE = 0.8711, 95% CI [-1.8787, 1.6494]), as the bootstrap confidence interval included zero. Therefore, Learning Motivation did not significantly mediate the relationship between Chemistry Self-Efficacy and Chemistry Achievement. Figure 1 shows the model.

CONCLUSIONS AND RECOMMENDATION

Conclusion

Nursing students have limited confidence in their own ability to comprehend and apply chemistry concepts. This was particularly seen in explaining concepts, laws, and theories. However, they showed great efficacy in using the periodic table of element. While students have the basic foundation in chemistry, challenges were encountered as more complex topics were being learned. The students also experienced considerable anxiety in learning chemistry, particularly when difficulty arises in understanding topics which stems from the fact that topics are prerequisites of more difficult topics. On the

other hand, less anxiety is experienced when dealing with laboratory procedures since this include structured activities. Students have great motivation in learning reflected in their desire to gain new insights. However, time allocation remained to be the source of limited motivation for them. Satisfactory level of chemistry achievement was revealed highlighting the need to strengthen this area. While the three variables when taken together predict chemistry achievement, it is important to note that chemistry self-efficacy was the only significant predictor when taken individually. Students who have greater confidence in their ability tend to excel in chemistry tasks.

Recommendations

Based on the findings of the study, several recommendations were proposed by the researchers. The low self-efficacy of students paves the way to the development of programs suited to uphold this aspect since this is the significant predictor of chemistry achievement. Anxiety may be further lessened while motivation may be strengthened to better equip students in learning chemistry. Similar study may be conducted on a wider scale to verify the generalizability of result.

Compliance with Ethical Standards

This study complies with the ethical standards by obtaining informed consent, informing the respondents that they can withdraw from the study should the need arise without causing any harm or conflict. Anonymity of the respondents was maintained. Data Privacy was followed. The respondents' well-being was safeguarded. No conflict of interest exists in the conduct of the study. Moreover, plagiarism was strictly avoided and there was no bias in the interpretation of data.

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