



Analysis of High School Students' Chemistry Learning Motivation Using the Chemistry Motivation Questionnaire (CMQ)

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Abstract

Learning motivation is an important factor that drives students to achieve success in their studies. This study aims to analyze the level of students' motivation in learning chemistry at SMAN 1 Siding in grades X, XI, and XII who study chemistry using the Chemistry Motivation Questionnaire (CMQ). The research method used is quantitative descriptive with data collection techniques using questionnaires and interviews involving 121 students from four classes, so the population in this study is all students studying chemistry subjects with the sampling technique using saturated sampling. The research results show that the majority of students' motivation to learn chemistry falls into the very high and high categories, with 57% in the very high category for grade X, 59% in the high for grade XI, and 69% in the high for grade XII out of 121 respondents. Based on five aspects of motivation, the three classes tend to score high on the value aspect of motivation. These findings can serve as a basis for teachers in designing more effective learning strategies that align with students' characteristics, so that the already high motivation aspects can be maintained and other motivation aspects can be enhanced to support the success of chemistry learning.

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INTRODUCTION

Chemistry is a branch of natural science that studies the properties, structure, composition, and energy changes accompanying the transformation of matter. Most of the chemistry material contains concepts that are difficult to understand, as it consists of chemical reactions, calculations, and abstract concepts. Therefore, a student is required not only to memorize the existing concepts but also to clearly understand the chemistry concepts they are studying. Chemistry is considered one of the most difficult subjects by most high school students, as evidenced by the generally low academic performance in chemistry (Sudiana et al., 2019).

The phenomenon of low learning outcomes is not limited to just one school, but also occurs in several schools. This condition indicates the

presence of learning difficulties faced by students, although the exact nature of these difficulties is not yet clear. To clearly understand the form of learning difficulties faced by students, an in-depth analysis of the learning difficulties and the identification of their causal factors are required (Sudiana et al., 2019).

One of the factors that greatly influences students' ability to learn chemistry is learning motivation. In chemistry learning, motivation becomes the main driver that can enhance students' desire to learn and understand the material being studied. Students with high motivation tend to show great enthusiasm and eagerness in participating in learning, making it easier for them to overcome various difficulties they encounter. Conversely, students with low

motivation often struggle to focus and lack enthusiasm in the learning process, which ultimately affects the low learning outcomes achieved (Djarwo, 2020).

The learning outcomes of X grade students in chemistry have an average percentage of 60% not completed, while the average learning outcomes of XI and XII grade students in chemistry are 54% not completed. So further analysis is needed to understand their learning motivation. The low motivation to learn chemistry among students has a significant impact on their academic performance, as motivation is one of the factors that determine the effectiveness of learning. Learning motivation itself is influenced by various factors, both internal (originating from within the student) and external (from the surrounding environment). Internal factors can include the desire to achieve, curiosity, and the need for self-development. Meanwhile, external factors can include support from family, teachers, and peers. The strength of an individual's motivation will greatly determine the quality of behavior displayed by students in the learning context, including in facing the challenges present in chemistry learning (Herwati et al., 2023).

Although various studies have examined students' learning motivation in science and chemistry education, research specifically analyzing high school students' chemistry learning motivation using the Chemistry Motivation Questionnaire (CMQ) is still relatively limited, especially in the upper secondary context. Most previous research has focused more on the relationship between motivation and learning outcomes or the application of certain models, so information regarding the chemistry learning motivation profiles of students based on specific motivational aspects is still relatively scarce.

In that context, the CMQ is considered an appropriate instrument because it was specifically developed to measure chemistry learning motivation thru five main aspects, namely intrinsic motivation and personal relevance; self-efficacy and assessment of anxiety; locus of control; career motivation; and value motivation. This measurement allows for obtaining results or a more in-depth picture of the students' motivation to learn chemistry (Huda & Rohaeti, 2023).

Therefore, this research aims to analyze the level of high school students' motivation to learn

chemistry using the CMQ and identify the most dominant aspects. The results of this study are expected to provide empirical contributions to the development of chemistry learning motivation studies and serve as a basis for teachers in designing learning strategies that better align with students' motivational characteristics, thereby improving the quality of chemistry education.

METHOD

This research uses a quantitative descriptive approach with the aim of analyzing the level of students' motivation to learn chemistry. The research was conducted at SMA Negeri 1 Siding, with the subjects being all students in grades X, XI, and XII who are taking chemistry, totaling 121 students. The selection of research subjects used a saturated sampling technique with the consideration that the entire population was made the sample.

The data collection technique in this study uses questionnaires and interviews. The learning motivation questionnaire used in this study is the Chemistry Motivation Questionnaire (CMQ) adapted from the Science Motivation Questionnaire (SMQ). The Science Motivation Questionnaire (SMQ) has been validated with a Cronbach's alpha coefficient of 0.93, which falls under the very valid criteria by Glynn et al., (2009). Next, the adapted Chemistry Motivation Questionnaire (CMQ) was translated into Indonesian.

The translation results were deemed valid by two language experts (English lecturers at FKIP UNTAN), meaning the translation is in accordance with the original text. This CMQ consists of 30 questions that measure five factors of chemistry learning motivation, namely intrinsic motivation and personal relevance; self-efficacy and assessment of anxiety; locus of control; career motivation; and value motivation using a Likert Scale. The alternative answers provided can be seen in the table 1.

Table 1 Criteria for Assessment of the Likert Scale Learning Motivation Questionnaire

Response Option	Score
Strongly Agree	4
Agree	3
Disagree	2
Strongly Disagree	1

The interview in the research is an unstructured interview conducted with 5 based

on their motivation categories. The purpose of conducting the interview is to strengthen the primary or main data. The interview was conducted with 15 questions, and the responses from the respondents are expected to serve as additional data that reinforce the results of the student chemistry learning motivation questionnaire.

The implementation of the research was carried out in several stages. The first stage was the preparation stage, which included the drafting of the research proposal and obtaining research permits from the university and school. The second stage was the implementation stage, which included the distribution of questionnaires and the conduct of interviews. The third stage was the data analysis stage and the preparation of the research report.

Data measurement uses a Likert scale with four alternative responses: strongly agree, agree, disagree, and strongly disagree. The data analysis technique in this study is descriptive statistical analysis. The data obtained were averaged based on the score of each respondent's answer. Then the percentage of students' motivation to learn chemistry is calculated using the percentage formula:

$$P = \frac{F}{N} \times 100 \%$$

Explanation:

P: Percentage of motivation

F: Number of scores obtained

N: Maximum score Subsequently

The results obtained are categorized based on the benchmark categories of motivation levels as presented in Table 2.

Table 2 Measurement Criteria for Motivation Categories.

Percentage (%)	Category
76-100	Very High
51-75	High
26-50	Moderate
0-25	Low

(Sugiyono, 2017)

RESULTS AND DISCUSSION

Result

This research was conducted on all students in grades X, XI, and XII who study chemistry, with a total of 121 participants. The aim of this research is to analyze students' motivation to learn chemistry. To determine the level of students'

learning motivation, it can be seen from the percentage obtained from the calculation of questionnaire responses, which are then categorized based on the motivation level category table and presented in the form of graphs, followed by a description.

Percentage of Each Learning Motivation Category Overall

The number of students in each learning motivation category varies. However, the largest number of students falls into the high learning motivation category. Based on the results of processing the chemistry learning motivation questionnaire data, the percentage of students learning motivation levels in three different grades, namely X, XI, and XII, was obtained. The percentage data is presented in the form of a graph to facilitate understanding and comparison between grades, then it can be seen in image 1.

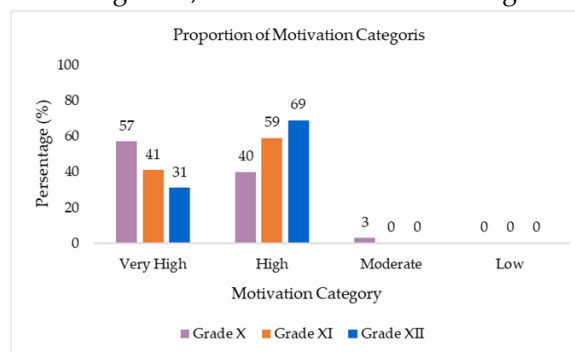


Figure 1. Proportion of Motivation Categories for Grade X, XI and XII Students

Based on Figure 1, the motivation to learn chemistry among students in all three grade levels is generally categorized as high to very high. Tenth-grade students are predominantly in the very high motivation category, while eleventh and twelfth-grade students tend to fall into the high motivation category. Additionally, very few students are found to have low motivation to learn, and there are no students in the moderate or low categories in the eleventh and twelfth grades. These findings indicate that students have a strong drive to engage in chemistry learning. The high level of motivation suggests a positive attitude toward the subject, which has the potential to support student involvement in the learning process and increase the likelihood of achieving better learning outcomes.

Percentage of Students Motivation to Learn Chemistry Based on Aspects

Data on chemistry learning motivation were obtained from a questionnaire consisting of 30

items divided into five aspects, namely Intrinsic Motivation and Personal Relevance, Self-Efficacy and Assessment of Anxiety, Locus of Control, Career Motivation, and Value Motivation. The acquisition of student motivation scores for each aspect is then calculated as a percentage for each

aspect in each class, namely grade X, XI, and XII. To facilitate understanding of the data, the percentage results of chemistry learning motivation based on five aspects for each class are presented in the form of graphs, then it can be seen in image 2.

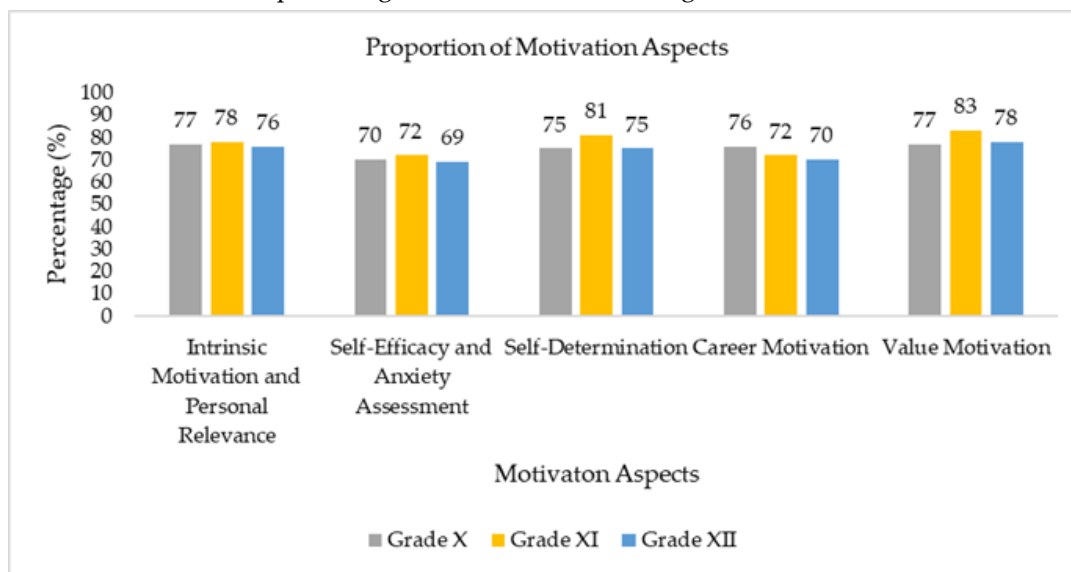


Figure 2. Proportion of Motivation Aspects for Grade X, XI and XII Students

Based on Figure 2, the analysis of chemistry learning motivation across the five motivational aspects indicates that Grade X students showed the strongest motivation in the aspects of intrinsic motivation and personal relevance, as well as career motivation, while self-efficacy and assessment of anxiety had the lowest score. For Grade XI students, value motivation emerged as the most dominant aspect, whereas self-efficacy and assessment of anxiety and career motivation were comparatively lower. Similarly, Grade XII students demonstrated the highest motivation in the value motivation aspect, while self-efficacy and assessment of anxiety remained the lowest among the five aspects.

Overall, the findings suggest that students across all grade levels are strongly motivated by the importance of achieving good academic performance in chemistry. In contrast, the relatively lower scores in self-efficacy and assessment of anxiety indicate that some students may still experience uncertainty regarding their ability to succeed in chemistry or feel anxious about evaluations and assessments. These results highlight the importance of instructional strategies that not only maintain students' achievement-oriented motivation but also strengthen their confidence and reduce learning-related anxiety in chemistry classes.

Discussion

Overall Student Motivation in Learning Chemistry

The difference in percentages obtained shows that the twelfth grade has a higher level of motivation compared to the eleventh and tenth grades. This result indicates a difference in motivation between grade levels, which is likely influenced by the science specialization system in the 2013 curriculum implemented in the eleventh and twelfth grades. Students who choose the science group tend to have a greater interest in chemistry because it is relevant to their academic needs and future study plans. This is in line with the research conducted by Haster et al., (2019), which states that there is a significant difference in the motivation to learn chemistry between students in the MIPA specialization program and those in the IPS program. The motivation to learn chemistry among students in the MIPA specialization is better compared to those in the IPS program. However, this finding is somewhat different from the research conducted by Huda & Rohaeti (2023), which used the CMQ-II on Indonesian high school students. The results showed that the class factor only contributed relatively little to the motivation to learn chemistry compared to other factors such as gender and chemistry learning anxiety.

On the other hand, in the X grade, which uses the independent curriculum, there is no differentiation that separates students based on the science or social science tracks. At this stage, students are still adjusting to the school environment, the change in the difficulty level of the material, and the teaching methods from the previous level. This condition causes students with diverse interests to continue taking chemistry subjects in general, resulting in tenth-grade students having a low percentage of motivation to study chemistry, although they still fall within the same category, which is the high category.

Based on the results obtained, students with very high and high motivation to learn chemistry show an interest in the subject. This is reinforced by interview results showing that students like and have an interest in learning chemistry because it is interesting and relevant to their lives and future career plans. In addition, students tend to be more active in the learning process, such as asking the teacher when they encounter difficulties, discussing with friends, and students also take the initiative to study independently, whether from books or other learning resources. This shows that the desire to learn is closely related to the motivation for learning that students possess. Students who have an affinity for a particular subject will be more actively encouraged to engage in the learning process. This is in line with the research conducted by Fajri et al., (2025), which states that the desire to learn refers to a person's tendency to focus and actively engage in acquiring knowledge.

On the other hand, students in the moderate chemistry learning motivation category show interest in chemistry learning, but it is inconsistent where in certain situations students appear enthusiastic, while in other conditions they tend to be unfocused. This is reinforced by interview results showing that students do not completely dislike chemistry learning, but they do not have a strong interest in it. Where in the learning process, students actively ask questions and complete the assigned tasks, but the motivation they possess is situational, such as the demand for grades. Students realize the importance of obtaining good chemistry grades because it will affect their average score and class promotion. In addition, in this category, students also show disinterest or lack of interest in

chemistry. Based on the interview results, it was found that students in this category do not like chemistry because it is considered difficult, not easy to understand, and not relevant to their future career plans.

Dislike for chemistry lessons causes students to become less active in class and less effortful in understanding the material to be studied or given. Then, the lack of effort made by students to gain an understanding of the material, where students only rely on the teacher's explanation and do not engage in independent learning from other sources. This causes the students' motivation toward chemistry learning to tend to be low, in line with the research conducted by Matondang, (2018) which states that interest is essentially the acceptance of a relationship between oneself and something outside of oneself. The stronger or closer the relationship, the greater the interest. In addition, interest is a characteristic, a full engagement of a person in a particular field of study, and a feeling of liking and enjoying learning the material to acquire new knowledge, attitudes, and skills.

Learning motivation is a reciprocal drive from both within and outside the learner that can generate enthusiasm and eagerness, as well as provide direction to learning activities so that the desired goals can be achieved. Motivation is greatly influenced by the needs and learning situations of students, so it is not constant, but can change depending on the learning conditions (Dewi et al., 2024). Thus, the high motivation for learning chemistry possessed by students indicates an implication for teaching practices. Students with high motivation, the focus of learning is not only directed at increasing interest but also at maintaining and strengthening that motivation thru contextual learning, problem-based learning, and practical work. Therefore, teachers need to create a learning environment that supports curiosity, provides opportunities for independent learning, and demonstrates the relevance of chemistry to students' real needs so that high motivation can be maintained and developed sustainably.

Motivation to Learn Chemistry Based on Aspects

Based on the data analysis results, the motivation to learn chemistry among students in grades X, XI, and XII varies in percentage across different levels.

Aspect of Intrinsic Motivation and Personal Relevance of Motivation

The percentage difference shown, although relatively small, indicates a dynamic of learning motivation influenced by the developmental stages of students and the academic demands at each level. The results indicate that the XI grade has a strong internal drive to study chemistry due to an interest in learning that is directly related to everyday life. The high results of intrinsic motivation and personal relevance among the eleventh-grade students indicate an improvement in their cognitive abilities and learning experiences. Students already have a foundation in chemistry knowledge, allowing them to relate the concepts they learn to everyday life phenomena. This condition is in line with the research by Nasaruddin et al., (2025), which states that many students feel less confident when faced with science material that is perceived as complicated and challenging. Therefore, one of the efforts that can be made is to apply a contextual learning approach, which involves directly linking science material to students real life experiences.

Then for the X grade, the results show that students at this stage still have a fairly strong internal spirit, where they are just beginning to study chemistry in more depth. Students at this stage are still in the process of adapting to the learning environment and the complexity of chemistry material, so their intrinsic motivation is not yet fully stable, although it is supported by a high level of curiosity. In line with the research conducted by Purwanto et al., (2023), which states that learning motivation in the early stages of education is influenced by the process of adjusting to a new environment and learning system.

Meanwhile, in the XII grade, the results show that at this stage, students are more focused on final exams, graduation requirements, and planning to continue their education to higher education levels, leading to increased academic pressure. As a result, learning activities are no longer fully driven by interest and curiosity, but rather by the drive to achieve certain results, which can lead to an increase or decrease in students' learning motivation (Juliana et al., 2025).

Self-Efficacy Aspects and Assessment of Anxiety

In this aspect, these results indicate that XI grade students have confidence in overcoming

challenges, which can reduce anxiety in learning. Additionally, students at this stage are in a relatively stable phase of development. Students have gone thru the adaptation period with the learning environment and conditions, resulting in a better learning experience. This is in line with the research conducted by Chairunnisa et al., (2021), which states that self-efficacy has a positive effect on students' cognitive learning outcomes, where students with high self-efficacy tend to be more confident.

Meanwhile, for the grade X students are in the early stage of learning chemistry at the senior high school level, therefore their limited learning experience may influence the development of their self-confidence and engagement in the learning process. However, due to the limited learning experience and the adaptation process to a new environment and material, it can affect students' confidence levels. Students need time to adjust to the demands or pressures of new learning and environments, where this adaptation process can influence their self-confidence in understanding the material (Zennaria & Efendy, 2025).

Meanwhile, the XII grade, with the lowest percentage, is influenced by academic pressure such as the focus on completing studies and final exams. This pressure can increase anxiety and lower self-confidence. The difficulties experienced by students in understanding a subject can affect their psychological condition, such as the emergence of anxiety accompanied by excessive fear, unstable emotions, and restlessness when unable to complete tasks (Rahmawati, 2024).

Therefore, the lower percentage in the self-efficacy and anxiety assessment aspect suggests that although students have relatively high motivation to learn chemistry, they still face challenges related to a lack of confidence in their academic abilities and anxiety during the learning process. Hence, learning strategies that enhance students' self-confidence, provide opportunities for successful learning experiences, and reduce anxiety in chemistry learning are needed.

Aspect of Self-Determination

In the aspect of self-determination, the XI grade achieved a percentage of 81%, higher than the X and XII grades, which both had a percentage of 75%. This result indicates that the XI grade has good decision-making abilities and learning

strategy management. Self-determination is related to an individual's ability to regulate behavior, set goals, and make independent decisions in learning activities (Prathamie et al., 2022).

Meanwhile, the similarity in percentages obtained by students in grades X and XII indicates that although there is a difference in grade levels, high academic pressure can affect their perception of self-determination. The X grade students in this condition are due to limited learning experiences and the adaptation process to the learning environment and educational system, which makes them not yet fully capable of independently determining learning strategies. Meanwhile, for XII grade students, despite having more mature experiences, high academic pressure such as final exam preparation and study completion can affect students' ability to manage their learning. This pressure causes students to become more dependent on external demands rather than internal motivation. This is in line with the research conducted by Prasetyaningtyas et al., (2022), which states that academic anxiety is essentially needed by students because it refers to manageable psychological pressure; and it motivates students to perform better academically.

Aspect of Career Motivation

The high career motivation in X grade can be caused by the initial enthusiasm of entering high school and the great hopes for future aspirations. At this stage, students are in the early exploration phase, so they have high hopes and aspirations for the future. Such as understanding one's strengths and weaknesses, understanding that each individual is different and has the ability to make decisions related to their life choices, as well as understanding what they need in their career field (Riswana et al., 2023).

Meanwhile, for the XI grade, the results obtained indicate a process of adjustment and deepening of career interests. At this stage, students begin to compare their expectations with the actual conditions, such as academic abilities, environmental support, and available opportunities. This process often leads to doubts and uncertainties in determining the career path. This is in line with the research conducted by Khoirunnisa & Lestari, (2024), which states that career decision-making has become one of the common issues faced by high school students. Generally, the career choices that students will

make pose a challenge due to the lack of career information and pressure from their environment.

Meanwhile, in the XII grade, the results show that at this stage, students are more realistic in their career choices, which are becoming more concrete, leading some students to experience confusion and pressure in determining their next steps. At this stage, students are faced with real choices such as continuing their education to university or entering the workforce. The pressure to determine the future often causes anxiety and confusion, especially for students who lack self-confidence, do not know their interests and talents, and have little experience (Wijaya et al., 2025).

Aspect of Value Motivation

These results indicate that XI grade students have a strong orientation toward achieving academic grades as an indicator of learning success. The high motivation for grades among XI grade students indicates that at this stage, students are in a stable phase of the learning process, where they are not burdened by graduation pressure and have passed the adaptation period. The high motivation within students will help them become more active and diligent, allowing them to achieve good academic performance, whereas low motivation will yield the opposite results (Darmawan & Lailiyah, 2026).

Meanwhile, XII grade students at this stage are more focused on graduation targets and selection for continuing to higher education, although their motivation for grades is still relatively high. The pressure of facing final exams often makes students more focused on the end result rather than the learning process itself. In line with the research conducted by Ibrahim & Safitri, (2025), which states that approaching graduation, the condition of XII grade students will experience a decline in learning motivation due to facing academic pressure, achievement demands, and future uncertainties.

Meanwhile, for X grade students, they are still in the adjustment phase to the new assessment system. The transition from junior high school to senior high school requires students to adapt to the new level of material difficulty, learning methods, and different assessment systems. This adaptation process can affect students' learning motivation, especially in understanding the applicable assessment systems or standards. In

line with the research conducted by Kasari & Sawitri, (2018), which states that entering a higher level of education requires students to be able to adapt to new things, such as the school environment, regulations, teachers, and new friends. In addition, they must also recognize and explore their abilities in the academic field.

Overall, the results of this study indicate that the level of students' motivation to learn chemistry does not always increase gradually from grade X to grade XII; students' motivation to learn chemistry is dynamic and influenced by academic demands at each grade level (Rizqiya et al., 2025).

Based on the research results obtained, the level of chemistry learning motivation among 11th-grade students is the most optimal based on the five aspects of motivation, with a percentage of 78% for intrinsic motivation and personal relevance, 72% for self-efficacy and assessment of anxiety, 81% for self-determination, 83% for value motivation, and 72% for career motivation. The condition shows that XI grade students have a strong intrinsic and extrinsic motivation to achieve the expected learning objectives.

The high percentage in the aspects of value motivation and self-determination indicates that students are not only externally driven by grades and academic demands but also by personal awareness of the importance of learning chemistry. With good intrinsic motivation, students tend to be more active, have a high level of curiosity, and are able to persevere in facing learning difficulties. Meanwhile, extrinsic motivation such as grades and career orientation acts as a reinforcement that encourages students to achieve optimal learning outcomes.

CONCLUSION

Based on the findings of this study, it can be concluded that the chemistry learning motivation of Grade X, XI, and XII students at SMAN 1 Siding generally falls within the high to very high categories. Analysis of the motivational aspects revealed that grade motivation was the most dominant aspect among the students, indicating that academic achievement and learning outcomes are the primary driving forces in learning chemistry. These findings suggest that students have a positive attitude toward chemistry learning and a strong desire to achieve academic success. Therefore, teachers can use this

information on students' motivational profiles to design more effective instructional strategies, such as connecting learning materials to students' academic goals, providing constructive feedback, and creating a learning environment that enhances students' self-confidence and engagement in chemistry learning.

RECOMMENDATION

Based on the research results regarding the chemistry learning motivation of students in grades X, XI, and XII, the researcher provides the following suggestions:

For Teacher

Teachers are encouraged to develop contextual and student-centered instructional strategies by relating chemistry concepts to everyday phenomena and their applications in various fields. In addition, efforts to enhance self-efficacy and reduce assessment anxiety should be implemented through constructive feedback, progressively challenging tasks, and continuous formative assessment to support students' motivation and engagement in chemistry learning

For Future Researchers

Future researchers are encouraged to investigate other factors that may influence students' motivation to learn chemistry, such as the social environment, family support, and learning styles. Furthermore, the use of a mixed-methods approach is recommended to provide a more comprehensive understanding of students' chemistry learning motivation and the underlying factors that shape it.

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