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BELIEF AND PERCEPTIONS ABOUT CHEMISTRY TEACHING AND LEARNING: STUDY OF PUBLIC SCHOOLS IN MUZAFFARABAD AZAD KASHMIR

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Abstract

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Chemistry is taught as an essential discipline at the secondary level to create a scientific attitude in students towards science education. The primary purpose was to explore the factors that contribute to students' high/low achievement in chemistry, in general to both boys and girls at the secondary level in public schools of Muzaffarabad Azad Jammu and Kashmir. The present study also found out the effect of factors associated with students' high and low achievement. The factors were divided into three major categories, teacher-related factors, student-related factors, and school-related factors, respectively. A quantitative research method was used to conduct this study and a descriptive survey research design was employed. The study was conducted in 17 public schools of the Municipal Corporation area of Muzaffarabad. 8 out of 17 schools were boys' and 9 were Girls high schools. The population of the study was all secondary school students currently in 10th grade. To gather the necessary data, a questionnaire was used to collect data from students to determine the causes of students' high/low achievement in chemistry. The present study found that students' interest in chemistry, motivation, teachers' attendance, teachers' pedagogical strategies, use of modern instructional resources, school environment, students' previous knowledge, students' involvement in-class activities, and laboratory adequacy are significantly related to student's achievement. The study also revealed that the students could not learn and perform significantly well due to certain constraints like teachers' frequent absence in some schools, lack of resources, laboratory inadequacy, and weak scientific foundation.

Keywords: Chemistry, Achievement, Motivation, Administration, Performance

Introduction

Chemistry is regarded as one of the most important disciplines in the secondary school curriculum and its importance in education has worldwide recognition. The study of Chemistry is essential in all aspects of life. It is among the critical subjects used for selective advancement in the education system. This study is about the factors that affect students' chemistry achievement at the secondary level. Among the factors that have been identified, that affect students' chemistry achievement are teaching strategies, teachers' professional skills, students' interest, motivation, attitude, involvement in class, laboratory adequacy, school environment, school location, and principals' concern regarding students' chemistry learning. (Zareen, Imran et. al, 2023), It is based on this, that, the study constructed on the achievement of students in chemistry at the secondary level in public schools in terms of student-related variables, (students' interest, motivation, prior knowledge, attitude, involvement in class, weak vocabulary) teacher-related variables (teaching strategies, use of instructional materials, teachers' professional skills, experience, teachers' attendance, effectiveness) and school-related variables (school environment, school location, laboratory adequacy, Principals' feedback) respectively. This shows that there is a research gap even in identifying the factors associated with students' high/low achievement in chemistry. The study therefore sought to investigate the influence of the factors on students' high/low chemistry achievement. There are so many other factors, associated with students' chemistry achievement other than those studied in literature, which are not well-researched in Azad Kashmir. The researcher found it imperative to ascertain this association from a Pakistani perspective, specifically for Azad Kashmir (Muzaffarabad). (Sindh, Singh, et. al. 2023), This shows that this is an important problem that has been studied in different parts of the world and is being

neglected in this part of the world and it is important. So, this study is going to fill this gap in the literature and in this way, this research study will contribute to the entire body of existing knowledge. The significance of this study is to find out the contributing factors involved in students' subsequent achievement in chemistry. (Sarwar, Khurram, 2023), There has been a lack of systematic and in-depth investigation into the situations and factors that influence the teaching and learning of chemistry in high schools in Azad Kashmir. It would be helpful to identify the problematic areas in teaching and learning chemistry at the secondary level, especially in public schools of Muzaffarabad.

Definition of Major Variables and Terms

In this study, the following terms were used, their meaning is explained below:

Chemistry

It is the branch of science that deals with the study of matter, changes in matter, and the laws or principles that govern the changes.

Chemistry Achievement

It refers to the competency level attained in chemistry knowledge, skills, and concepts measured in terms of grades, that a student scores in chemistry in the annual board examination.

Student-Related Factors

It refers to the factors that are related to students' self and have a significant influence on students' chemistry achievement. It includes students' interests, motivation, prior knowledge, attitude, involvement in class, and vocabulary. Student-related factors are the intervening variables that affect the students' high/low achievement in chemistry at the secondary level. These include students' interest, attitude, students' involvement in chemistry class, prior science knowledge, motivation, socio-economic status, and students' self-efficacy toward chemistry learning (Kashu, 2014; Adodo & Gbore 2012; Kyalo, 2016; Ozdemir, 2003).

Teacher-Related Factors

It refers to the factors that are related to the teachers that assist in educating the students and affect their chemistry achievement. These include teaching strategies, use of instructional materials, teachers' professional skills, experience, teachers' attendance, and effectiveness. Teacher-related factors include the factors related to teachers' professional skills, experience, pedagogical strategies, attendance, qualification, classroom practices, and effectiveness (Nbina & Barineka, 2012; Sadler & Loehr, 2004; Abuseji, 2007; Abudu, 2014; Adesoji & Bosun, 2018; Beyessa, 2014)

School-Related Factors

It refers to the physical resources, human resources, and learning resources used by a school in the promotion of students' academic achievement. It includes school environment, school location, laboratory adequacy, and Principals' feedback. School-related factors include school environment, school location, laboratory adequacy, and proper feedback. The abilities of learners in terms of how they contribute to students' achievement in chemistry include mathematical abilities, self-learning skills, problem-solving skills, self-confidence, and practical skills (Akani, 2015; Hofstein, 2004; Badeleh, 2011; Burak, 2009). Data was collected from 17 public secondary schools in the municipal corporation area of Muzaffarabad Azad Kashmir. Seventeen secondary schools included in the municipal corporation area of Muzaffarabad were selected, eight boys' and nine girls' schools. Three hundred students were selected as a sample for the study. Data were collected from the selected schools through a questionnaire. An observation sheet was also used to confirm the collected data through the researcher's observation during school visits. (Bridge, Horey, et. al. 2023), The present study found that student's interest in chemistry, motivation, teachers' attendance, teachers' pedagogical strategies, use of modern instructional resources, school environment, students'

previous knowledge, students' involvement in-class activities, and laboratory adequacy are significantly related to student's achievement. It was found that these factors positively affect and contribute to students' achievement in chemistry at the secondary level.

Research Problem

The purpose of this study is to investigate the contributing factors involved in students' subsequent achievement in chemistry at the secondary level in public schools. The factors are categorized as student-related, teacher-related, and school-related. These factors affect the students' chemistry achievement at the secondary level in public schools of Muzaffarabad Azad Kashmir.

Research Objectives

- To investigate the effect of student-related factors on students' chemistry achievement and how these factors are associated with students' high or low achievement.
- To find out the effect of teacher-related factors on students' chemistry achievement and how these factors are associated with students' high or low achievement.
- To inquire about the effect of school-related factors on students' chemistry achievement and how these factors are associated with students' high or low achievement.

Significance of the Study:

This study will help the students, chemistry teachers, principals, curriculum developers, examination board, and public-school administration to improve students' chemistry achievement, chemistry teachers' effectiveness, and administration, the decisions regarding chemistry teachers' recruitment, curriculum, board examination, etc. This research will also be an opportunity for future researchers who want to contribute to science education and chemistry teaching.

Research Questions

1. What is the effect of student-related factors on students' chemistry achievement and how these factors are associated with students' high or low achievement?

2. What is the effect of teacher-related factors on students' chemistry achievement and how these factors are associated with students' high or low achievement?
3. What is the effect of school-related factors on students' chemistry achievement and how these factors are associated with students' high or low achievement?

Delimitations of the Study:

The present study is delimited to the public schools under the Municipal Corporation of Muzaffarabad Azad Kashmir. Only 17 public schools were targeted, nine girls' schools and eight boys' schools.

Literature Review

Teacher-Related Factors

There is a relationship between the academic achievement of chemistry students and the use of instructional material in teaching and learning chemistry at the secondary level. Instructional materials contribute to effective teaching-learning of chemistry at the secondary level. The students taught with the help of instructional materials perform better and higher than those taught without instructional materials (Adalikwu & Iorkpilgh, 2013). Tai, Sadler, & Loehr (2004) investigated the factors influencing success in chemistry. Their study revealed that the high school teachers' pedagogical strategies are linked to the student's performance in chemistry. The teachers teaching science education should use a collaborative method in their classes and involve students in their lessons since it enhances students' science achievement. The students who were taught by actively involved in class achieved better than those taught with lecture-based methods (Nkechinyere & Ordu, 2018). Abudu (2014) found the relationship between teachers' attitudes and students' academic achievement in secondary school chemistry. Certain factors are associated with the student's low achievement in chemistry at the secondary level. These are the method of instructional material, the teacher's attitude, laboratory inadequacy, and students' poor

scientific background. Their study revealed that chemistry teachers' attitudes significantly affect students' achievement in chemistry at the secondary level. Wenglinsky (2001) indicated that the effect of classroom practices designed by the teachers directly contributes to students' learning. He claimed that teachers could contribute as much to students' learning through effective classroom practices as students themselves. Abdullahi (2010) assessed the effects of teachers' effectiveness on students' achievement in mathematics. His study revealed that teacher effectiveness positively affects students' academic achievement in mathematics. He suggested that students' achievement can be enhanced by increasing teacher effectiveness by providing qualified and experienced teachers.

School-Related Factors

Adesoji & Olatunbosun (2008) established that school environment and teacher-related factors influence students' achievement in chemistry. Their study revealed that school location, school environment, laboratory adequacy, and teachers' attendance at chemistry workshops directly influence the students' achievement in chemistry at the secondary level. Oginni, Awobodu, Alaka, & Saibu (2013) examined the role of school factors in students' achievement in chemistry. They found out that school location, laboratory adequacy, and frequency of practical classes are the factors that predict students' academic achievement in chemistry at the secondary level. Based on their study, Korir & Kipkemboi (2014) established that school environment and peer influence significantly affect students' academic performance. They stated that school contributes to a child's academic performance. The head teacher and the teachers either have a positive or negative influence on students' academic achievement. According to Edomwonylotu & Aava (2011), certain factors influence students' positive achievement in chemistry. These factors include school environmental factors like time, attitude,

adequacy, etc. Improvement in these environmental factors will improve the student's performance in chemistry. [Kyalo \(2016\)](#) inquired about the school factors that influence students' performance in chemistry. His study revealed that fundamental concepts, preparation, teaching and learning methods, students' attitudes, involvement, and assessment methods are some of the school factors influencing students' chemistry performance. [Akani \(2015\)](#) inquired about the role of the laboratory in students' academic achievement in chemistry in secondary schools. He found out that the use of the laboratory contributes to developing learners' attitudes towards learning chemistry. Involving the students in laboratory activities at the high school level enables them to promote their science learning. The laboratory activities enable teaching the lesson effectively and enhance students' science learning ([Hofstein, 2004](#)). [Badeleh \(2011\)](#) compared the traditional method and the use of the laboratory method and their influence on students' achievement and retention in chemistry. His study indicated that using the laboratory in teaching chemistry was found more effective than teaching chemistry by using the traditional method at the elementary level. [Burak \(2009\)](#) stated that laboratory application enhances students' science progress, develops problem-solving skills, and enhances their interest and attitude toward science education. He suggested that teachers use the laboratory while teaching to improve students' performance in chemistry.

Student-Related Factors

Students themselves contributed to their failure in chemistry. Their negative attitudes, lack of interest, and lack of confidence are contributing factors. Students' negative attitudes result from wide syllabus coverage, lack of exposure to a well-equipped laboratory, and poor teaching methods. The students' negative attitude affects students' academic achievement in chemistry at the secondary level ([Salome, 2013](#)). Students' chemistry

achievement has a positive relationship with their involvement in classroom activities by the teacher. The teacher-centered activities had a positive impact on students' science achievement on TIMSS tests ([Ozdemir & Ertugral, 2003](#)). Students' chemistry achievement has a positive relationship with their involvement in classroom activities by the teacher. The teacher-centered activities had a positive impact on students' science achievement on TIMSS tests ([Ozdemir & Ertugral, 2003](#)). [Adodo & Gbore \(2011\)](#) studied the effects of students' attitudes and interests on their academic performance in science. They suggested that a suitable teaching method involving students boosts students' academic achievement, interest, and attitude toward science. According to them, students' interest in science is more significant in enhancing their academic performance than their attitudes. They demonstrated that students' interest motivates and enhance students' attention and memory ([Jegede, 2007](#)). [Brown et al. \(2015\)](#) inquired about the relationship between students' attitudes and the achievement of undergraduate students in chemistry. They found out that the student's achievement in chemistry is independent of students' attitudes. [AKBAP & Kan \(2007\)](#) investigated the factors that influence chemistry achievement. They concluded that students' motivation and anxiety are significant predictors of their achievement in chemistry. [Alordiah, Akpadaka, & Oviogbodu \(2015\)](#) studied the influence of gender, school location, motivation, and socio-economic status on students' achievement in mathematics. The study results showed that these factors significantly influence students' academic performance in mathematics. [Cavas \(2011\)](#) studied that primary students' science motivation significantly differs in gender and grade level. Students' motivational level toward science contributes to their attitudes and achievement in science. [Seery \(2009\)](#) inquired about the role of students' prior knowledge and students' aptitude in their chemistry

performance. He found that there is a strong correlation between students' prior knowledge and their exam performance in chemistry. Students' prior knowledge is the most significant factor in predicting students' performance in chemistry. Prior knowledge greatly influences students' exam performance more than students' aptitude. This study was intended to examine the factors that affect the students' chemistry achievement at the secondary level. The previous studies suggested that certain factors affect the performance of secondary students in chemistry. The previous studies revealed that teachers' attitudes, instructional methods, students' attitudes, students' prior knowledge, and some school factors highly contribute to their achievement in chemistry and the factors associated with students' chemistry achievement.

Research Methodology

This study investigated the effect of factors on students' achievement and how those factors were associated with students' high/low achievement. Data was collected from 17 public secondary schools in the municipal corporation area of Muzaffarabad Azad Kashmir. A quantitative research method was used to conduct the present study. The research design used in this study is a descriptive survey. This design was suitable for this research as this study focuses on the academic achievement of secondary students and the factors associated with students' high/low achievement in public schools of Muzaffarabad.

Population

The area of the study was limited to public secondary schools of the municipal corporation area of Muzaffarabad Azad Kashmir, in which 17 secondary schools were included. 8 boys' secondary schools and 9 girls' high schools. All the 10th-grade students from public sector schools of Muzaffarabad Azad Kashmir constituted the population from which the sample was drawn. The total enrolled students were 833, 465 boys and 368 girls. The study targeted 17 secondary public schools with a

population estimate of 833 Students. The enrolment shows that there are 465 boys and 368 girls

Sample

A sample of 300 students was selected from 17 public schools in Muzaffarabad, 169 male and 131 female students. A stratified random sampling technique was used to select samples, and then students were randomly selected. The sample was selected from the list of population through a sampling generating site (<https://sample-size.net>). A stratified random sampling technique was used to select a sample, and then students were randomly selected, as it is an unbiased technique. All the members of the population have equal chances to get selected. According to [Creswell \(2012\)](#), in stratified sampling, researchers divide (stratify) the population on some specific characteristics (e.g., gender) and then, using simple random sampling, a sample from each subgroup of the population (e.g., males and females). The use of this procedure guarantees that the sample includes specific characteristics that the researcher needs in the sample. Stratification ensures that the stratum desired will be represented in the sample in proportion to that existence in the population.

Table 1
Sample size

Total Sample	Boys' Schools	Public Schools	Girls' Schools	Public Schools
300	169		131	

Sample grid for students

Table 2

School-wise details of students

	Total	Public Schools	
		Male Schools	Female Schools
Schools	17	8	9
Students	833	465	368
Sample for study 300		169	131

Variables

The following were the main variables that were considered in the study

Dependent Variables

Students' achievement in chemistry

Intervening Variables

- *Student-Related variables include:*
- Their learning attitudes, lack of interest, family background, self-learning skills, prior knowledge, aptitude, learning styles, vocabulary issues, and time spent.
- *Teacher-related variables include:*
- Instructional material, pedagogical skills, regularity, attitude, teaching competencies, qualification, satisfying the students, motivation
- *School-related variables include:*
- School location, environment, laboratory adequacy, timetable, principal's visit, learner feedback policy.

Research Instruments

A questionnaire was used to seek out information from secondary school students about the factors associated with their high/low achievement in chemistry. The questionnaire constituted 25 items based on a five-point Likert scale. It consisted of two sections. Section I contained the demographical information of students, while section II constituted three parts. Part I consists of ten statements, part II has ten statements, and part III has five statements, respectively. The questionnaire was designed in two languages to develop ease in understanding the statements. The statements in the questionnaire were simple and easy to understand. The purpose of the observation sheet in this study was to verify the responses from the students administered through a questionnaire.

Reliability and Validity

To test the reliability of the instrument to be used in the present study, the test re-test method was used. The questionnaire was administered twice among twenty students from four schools within two weeks. This indicated the extent to which the questionnaire

gave the same responses every time it was administered. The reliability of the items was based on estimates of the variability among the items. To determine the coefficient of stability, Cronbach's Alpha coefficient was applied to the data to check the reliability of the research instrument. The results are presented in the following tables.

Reliability (Cronbach's Alpha Coefficient)

(a) Case Processing Summary

	N	%
Valid	300	100.0
Cases Excluded	0	0
Total	300	100.0

(b) Reliability Statistics

Cronbach's Alpha	No. of Items
0.88	25

Neuman (2000) indicated that a reliability coefficient of at least 0.7 of Cronbach's Alpha is considered enough for the research instrument to be used. The results above showed that 0.88 validates that the tool used is reliable. In this study, face validity was used to check the suitability of items to their objectives. The above aspect of validation was achieved by subjecting the instrument to the content expert as the researcher's supervisor. In this research study, the instrument was assessed through experts' opinions on the items. Members of the supervisory committee took part in this process and suggested whether the questionnaire measures what it is supposed to measure.

Data Analysis

The students' filled questionnaires provided data that was examined and then coded for data analysis. The responses were assigned codes as Strongly Agree (SA) 5; Agree (A) 4; Undecided (UD) 3; Disagree (D) 2; Strongly Disagree (SDA) 1. Statistical Package for Social Sciences (SPSS) was used for data analysis, as it

enabled the handling of large amounts of primary and secondary data efficiently and was also timesaving. The analysis was done using the Chi-square technique. The Chi-square test of association was used to test the hypothesis of an association between the two genders and other correlated factors.

Variables	Marks in Chemistry	Pearson chi-square Value	Degree of freedom Df	P-value
Obtained Marks in Chemistry and students' interest in chemistry	Below 33% = 23	24.18	4	.000
Marks obtained in Chemistry and students' previous science knowledge	33-44% = 35	210.007	16	.000
Achievement in chemistry and the teaching strategies used by the teacher to teach chemistry	45-59% = 83	108.570	16	.000
Students' chemistry achievement and their involvement in chemistry lessons	60-79% = 137	95.083	16	.000
Teachers' attendance and students' achievement in chemistry	80% and above = 22	393.593	16	.000
Students' chemistry achievement and School environment.	Total = 300	206.869	16	.000

Results and Discussion

This study was designed to examine the factors studied in the literature contributing to students' high/low achievement in chemistry. Data was collected through a questionnaire from secondary school students. (Tong, Yu, Deacon, et. al. 2024), An observation sheet was also used to confirm the collected data through the researcher's observation during school visits. Pearson chi-square test of association was used to find out the association among the

listed factors and chemistry achievement of high/low achievers. The statistical significance of the results was examined at $\alpha=0.05$ significance level. P values (<0.05) of these statistics depict the marks obtained in chemistry at the secondary level. This section analyses and presents the study's findings and discusses the results, respectively. Analysis of the collected data from secondary school students revealed that the students-related factors (interest in chemistry, students' previous science knowledge, involvement in chemistry lessons), teacher-related factors (teachers' teaching strategies to teach chemistry, teachers' attendance), and school-related factors (school environment) are significantly associated with students' achievement in secondary school chemistry. The P-value is 0.000, which is less than the significance level, which is 0.005. So, it is concluded that there is a relationship between student-related factors (interest in chemistry, students' previous science knowledge, involvement in chemistry lessons), teacher-related factors (teachers' teaching strategies to teach chemistry, teachers' attendance), and school-related factors (school environment) and their marks in secondary school chemistry.

Obtained Marks in Chemistry and students' interest in chemistry

Level of significance: $\alpha=0.05$

Test statistic to be used:

$$\chi^2 = \frac{\sum_{i=1}^r \sum_{j=1}^c (o_{ij} - e_{ij})^2}{e_{ij}}$$

Marks in chemistry	SDA	DA	UD	A	SA	TOTAL
Below 33%	0	9	0	5	9	23
33-44%	26	9	0	0	0	35
45-59%	0	9	18	29	27	83
60-79%	0	0	18	57	62	137
80% and above	0	0	0	8	14	22
Total	26	27	36	99	112	300

Chi-square Test

of freedom	P value	Value	Degree
Pearson chi-square			24.18
4	.000		

The value of Pearson chi-square is 24.184, and its probability value is 0.000 with 4 degrees of freedom which is less than the level of significance that is 0.05, it concludes that there is a relationship between students' interest in chemistry and their marks in chemistry at the secondary level.

Achievement in chemistry and the teaching strategies used by the teacher to teach chemistry

Level of significance: $\alpha=0.005$

Test statistic to be used:

$$\chi^2 = \frac{\sum_{i=1}^r \sum_{j=1}^c (o_{ij} - e_{ij})^2}{e_{ij}}$$

Marks in chemistry	SDA	DA	UD	A	SA	TOTAL
Below 33%	0	9	0	10	4	23
33-44%	0	0	11	5	19	35
45-59%	9	0	9	52	13	83
60-79%	9	20	18	61	29	137
80% and above	0	0	0	22	0	22
Total	18	29	38	150	65	300

Chi-square Test

Value	Degree of freedom	P value
Pearson chi-square		108.570
16	.000	

The value of Pearson chi-square is 108.570, the degree of freedom is 16, and the p-value is 0.000 which is less than the level of significance, which is 0.005. It presents that there is an association between the teaching strategies used for chemistry teaching and students' chemistry achievement.

Discussion

This study examined a Gender-based comparison of students' achievement in chemistry at the secondary level in public schools of Muzaffarabad. Students' responses regarding the factors were also perceived, and an observation sheet was also used to

triangulate the results. (Van, Gotch, et. al. 2024), The study's objectives were to find out the factors (that were explored in the literature review) i.e. student student-related, teacher-related, and school-related, to students' chemistry achievement and their association with students' high/low achievement. The study was conducted in 17 public schools in the Municipal Corporation area of Muzaffarabad. 8 out of 17 schools were boys,' and 9 were Girls' high schools. The study population was all secondary school students currently in 10th grade. A sample of 300 students was selected out of 833 students. 169 out of 300 were boys, and 131 were girls. Several studies on students' chemistry achievement and the factors associated with high/low achievement revealed the effect of factors associated with students' high and low achievement. (Batool, Faqir, et. al. 2024), The data produced were subject to quantitative analysis. Pearson chi-square was also calculated to determine factors related to students' chemistry achievement. It was found that these factors positively affect and contribute to students' achievement in chemistry at the secondary level.

Findings

The present study found that students' interest is an important factor that affects students' chemistry achievement.

- The present study's findings reported that the teaching strategies adopted by the teacher to teach chemistry affect students' chemistry achievement.
- The present study also indicated a strong correlation between the students' involvement in chemistry class and their achievement in chemistry.
- The present study found the school environment to be another crucial contributing factor affecting students' achievement in chemistry.
- The current study analyzed that laboratory adequacy is positively related to students' high chemistry scores. The time spent in the

laboratory during lab hours contributes to students' high chemistry achievement.

- The present study also revealed that the student's previous science knowledge positively correlates with students' chemistry achievement at the secondary level.
- The present study revealed that teachers' attendance is an important factor in students' chemistry achievement.
- The present study also perceived that modern resources are positively associated with students' chemistry achievement. Teachers who use modern resources and AV aids to teach chemistry lessons significantly enhance their students' achievement.
- The present study also analysed that motivation and students' chemistry achievement are significantly related. Motivation is an essential factor that enhances students' achievement in chemistry.
- The present study found that student's interest in chemistry, motivation, teachers' attendance, pedagogical strategies, use of modern instructional resources, school environment, students' previous knowledge, students' involvement in in-class activities, and laboratory adequacy are significantly related to student's achievement.

Conclusion

Based on findings and discussions, it can be concluded that some factors affect students' achievement in chemistry i.e. better school environment, students' interest, teachers' attendance, teaching strategies, students' previous science knowledge, and students' involvement in chemistry class.

Recommendations

This study recommends the following measures that could be taken to enhance students' chemistry achievement at the secondary level in public schools of Muzaffarabad.

1. The lagging schools have very less use of AV aids in chemistry teaching. School administration should ensure that teachers are using AV aids in chemistry teaching. Using

AV aids and modern resources can enhance students' chemistry achievement and interest in chemistry learning.

2. Most public schools do not have chemistry labs, and if there are, the teachers cannot operate and handle the apparatus. So the government and school administrations should take steps to establish chemistry labs in schools.
3. The government should take steps for the professional development of teachers and provide knowledge about the appropriate use of teaching methods rather than conventional methods. The school environment and the resources provided should have a proper monitoring system by the authorities and government officials to check whether the resources are properly utilized.

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