

Research Article

Factors Influencing Undergraduate Chemistry Performance: A Study on Attitudes, Laboratory Use, and Teaching Methods at Somali National University

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Abstract

The study was carried out to investigate Factors influencing Undergraduate Students' Performance in Chemistry. The study had three objectives which are 1) To examine the relationship between students' attitude and performance in chemistry. 2) To assess the impact of the utilization of science laboratories on performance in chemistry. 3) To evaluate the relationship between teachers' teaching methods and performance in chemistry. The study adopted a descriptive correlation research design to examine factors influencing performance in chemistry. The researchers utilized descriptive, correlation, and regression analysis to attain the objective of the study and test three research hypotheses. 70 respondents were selected for the study using a stratified sampling technique. The target population of the study was undergraduate students in the Department of Education. The participants were distributed a closed-ended questionnaire with a Five-Likert scale that measured student attitude, teaching method, utilization of science laboratories, and chemistry performance. The questionnaire was answered by the chemistry students in Faculty of Education. Statistical package for social science (SPSS) software was utilized to analyze the collected data through descriptive statistics, correlation, and regression analyses. The noteworthy findings indicated that there is a strong positive relationship between student attitude toward chemistry and performance in chemistry ($r=.766$ and $p<0.001$). This means that Improving student attitudes toward chemistry is likely to enhance their performance. The study also found that there is a strong positive relationship between utilization of science laboratories and performance in chemistry ($r=.939$ and $p<0.001$). Finally, the result showed there is a strong positive relationship between teaching method and performance in chemistry ($r=.882$ and $p<0.001$). This study has found that student attitude toward chemistry, utilization of science laboratories, and teacher teaching methods have a positive relationship with performance in chemistry. Moreover, students with excellent performance in chemistry have a better attitude toward chemistry, utilization of science laboratories, and teacher teaching methods. Future research should consider large samples or additional science disciplines to extend these insights.

Keywords

Student Attitude, Utilization of Science Laboratories, Teaching Methods, Undergraduate Chemistry Performance

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1. Introduction

Chemistry is regarded as one of the core science subjects because of its relations with many fields such as engineering, health, biology, physics, and geology [3]. It plays a vital role in developing countries as it influences our daily lives, society, economics, and ecology [13].

One of the challenges that students encounter is poor performance in science subjects, particularly chemistry [7]. As Cardellini, L. [5] suggested, in recent years, students' curiosity and performance in chemistry have declined. However, poor performance in science subjects like chemistry has been a concern over the past few years [7].

Some studies have shown that the quality of teaching and classroom climate can contribute to or hinder the performance of students in science subjects, particularly chemistry. Some findings have indicated factors such as a student's interest, reasoning ability, self-concept, gender, and study habits are among the factors that can contribute to poor performance in chemistry [25]. In addition, according to Cardellini, L. [5], the instructional teaching method is widely seen as one of the main reasons students feel bored and lack of enthusiasm when studying science subjects, particularly chemistry.

In Somalia, there is no academic paper on factors influencing students' performance in chemistry; therefore, the study investigates factors influencing students' performance in chemistry from the Department of Education at Somali National University, Mogadishu, Somalia. The relationship between factors like student attitude, laboratory facilities, instructional methods, and students' performance in chemistry has not been well researched. Therefore, there is a need to conduct the study and the main purpose of the study is to find out which factors influence undergraduate students' performance in chemistry in the Department of Education, collect information and the points of view of the respondents in the Department of Education and put forward the best ways to overcome these challenges.

The study was carried out among major first-year students, second-year students, third-year students, and fourth-year students of chemistry, both male and female, from the Department of Education at Somali National University. The study involved undergraduate students, and the purpose of the study was to obtain possible factors influencing students' performance in chemistry from the department of education at Somali National University.

1.1. Objective of the Study

- 1) To examine the relationship between students' attitudes and their performance in chemistry.
- 2) To assess the impact of science laboratory availability on students' performance in chemistry.
- 3) To evaluate the relationship between teaching methods and students' performance in chemistry.

1.2. Alternate Hypothesis

- 1) There is a significant relationship between student attitude and performance in chemistry.
- 2) There is a significant relationship between the utilization of science laboratories and performance in chemistry.
- 3) There is a significant relationship between teachers' teaching methods and performance in chemistry.

1.3. Significance of the Study

Factors affecting undergraduate chemistry performance have not been well comprehended so far. Therefore, since there are no formal studies of the performance in chemistry in Somalia, the study findings will shed light on the factors contributing to the poor performance in chemistry. The result will also help the university board, head of the department, and lecturers to have a knowledge of key factors hindering the performance of science subjects, particularly chemistry.

Moreover, the study will further contribute to the existing knowledge of factors influencing the performance of chemistry by critically examining the relationship between attitudes, laboratory use, teaching methods, and performance in chemistry.

2. Literature Review

2.1. Student Attitude Toward Chemistry and Performance in Chemistry

In general, an attitude is defined as the tendency to acquire a new skill, and it can either be positive or negative depending on the individual's characteristics [23], but attitude toward learning chemistry has been defined as the students' view of the subject, laboratory tasks, the role of teachers, and students [16]. However, studies have demonstrated that there is a significant relationship between students' attitudes toward subjects and their performance [2]. Therefore, it has been found that students with negative attitudes toward learning chemistry face challenges such as disappointing exam results, reluctance in laboratory activities, and inattention in class [2], while students with a positive attitude in chemistry have an excellent performance in chemistry [14].

In addition, studies have been devoted to investigating the effect of gender on attitude toward learning science subjects, and they have found that gender differences have a significant impact on students' attitudes toward learning chemistry among university students; therefore, male students exhibit a more positive attitude than female students, and this implies that male students get better performance in chemistry when compared to female students [16].

2.2. Utilization of Science Laboratories and Performance in Chemistry

Laboratories have been widely seen as one of the distinctive features of science teaching [9], and their absence, however, has led many researchers to argue that science is meaningless to students [8]. Numerous studies have been carried out to investigate the relationship between laboratory use and performance in chemistry. Therefore, some of these studies have shown that the use of laboratories can improve students' performance in science subjects, particularly chemistry [20]. Moreover, studies have also suggested that students' ability to receive the expected concepts and skills in science depends thoroughly on the availability of laboratory materials [10].

A study on the availability and utilization of a science laboratory for the teaching and learning of science has indicated that the availability of chemistry laboratory equipment had a significant impact on students' performance in chemistry [20]. On the other hand, Amba [1] had thoroughly investigated whether there is a relationship between student performance and laboratory facilities and found that science laboratories have absolutely no relationship with student performance in chemistry.

2.3. Teaching Method and Performance in Chemistry

The purpose of imparting knowledge to learners is to bring an observable change to their cognition and behavior [15].

2.4. Conceptual Framework

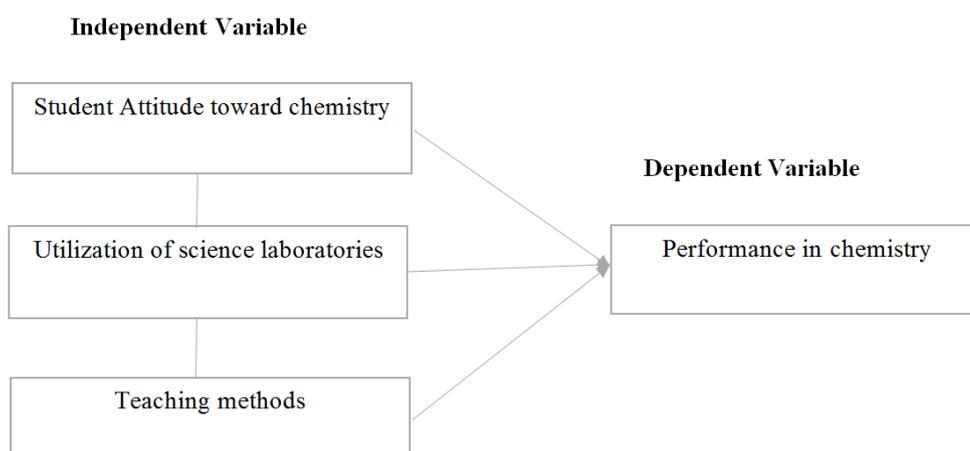


Figure 1. Depicts the Conceptual framework of the independent and dependent variables.

3. Methodology

The study was adopted through descriptive investigative

However, there are many methods that knowledge can be transferred to learners, and the most widely employed method adopted by teachers during teaching is the teacher-centered method, and student-centered comes next, but it has brought concern about its effectiveness among educational researchers [15-22, 11]. Therefore, instructors are required to adopt the best method that makes it easy to pass knowledge to students [15].

In the teacher-centered method, students receive knowledge from their teachers without any active participation during the lecture, and practical is less utilized while theoretical and memorization are more emphasized. However, most of the teachers of today focus on student-centered methods to promote active learning. This approach has been described as the most effective strategy since it does not rely on the imparting of knowledge from lecturer to student [15-22]. Moreover, the instructional method that the teacher opts for is always governed by the information and content intended to be delivered [19].

A plethora of studies have been conducted to investigate the extent of relationship between teaching method and performance in chemistry. For instance, a study done by Cheruiyot [6] on the influence of teaching strategies in chemistry practicals on performance in chemistry has found that teaching strategies utilized by teachers have a huge impact on performance in chemistry, while Jeffrey A. Luceros [11] has found that teaching methods utilized by instructors during teaching do not have a significant relationship to performance in science.

research design to examine factors influencing undergraduate student's performance in the department of chemistry. The researchers utilized descriptive correlation and regression analysis to attain the objective of the study and test three

research hypotheses. 70 respondents were selected for the study using a stratified sampling technique. The target population of the study was undergraduate students in the department of education. Questionnaire was utilized as the main data collection tool. The participants were distributed a closed-ended questionnaire with a five-likert scale which measured student attitude, teaching method, utilization of science laboratory, and chemistry performance.

Reliability

Reliability is widely used to measure the internal consistency of Likert items in a questionnaire. Many scholars have proposed that Alpha α values between .65 and .85 are acceptable [26]. Cronbach's alpha was used to examine construct reliability. The results revealed that the student attitude towards the chemistry scale with five items ($\alpha = .812$) and utilization of the science laboratories scale with five items ($\alpha = .885$) were found reliable. Similarly, the teaching methods scale with four items was also found reliable ($\alpha = .722$). Reliability results are summed up in Table 1.

Table 1. Reliability.

Constructs	No. of items	Cronbach Alpha α
SAC	5	.812
USL	5	.885
TTM	4	.722
PC	5	.814

Abbreviations: SAC= student attitude toward chemistry. USL= utilization of science laboratories. TTM= teacher's teaching method

4. Data Analysis and Discussion

4.1. Demographic Information

The questionnaire that was distributed to the respondent consisted of two appendixes: Appendix A was about general information about the participants, and Appendix B was about questions related to the objectives of the study. In terms of gender, 57.1% of the respondents were male, while 42.9% of the respondents were female. According to the age of the respondents, 40.0% were below 20 years old, 55.7% were between 21 and 30 years old, and 4.3% were above 30 years old. According to the marital status of the respondents, 85.7% were single, while 14.3% were married. In terms of the educational background of the respondents, 2.9% of them were in year one, 25.7% of them were in year two, and 42.9% were in year three, while 28.6% were in year four.

Table 2. Demographic information.

Variable	Frequency	Percentage
Gender		
Male	40	57.1
Female	30	42.9
Total	70	100.0
Age		
Below 20 years	28	40.0
21-30 years	39	55.7
Above 30 years	3	4.3
Total	70	100.0
Marital status		
Single	64	91.4
Married	6	8.6
Total	70	100.0
Educational background		
year one	2	2.9
year two	18	25.7
year three	30	42.9
year four	20	28.6
Total	70	100.0

4.2. Correlation Analyses

Table 3 depicts the correlation analysis among independent and dependent variables. The study found a strong positive relationship between student attitude toward chemistry and performance in chemistry ($r = .766$ and $p < 0.01$). The study also found that there is a strong positive relationship between utilization of science laboratories and performance in chemistry ($r = .939$ and $p < 0.01$). The study also found that there is a strong positive relationship between teaching methods and performance in chemistry ($r = .882$ $p < 0.01$).

Table 3. Correlation Analyse.

	SAC	USL	TTM	PC
SAC	1			
USL	.819**	1		
TTM	.966**	.892**	1	
PC	.766**	.939**	.882**	1

** . Correlation is significant at the 0.01 level (2-tailed)

4.3. Multiple Regressions

The problem

To investigate the influence of student attitude toward chemistry, utilization of science laboratories, teaching methods on performance in chemistry.

H₁: There is a significant influence of student attitude toward chemistry on performance in chemistry. H₂: There is a significant influence of utilization of science laboratories on performance in chemistry. H₃: There is a significant influence of teacher's teaching methods on performance in chemistry.

The dependent variable (performance in chemistry) was regressed on predicting variables of student attitude toward chemistry, utilization of science laboratories, and teacher's teaching methods. The independent variable significantly predicts performance in chemistry, $F(3, 289) = 119.889$, $P < 0.001$, which indicates that the three factors under study have a significant influence on performance in chemistry. Moreover, the $R^2 = .889$ depicts that the model explains 88.9% of the variance in the performance in chemistry. Table 10 shows the summary of the findings.

Table 4. Multiple regression analyses.

Hypothesis	Regression weight	B	t	P-value	Hypothesis supported
H ₁	SAC → PC	.898	21.888	.000	H ₁ Accepted
H ₂	USL → PC	.863	19.978	.000	H ₂ Accepted
H ₃	TTM → PC	.770	18.221	.000	H ₃ Accepted
R	R value	.889			
R ²	R ² value	.79			
F(3, 289)	F value	119.889			

Linear regression analysis was adopted to test the hypotheses. The dependent variable which is performance in chemistry was regressed on student attitude toward chemistry, utilization of science laboratories, and teacher teaching method. H₁ supported that there is a significant positive relationship between student attitude toward chemistry and performance in chemistry. H₂ supported, it indicates that there is a significant positive relationship between utilization of science laboratories and performance in chemistry. H₃ accepted that there is a significant positive relationship between teaching methods and performance in chemistry.

4.4. Discussions

This study aimed to assess factors influencing student performance in chemistry at the university level. This study was intended to examine the influence of student attitudes toward chemistry, utilization of science laboratories, and teacher teaching methods. The study indicated a positive relationship between student attitude toward chemistry and performance in chemistry at ($r = .766$ and $p < 0.01$). This is in line with the findings of previous studies by Mao et al., [17] and Roebianto [21]. Mao et al., [17] and Roebianto [21] reported a positive relationship between student attitude toward science and achievement in science of students.

The study also found a positive relationship between utilization of science laboratories and performance in chemistry at ($r = .939$ and $p < 0.01$). This agrees with the findings of

Feyzioğlu [4] and Khamali et al., [12], that there is a significant positive relationship between laboratory use and student science achievement. Moreover, the study revealed a positive relationship between teacher teaching methods and performance in chemistry at ($r = .882$ and $p < 0.01$). This finding is supported by Ntibi et al., [18] and Sugano & Nabua [24] who reported a significant relationship between instructional strategies and performance in chemistry.

Linear regression analysis was adopted to test the hypothesis. The dependent variable which is performance in chemistry was regressed on student attitude toward chemistry, utilization of science laboratories, and teacher teaching method. H₁ supported that there is a significant positive relationship between student attitude toward chemistry and performance in chemistry. H₂ supported, it indicates that there is a significant positive relationship between the utilization of science laboratories and performance in chemistry. H₃ accepted that there is a significant positive relationship between teaching methods and performance in chemistry.

5. Conclusion and Recommendation

This study has found that student attitude toward chemistry, utilization of science laboratories, and teacher teaching methods have a significant positive relationship with performance in chemistry. The study found a strong positive relationship between student attitude toward chemistry and performance in

chemistry ($r=.766$ and $p<0.01$). The study also found that there is a strong positive relationship between utilization of science laboratories and performance in chemistry ($r=.939$ and $p<0.01$). The study also found that there is a strong positive relationship between teaching methods and performance in chemistry ($r=.882$ $p<0.01$). Moreover, students with excellent performance in chemistry have a better attitude toward chemistry, utilization of science laboratories, and teacher teaching methods. The study suggested the following recommendations:

- 1) Lecturers should enhance student attitudes toward chemistry to improve performance in chemistry by providing seminars and training about the chemistry field.
- 2) The University board should equip science laboratories, and science lecturers should use science laboratories to augment performance in chemistry.
- 3) Lecturers should opt for the best teaching method for their lectures to enhance performance in chemistry.

Abbreviations

SPSS	Statistical Package for the Social Sciences
SAC	Student Attitude Toward Chemistry
USL	Utilization of Science Laboratories
TTM	Teacher's Teaching Method

Author Contributions

Abdimalik Osman Hashi: Conceptualization, data collection, methodology, software, formal Analysis, writing – original draft, Writing – review & editing.

Abukar Osman Mohamud: Conceptualization, data collection, Formal Analysis, Writing – review & editing.

Abdullahi Mohamed Farah: Supervision, Writing – review & editing.

Conflicts of Interest

The authors declare no conflicts of interest.

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Research Field

Abdimalik Osman Hashi: Education, Chemistry, Biology, Ecology, Water, Environment

Abukar Osman Mohamud: Chemistry, Water, Civic education, Psychology, Biology, Analytical chemistry

Abdullahi Mohamed Farah: Material Science, Organic Chemistry, Analytical chemistry, Education, Water