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Attitudes of Students Towards Chemistry in Public Secondary Schools in Likuyani Sub-county, Kakamega County, Kenya

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This study investigated attitudes of students towards chemistry in public secondary schools in Likuyani Sub-county, Kakamega County, Kenya. The research used descriptive survey research design. The target population was all public secondary schools, all school principals, and all form four students in Likuyani Sub county. 12 schools were selected by stratified random sampling. 366 students were selected by simple random sampling. 68 teachers were also randomly selected from each school. Data was collected using questionnaires. The data was sorted, coded and analysed. Descriptive statistics was used to describe and summarise sets of data by using tables, frequencies, percentages, means and standard deviation. Independent t-test was used to test the hypothesis. The findings revealed that while students generally had a positive attitude towards chemistry, many also found the subject challenging and uninteresting due to its complex concepts.

Keywords: Attitudes, Chemistry, Public secondary schools, Kakamega

Introduction

Student's attitude toward chemistry can be understood as a reflection of their thoughts and feelings about the subject and related topics. According to Brown et al. (2014), it can be challenging to investigate students' attitudes about a particular issue. Research on student attitude, achievement, and the connection between these two factors is expanding. Research by Majid and Rohaeti (2018) showed that students' motivation and learning outcomes were enhanced by having a positive attitude toward studying.

In a similar vein, Kahu and Nelson (2018) concluded that a student's attitude plays a crucial role in determining their academic success. They contend that while there are other variables that affect students' academic performance, students are ultimately in charge of their education and actively participate in both the teaching and learning processes.

Students' attitudes toward science have an impact on their performance and learning outcomes because they determine feelings like liking or disliking scientific classes (Kurniawan et al., 2019). Such attitudes can either encourage students to pursue interests or similar fields of study, or they can discourage them from pursuing occupations requiring even a moderate level of proficiency in the topic (Recber et al., 2018).

Secondary students generally have a positive attitude toward science, however, a smaller percentage of pupils still have a negative attitude (Naiker et al., 2020a). Under these circumstances, student attention spans and attitudes toward scientific courses are improved in large part by the motivation of the teacher and the design of the learning process. A recent trend has been to look at more specialised science disciplines, like chemistry (Montes et al., 2018; Rüschenpöhler & Markic, 2020; Sharma et al., 2021).

This is a result of research showing a discernible decline in students' interest in and performance in particular science subjects (Vilia et al., 2017; Sharma et al., 2018). Numerous subjects, including mathematics, English, physics, and chemistry, have been the subject of studies on the impact of student attitude toward achievement (Vilia et al., 2017; Dimosthenous et al., 2020; Kaur and Vadhera, 2021; Sharma et al., 2021).

Research examining student success and achievement in chemistry has shown the detrimental effects of a number of problems, such as unattractive teaching strategies (Najid et al., 2021), students' disinterest in the subject (Majid & Rohaeti, 2018), and lack of enjoyment in the subject (Duangsri et al., 2017). Nonetheless, research has shown a relationship between academic success and students' favourable opinions on the subject of chemistry (Brown et al., 2015; Vilia et al., 2017; Kousa et al., 2018; Montes et al., 2018; Kenni, 2019; Wahyudiati & Rohaeti, 2020).

Further research by Fraser and Lee (2015) has suggested that although self-efficacy, motivation, and the learning environment are important contributors to student accomplishment, student attitude plays a substantial role as well. In an

effort to investigate the possible effects of these extra variables, a variety of research projects have been carried out to assess students' attitudes and/or academic performance in chemistry from various angles and dimensions, including gender-based disparities (Steegh et al., 2021), the impact of instructional strategies (Mwangi et al., 2020), students' self-efficacy (Kadioglu-Akbulut & Uzuntiryaki-Kondakci, 2021), and students' experiences with the subject (Kaur & Vadhera, 2021; Naiker et al., 2021).

Celik (2018), demonstrated that giving students an interactive and engaging learning environment only improved their performance provided the students had a favourable attitude toward the subject; otherwise, no gain in performance was seen. This emphasises how crucial it is for teachers to gauge and comprehend their students' attitudes toward chemistry.

Statement of the Problem

Researchers have worked to improve the Chemistry curriculum for secondary schools, but recent results show that achievement in Chemistry and other courses has remained consistently poor. Numerous factors, such as the student's socioeconomic situation, the availability of learning materials, the cultural environment, the size of the family, the student's vocabulary of scientific terminology, and computing, have been found to affect student accomplishment. Research on students' attitudes towards chemistry appears to be scarce.

When given the option, a lot of students in Kenya drop science classes and even those who do end up performing below average (Bitok et al., 2019; Malala et al., 2021). According to research findings and KNEC records, the mean scores for Chemistry are between 25% and 26%, while for biology and physics, they range between 27% and 32%. The entire performance is subpar, with chemistry being the weakest of all. The views that students have about chemistry could be the cause of this performance gap.

A number of studies have been conducted in Kenya to look at the potential causes of the low enrolment and poor performance in science. The bulk of the research focused on the strategies that teachers employed to teach mathematics and science. Arniezca and Ikhsan (2020) point out that student resistance may be the real reason behind most school failures rather than insufficient training. Musengimana, Kampire, and Ntawiha (2020) support this claim by pointing out that most students dislike the sciences, hence it is critical to take their emotions into account in addition to their thoughts.

Additionally, Do and Pham (2021) contended that rather than a lack of study skills, a student's attitude toward a subject determines how well they do in it. Each of these reasons emphasises how crucial attitudes are in determining whether or not success is achieved. This implies that in order to succeed, positive attitudes toward the sciences should be fostered. None of these studies was conducted in Kakamega County. Therefore, this study investigated attitudes of students in public secondary schools in Likuyani Sub-county towards chemistry.

Scope and Delimitation of the Study

The research confined itself to public secondary schools in Likuyani Sub-county in studying the attitudes of students towards chemistry. Furthermore, the study was limited to form four students.

Operational Definition of Concepts

Attitudes towards Chemistry: Students' thinking or feeling about chemistry as measured by an attitude scale.

Significance of the Study

The study offers insight to the compounding problem for some students not performing well in chemistry. Also, the study has come up with ways of improving attitudes of secondary school students towards chemistry.

Research Questions

The study was guided by the following research questions:

1. What are the attitudes of students towards chemistry?
2. Is there a relationship between students' gender and their attitudes towards chemistry?
3. Is there a relationship between teachers' gender and attitudes of students towards chemistry?
4. Is there a relationship between teachers' qualification and students' attitudes towards chemistry?

Research Hypotheses

1. There is a relationship between students' gender and their attitudes towards chemistry.
2. There is a relationship between teachers' gender and attitudes of students towards chemistry.
3. There is a relationship between teachers' qualification and students' attitudes towards chemistry.

Research Design and Methodology

Research Design

This study used the descriptive survey design. This design describes a situation or a population systematically. According to Creswell (1994), the descriptive method is used to gather information about the present existing condition.

Target Population

The target population for this study was all the public secondary schools in Likuyani Sub-county, Kakamega County. This comprised both day and boarding schools. The respondents comprised all the form four students. Form four students were chosen because they were in contact with a better section of the curriculum and provided information on attitudes towards the subject.

Sample and Sampling Procedures

The study selected 12 schools using the stratified random sampling technique because they are of different categories. The schools were categorised into three categories; single sex boys, single sex girls and mixed-day secondary schools. The sample included four boys' schools, four girls' schools and four mixed day secondary schools. Only form four students took part in the study. 366 form four students were selected randomly across the schools proportionate to the number of candidates per school.

Research Instruments

Structured questionnaires were used to collect quantitative data.

Validity of the Instruments

The validity of the instruments was checked by experts who read and gave feedback on the appropriateness of the questions, the respondents and the relevance of the questions to the research questions. They also checked if the language and instructions used were appropriate.

Reliability of the Instruments

Reliability of the measuring instrument was determined through the split-half method. In split half, a measure is split into two parts, each of them is treated as a separate scale and scored accordingly. Results of the findings were compared using the spearman's brown prophecy formula as follows:

$$\mathrm{r} = \frac{2 \times \text{correlation between the halves}}{1 \times \text{correlation between the halves}}$$

$$r = \frac{2 \times r}{1 + r}$$

The results achieved a correlation coefficient of 0.76 for the questionnaire administered to students.

Presentation and Discussion of the Findings

Introduction

This chapter presents the following sections: demographic information of students and teachers, attitudes of students towards chemistry, the relationship between selected variables and students' attitudes towards chemistry and test of hypotheses.

Demographic Characteristics of Students and Teachers

The study sought to find out the gender distribution of the students, to which the results indicated that the majority of students in public secondary schools in Likuyani Sub-county were female, represented by 65.4%, whereas male students were 34.6% as shown in Table 1.

Table 1

Students' Gender

Students' Gender	Frequency	Percentage (%)
Male	94	34.6
Female	177	65.4
Total	271	100

The study also sought to establish the gender distribution of teachers, the results of which indicated that majority of the chemistry teachers in public secondary schools in Likuyani Sub-county were male, represented by 73.1%, whereas only 26.9% were female as shown in Table 2.

Table 2

Teachers' Gender

Teachers' Gender	Frequency	Percentage (%)
Male	26	73.1
Female	9	26.9
Total	35	100

The teachers' qualifications were also investigated; indicating that majority of the teachers had bachelor's degree qualifications, represented by 80.8%, whereas 19.2% had master's qualifications. None of the teachers had higher qualifications or qualifications below a bachelor's degree, as shown in Table 3.

Table 3

Teachers' Academic Qualifications

Teachers' Qualifications	Frequency	Percentage (%)
PhD	-	-
Masters	7	19.2
Bachelors	28	80.8
Diploma	-	-
Total	35	100

Students' Attitudes towards Chemistry

Further, the study determined the attitudes of students towards chemistry in public secondary schools in Likuyani

Sub-county. The respondents were provided statements to indicate their level of agreement or disagreement, whether they strongly agreed, agreed, were undecided, disagreed or strongly disagreed. Table 4 shows the findings respective to students' attitude towards chemistry.

Table 4

Students' Attitude towards Chemistry

Statements	SA	A	U	D	SD	Mean	Std. Dev.
I enjoy learning chemistry	167 (61.5%)	66 (24.4%)	28 (10.3)	10 (3.8%)	0	1.56	.831
I don't like chemistry because there are too many concepts in chemistry	24 (9.0%)	24 (9.0%)	17 (6.4%)	69 (25.6%)	136 (50.0%)	3.99	1.324
Learning chemistry is not interesting	17 (6.4%)	24 (9.0%)	24 (9.0%)	49 (17.9%)	156 (57.7%)	4.12	1.269
Every student should study chemistry	180 (66.7%)	45 (16.7%)	10 (3.8%)	7 (2.6%)	28 (10.3%)	1.73	1.296
Learning chemistry is a waste of time	7 (2.6%)	0	17 (6.4%)	24 (9.0%)	222 (82.1%)	4.68	.814
I encourage my siblings to study chemistry	188 (69.2%)	56 (20.5%)	10 (3.8%)	4 (1.3%)	14 (5.1%)	1.53	1.016
I encourage my fellow students to allocate enough time for chemistry revision	163 (60.3%)	69 (25.6%)	35 (12.8%)	0	4 (1.3%)	1.56	.815
Practicals make chemistry difficult	10 (3.8%)	14 (5.3%)	10 (3.8%)	52 (19.2%)	184 (67.9%)	4.42	1.051
I would like to pursue a chemistry-related course in future	184 (67.9%)	52 (19.2%)	17 (6.4%)	10 (3.8%)	7 (2.6%)	1.54	.963
I encourage my fellow learners to like chemistry	191 (70.5%)	66 (24.4%)	10 (3.8%)	4 (1.3%)	0	1.36	.624

The findings indicated that students have varied attitudes towards chemistry. In large part, 167 (61.5%) of the respondents agreed that they enjoy learning chemistry, 180 (66.7%) also agreed that every student should study chemistry, a further 188 (69.2%) indicated that they encourage their siblings to study chemistry, 163 (60.3%) indicated that they encourage fellow students to allocate enough time for chemistry revision, 184 (67.9%) indicated that they would like to pursue a chemistry-related course in future and 191 (70.5%) indicated that they encourage fellow learners to like chemistry. However, 136 (50.0%) indicated that chemistry has many concepts which make it unpleasant, 156 (57.7%) indicated that learning chemistry is uninteresting, 222 (82.1%) indicated that learning chemistry feels like a waste of time, and 184 (67.9%) were of the opinion that chemistry practicals make the subject difficult. These results revealed that in public secondary schools in Likuyani Sub-county, despite there being a positive perception of chemistry among students, the teachers and principals still have to motivate students whose attitude towards the subject is low to make them like it, as well as improve on delivery of content to make its concepts easily understood.

Tests of Hypotheses

The following null hypotheses were tested at 0.05 significance level.

> H_{01}: There is no significant difference between mean attitude towards chemistry scores of boys and girls.
>
> H_{A1}: There is a significant difference between mean attitude towards chemistry scores of boys and girls.

The null hypothesis was tested using t-test. The results are presented in Table 5.

Table 5

t-Test Results Comparing Mean Attitude towards Chemistry between Boys and Girls

	Students' Gender	n	Mean	Std. Dev.	t	Sig.
Mean Attitude	Boys	94	41.32	4.378	16.657	.002
	Girls	177	29.28	6.235		

The results of the t-test revealed a significant difference in mean attitude scores between boys (M = 41. 32; SD = 4.378) and girls (M = 29.28; SD = 6.235), with t (271) = 16.657, p = .002 at the 0.05 significance level. This suggests that boys have significantly more positive attitudes towards chemistry than girls. The researcher rejected the null hypothesis, supporting the alternative hypothesis that there is a relationship between students' gender and their attitudes towards chemistry

Mean Students' Attitudes towards Chemistry by Teachers' Gender

> H_{02}: There is no significant difference between mean attitude towards chemistry scores of students taught by female and male teachers
>
> H_{A2}: There is a significant difference between mean attitude towards chemistry scores of students taught by female and male teachers.

Table 6 shows the mean students' attitudes towards chemistry by teachers' gender.

Table 6

t-Test Results Comparing Mean Attitude towards Chemistry between Boys and Girls

	Teachers' Gender	n	Mean	Std. Dev.	t	Sig.
Mean Attitude	Male	26	47.35	2.019	6.531	.002
	Female	9	42.89	0.333		

The results of the t-test revealed that there was a significant difference in mean attitude of students' attitudes towards chemistry between students taught by male teachers ($M = 47.35; SD = 2.019$) and female teachers ($M = 42.89; SD = .333$) with $t(35) = 6.531$, $p = .002$ at 0.05 significance level. The researcher rejected the null hypothesis. Hence, there is a relationship between teachers' gender and students' attitude towards chemistry.

Mean Students' Attitudes towards Chemistry by Teachers' Academic Qualification

> H_{03}: There is no significant difference between mean attitudes towards chemistry scores of students taught by teachers of different academic qualifications.
>
> H_{A3}: There is a significant difference between mean attitude towards chemistry scores of students taught by teachers of different academic qualifications.

Since there are only two levels of the independent variable, the null hypothesis was tested using t-test. The results are presented in Table 7.

Table 7

t-Test Results Comparing Mean Attitude towards Chemistry Scores of Students Taught by Teachers of Different Academic Qualifications

	Teachers' Gender	n	Mean	Std. Dev.	t	Sig.
Mean Attitude	Master's	7	50.00	.000	6.178	.000
	Bachelor's	28	45.25	2.012		

The results of the t-test revealed that there was a significant difference in mean attitude of students' attitudes towards chemistry between students taught by teachers with master's degree ($M = 50.00; SD = .000$)and teachers with bachelor's degree ($M = 45.25; SD = 2.012$)$with t(35) = 6.178, p = .000$ at 0.05 significance level. The researcher rejected the null hypothesis. Hence, there is a relationship between teachers' academic qualifications and students' attitude towards chemistry.

Summary, Conclusion and Recommendation

Summary

This study investigated the attitudes of public secondary school students towards chemistry in Likuyani Sub-county, Kakamega County, Kenya. A descriptive survey design was used to sample 12 schools, 366 students, and 68 teachers. Data was collected using questionnaires and analysed using descriptive statistics and t-tests.

The results indicated that, while students generally had a favourable view of chemistry, a significant number perceived the subject as complex and uninteresting due to its challenging concepts. The analysis revealed a significant difference in attitudes between genders, with boys having more negative attitudes than girls. However, there was no significant difference in students' attitudes based on the gender or qualifications of their teachers. Instead, factors such as teaching methods, learning environment, and teacher-student interactions may also influence students' attitudes towards chemistry.

Conclusion

The study's results suggest that students overwhelmingly have favourable views towards chemistry, since a significant number of them express pleasure and a strong inclination to pursue chemistry-related courses in the future. A significant proportion of participants also indicated their promotion of chemistry education and their commitment to its ongoing improvement. Nevertheless, there is a prevailing belief that chemistry can be difficult because of its multitude of principles, leading to many students perceiving the topic as dull and the practical aspects as demanding.

The study found a significant influence of gender on students' attitudes towards chemistry. The statistically significant difference in mean scores indicated that boys had more negative attitudes than girls. However, there was no significant difference in students' evaluations of chemistry based on the gender of their teachers. Additionally, the qualifications of teachers did not significantly predict students' attitudes. These findings suggest that factors such as teaching methods, learning environment, and teacher-student interactions have a greater influence on students' views of chemistry.

In general, the results emphasise the intricate nature of attitudes towards chemistry, in which students' experiences and evaluations of the topic are influenced by both internal and external elements.

Recommendations

To enhance students' attitudes towards chemistry, the following recommendations are proposed based on the findings:

1. .Optimise Student Engagement via Interactive Teaching Methods: Given the varying perceptions among students regarding the complexity and level of interest in chemistry, educators should integrate more interactive and student-centred teaching approaches, including practical experiments, real-world applications of chemistry, and collaborative activities. This approach has the potential to enhance the subject matter's appeal and relevance, therefore mitigating unfavourable perceptions, especially among students who find it disagreeable.

2. Advocate for Positive Gender Dynamics in Chemistry Education: Considering the notable disparity in views between males and females, educational institutions should prioritise the establishment of an all-encompassing learning atmosphere that fosters meaningful involvement of both genders in the field of chemistry. The implementation of gender-responsive approaches, such as mentoring programs or gender-based peer support groups, might effectively tackle the particular obstacles encountered by boys, who displayed more unfavourable views towards chemistry.

3. Simplify Chemistry Practicals: A significant number of students encounter difficulties during chemistry practicals, which negatively impacts their attitudes. Minimising the complexity of practical tasks, guaranteeing sufficient resources, and offering detailed instructions can effectively alleviate tension. Integrating cutting-edge technologies and virtual laboratories can enhance the accessibility and engagement of practical exercises.

4. Enhanced Teacher-Student interactions: Given that elements such as teacher feedback and assessment have a greater impact on students' attitudes than teacher qualifications, it is imperative to cultivate favourable teacher-student interactions. Instructors should deliver constructive criticism, provide individualised assistance, and establish a supportive environment that inspires students to excel in chemistry.

5. Promote Recognition of the Significance of Chemistry: In order to challenge the stereotype that chemistry lacks appeal or is a futile use of time, educational institutions and instructors should emphasise the practical significance of chemistry in real-life scenarios and professional prospects. Engaging guest speakers from chemistry-related disciplines or arranging career seminars could enhance students' understanding of the subject's significance and stimulate their enthusiasm for future exploration.

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