
GENDER DIFFERENCES IN SECONDARY SCHOOL CHEMISTRY ACHIEVEMENT: A CASE STUDY OF MUZAFFARABAD, AZAD JAMMU AND KASHMIR

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ABSTRACT

This paper investigates gender differences in chemistry results of public secondary schools in Muzaffarabad, Azad Jammu, and Kashmir. The ninth-grade board results were data from the 17 public schools operating in the Muzaffarabad Municipal Corporation area, Azad Jammu and Kashmir. A sample size of 300 students was drawn using a stratified random sampling technique from these schools. Researchers used an independent t-test sample for a comparative study of the chemistry results for selected students. The P-value for boys was 0.13, and the P-value for girls was 0.10, below the significance level. The study findings revealed that girls performed significantly higher in secondary school chemistry than boys. This research study is the first of its kind in the Azad Kashmir region, making way for large-scale studies of similar nature in Azad Jammu and Kashmir to develop a research database for an underreported and understudied region in the future.

KEYWORDS

Chemistry achievement, Gender differences; Public schools

INTRODUCTION

Chemistry is an essential discipline in the secondary school curriculum in Pakistan, and its importance in education is widely recognized. It is worth emphasizing that chemistry, along with other science, and technology disciplines, is taught in highly developed, industrialized, and technologically advanced societies (Burmeister, 2012). Teaching and learning science play substantially in the technological advancement of developing nations. Chemistry is embedded in our lives and society and has significant economic, ecological, and societal influence (Hofestein, 2011). The teaching of chemistry is considered necessary for secondary school science students in Pakistan. In a modern world, girls and boys learn essential sciences in schools. Interestingly, despite the importance of chemistry to humankind and the efforts of researchers to enhance the teaching-learning of chemistry, studies identify a difference in students' chemistry achievement in schools. Many researchers found that gender significantly influences the performance of chemistry students. Some variables can be used to predict student performance in chemistry, and gender is considered one of them. (Francis & Monisola, 2013). Busolo (2010) explored a positive correlation between students' gender and achievement in chemistry. Busolo (2010) identified gender as strongly associated with chemistry achievement.

Pakistan, a developing economy, needs to encourage the participation of both genders in science and technology learning. This study explores gender role in the academic performance of secondary students in chemistry in selected public schools of Muzaffarabad, Azad Kashmir. A sample for this study was selected from a population of public secondary school students. This article is organized under the headings of the literature review, the study's objectives, the research questions followed by the significance of the study, delimitations, the research design, the findings, the discussion, and the conclusion. The literature review in the next section reveals that researchers have already established the role of gender in students' achievement.

LITERATURE REVIEW

The issue of sex differences in education is a highly researched area, i.e., the comparison of girls' and boys' characteristics and performance on various education considerations. As WHO (2014) characterizes sex as the biological and physical traits of men and women, the term gender defines social, economic, political, and cultural characteristics associated with being men and women. This is intriguing to notice that all societies have conventional notions of gender that discriminate against girls (Global Monitoring Report, 2002). An investigation involving the data from the Trends in International Mathematics and Science Study (TIMSS) explored primary-level students' performance on global assessments, indicating gender differences in reading favoring girls (OECD, 2009). In secondary school, girls' average scholastic and mathematical performances are higher than boys. Gender has a significant influence

on students' chemistry performance. Certain factors could predict students' chemistry performance, and gender is one of those variables (Francis & Monisola, 2013). It is found that the boys' attitude is less study-oriented than that of girls'. Consequently, female students performed better than male students at the secondary level. This achievement difference in secondary school chemistry can be associated with the gender of the students (Houtte, 2004).

Academic achievement displays knowledge attained and examination scores or marks assigned by the teachers. Achievement is a task-based behavior that evaluates an individual's performance with respect to some external or internal criterion. This includes competition among the individuals in terms of excellence (Algarabel and Dasi, 2001). Yamtinah, Masykuri, Ahadi, and Shidiq (2017) investigated gender differences in the attitude of students toward science. They revealed that, in general, boys and girls showed similar scientific attitudes. They found that male students were sharp at observation while female students performed better in conceptual knowledge and data interpretation. Bang and Baker (2013) investigated gender differences in scientific achievements and the attitude of secondary students. They showed that male and female students in coeducational schools had significant positive attitudes and high scientific learning achievement levels. According to Kashu (2014), boys' performance was found to be better than girls in science and arithmetic. He justified that the institutes created for girls appear not to give an advantage to girls. Busolo (2010) found a positive relationship between the gender of the students and their chemistry achievement. According to him, gender is highly related to student achievement in chemistry. His work revealed that boys scored more than girls in chemistry because boys have a strong affinity and interest in chemistry.

Bursal (2013) investigated science achievement and gender differences at the elementary level. He found out that science achievement decreased as the grade level increased. He stated that while both genders lowered their science scores as they progressed to a higher level, girls achieved high scores in science than boys at the elementary level, and that was due to girls' increased interest in science. Boys scored higher in chemistry than girls at the secondary level. Boys show a more positive attitude towards chemistry than girls (Cheung, 2009). Adane, Hailemariam, and Girmadadi (2017) emphasized that girls were affected by various external and internal factors. They referred to internal factors such as school and external factors such as parents: internal factors comprised of the dearth of tutorial classes and laboratory teaching approach. The lack of awareness regarding the benefits of a tutorial class for girls also affects their performance in chemistry at the secondary level. Sempala (2005) investigated the role of gender in the students' performance in practical courses in chemistry. He found girls' performance slightly better than boys, but girls showed low self-confidence in performing chemistry practicals. Boys recorded and interpreted the

results more accurately than girls, indicating that boys performed better in practical chemistry courses than girls. Velo, Hong, and Lee (2015) inquired about gender differences in chemistry achievement and self-regulated learning. They found that boys scored significantly better in chemistry than girls, but no differences were found in the self-regulated learning approach.

Heng and Karpudewan (2014) studied gender and attitude towards chemistry learning at the secondary level. The study showed that the gender and class levels substantially affected the attitudes of secondary school students toward learning chemistry. Their study showed girls having a more positive attitude toward learning chemistry than their male cohorts. The study compares the chemistry achievement among male and female students in secondary schools. This domain includes gender disparities and how these differences affect students' chemistry achievement at the secondary level. The present study also examined the difference in student achievement. According to the literature, chemistry is an important subject that can be taught at the secondary level since it provides many opportunities to foster scientific discipline and trains students to develop thinking, observation, and reasoning skills. It provides learners with knowledge of chemical facts. Therefore, it is necessary to understand the chemistry concepts at the secondary level.

Gender is a strong predictor of achievements of both genders at the school level. Previous studies also suggest that certain factors influence students' high and low chemistry achievement at the secondary level, and gender is the most important (Francis & Monisola, 2013). Busolo (2010) found a positive relationship between learners' genders and achievement in chemistry. According to him, gender is strongly associated with chemistry achievement. It is significant for a developing country such as Pakistan to involve both genders in advancements in science and technology. Thus, studying the differences in both genders' achievement in chemistry at secondary school is significant. This study highlighted the achievement gap of public school students in chemistry at the secondary level. The research findings will also provide guidelines to chemistry teachers on the intervention strategies suggested for improving the boys' and girls' achievements in chemistry and reducing the gender gap in chemistry achievements. This research is also an opportunity for future researchers who want to contribute to science education and chemistry teaching. Current research was limited to Municipal Corporation Muzaffarabad public schools, Azad Jammu, and Kashmir. The 17 public schools were selected as data collection sites, of which 9 were girls' schools, and eight were boys' schools.

RESEARCH OBJECTIVES

1. Comparison of the performance of boys and girls in chemistry at the secondary level in the public schools of district Muzaffarabad.

2. What is the difference in the achievement of male and female students in chemistry at the secondary level?

RESEARCH QUESTIONS

1. What is the performance of boys in secondary school chemistry?
2. What is the performance of girls in secondary school chemistry?
3. What is the difference between the achievements of both sexes in chemistry at secondary school?

RESEARCH HYPOTHESES

1. There is no difference in achievement between male and female students in chemistry at the secondary level.
2. There is a difference in achievement between male and female students in chemistry at the secondary level.

RESEARCH METHODOLOGY

This study used a quantitative research method to explore the gender-based comparison of the achievement of secondary-level chemistry students in the Muzaffarabad district. This study investigated comparative gender achievements in the subject of chemistry for secondary-level students in public schools of Muzaffarabad, Azad Kashmir.

Research Design

The research is a descriptive survey designed by collecting data from different schools, and the study was numerically explained. The variables considered in the study were the gender of the students and their academic achievements in chemistry.

Population

All 10th-grade students from public sector schools in Muzaffarabad, Azad Kashmir, were the population from which a sample was taken. The total number of students enrolled was 833 - of which 465 were boys and 368 were girls. The study targeted all 17 secondary public schools with an estimated population of 833 Students. The enrollment shows that there are 465 boys and 368 girls.

Sample

A sample size of 300 students was selected from 17 public schools in Muzaffarabad, of which 169 were male and 131 were female. The sample was selected from the list of populations through a sampling-generating site. For sampling, stratified random sampling techniques were used, and students were randomly selected, as it is an impartial technique and all members of the population have equal chances of being selected.

Sample size

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

The procedure used to select the sample and collect data is given below

The study area was limited to public secondary schools in the municipal corporation area of Muzaffarabad Azad Kashmir, in which all 17 secondary schools were selected (8 boys' secondary schools and nine girls' high schools). Principals were formally contacted and requested to provide data for the study through department-approved consent forms. The students in these schools were selected using stratified random sampling. The researchers personally visited the selected schools and met principals at scheduled appointments. For this purpose, the researchers developed a consent letter for the principals. They responded positively and allowed the researchers to collect data from the school. The researchers collected published gazettes of the ninth-grade board exam to compare the results in the chemistry of selected students of both genders.

Data Analysis

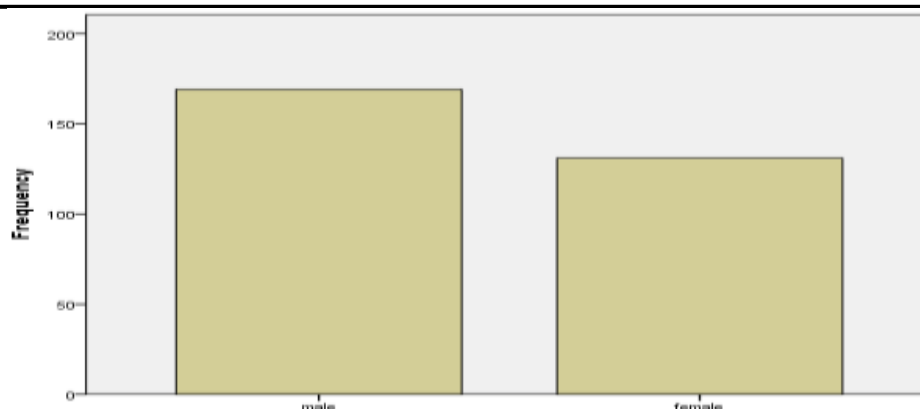
Two research questions guided this study. The student achievement result was analyzed with the help of SPSS. The independent-sample t-test was used to determine differences in boys' and girls' chemistry results at secondary school. Analysis was performed using the independent sample t-test. The analyses and interpretations of the data led to conclusions and recommendations.

FINDINGS AND RESULTS

Table 1 indicates the percentage distribution of male and female and female students. A total of 300 students were taken as a sample for the study (169 boys and 131 girls). 56.3 percent of the respondents were male students, and 43.7 percent were female.

Table 1.

Gender	Frequency	Percent
Male	169	56.3
Female	131	43.7
Total	300	100.0



Distribution of Marks in Chemistry

Table 2 indicates the distribution of respondents according to their individual chemistry achievements on the ninth-grade board examination. Twenty-three students' marks were below 33%, 35 students achieved between 33-44%, 83 students' achievement was between 45-59%, 137 secured between 60-79%, while 22 students got 80% and above in chemistry. It shows that most students achieved between 60-79% in chemistry.

Table 2.

Marks	Frequency	Percent	Cumulative Percent
Below 33%	23	7.7	7.7
33-44%	35	11.7	19.3
45-59%	83	27.7	47.0
60-79%	137	45.7	92.7
80% and above	22	7.3	100.0
Total	300	100.0	

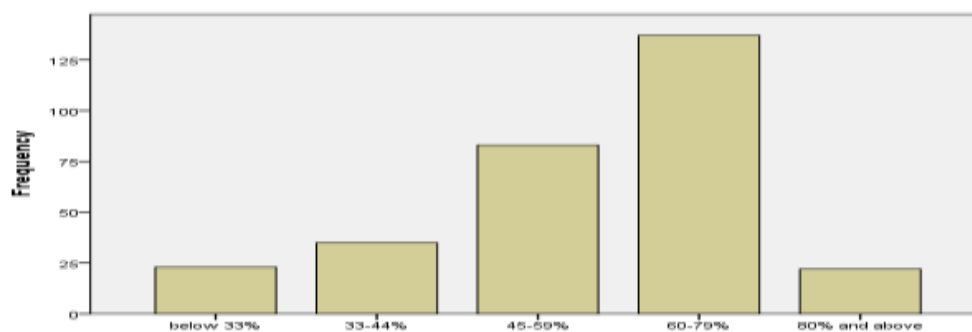


Table 3.Level of significance: $\alpha=0.05$

Independent sample t-test comparing the difference in the achievement of boys and girls in secondary school chemistry

Variable	Group	N	Mean	SD	T	Degree of freedom	P-Value
Marks	Boys	169	34.047	11.59	-2.512	298	0.13
	Girls	131	37.145	9.150	-2.587	297.8	0.10

Interpretation: To test this hypothesis that there is no difference in achievement between male and female students in chemistry at the secondary level, the researchers used an independent sample t-test. The P-value for boys is 0.13, and for girls, the P-value is 0.10, which is less than the level of significance of 0.05. Therefore, the researchers did not accept H_0 and concluded that there was a significant difference between the achievement of boys ($M = 34.047$, $SD = 11.59$) and the girls ($M=37.145$, $SD=9.150$). The P-value (0.10) and the mean score of girls suggests that the girls achieved higher than boys in secondary school chemistry board exams.

Comparison of Participants' Achievement in Chemistry

Data analysis revealed that male students scored significantly lower than female students in secondary school chemistry on the annual board exam in grade IX. It was found that the total mean score of girls is higher (37.145) than boys' mean score (34.047) in chemistry at the secondary level. The above findings align with Houtte's (2004) study, which identifies girls as higher achievers than boys. On the other hand, these findings are contrary to Busolo's (2010) findings, which found boys' achievements higher than girls in chemistry. Yamtinah et al. (2017) found that both genders have similar results.

DISCUSSION

This study examined a gender-based comparison of students' achievement in chemistry at the secondary level in the public schools of Muzaffarabad. The achievement in chemistry obtained by the boys and girls in the annual board examination was compared. The study's objectives were to compare male and female students' achievement in secondary school chemistry. The study was conducted in 17 public schools in the Muzaffarabad Municipal Corporation area. 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 out of 833 students was selected. 169 out of 300 were boys, and 131 were girls. The researchers personally visited the selected schools and collected chemistry results in the 9th-grade 9th annual board examination, published through the annual result gazette. The data produced in this study was quantitatively analyzed.

Mean scores and standard deviations were calculated for the student results in chemistry. An independent sample t-test was performed to analyze the results of the chemistry achievement of the participants to determine the difference in the achievement of boys and girls. Most studies report a gender-based difference in students' chemistry achievement (Francis & Monisola, 2013). Some researchers revealed that boys perform better in chemistry than girls (Busolo, 2010), while others reported that girls' chemistry achievement is higher than boys (Bursal, 2013). This study found that girls perform better in chemistry in Muzaffarabad's public schools ($M=37.145$) than boys ($M = 34.047$). An independent sample t-test demonstrated a significant difference in chemistry achievement based on gender. The main general finding was that the gender difference in chemistry achievement was identified, and it was indicated that girls' achievement in chemistry is significantly higher than boys' achievement.

On the basis of the findings and discussions, there exists a gender difference in the achievement of students in chemistry at the secondary level in the public schools of Muzaffarabad, Azad Kashmir, and female students from the public sector achieved significantly higher in chemistry as compared to male students of the public schools of Muzaffarabad Azad Jammu and Kashmir.

RECOMMENDATIONS

Gender gap is a significant area of research in education, further studies are recommended to explore the findings of this study.

The findings of this study are limited to secondary schools of the municipal corporation of Muzaffarabad Azad Kashmir. So there is a need to conduct similar research on a larger scale primarily in rural areas.

Studies might be conducted in other regions to explore the factors, other than those studied in the present study, correlated to students' high/low chemistry achievement.

Factors that are explicitly related to gender should also be explored.

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