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**Role of Demonstration Method in learning Chemistry:
A Study of Students' Perception in Islamabad-Rawalpindi**



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Abstract

Science is all about exploring and understanding the world around us. It's a backbone behind every innovation in medicine, technology and every other field of life. When it's comes to learning science, demonstration is the superpower tool for it. They make highly complex ideas more easy and understandable in subjects like chemistry, biology and physics. By demonstrating how things work in real life and it's resolve many confusion that's created in our mind. This study explores the perceptions about demonstration method in achieving the science learning outcomes specifically in the subject of chemistry. The objectives for the study to find out students' perception of using demonstration method in achieving learning outcome in chemistry. This study is fully based on descriptive and qualitative in nature. This study includes the 10 sample institutes in Rawalpindi and Islamabad, Pakistan that's contain 200 secondary school students specially in the subject of chemistry and that's includes 5 institutes from Islamabad and 5 institutes from Rawalpindi, Pakistan. With the help of questionnaire as research instrument, the data is collected through random sampling technique and analyzed the data through SPSS. This study revealed that most of the students prefer demonstration method than others teaching methods. This study suggests that incorporating demonstrations into science education can enhance more engagement, attitude and interest in students and it will be highlighting the student-centered and experimental strategies for the educators and policy makers.

Keywords: Student Perception, Demonstration Method, Learning Outcomes, Chemistry, Higher Secondary Level, Teaching Methods, Practical Learning, Classroom Instruction.

INTRODUCTION

Chemistry can be a tough subject, but it is also very interesting when you get the opportunity to see it in action. It is a very important period in higher secondary education when students are able to grasp such complex ideas. This is where effective methods come in. One of the best methods is using demonstrations. It is a very effective way of making the abstract concrete and engaging the students. By seeing how things work in real life, students find the lessons more engaging and fun. They grasp and understand what they are being taught much better. (Stroumpouli et al., 2022).

Demonstration is a significant technique in the science learning and teaching process, where it is used to make concepts easy and memorable for students, thus enabling them to learn concepts more efficiently. A good demonstration strategy is one that ensures a student-centered activity is created, where students are placed at the core of the learning and teaching process, and the role of the teacher is that of a facilitator. For this purpose, a good demonstration strategy is one that ensures students are motivated to carry out the experiment themselves by asking questions, brainstorming, and conducting debates. (Sari et al.,2024).

Teaching alone is not the task of a teacher; a teacher has to put more emphasis on the learning process too. The knowledge that the students learn in schools has to be used in the survival of the students and the provision of life. So, education is not just limited to science alone. Learning in schools is done through the application of different learning methodologies to uncover the potential that has not been tapped in the students, making the learning experience thrilling and enjoyable for the students. So, the teachers have to be knowledgeable about different learning methodologies. (Mudzakkir, M., & Darmawan, D. 2024).

The demonstration in teaching the concept of science is successful since it is conducted in a manner that ensures easy understanding of the concepts. This is particularly successful in teaching language, where students are given a clear example of how language is used in real-life situations. This concept is successful in that it supports the constructivist learning theory, where it is assumed that students learn better when they are actively engaged in class and when they can relate concepts to real-life experiences. During the entire learning process, the demonstration method was successful in enhancing student understanding and interest. It was successful in bridging the gap between concepts and real-life implementation, thus enhancing student engagement in class. Students gradually demonstrated improvements in their performance. This method is successful in enhancing overall academic success. (Vinko et al., 2020).

The demonstration technique, where the teacher shows students through a specific activity or concept with explanations, can sometimes be used as a whole teaching approach or as a teaching strategy. This technique enables students to observe and understand while the teacher explains the activity or concept first, then shows them through the activity or concept in steps, and finally, students are encouraged to practice what they have observed. This practice helps in molding

students' understanding and behavior. (Loiser et al., 2022).

Demonstrations give students access to information and real-world experiences that enhance the significance of learning. Teaching practical skills, relating theory to practice, and maintaining student interest are all made easier with this approach. Additionally, it aids in the development of observational skills, progress tracking, and task performance confidence. (Jones et al., 2024).

PROBLEM STATEMENT

Many students struggle to grasp the concepts in sciences specially in chemistry through traditional lecture methods. This often results in low academic performance, poor conceptual understanding, and low interest in the subject. The demonstration method, which involves visually showing scientific processes and experiments, is believed to enhance students' comprehension and engagement. In this study, the researcher highlighted the student's perceptions of demonstration method in achieving learning outcomes in the subject of Chemistry at higher secondary level in Twin cities.

RESEARCH OBJECTIVES

1. To find out students' perception of using demonstration method in achieving learning outcomes in chemistry.
2. To evaluate the effectiveness of the demonstration method in achieving learning outcomes in chemistry.

RESEARCH QUESTIONS

1. What are students' perceptions of using the demonstration method in achieving learning outcomes in chemistry?
2. How effective is the demonstration method in achieving learning outcomes in chemistry at the higher secondary level?

RATIONALE OF THE STUDY

Demonstrations in natural science subjects like chemistry help make abstract ideas or concepts more understandable by showing real-life examples. They engage students actively, improving their interest and motivation. This hands-on approach enhances both theoretical knowledge and practical skills. Various researches show that demonstrations enhance comprehension, involvement, and recall. They foster curiosity, enhance problem-solving skills, and establish an engaging learning atmosphere. Their influence is further increased by using digital simulations. However, student involvement, instructor skill, and resources all affect how effective

they are. This study will be examining the impact of demonstration to improve chemistry education and also its show how the demonstration is effective to enhance the student's outcomes.

REVIEW OF LITERATURE

Numerous studies have examined how well the demonstrative technique works to meet learning objectives in chemistry. Demonstration has been seen to have a positive impact on students' understanding, motivation, and participation in their science lessons. In this section, relevant research on the role of demonstrations in the teaching of chemistry, their impact on students' learning, and factors affecting their impact will be discussed. Demonstrations provide the link between the theoretical and the practical. The enhancement of conceptual understanding in science requires practical work, which is carried out by the teacher in demonstrations. Also, point out the fact that demonstrations make abstract concepts concrete by allowing students to observe the chemicals' reactions. According to research, students' recall of learned concepts is greatly promoted by their witnessing the experiments rather than hearing about them. (Kelley & E. W. 2020).

The impact of demonstrations on the achievement of chemistry students has been the subject of a number of studies. Discovered that the demonstration has a positive influence on the development of the problem-solving skills of chemistry students and promotes the learning of inquiry skills. Students who were taught chemistry through demonstrations performed better than those who were taught chemistry through conventional teaching methods. In addition, students who were exposed to the learning of chemistry through the demonstration method were more engaged in the learning activity and had a conceptual understanding of the chemistry they were learning, according to a study that used a meta-analysis technique. According to the study, well-planned demonstrations may help in the dispelling of myths in chemistry by offering tangible evidence of the science in question. (Bello et al. 2023).

According to the Oloje, M. (2024) The effectiveness of the demonstration method in enhancing the learning results of secondary school students in chemistry was assessed. The results showed an increase in the percentage of correct answers from 29% to 84%. This indicates that students who are taught through demonstrations have a better comprehension of the subject. This shows that demonstrations in chemistry are effective in enhancing students' academic performance. Teachers'

perceptions regarding the effect of chemistry demonstrations on students' attention and comprehension were also assessed. The study involved 81 teachers from primary and secondary schools. The study showed that demonstrations are effective in enhancing students' interest in chemistry. Demonstrations are also effective in enhancing the quality of chemistry lessons. According to the study, demonstrations are effective in helping students understand difficult chemistry concepts. Lectures with demonstrations are effective in enhancing students' recall and problem-solving skills more than lectures without demonstrations. This shows the effectiveness of demonstrations in teaching chemistry, as demonstrated in the past.

In the case of science education, demonstration is a vital tool since it assists learners in picturing intricate ideas and procedures that may be hard to comprehend simply by theoretical knowledge. It makes the learning experience more valuable and captivating by filling the gap between theoretical knowledge and practical applications. Through the demonstration of science ideas, learners are fascinated, encouraging them to conduct in-depth research on the ideas. Furthermore, the demonstration of learning procedures assists in the development of scientific thinking in learners. Overall, demonstration enhances learning, participation, and retention in science lessons. (Pangaribuan, et al., 2022)

RESEARCH METHODOLOGY

This study will be quantitative and descriptive in nature. For the purpose of this study, the population consists of 203 higher secondary level institutes which are affiliated with federal board of intermediate and secondary education in Rawalpindi and Islamabad. The researcher is delimited their study due to time & lack of resources for their research work and the delimitation of their study are as follows:

- Colleges affiliated with FBISE only
- Only 12th class students

3.3 SAMPLE FOR THE STUDY

The sample of the study will be drawn with the help of random sampling technique and consist of 200 students from twenty higher secondary institutes which are affiliated with FBISE in Rawalpindi & Islamabad. The sample size is selected by using L.R. Gay and the collection of data using by convenient sampling method.

Table 1.1: Sample of the study

Sr.no	Level	No. of Institute	No. of students	Affiliation
1	HSSC	10	200	FBISE

RESEARCH INSTRUMENT

For efficient and reliable data collection a questionnaire will be used as research instrument developed by researcher himself with proper validation of expertise, the questionnaire consists of five sections. The first section contains demographic information; section B contain items related to students' perceptions of demonstration method. Research instrument contain 8 items with five options to choose from "strongly agree, agree, neutral, disagree, and strongly disagree". The students are allowed to select any option based on their past experiences.

DATA ANALYSIS

After the data collection from sample institutes, the data was coded, entered, cleaned and analyzed by the using of SPSS. An appropriate statistical analysis was conducted according to the variables of the study. Descriptive and inferential analysis was carried out for this study and result was presented in the tabulated forms.

RESULT AND FINDINGS**Table 1.2: Perceptions about Demonstration Method**

Item	SDA	DA	N	A	SA
	Percentage				
Demonstrations enhance chemistry subject in the understanding of the concepts.	12	06	17	30	35
Demonstrations make chemistry lesson more interesting for me.	03	06	16	46	30
Demonstration method makes learning more active when I watch demonstrations in class.	03	09	15	45	29
Demonstrations help me	01	06	15	46	33

stay focused in class.

I understand better when the teacher shows experiments.

Students prefer demonstrations more than only listening to lectures.

Demonstrations make me curious to know more about chemistry.

Watching experiments makes enjoy more than just reading from the book.

02	06	16	50	26
01	07	28	30	35
03	07	15	39	36
01	08	25	28	38

Table 1.2 Provides data on students' perceptions about demonstration method. The responses were measured on a Likert scale ranging from Strongly Disagree (SDA) to Strongly Agree (SA). Here is the interpretation of each item:

The majority of 35% of students strongly agreed, 30% agreed, 06% disagreed and 12% strongly disagreed that the demonstrations enhance chemistry subject in understanding the concepts. Thus, the statement was accepted.

The majority of 46% of students agreed, 30% strongly agreed, 06% disagreed and 03% strongly disagreed that the demonstrations make chemistry lesson more interesting. Thus, the statement was accepted. The majority of 45% of students agreed, 29% strongly agreed, 09% disagreed and 03% strongly disagreed that the demonstration method makes learning more active when they watch demonstrations in class. Thus, the statement was accepted.

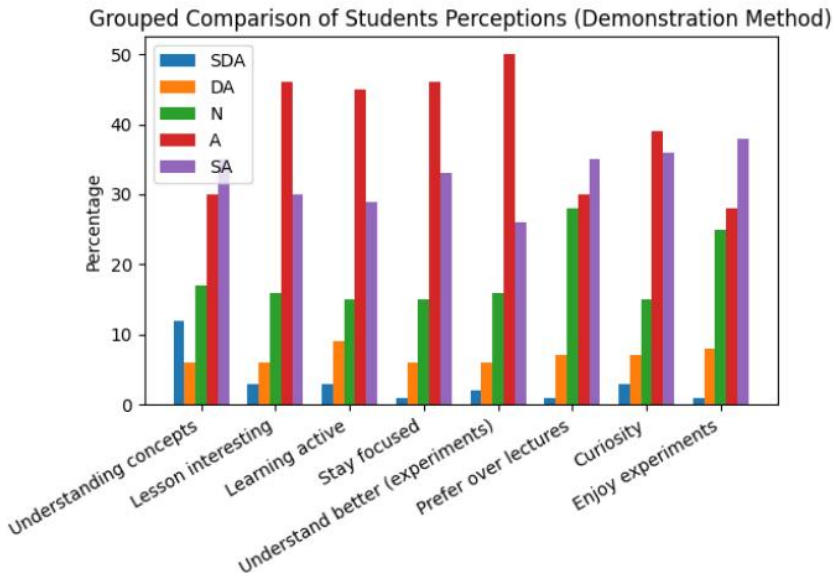
The majority of 46% of students agreed, 33% strongly agreed, 06% disagreed and 01% strongly disagreed that the demonstrations help them to stay focused in class. Thus, the statement was accepted. The majority of 50% of students agreed, 26% strongly agreed, 06% disagreed and 02% strongly disagreed that they understand better when the teacher shows experiments. Thus, the statement was accepted.

The majority of 35% of students strongly agreed, 30% agreed, 07% disagreed and 01% strongly disagreed that the students prefer demonstrations more than only listening to lectures. Thus, the statement was accepted.

The majority of 39% of students agreed, 36% strongly agreed, 07% disagreed and

03% strongly disagreed that the demonstrations make them curious to know more about chemistry. Thus, the statement was accepted.

The majority of 38% of students strongly agreed, 28% agreed, 08% disagreed and 01% strongly disagreed that the watching experiments makes enjoy more than just reading from the book. Thus, the statement was accepted.



One-Sample t-test Showing the Effectiveness of the Demonstration Method in Achieving Learning Outcomes in Chemistry

Table 1.3: *One-Sample t-test for Learning Outcomes*

Variable	Test Value	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Learning Outcomes	24	30.093	356	.000	5.34454	4.9953	5.6938

The above table 1.3 showing the result of the One-Sample t-test performed to determine the efficiency of the demonstration method in realizing the learning outcomes in chemistry. The mean score of the students' learning outcome was 29.34 (SD = 3.36) and this score was higher than the neutral test value of 24. The computed t-value is 30.093 and its significance value is .000 with degrees of freedom of 356 and is less than the level of significance 0.05. Thus, the null hypothesis is rejected.

FINDINGS/CONCLUSION

The finds for this study shows that the students have a positive perception about the demonstration method in the process of learning chemistry subject at higher secondary school level. The result presented in Table 1.2 indicate that most of the

students agreed and strongly agreed with statements which are related to the effectiveness of the demonstration method at this level. Mostly students indicated that demonstration method helps them to understand chemistry concepts more clearly and easily. This indicates that when teachers demonstrate or show experiments or practical activities in classroom, students were likely to connect theoretical knowledge with the practical understanding.

The results also indicate that demonstrations make chemistry subject more engaging and interesting for the students at higher secondary level. Most of the students agreed that watching experiments in class raised their curiosity and motivation to learn more about scientific knowledge. This study suggests that practical-based teaching helps in creating a conducive classroom environment where students remain active and focused during the lesson. More importantly, students preferred practical based over simply listening to lectures, which shows that visual and practical presentations of scientific concepts improve students' learning experiences especially in the subject of chemistry.

Table 1.3 shows that one-sample t-test was performed to find out if there are significant differences between the scores of the perceived learning outcomes and the null score of 24. It was found that the mean of the scores on perceived learning outcomes is 29.34 (SD = 3.36), which is significantly different from the test value of 24. The obtained t-value is 30.093 with 356 degrees of freedom, and the significance value is $p = .000$, which is less than the .05 level of significance. The null hypothesis is thus rejected.

Overall, this study concluded that demonstration methods play very crucial role in improving students' understanding, interest, and engagement in the subject of chemistry in terms of learning. In contrast, the traditional lecture based method having less impact and low effectiveness in motivating students and supporting active learning. Scientific subjects like chemistry, biology and physics demands demonstration based kinds of methods that's helps students in learning better and long term.

DISCUSSION/RECOMMENDATION

This study concluded that majority students demand demonstration method compared to the traditional lecture method in learning chemistry at the higher secondary level. Most students agreed that demonstrations support them to understand chemistry concepts more easily and make lessons more interesting and specially engaging.

Observing experiments in the classroom increases students' curiosity and motivation to learn scientific concepts in the subject of chemistry. Demonstration-based lecture also helps students remain active and focused during the lesson because it connects theoretical knowledge with practical understanding in the subject of chemistry. On other hands, the purely lecture method was not positively perceived by majority students, as many reported that it does not help them understand complex chemistry concepts effectively. Students also indicated that lecture-based teaching does not encourage curiosity, active participation, or deeper exploration of the subject. This study suggests that relying only on lectures may reduce students' interest and engagement in chemistry learning at higher secondary level in twin cities in Pakistan. Therefore, the demonstration or practical based method plays a vital role in improving students' understanding and making chemistry learning more effective at the higher secondary level. Here's some recommendation as per this study:

Using of Demonstration based method in Teaching style. Teachers must use the demonstration method while teaching chemistry at the higher secondary level. Demonstrations based method help students to understand difficult concepts more clearly by connecting theory with practical examples. This method also increases students' engagement and participation in the classroom.

Provision of Laboratory facilities in every institute. Schools/ colleges should provide proper laboratory facilities, chemicals, and equipment to support demonstration-based teaching that will help for the students in learning. Adequate resources will help the teachers to perform experiments and practical activities more effectively. This will enhance students' understanding and make science learning more meaningful and also helpful for long term learning.

Trained the teachers and developed them professionally. Practical and activity-based science teaching methods should be prioritized in teacher preparation programs. Teachers can learn how to perform successful demonstrations in the classroom by participating in training sessions or workshops. This will raise the standard of instruction and improve the educational opportunities for pupils.

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QUESTIONNAIRE

ROLE OF DEMONSTRATION METHOD IN LEARNING CHEMISTRY: A STUDY OF STUDENTS' PERCEPTION IN ISLAMABAD-RAWALPINDI

Part A: Demographic Information

- Name (Optional): _____
- Gender: _____
- Institute name: _____
- Class _____ City: _____

Instructions:

I am Ahsan Shafique, an M.Phil. student in Education at PMAS Arid Agricultural University Rawalpindi. I am conducting research on 'Students' Perceptions of the Demonstration Method in Chemistry.' Your participation in this survey will provide valuable insights into the effectiveness of this teaching approach.

Read each statement carefully and put a tick (✓) in the box that shows your opinion.

Use the following scale:

1 – Strongly Disagree (SD)

2 – Disagree (D)

3 – Neutral (N)

4 – Agree (A)

5 – Strongly Agree (SA)

Sr. no	Perceptions about Demonstration Method	1	2	3	4	5
1	Demonstrations enhance chemistry subject in understanding the concepts.					
2	Demonstrations make chemistry lesson more interesting for me.					
3	Demonstration method makes learning more active when I watch demonstrations in class.					
4	Demonstrations help me stay focused in class.					
5	I understand better when the teacher shows experiments.					
6	Students prefer demonstrations more than only					

	listening to lectures.					
7	Demonstration makes me curious to know more about chemistry.					
8	Watching experiments makes enjoy more than just reading from the book.					
Sr. no	Effectiveness of Demonstration on Learning Outcomes	1	2	3	4	5
1	Demonstrations increase my interest in studying chemistry.					
2	Demonstrations encourage active participation in class.					
3	Demonstrations make chemistry easier for me to learn.					
4	I understand difficult topics better when demonstrations are used.					
5	Demonstrations help me remember chemistry concepts for a longer time.					
6	Demonstrations improve my ability to solve chemistry problems.					
7	Demonstrations help me apply chemistry concepts in practical situations.					
8	Demonstrations improve my academic performance in chemistry.					

Thank you for your time!