

The Development of Low Cost Learning Material For The Teaching of Chemistry at Secondary Level.

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ABSTRACT

It is the age of science and technology. Scientific inventions have done wonders. Scientific knowledge is valued all over the world and great emphasis has been placed on scientific approach in all field of life. Progress and promotion of scientific education in the schools, colleges and universities will lead the nation to compete with the rest of the world. Keeping our students properly on the scientific track, it is necessary that equipment, apparatus, modern devices and training on the part of teacher would be required. So the main purpose of this study is to find out the present situation of the laboratories, equipment and the construction of low cost materials for the chemistry laboratory. The researcher has prepared relevant material for chemistry laboratory and desires to demonstrate it when required. Random Sampling Technique was used. The study sample consisted of 63 Government and 37 private high schools of district Dir (L), Dir (U), Malakand and Swat. It was a survey based research. So, two types of questionnaires were developed. The first questionnaire having twelve items was meant for the science teachers. The second questionnaire containing ten items was meant for science students. Most of the questions were in closed form data were collected and put into different tables. The response was hundred percent because the researcher himself administered and collected the questionnaires. The frequency of the actual responses was added up and percentage was found out. Then findings were drawn on the basis of collected data. Finally recommendations were made on the basis of available data by the researcher to solve the problem and develop low cost learning material for the teaching of chemistry at secondary level and the methods how to fabricate them. It was concluded that majority of the schools had no chemistry laboratory and there was lack of appropriate equipments.

Key Words: Low Cost Learning Material, Chemistry, Scientific Education and Scientific Attitude

INTRODUCTION

Rationale and background of the study :

Scientific education has always remained a great concern for educationists and policy makers in Pakistan. Emphasis has always been placed on developing a scientific attitude in students which will be possible through laboratory activities, field studies and library work. Students must believe that it is important to search for evidence, to collect data and to be as objective as possible. They need to be taught the distinction between opinions and facts so that they can evaluate statements they read in newspapers and magazines. Scientific instruction must be purposefully designed to stress what science is and how scientists work and think. The education policy of 1972-80 envisages a shift from meaningless general education to more purposeful and scientific education. In order to meet these targets we need to have standard text books, well trained and interested teachers, adequate laboratories and good libraries. At secondary level the three major subjects of science teaching are Physics, Chemistry and Biology.

Contribution of science laboratory:

•Kehle (1979) pointed out that “one of the overall objectives in teaching science is involvement and understanding of the process of science. Therefore, effective use of the laboratory is a prerequisite in scientific instruction. There is a lot of evidence that secondary schools students need concrete experiences in order to develop intellectually, therefore, laboratory is viewed as a place, where students gain insights into the process of science, establish suitable controls, formulate hypotheses, collect data, interpret results and draw conclusions. According to Richardson (1988) the following are the main “contributions of a laboratory in teaching science”.

- The science laboratory is a place, where space and resources are available for the solution of problems, these problems may arise during classroom discussions, demonstrations, field trips and experimentations.
- The science laboratory provides opportunities to students to verify the laws, principles and generalizations through scientific investigations.
- The science laboratory can be used effectively in the development of scientific attitude, habits and acquisition of knowledge coming students.
- The science laboratory can be useful in developing an increased awareness and understanding of a scientist's role in the society among students. A recognition of the contribution to science made by scientists is possible when students work in the laboratory.

The essence of scientific education is an involvement and understanding of the process of science. Therefore, effective use of the laboratory is the pre-requisite in science, as science is an experimental, observational and laboratory oriented discipline.

The significance of the laboratory activities can be understood in the light of the following four broad roles.

- Gaining basic lab skill
- Developing observation skill
- Explaining a particular concept and
- Having best experience

The non-availability of equipment in laboratory hinders teaching of science effectively. The use of chalk, board or the drawings of the experiments in work books are not the solution to the problem. Therefore, there should be low cost science equipment for the learning of chemistry at secondary level and methods to fabricate them.

The fact that science teacher is responsible for the science teaching cannot be denied. A science teacher occupies central position in science teaching, therefore, an effective teacher must have the following responsibilities.

- Professional and scientific competence. Science is an activity based approach subject. It believes on experiments. Therefore, the responsibilities of the science teacher are that of his own continued growth in professional and scientific competence.
- Effective science teacher must have the knowledge of student's attitude, because it helps the teacher to select proper method for the presentation of contents according to the interest of the student.
- Responsibility for assisting young people to their growth is the use of the method and contents of science.

- It is the responsibility of science teacher to facilitate learning by his teaching. (William 1998).

Chemistry has a very important role in our daily life. The food we eat, the clothes we wear, the building materials we use, the yielding of agricultural products, and the medicines we need maintain health and other human necessities, all depend on the chemical knowledge. Tremendous development in science and technology would not have been taken place without the development in chemistry. The advancement in communication, space, travel, agriculture and so many other fields have been made possible mainly due to the development in chemistry.

OBJECTIVES

The present study aimed to achieve the following objectives:

- To explore the existing condition of the chemistry laboratories in the schools.
- To find out whether relevant equipments for the purpose of experiments are available in school laboratories.
- To suggest ways and means for developing laboratories with low cost materials.

Hypotheses:

This study made the following hypotheses.

- The chemistry laboratories in school are not properly furnished.
- The teachers are not familiar with low cost materials for performing experiments.

Significance of the study:

- This study is expected to be helpful for the policy makers in the promotion of scientific education, especially chemistry, in the region.
- Science provides opportunity for the practical studies of the various aspects of life. Chemistry is a special subject which leads the students to get opportunity to play a role in the progress of the nation. So the study of chemistry is more important. This study is hoped to be helpful in identifying the problems in teaching and learning of science at secondary level.
- Chemical science has contributed significantly to the advance civilization. With a growing understanding and ability to manipulate chemical molecules. Chemists also developed innovative plastics and synthetic fibers for use in a both industrial and consumer products.
- This study will be helpful for the science teachers as well. Because science teachers are responsible for the development of scientific attitude in their students.

Low Cost Materials:

The use of those cost effective materials found around us as used up and thrown away garbage, in chemistry laboratory for effective learning is called low cost materials.

RESEARCH METHODOLOGY

It was a descriptive type of study.

Population and Sample Size:

All the teachers and students of government and private high schools in Malakand division constituted the population of the study. There are 780 private and government high schools in Malakand division. While the total number of science students are 26021 enrolled in class Ten. It was proposed that the sample size for this article would 100 teachers of science and 100 science students of class Ten. The respondents were selected, using the simple random sampling technique

Instruments:

This was a descriptive research, so two types of questionnaires were prepared for the data collection viz.

- Questionnaire for the science teachers .
- Questionnaire for the science students.

ANALYSIS OF DATA

Problem of Low Cost Materials:

Table 1. Indicating the problem of low cost materials in the subject of chemistry

S.No.	ITEM	Response			
		Yes		No	
		No.	%age	No.	%age
1	Can you construct low cost materials?	12	12%	88	88%
2	You have got any training for the construction of low cost materials?	27	27%	73	73%

The table indicates that 12% of the science teachers could construct low cost materials while 88% of them could not construct it. The table clarifies that 27% of the science teachers got training for the construction of low cost materials. While 73% did not get any training for this purpose.

Problem of Construction of Low Cost Materials:

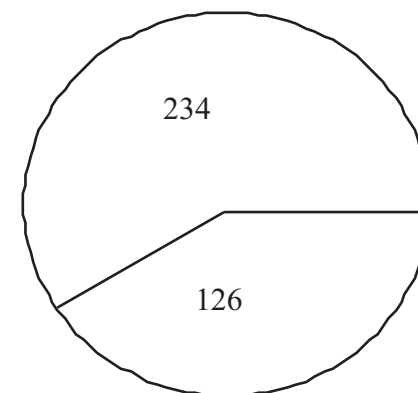
Table 2. 9 Students view on the construction of low cost materials for chemistry laboratories.

S.No.	ITEM	Response			
		Yes		No	
		No.	%age	No.	%age
1	Can you construct low cost equipment (materials) for a activity?	-	-	1000	100%
2	Do you prepare any model for the chemistry laboratories?	50	5%	950	95%

The table indicates that none of the students said that their science teachers had constructed low cost equipment (materials) for the activity

The table show that 5% of the science students construct low cost material for the chemistry laboratory while 95% do not

- Preparation of model for chemistry laboratory = $50/1000 \times 360 = 18.00$
Cannot prepare model = $950/100 \times 360 = 3420$



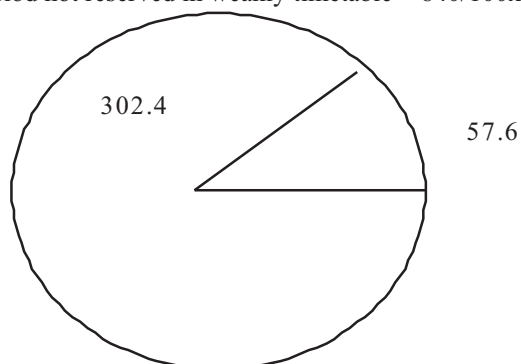
Problem Related To Practical Work:

Table 3. Students' view on the practical work in chemistry laboratory

S.No.	ITEM	RESPONSE			
		Yes		No	
		No.	%age	No.	%age
1	Is there a practical period reserved in your weakly time table?	160	16%	840	84%
2	Do you think that practical are essential for chemistry learning?	1000	100%	-	-
3	Is your chemistry teacher interested in your practical work?	470	47%	530	53%

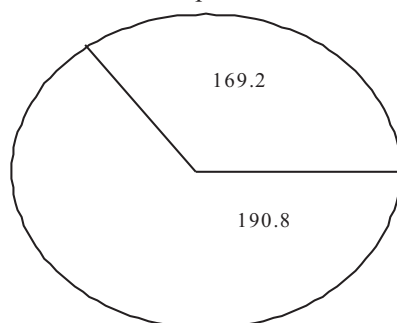
We observe from the table that 16% of the science student responded that practical period is reserved in the weakly time table. While 84% said that there was no period reserved. The table clarifies that according to 100% of science students that practical are essential for chemistry learning. The table shows that 47% of the science students said that their chemistry teacher was interested in practical. While 53% said that their teacher was not interested. The fact is shown as follows:

- Practical period reserved in weakly timetable = $160/100 \times 360 = 57.60$
Practical period not reserved in weakly timetable = $840/100 \times 360 = 302.40$



- The number of chemistry teacher interested in practical work = $470/1000 \times 360 = 169.20$

Number of chemistry teacher interested in practical work = $470/1000 \times 360 = 169.20$

**FINDINGS**

• On the basis of analysis the following findings were drawn. With reference to the qualification of science teachers, it was found that most of them did not have a degree for the teaching of chemistry.

- Four percent of science teachers were M.Sc M.Ed with the subject of chemistry and successfully performed experiments with the available materials.
- Four percents of the science teachers were M.Sc B.Ed with chemistry in M.Sc while the same percent in M.Sc B.ED with other subject other than chemistry. They performed chemistry practical with the available material to some extent.
- It is amazing that seventeen percent science teachers were simple B.Sc with chemistry subject and three percent were without any professional qualification. Six percent of them were M.Sc chemistry while eleven percent with no professional qualification.
- According to eighty percent of the concerned science teachers there existed a laboratory, but it was not well equipped. While twenty percent said that there were no science laboratories in their schools.
- It was observed that two percents of the science teachers told that there are separate chemistry laboratories are available in their schools while ninety eight percent said that there is no any separate chemistry laboratory in school.
- According to the forty percent of science teachers chemistry equipment as provided while the remaining said that no equipment was provided.
- Forty five percent were satisfied with the provided laboratory equipment while fifty five percent are not satisfied.
- A very small number of science teachers could construct low cost material for science teaching, while the majority of them were ignorant to construct low cost material.
- Twenty seven percent of teachers had got training for the construction of low cost materials while seventy three percent did not get any training for this purpose.
- As regard the equipment, fifteen percent of chemistry teachers claimed that the reasons for the lack of equipment in the laboratories are expensive material in the market. While seventy three percent were in the opinion that the reason was the non availability in the market while the remaining clarified that there were other reasons as well.

- Most of the science teachers had command over chemistry subject.
- Forty seven percent of science students said that their chemistry teacher performed chemistry practical while fifty three percent of them said that their teachers did not perform experiments. So the same percent of students are satisfied with the practical activity of their chemistry teachers. While the remaining of them were not satisfied with their practical activity.
- None of the students said that their science teachers had constructed low cost material for the activity.
- A few of the science students constructed low cost material for the chemistry laboratory while the majority of them did no.
- Sixteen percent of the science students said that practical period is reserved in the weekly time table while eighty four percent said that there was no period reserved.
- All the science teachers and science students were of the opinion that practical is essential for chemistry learning.

CONCLUSION

This study reaches to the following conclusions:

A very small number of science teachers seemed to be familiar with the term “low cost” material for the science teaching. Ninety five percent science teachers were ignorant of preparing and using low cost material. The science teachers also expressed the view that they were not provided any training for constructing the low cost material for the purpose of chemistry practical.

Majority of science teachers admitted that the materials for the chemistry practical were quite expensive and they were lacking funds for purchasing it. Some funds were provided by the Education and Literacy Department but they were not sufficient. The teachers also added that the principals of the institutions did not take any interest in the purchase of laboratory equipments. The schools had no private funds to be used for the laboratory purposes.

There were few teachers of science with a master degree in the subject of chemistry. Four percent science teachers were M.Sc (chemistry) as well as possessing M.Ed degree. They were competent enough to teach chemistry and conduct practical. They could not perform all experiments due to lack of laboratory equipments in their educational institutions.

It was surprising that eighty four percent teachers reported that no period was reserved for the chemistry practical. It depended on the science teacher to teach the subject and perform practical as per their activities. Even if the teachers were willing to perform experiments, they could not do it, because of lack of equipments in the laboratories.

The science students reported that they were not satisfied with the performance of their teacher regarding practicles in the laboratory. Rarely the science teacher took them to the laboratory for conducting experiment. Moreover, the equipments in the laboratory were not sufficient for the experiments.

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