



## **Laboratory Teaching and Challenges: A Study of Secondary Schools in District Chitral**

**RiazuddinAhmad<sup>1\*</sup>, Safder Hussain<sup>2</sup>, Sohail Roomi<sup>3</sup>, Safia Jabeen<sup>4</sup> & Bibi Ruqia<sup>5</sup>**

<sup>1,3,4,5</sup>Elementary Education Department Khyber Pakhtunkhwa

<sup>2</sup>University of Chitral Khyber Pakhtunkhwa

\*Email: [riazchem02@gmail.com](mailto:riazchem02@gmail.com)

---

**Abstract:** Science education at secondary school level plays an important role in the development of scientific attitudes and development of psychomotor domain which help the individuals to understand themselves and the environment in which they live. The purpose of this descriptive study was to explore the problems faced by science teachers while doing Laboratory work at secondary school level in District Chitral. All science teachers in 10 different urban and rural schools were taken as the research sample. Adopted questionnaire and structured-open-ended interview methods were used to collect data. The collected data was analyzed using statistical tools and the result showed that the major challenges of science teachers are over workload, lack of laboratories, unavailability of scientific equipments and chemicals and ignorance of authorities. The study concludes that science teacher is the busiest teacher in secondary school having six classes each day and shortage of laboratory facilities is additional challenge for science teachers at government secondary schools. The study recommends hiring more than one science teacher in each school, science teachers should be provided in-service training and school labs should be properly equipped to facilitate laboratory teachings.

**Keywords:** Science education, Laboratory work, educational experts, challenges, In-service training

---

### **1. Introduction**

Science is one of the most prominent discipline and basic area of learning in educational institutes of Pakistan. The beginning of science as subject in school from early grades lends its support with the view that science can be taught at any grade by keeping its suitability to the level of understanding

and tempo of the learners [1]. Furthermore, the idea that education is for the growth of the individual and humanity demands a curriculum, which be supposed to respond to the developmental stages based on the structural element derived from the discipline [2].

Science education is not only a need of a particular group but it is must of all together with both male and female children belonging to both urban and rural areas. Nations have made improvement not because of capital, scientists and Engineers but because all this owes to the scientifically literate society. This implies that all the individuals of society should have minimum important knowledge and understanding of science that makes them proficient of using it wherever situation arises. It implies that the purpose of science education is to promote scientific literacy encompassing awareness and understanding of those essential aspects of science that ensure full participation of all individuals in society. The developmental plan of Pakistan and vision 2030 envisage a strong science and technology base on its own soil, therefore, there is no more urgent priority than science and Mathematics education [3]. Science learning at secondary level plays a significant role in increasing technical attitudes, which helps the learners to recognize themselves and the surroundings in which they live. Teaching of science at secondary level produces rationale thinking, attitudes and skills in the students, which brings about financial success in the humanity as these thinking, attitudes and skills are transformed into action in the field of medicine, agriculture, livestock, forestry, wildlife and different industries. Science education at secondary level is, therefore, the early step towards the development of a country. Furthermore, besides gaining factual information, it is important for the students to discover ideas for themselves through laboratory activities and field studies.

Science is a practical subject which depends on practical work and experimentation for its advancement. The development of practical skills and abilities must form an important part of the set of educational goals associated with science education, thus practical work has played a vital role in all our science education programs. The following broad stages are associated with experimental work in science [4].

- The perception and formulation of a problem to be solved by practical means.
- The design and planning of an experiment in the experimental procedure for solving the problem.
- The setting up of experiment and its execution.
- The conduct of measurement, observation and their systematic recording.
- The interpretation and evaluation of the experimental observations and data.

These stages vary from case to case depending upon the nature of the particular problem under investigation.

Laboratories can help students to obtain and retain various kinds of knowledge by making phenomenon more vivid and practical. They can reinforce the concepts presented through lectures, discussion or self study.

In addition, laboratories can enhance students' skills to deal with instruments and give them confidence needed to learn such other skills in new setting. Thus laboratory work can aid in the achievement of various goals of science teaching in schools, colleges and professional institutes.

It has been observed by the researcher that in district Chitral no proper attention is given to the practical component at secondary level, due to which much of theoretical efforts done by the teachers become useless.

All the above points related to the significance of practical component can be achieved only when there will be a qualified and motivated science teacher in the secondary schools for teaching science subjects and conducting practical work.

It has been observed in the context of Chitral that besides having qualified science teachers in secondary schools, no much importance is given to the practical components, which may be due to some problems associated with science teachers while doing practical.

This much important but ignored component of science education was felt by the researcher and researcher wanted to explore the problems faced by secondary level science teachers while doing practical at secondary level.

## **1.2 Rationale of Study**

According to the National Curriculum of Pakistan Laboratory work are compulsory components of science subjects at secondary level. Unfortunately this important component of science subject has been neglected by science teachers in the context of Chitral. This important but neglected issue has remained untouched by the researchers as well. The researcher being a science teacher observe this serious problem and felt an intense need to dig out the problem faced by science teachers while doing Laboratory work at Secondary level, so that some recommendations may be given to solve this problem, therefore the researcher select this area as subject of study.

## **1.3 Problem Statement**

It has been observed that in the present situation no proper attention is given to the practical components of science subjects at secondary level in District Chitral and in depth study to find out the problems faced by the science teachers is needed for the improvement of developing a sound background and laying a strong foundation of science education.

## **1.4 Objectives of the Study**

- To identify challenges in laboratory teachings at secondary schools
- To find out the existing facilities of science laboratories in government secondary schools

## 1.5 Research Questions

**Q1.** What challenges do science teachers face during laboratory teaching in secondary schools of District Chitral?

**Q2.** What is the condition of laboratory facilities (Infrastructure and Laboratory Equipments) in the government schools of District Chitral?

## 2. Literature Review

### 2.1 Importance of Laboratory and Other Facilities

Many researchers have acknowledged the need of laboratory experiences for potential teachers [5]. According to Hoftein and Luneetta [6] the laboratory has been set a vital and distinct role in science education, and science teachers have recommended that rich benefits in learning accumulate from using laboratory activities. As reported by Dilon (2008) laboratory work can be improved at school level if the said techniques are addressed at secondary teacher education level. As per some researchers the motivation and ownership for learning among students can be improved by applying the laboratory teaching methods [7].

Science is a unique subject in the curriculum of schools all over the world. This uniqueness is due to the variety of materials and experiments necessary for its effective teaching. Most of the subjects can be read and taught if ordinary tools like paper, pencil, textbook, chalk and blackboard are available. These are also essential for teaching science but if those are the only tools employed then science becomes a useless, dull and uninteresting subject [8].

Solomon [9] writes that from the very introduction of science in the school, the subject has been recognized as one requiring facilities. Today great emphasis is laid upon individualized instruction, for this reason it is necessary to plan science facilities in such a way that will stimulate and encourage the individual who explore actively the scientific phenomenon under teacher's guidance.

Laboratory is one of the basic needs to teach science in the schools, as teaching of science mainly depends upon practical work and experiments, which cannot be carried out without having a science laboratory. According to Saunders [10] (1990) *"In the laboratories are the tools, the resources and the investigators, from it comes the solution to the problems and new hypothesis is to be tested. This is more than a place, it should be thought of an approach and a method. Without laboratory teaching of science is impossible."* Students' progress in science is not possible without having adequate laboratory facilities at schools [11].

It is clear from the above discussion that science cannot be taught without a laboratory and other required physical facilities. But in most of our secondary schools there is no science laboratory and, in some schools, where a laboratory exists the equipment and science consumables are not available. Therefore, science teachers cannot perform the experiments with the students.

## **2.2 Importance of Laboratory Work in Science**

In science education every course is said to be complete if practical work is embedded with theoretical knowledge. . The practical work is to be carried out by individuals in science laboratory. Most of the achievements of the modern science are due to the application of experimental method. At school level the practical work has more importance due to the fact that individuals at school stage can learn best the scientific concepts and principles by “Learning by doing”. This is fact that an object handled impresses itself more firmly on the mind than an object merely seen from a distance or in an illustration. Centuries of entirely deductive work did not produce the same practical results as a only some decades of experimental work. On the basis of above discussion we can say that practical work forms a prominent feature in any science course [12].

According to Gupta [8] the important objectives of laboratory work are as under:

- Verification of the facts taught in the class
- Development of the habit of performing independent work among students.
- Creation of interest in science
- Preparation of students for careers in science
- Development of scientific skills
- Improve observation and critical thinking
- Development of reasoning habits
- Avoid memorizing the subject.
- Create interest for research.
- Have a clear understanding of science subject.
- Develop habit of doing systematic work

## **2.3 Challenges While Doing Laboratory Teaching**

Teachers are the key players in teaching learning process. Majority of the world population have experience of being in school and the job of the teachers is noticeable. However, studies shows the complexity of the role of teacher, specially where the teacher is responsible for the majority of the curriculum.

Some studies have given attention on secondary science teachers' use of laboratory activities [13]. In Tobin's [13] study, laboratory activities were usually used as "a frill" that was not abstractly incorporated with the science course as a total. His study suggests that when teachers have epistemological viewpoint in which they believe knowledge as a communicable entity, they view laboratory activities as an additional to the major session; they fail to see laboratory activities as opportunities for students to make meanings through scientific inquiry. This implies that teachers' epistemological beliefs influence their ways of using laboratory activities.

The lack of teachers is another crucial challenge. Usually, in the developed countries the number of teachers is high to meet the required necessities Teachers are frequently provoked by logic of service and status can often make up for a lesser income. However, where the earnings are undersupplied to live reasonably, teachers have to teach extra hours, practice other work, or put down the profession. Therefore, salaries are an issue. However, this is not a particular science education issue. What is also of concern in teacher supply is the relative attractiveness of the profession, access to quality teacher education and appropriately supported schools and careers after qualification. Where there is lack of suitable qualification and low motivation, due to lack of infrastructure such as equipment and laboratory for later stages of schooling, insufficient salaries and career structure, teacher motivation and retention drops [14].

The second challenge is having teachers of sufficient quality to meet the demands of educating future citizens.

### **3. Methods**

#### **3.1. Nature of the Study**

It is Survey type research, which involved collecting of data through questionnaire in order to answer the questions related to the problem. The collected data was tabulated in order to draw conclusions.

#### **3.2. Population**

The focus of this study is to identify the challenges science teachers face at Government schools; therefore, all science teachers at government schools are considered as population of the study. According to Educational Management and Information system (EMIS) Elementary & Secondary Education department there are a total of 42 science teachers in district Chitral.

#### **3.3. Sampling Technique**

The study chose 25 teachers in different urban and rural areas of District Chitral as its sample out of which 18 participants returned the questionnaire. 8 questionnaires were incomplete and were excluded and only 10 questionnaires and interviews were accepted.

#### 4. Data Analysis and Results

##### 4.1. Tabulation of Close Ended Data Collected through Questionnaire

**Table 4.1.1: showing Schools having separate rooms as laboratories**

No of Responses	YES	Percentage	NO	Percentage
18	17	80%	1	20%

Table 4.1.1 shows that 80% of government schools in District Chitral have a separate room as laboratory while 20% government schools do not have a separate room as laboratory.

**Table 4.1.2: Showing Schools having laboratories well equipped with all necessary equipments required for practicals at SSC level**

No of Responses	YES	Percentage	NO	Percentage
18	1	20%	17	80%

Table 4.1.2 shows that only 10% government schools in district Chitral are equipped with necessary equipment's required for practicals at secondary level while 90% schools do not have the facility of laboratory equipments.

#### Statement: 3

**How many in service training have you got for SSC practicals?**

**Table 4.1.3: Showing In service training facility for Science Teachers for SSC practicals**

No of Responses	No of Trainings					
	1-5	%age	5-10	%age	No	%age

18	7	40%	2	10%	9	50%
----	---	-----	---	-----	---	-----

Table 4.1.3 shows that 40% science teachers have got in service trainings for SSC practicals in the range of 1-5 numbers. 10% teachers have got in service trainings in the range of 5-10 numbers while 50% of science teachers do not have any training related to SSC practicals.

**Statement: 4**

**Table 4.1.4: Showing the support staff for Science teachers for the conduction of SSC practicals**

No of Responses	YES	Percentage	NO	Percentage
18	2	10%	16	90%

Table 4.1.4 shows that 90% science teachers don't have any laboratory assistant or other science teacher to help him/her while doing practicals while 10% science teachers are helped by laboratory assistants or by other teachers.

**Table 4.1.5: Showing the responses of science teachers for the statement that one science teacher is enough to teach science subjects (Physics, Chemistry and Biology) at SSC level**

No of Responses	YES	Percentage	NO	Percentage
18	2	10%	16	90%

Table 4.1.5 shows that only 10% science teachers are agree with the statement that one science is enough to teach the science subjects (Physics, Chemistry & Biology) at secondary level while 90% science disagree with this statement.



#### **4.2. Analysis of Open Ended Data Collected Through Questionnaire**

##### **Statement: 1**

**Do you think that only one science teacher is enough to teach science subjects (Physics, Chemistry & Biology) at secondary level? If NOT, why?**

According to table 4.1.6 90% science teachers say that one science teacher is not enough to teach science subjects (Physics, Chemistry & Biology) at secondary level. When the researcher asked, “Why Not”? Then the teachers replied as:

“There are six classes for a science teacher in one day and it is very difficult to teach six classes in one day”

Another teacher said, “it is very difficult to teach three different science subjects each to class 9<sup>th</sup> and 10<sup>th</sup> therefore it is necessary to provide science subject specialist at secondary level”.

##### **Statement:**

**What are the three main problems which you face while doing practicals?**

The teachers were asked to share some of the major problems which they face while doing practicals. The responses of majority are as follow:

- Lack of equipments and chemicals
- Lack of time
- Lack of proper laboratory
- Unable to perform practical's due to non-availability of in-service trainings
- Overcrowded classes
- Unavailability of laboratory assistants
- Small classroom as laboratory which is not enough for students
- No supervision from education department
- Equipments and chemicals available in schools are of very low quality
- Burden on science teacher

#### **5. Findings, Conclusions and recommendations**

##### **5.1. Findings**

On the basis of analysis of data collected, interpreted and tabulated in this study, the following findings have been made.

- i. It is found that 80% government schools in district Chitral have separate rooms as laboratories.
- ii. The laboratories of only 10% government Schools in district Chitral are well equipped with all necessary equipments required for the practicals at SSC level, while 90% laboratories in government Schools do not have necessary equipments required for practicals at SSC level.
- iii. It is found that 40% science teachers have got in-service training in the range of 1 to 5 years; only 10% science teachers have got training in the range of 5 to 10 years.
- iv. 50% science teachers have not got any opportunity of in-service training till now.
- v. No support staff is there to help science teacher to do practicals.
- vi. 90% science teachers say that one science teacher is not enough to teach science subjects at SSC level

#### **5.1.1 Findings Made Through Analysis of Data Collected Through Open Ended Questionnaire**

- i. One science teacher has to teach six different subject in a day
- ii. There is workload on science teacher
- iii. No proper laboratory is available in most of the government schools
- iv. It is found that equipments and chemicals available in the school laboratory are of very low quality.
- v. It is found that science teachers remain busy in classes during the whole school day due to which they do not get time for practical.

#### **5.2 Conclusion**

On the basis of findings made through the analysis of data obtained from documentary evidence and collected by interviews the following conclusions have been drawn.

- i. Some of the government high schools do not have separate rooms as laboratories
- ii. Most of the government schools laboratories do not have necessary equipments required for practicals at SSC level
- iii. For most of the science teachers in government schools do not have any opportunity of in service training for SSC practicals.
- iv. The science teacher is the most busy teacher in a school having six periods each day
- v. In most of the schools the laboratory equipments are of low quality.
- vi. Practical component is ignored by almost all science teachers in government Schools.

#### **5.3 Recommendations**

In the light of conclusions drawn from the findings of this study the following recommendations have been made.

- i. All the laboratories must be equipped with all the necessary equipment's required for the practicals at SSC level so that the science teacher can easily perform practicals for students.
- ii. More than one science teachers are needed in each GHS to reduce the burden on science teachers so that they may conduct practicals for their students.
- iii. The establishment of a sustainable monitoring and supervision system for science subjects is needed to supervise science teachers and to provide them with professional assistance for the conduction of practicals at secondary school level.
- iv. Conducting in-service trainings and workshops for secondary school science teachers on regular basis is a pertinent need.
- v. District Education Department and the Principals/ Head Teachers should not assign extra duties to the science teachers so that they may do justice to the teaching.

### References

1. Shami, D. P. (2008). *Reforming science Curriculum and Teaching*. Islamabad:
2. Science, A. A. (1993). *Benchmarks for science literacy*. New: Longman
3. J.W Beatty., & B. (2002). Practical work in 11 – 13 science: The context, type and aims of current. *British Educational Research Journal*, , 23-25.
4. Bates, G. R. (2004). *The role of the laboratory in secondary school science programs*. Washington: National Science Teachers Association.
5. Prabha, S. (2016). Laboratory Experiences for Prospective Science Teachers: A Meta-analytic Review of Issues and Concerns. *European Scientific Journal* , 035-250
6. Hofstein, A. (2004). The laboratory in science education: Foundations for the twenty-first century. *Science Education* , 88-54.
7. Akarsu, B. (2015). Pre-Service Teachers' Attitudes Towards Lab Applications in Science Teaching,. *Journal of European Education* , 56-61.
8. Gupta, V. (1995). *Teaching and Learning of Science and Technology*. New Delhi: Vikas Publishing House Pvt: Ltd.
9. Solomon, J. (1980). *Teaching Childrens in the Laboratory*. London: Croom Helm Publisher
10. Saunders, A. (1990). Do Practical Subjects encourage understanding of science? *SSR* , Volume 71 p 125.
11. Fitzpatrick, & Frederrick. (1980). *Policies for science Education* . New york: Bereave of publication, Teachers college Columbia University.
12. Carun, A. A. (1989). *Teaching Science through discovery*. Ohio: Ohio Merill Publishing.
13. K.Tobin. (1986). Secondary science laboratory activities. *International Journal of Science Education* , 199-211.
14. Yadas, M. (2002). *Teaching of Science* . New Delhi: J.L Kumar for Anmol publication Pvt. Ltd.