

Effectiveness of Science Labs at Secondary School Level in Pakistan: an Evaluative Study

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Abstract

The study was adopted descriptive research strategy in which the existing condition of the science labs in the secondary schools of District Hyderabad, Sindh Province, Pakistan was assessed. The study focused on the main objectives; to find out the availability of physical facilities in the labs of secondary schools, to assess the current competencies of science subject teachers in practical/lab work and to find out the problems faced by science subject teachers in carrying out practical work in laboratories. The population of the research study was comprised of science teachers, and science lab staff of government secondary schools of District Hyderabad. For sample four schools (two male and two female) were randomly selected and from each school four science teachers were also randomly selected. Data was collected through questionnaire, and quantitative approach was used for data analysis. Main findings of the study were; there existed no good science labs in the government secondary schools, science practical experiments were seldom conducted, proper funds were not provided for the purchase of apparatus, teachers were not trained to conduct experiments, shortage of technical staff was also observed, practical work in the science labs was given less importance and whole reliance was on theoretical work. The research study recommended that science teachers should be trained to conduct science practical's, proper funds should be provided to the schools for purchase of science apparatus, shortage of technical staff should be overcome, science fairs should be organized regularly in the schools and computers, internet and multimedia projects should be provided to the science labs in the government schools.

Key words:

Education, Science Education, Science Lab, Science Lab staff, Science Student, Science Teacher, Secondary level.

1. Introduction

Due to rapid advancement in science and technology, we are now living in modern scientific era. Application and influence of science can be easily observed in every field of today's modern life. Now it is becoming a growing necessity for teachers and students in educational institutions to understand the concepts and theories of science. [1]. Advancement in science and technology is contributing a lot in different sectors of modern economy world over. Scientific development has great

contribution in the defense of a country; it has enhanced the quality of industrial products, modernized irrigation system and outputs of agricultural products have also increased tremendously. Science has also found remedies for different fatal diseases due to which life expectancy rate has increased in different developed countries of the world. Scientific advancement has made communication system very fast through the invention of automobiles and aircrafts. Therefore in recent times, the life of the people has become more comfortable and easy with new and fast inventions of science. [2]

For effective learning of science, lab work or conducting of experiments is of utmost importance. American educationists, [3] and [4], in the early sixties regarded laboratory work as "an essential feature for teaching of science effectively and regarded it as a process of discovery". [5] stressed the organizing of the school curriculum on a scientific basis and advocated learning by doing through his "project method". Songsil emphasized the "use of the scientific method as a mode of inquiry to satisfy our doubts". [6]. The ultimate goal of these all was to have more emphasis on practical and experimental work in learning of science so that in the coming years good scientists could be produced from the educational institutions of the world. Due to efforts and contributions of these theorists and scientists, the emphasis was shifted from the "science is to teach and learn", to "how we teach and learn science" [7]. Martin investigated and found that "practical based approach should be followed while teaching of all science subjects listed in the syllabus" [8] while the Blosser regarded the practical work in science as the 'gem' of science teaching" [9]

In the field of science and technology, successive governments in Pakistan also laid good emphasis on advancing the country in science and technology. In all educational policies and plans presented in the country, top priority was on the promotion of science and technology but this goal still could not be achieved because spending on education is hardly 2% of the GDP in Pakistan. In the curricula of the schools, science is included from class 1.in the education system of Pakistan. At primary school level, it is integrated with other

subjects and from sixth to eight classes; general science subject is taught. While in IX class science subjects such chemistry and biology are taught and in class tenth, Physics and Mathematics are offered to science students. Computer science is also offered as an elective subject at this stage. The subject of general science is offered to arts group students as an integrated compulsory subject. [10]

In most of the government schools in Pakistan, science subjects are taught theoretically and laboratory work is seldom carried out. Because proper science labs are not available and there is acute shortage of apparatus and technical staff in labs of schools. Science teachers also lack required skills and expertise to get conduct practical's effectively in the labs due to not having training opportunities in science practical subjects. In secondary schools of rural areas, shortage of science teachers is also big problem in government schools, science syllabi being taught is out dated and has less relevance to the present modern needs the method of examination is full of flaws and having focused on memorization and rote learning. According to [11] "the factual information is in abundance in the science course content in Pakistan and the science content is outdated; science teachers lack required skills and strategies to teach science effectively. Most common method applied for teaching of science is lecture or "chalk and talk method". Laboratory work is avoided and neglected. This sort of condition is causing lack of interest towards the science subjects". [12]

2. Rationale for the study

Science education in Pakistan especially in government schools is suffering because of lack of adequate science lab facilities and lack of trained teachers. According to a UNESCO study "over 90 percent of government schools in Pakistan do not have adequate physical facilities and trained teachers for teaching science. More than 17000 secondary schools do not have physical buildings including laboratory facilities. In the Sindh province, many government secondary schools do not have science laboratory and in those schools where science laboratories exist, are not properly functional due to number of reasons. The problem is worse in rural areas where the science education is the most neglected. [12][13] Thus the research topic "Effectiveness of Science Labs at Secondary School level in Pakistan: An Evaluative Study" was selected for the research study.

Research Objectives

Objectives of the study were;

1. To find out the availability of physical facilities in the science labs of secondary schools.

2. To assess the current competencies of science subject teachers in practical/experimental work in science labs in secondary schools.
3. To find out the problems faced by science subject teachers in carrying out practical/experimental work in science labs.
4. To suggest recommendations for effectiveness of science labs in secondary schools.

Research Methodology

The research study was descriptive-survey type and quantitative approach was followed to conduct the research. The population for the research study was comprised of all male/female secondary schools of District Hyderabad (56+41) science teachers both male/female (2048+1857) working there. For the sample, four (04) schools both male and female were randomly selected from each Taluka (sub-division) of District Hyderabad. Four (04) science teachers (04) were also randomly selected from each of the sampled schools. In this way total (64) science teachers became the sample of the study Data was collected through questionnaire. The questionnaire for science teachers was designed on a five point Likert scale; strongly agree, agree, undecided, disagree and strongly disagree'. (Likert,1932). Both open and close ended items were included in the questionnaire. Reliability (0.928) of the questionnaire was determined through Alpha Cronbach (1977) method, and the validity was determined through the feedback provided by expert panel. Data was analyzed by using frequencies, percentages and diagrams.

Testing of Hypothesis

Null Hypothesis

There is no significant difference in the views of urban and rural science teachers about the functioning and effectiveness of science labs in secondary schools.

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Step 0: Tabulation Data

Group I		Group 2	
Urban		Rural	
X1	X21	X2	X22
48	2304	39	1521
52	2704	41	1600
-	-	-	-
-	-	-	-
52	2704	42	1764
45	2025	37	1369
$\sum X1 = 1877$		$\sum X2 = 1038$	
$N_1 = 38$		$N_2 = 26$	
$\sum X_1^2 = 93049$		$\sum X_2^2 = 40111$	

Result

Referring to the table No.02, it was found that the tabulated value of $t'=1.96$ with $df=62$ at $\alpha=0.05$ was less than the computed value of $t = 6.276$. Therefore the null hypothesis was rejected and it was concluded that there was significant difference among the views of urban and rural science teachers about the functioning and effectiveness of science labs in their respective schools. From inspection of the table, it was clear that urban and rural science teachers expressed different views regarding the effectiveness of science labs and conducting experiments in secondary schools because successive governments in the province focus more on urban areas' schools than the rural areas' schools.

Data Analysis

Table 2: There exist good science laboratories in your school

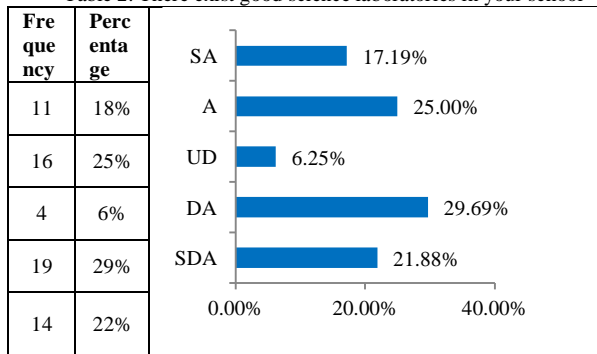


Table No. 2 A high percentage of the respondents (52%) expressed their opinion in at least one shade. it indicates that majority of the science teachers believed that in their schools good science labs do not exist. Findings of the study were aligned with [14].

Table 3: There is available proper and sufficient apparatus in your school's lab.

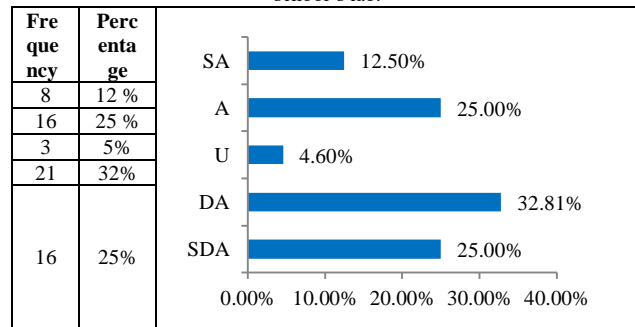


Table No. 3 A high percentage of the respondents (58%) expressed their opinion in at least one shade. This shows that majority of science teachers were of the view that proper and sufficient apparatus in the science labs of their school is not available. The Finding is aligned with [15]

Table 4: School administration provides all required facilities to science teachers and students to carry out experiments in science labs property

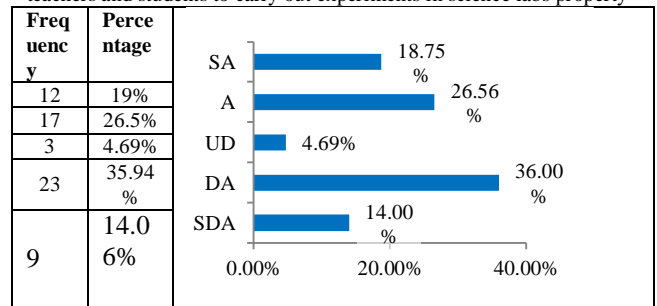


Table No. 4 A high percentage of the respondents (50%) expressed their opinion in at least one shade. This explicit that majority of the science teachers express opinion that school administration does not provide all required facilities to teachers and students to carry out experiments in labs. The finding is aligned with [14][15].

Table 5: Teachers use science laboratories frequently in the schools.

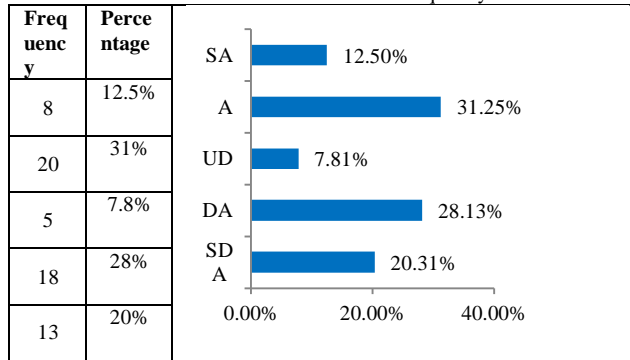


Table No. 5 A high percentage of the respondents (48%) expressed their opinion in at least one shade. This indicates that majority of the science teachers viewed that teachers and students do not use science labs frequently in the schools.

Table 6: Science teachers are trained to conduct science experiments properly

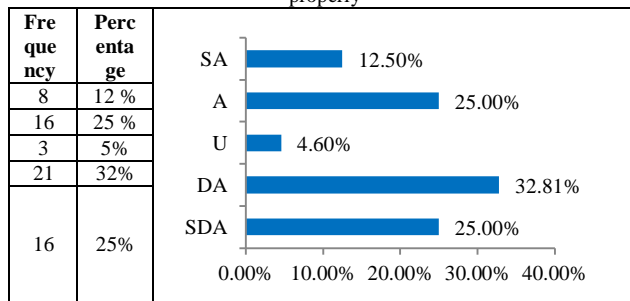


Table No. 6 A high percentage of the respondents (54.6%) expressed their opinion in at least one shade. It shows the majority of science teachers were of the opinion that most of teachers are trained to conduct science experiments.

Table 7: Teachers try to provide better understanding about the science experiments to students.

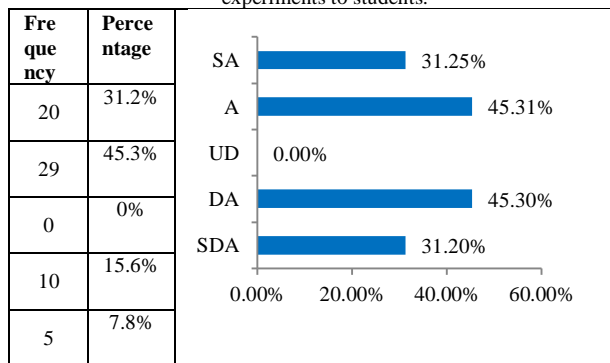


Table No. 07 A high percentage of the respondents (76.5%) expressed their opinion in at least one shade. It indicates that majority of science teacher's views explicit

that teacher try to provide better understanding about the science experiments to students.

Table 8: Teachers try to clear scientific concepts, which are related to the science experiments.

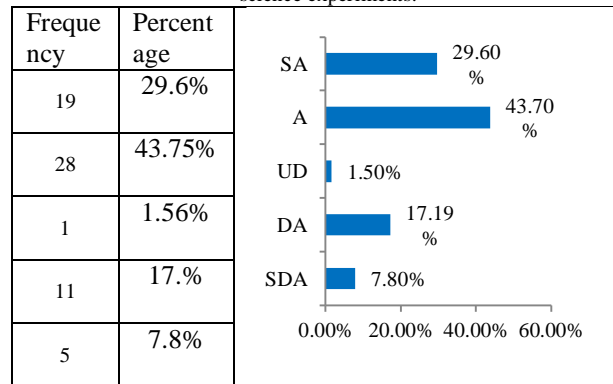


Table No. 08. A high percentage of the respondents (73.4%) expressed their opinion in at least one shade. This shows that majority of science teachers believe that teachers try to clear scientific concepts which are related to the science experiment.

Table 9: Teachers try to create the scientific thinking among students.

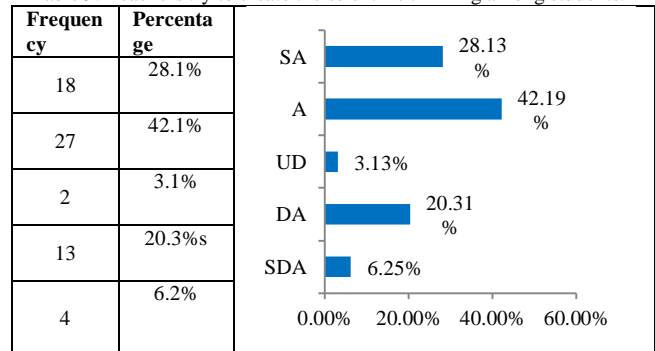


Table No.09 A high percentage of the respondents (70.3%) expressed their opinion in at least, one shade. It indicates that majority of the science teachers were of the opinion that teachers try to create the scientific thinking among students.

Table 10: All the experiments given in practical journals are well defined and easy to understand.

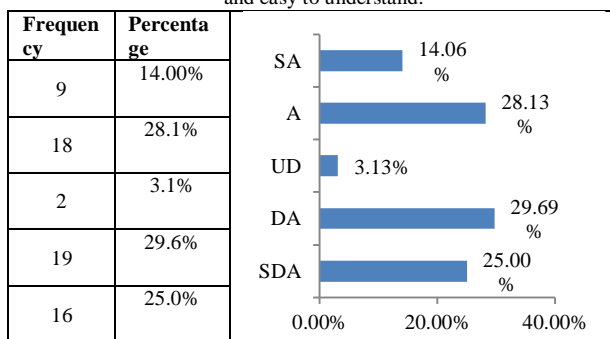


Table No. 10A high percentage of the respondents (54.69%) expressed their opinion in at least one shade. It indicates that majority of science teachers have the opinion that all the experiments given in practical journals are not well defined and easy to understand.

Table 11: Do you take the tests related to science experiments before annual examination?

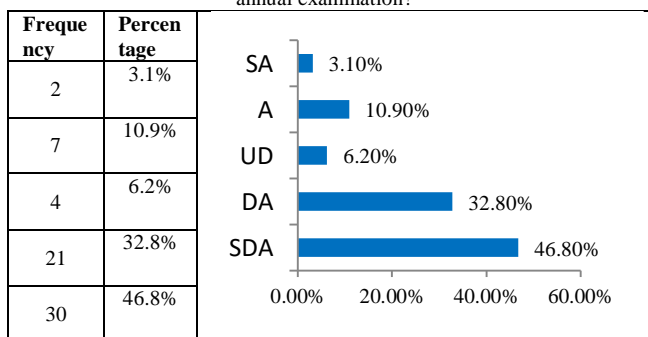


Table No.12A high percentage of the respondents (79.6%) expressed their opinion in at least, one shade. It shows that majority of science teachers believe that they do not take any tests related to science experiments before annual examination

Table 12: Do you assign the science project to students?

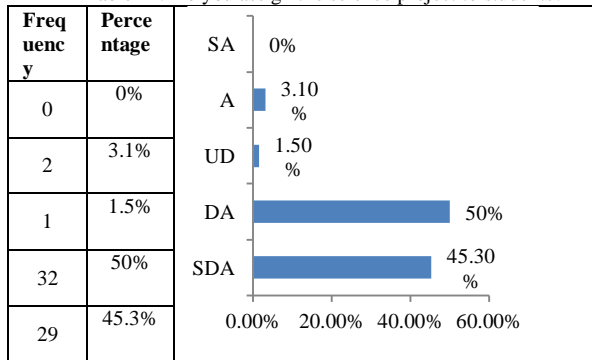


Table No.12 A high percentage of the respondents (95%) expressed their opinion in at least one shade. This

indicates that majority of science teachers have opinion that they do not assign the science projects to students.

Table 13: Does your school administration arrange the science fairs?

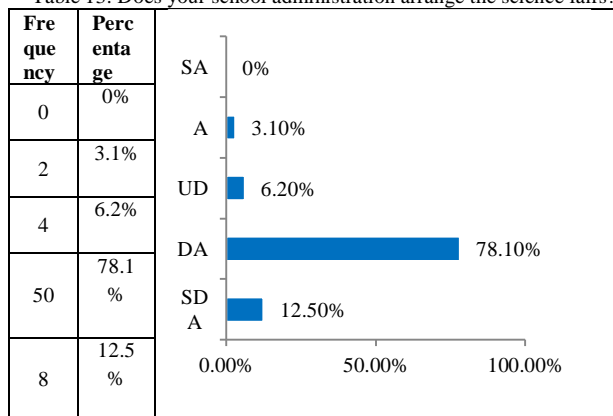


Table No.13.A high percentage of the respondents (90.6%) expressed their opinion in at least one shade. This shows that majority of science teachers agreed with the statement that the school administration do not arrange science fairs.

Table 14: Teachers get covered all assigned experiments in required time.

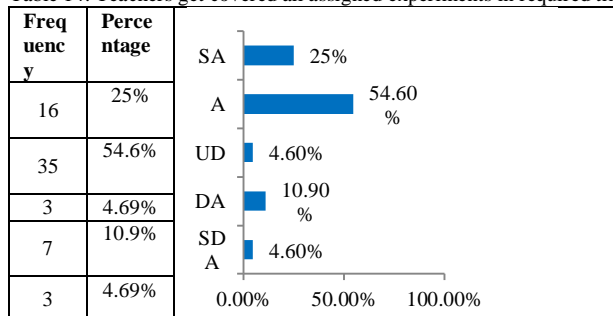
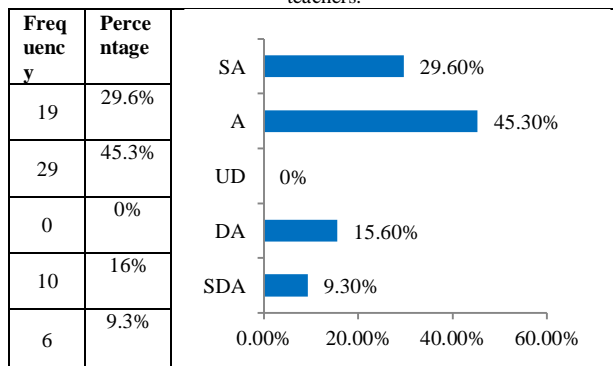


Table No. 14. A high percentage of the respondents (79.68%) expressed their opinion in at least, one shade. This shows that majority of science teachers viewed that they get covered all assigned experiments in required time.

Table 15: Trainings are necessary to conduct the experiments for science teachers.



Examining the table No. 15, it is explicit that 75% of science teachers believe that trainings are necessary for conduct of science practical's effectively.

Findings of the study

Positive trends

The responses against the following items of teachers' questionnaire showed the positive trend;

1. Science teachers are trained to conduct science experiments properly.
2. Teachers try to provide better understanding about the science practical to students.
3. Teachers try to clear scientific concepts which are related to the practical.
4. Teachers try to create the scientific thinking among students.
5. Teachers get covered assigned experiments in required time.
6. Training is necessary to conduct the experiments for science teachers.

Negative Trends

The responses against the following items of teachers' questionnaire showed the negative trends;

1. There exist good science labs in your school.
2. There exist proper and sufficient apparatus in your school science lab.
3. School administration provides all required facilities to science teachers and students to carry out experiments in science labs properly.
4. Teachers and students use science labs frequently.
5. Students take interest in experiments in science labs.
6. All the experiments have been well defined in practical journals.
7. You conduct the practical exam before annual examination?
8. You assign the science project to students?
9. Your school administration arranges the science fair?

Recommendations

In the light of findings the following recommendations are being submitted for the improvement of science practical.

1. Teacher trainings for the conduct of science experiments should be arranged. Teacher manual for the conduct of science experiments should be prepared by the Sindh Text Book Board STBT.
2. Science Teachers' demands and requirements related to apparatus, provision of models, charts,

multimedia projectors, internet and other technological equipment should be fulfilled on priority basis.

3. The science teachers should apply relevant and activity based teaching methods like inquiry-based teaching combined with open-ended inquiry based experiments in the classrooms. Science teachers should also assess the students' performance weekly in science experiments.
4. science Practical journals should be updated and language of printed content in the practical journals should be made easy. Practical marks ratio should be increased. New and latest experiments in the practical journals should be included.
5. Budget for science labs of government schools should be increased and budget allocations and expenditures procedures should be made easy and smooth.
6. Science fairs at school, District and Regional level should be organized annually. Students whose science projects are of good quality should be rewarded highly and their projects should be sent to science exhibitions held at national and international level.
7. Internal and external assessment system for science practical's should be strengthened and improved by the school administration and B.I.S.Es.
8. There should be combination between teaching of theory and practical work. Teachers should get performed science experiments with the related theoretical topics simultaneously and practical work should not be carried out at the end of course or at the time when annual exams draw near.
9. n teachers training institutes, equal focus should be given to the theoretical as well as practical aspect of teaching science subjects and in training programs special focus should be given on designing of low cost teaching aids for effective teaching of science and conducting science experiments. Science teachers should also be trained in using modern teaching technology along with hand-on lab activities.
10. The provincial government authorities should take steps to form the consortium of universities, colleges and schools for exchange of physical resources, technical, and human resources for the improvement of quality of science teaching and practical work in science labs. at college and school level. Moreover, private sector institutions should also be collaborated with the government schools for the same purpose.

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