EFFECTIVENESS OF PRE-LABS AT SECONDARY SCHOOL LEVEL CHEMISTRY LAB

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ABSTRACT: The conventional way of preparing students for the lab work is to encourage them to read manual for the lab wok, but this procedure typically overloads their working memory with the information. On the other hand only a limited number of students try to understand or do read the manuals before entering into the laboratory. The present study was designed to explore "The impact of pre-labs in chemistry laboratory at secondary level". Sample of this study consists of boys (n =119) and girls (n=116) studying chemistry at secondary school level. Boys sample was further divided into control group (n= 65) and experimental group (n=54). Similarly, girls sample was divided into control group (n=55) and experimental group (n =61). Pre-labs and post-labs were developed, keeping in view information processing model for teaching-learning science and Bloom Taxonomy of Educational Objectives. Data collection was continuous through out the academic session till the eighteen experiments were completed. The data were analyzed, by using SPSS. T-test applied at 0.05% level of significance. Study revealed that Pre-lab has improved student's understanding in chemistry lab. It is also indicated that Pre-lab has strong effect in improvement of academic achievement of boys than that of girls.

Key words:-Chemistry laboratory, Pre and Post lab, Information Processing Model, Eighteen Experiments, understanding improved.

INTRODUCTION

Laboratory work is an essential component at every level of chemistry course (Bennett and O'Neale, 1998). Practical work familiarizes the students with physical world around them, enhances the learning in science education and help in understanding of scientific process (Levinson, 1993, Hodson, 1993). Therefore, practical work is held in high esteem by most science educators and is regarded as an essential requirement for science teaching (Brian and Stephen,1992).

Aims for laboratory work at school level are: Manipulative skills, observational skills, the ability to interpret experimental data, the ability to plan experiments, Interest in the subject, enjoyment of the subject, a feeling of reality for chemical phenomena, (Johnstone and Shuaili, 2001). For practical activities of the students, science laboratories are established, demonstrators/staff appointed, time is allocated in time tables of the institutions and lab manuals are written (Lunetta, *et al*, 2006).

Domin Daniel S, (1999), has observed that most experiments in the laboratory manuals engage the students only to the lower order intellectual skills, that is with reference to Bloom's taxonomy namely, knowledge, comprehension, application. While the higher order skills of evaluation, analysis and synthesis, are not engaged.

Pre-lab exercise is a short task to be completed before the laboratory starts. Its fundamental aim is to *prepare the mind for learning.* In a series of experiments, the effectiveness of pre-laboratory activities has been shown its effectiveness. Studies in undergraduate laboratories have revealed that pre-labs increased performance while it was found that students were dramatically more positive about laboratories, (Zaman, 1996, Johnstone *et al*, 1998, Safdar, 2002, Kausar, 2004). Many other examples of positive results from the use of Pre-lab work is exist (Carnduff and Reid, 2003).

Need for pre-labs are evident from well established learning theories of cognitive psychologists**.** Cognitive psychologists emphasize the importance of previous knowledge in learning. According to Jerome Bruner, previous information helps to discover relationship within the information to be learned. Similarly, according to Jean Piaget, students interpret new knowledge on the basis of existing knowledge. While David Ausubel thinks that the single factor which influences the learning of students is their previous knowledge (Bennett, 2003). Therefore laboratory manuals has been introduced to prepare the students for lab activities (Domin, 1999).

Keeping in view above cited evidences this research intended, to use pre and post labs at secondary level Chemistry lab.

MATERIAL AND METHOD

Population: Secondary schools of Islamabad (capital territory of Pakistan) where science laboratories for chemistry teaching are available at secondary school level were taken as the population of this study.

Sample: Two schools from the population were randomly selected as sample of this study. Each school in the sample had four sections of students at secondary level classes i.e. two sections for ninth class and two for tenth classes.

Two sections of the secondary chemistry classes in each school were taken as an experimental group and two sections as a control group.

In experimental group (With Pre-labs) the number of boys and girls were 54 and 61 respectively. The number of boys and girls in control group (with out Pre-labs) were 65 and 55 respectively. Thus, the total number of boys in this study was 119 and that of girls was 116. The experimental group consisted of 115 students and control group consisted of 120 students. Thus the whole sample consisted of 235 students.

Instrument/Tools: Pre and Post-labs were developed by the researcher to administer in this experimentation which were used for collection of data.

Pre- labs: Pre-labs of eighteen experiments were developed, keeping in view "to reduce the noises and increase the signals", by eliminating irrelevant information and highlighting the relevant information. These eighteen Pre-labs were sheets/hand outs consisting of objectives of the experiments, theories, procedure and method for the experiments. Answering the possible questions those may appear in the mind of sample students. The pre-labs were given to the experimental group (115-students, with Pr-lab sample) at least one week before the start of that particular experiment. These students were allowed to understand the theoretical base of the experiment prior to perform in lab with the help of pre-labs and the teachers. In this way preparation of the sample (experimental group) was continuous through out the academic session, prior to perform the practical in the lab. More over, before starting the experiment the teachers/lab demonstrators confirmed the 'preparation' of (with Pre-lab group) sample students.

Post–labs: Assessment is at the heart of the process of promoting children learning. Keeping in view the Bloom's taxonomy of educational objectives, Post –labs of eighteen practical were prepared to know the effectiveness of Pre-labs. It was a short test administered at the end of each practical to the whole sample (with pre-lab group and with out pre-lab group), to know the difference of sample's achievement. Items in the Post-labs were developed exactly relevant to that experiment and related theory in the text book. The Philosophy behind questions was psychomotor domain of Bloom's taxonomy of educational objectives, up to the level of application and synthesis.

To avoid the errors, whole procedure was explained to the Lab-demonstrators/Chemistry teachers regarding this experimentation.

Data collection: Pre-labs were provided, one week before the start of each experiment to (With Pre-lab) the experimental group only. Students discussed the Pre-labs with concerned teachers and good time (one week) was given to them to study and come prepared for the experiment. Thus the group with Pre-lab was given a confirm chance to come prepared for the experiment before to enter into the lab.

Post-labs were administered to both groups, i.e. experimental group (With Pre-lab) and control group (Without Pre-lab) just after the completion of each experiment. Researcher him self collected and evaluated each Post-lab and prepared / organized files/ data of each student's performance to analyze the results.

The scores made by the students sample in each Post-lab were analyzed by using SPSS program in the computer. T-test was implied at 0.05% level of significance to know the mean difference between the two sample groups (with pre-lab and with out pre-lab).

RESULTS

In table-1, while looking at the mean scores/marks, it is indicated that with pre-lab students performed better in the Post–lab than the students performed experiment with out pre-lab.

The significance value ($p = 0.270$) is greater than alpha ($\alpha = 0.05$) at the degree of freedom 233. Hence there is no significant difference between the academic achievements of the sample students with pre-labs and with out pre-labs in the subject of chemistry lab work at secondary level.

In table-2, the mean scores/marks obtained by the boys sample with and without pre-lab shows that the boys with Pre- lab performed better in the Post lab work than the boys with out pre lab. The table reflects that the significance value ($p = 0.001$) is less than alpha ($\alpha = 0.05$) at the degree of freedom 117. Hence there is significant difference between the academic achievement of the boys with pre-labs and the boys with out pre-labs.

In table-3, mean score/marks show that the girls with pre-lab performed better in the post-lab work than the girls with out-pre lab. It also reflects that the significant value ($p = 0.010$) is less than alpha ($\alpha = 0.05$) at the degree of freedom 114. Hence there is a significant difference between the academic achievement of the girls with pre-labs and with out pre-labs

Table -1: Post-Lab Scores of Whole Sample (With Pre-Lab & With Out Pre-Lab).

Groups/Sample	N	Mean	Mean Difference	Std. Deviation	t	df	*p*
With Pre-Lab	115	47.43		14.945	1.106	233	.270
With out Pre-Lab	120	45.18	2.251	16.193			

Table-2: **Post-lab Performance of Boys (With and With Out Pre Labs)**

Boys Group	N	Mean scores	Mean Difference	Std. Deviation	t	df	*p*
With Pre- lab	54	40.78		14.917	3.345	117	.001
With out Pre-lab	65	33.43	7.347	8.707			

Table- 3: Post-Lab Performance of Girls (With and With Out Pre-Labs)

Girls Group	N	Mean Scores	Mean Difference	Std. Deviation	t	df	*p*
With Pre-Lab	61	53.31		12.362	2.610	114	.010
With Out Pre-Lab	55	59.05	5.743	11.214			

DISCUSSION

Johnstone *et al* (1998), Zaman (1996), Safdar (2002) had studied the effect of pre-labs in an undergraduate Physics laboratories and Kausar (2004), studied the effect of pre-labs on girls in undergraduate Biology laboratories. Results of all these studies favored the use of Pre-labs significantly. This study reflects that girls, with out pre-labs group, performed significantly better in the post-lab (Chemistry) work than the girls with Pre-lab, by contrast with the findings of the previous research (Zaman 1996; Johnstone *et al* 1998, Safdar 2002, Kausar 2004). Girls out performed than boys in academic achievement in post labs. This result is similar to the studies of Tahir (2005), "effect of information and communication technology on academic achievement and retention of students of mathematics" and Tabassam (2004), "effects of computer assisted instruction on the secondary school students' achievement in science". In these studies girls performed significantly better than the boys.

Conclusion: The over all sample performance in the post lab work reflected that there is no significant difference of the students achievement, when they performed with pre-lab and with out pre-lab. The boys with pre-lab performed better in the post lab than the boys with out pre lab at the significant level. The girls with out pre lab performed significantly better in the post lab than the boys with out pre-lab. Over all results of post-lab work (Chemistry lab) reflects the use of pre-labs is beneficial for the improvement of students understanding. Use of pre-labs in chemistry lab at secondary level/other levels, require further study to understand the effectiveness of pre-lab.

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