

Effect of Lab Activity on Science Comprehension at Elementary School Level in Pakistan

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Abstract

This aim of this research was to investigate the effectiveness of lab activities on the performance of elementary school students in learning science concepts. The study was conducted on 50 students of grade 6th studying general science comprising two groups of 25 students each i.e. control group and experimental group. The students were from poor socio-economic background and had no chance of taking part in experimental work before. Control group was instructed through traditional lecture-based teaching method while experimental group got a chance of performing lab activities. The posttest-only control group research design was opted for the collection of data. Students t-test was performed for data analysis. The results showed that there was significant difference in the academic achievement of students of both groups. The students of experimental group had a great understanding of the concept and performed well in this domain as specified by t-value of 5.06 at $df=48$ which is statistically significant. But the students of control group outperform the experimental group in content learning exam with t-value 2.26 at $df=48$ which is also statistically significant. It can be concluded from the results that activity-based teaching methods are effective in building students' understanding of the general science concepts. Results also revealed that traditional teaching approaches are also beneficial in terms of memorizing and writing content. As our examination system requires the students to perform both in concept based and rote-memorization demanding questions. So, it is necessary to incorporate the activity-based teaching strategies with the traditional teaching methods as both have their own significance in respective examination.

Keywords Activity Based Science Teaching, Concept Buildings

Introduction

Activity-based teaching learning is a technique in which students are occupied in acquiring knowledge (Prince, 2004). Panko *et al.*, (2007) define activity-based learning process in which students are not passive learners but they take part in an active manner in the learning activities. McGrath (2011, p.23) explained the activity-based teaching as a method in which learners process his knowledge by doing and critically reflecting in comparison to traditional teaching approaches in which the learner is only restricted to knowing. Each learner has the capability to learn through application and direct participation in activities and in this way, they develop their thinking about world. They make sense of things in their own perspective. Activity-based method of teaching help them to build up their perception. According to Rillero, 1994 "A child best learns to swim by getting into water; likewise, a child best learns science by science."

Science is not only restricted to reading and listening, but it engages learners in experimental work so that they are able to develop their skills (Ewers, 2002). Learning science makes the students logical thinkers who organize the learnt concepts in a way that they can utilize these in dealing real life problems. So, teaching science in a way that it makes learner to

be able to get benefit from it and utilize it for the services of mankind is the most crucial part of the curriculum and education system (Safdar, 2007). And it is the one person who can make it possible and that is the teacher. The role of teacher in teaching science cannot be restricted to as a giver of information but it is who provide the society with the best of the brains to solve the prevailing problems.

The task of educating students is not easy and it only demands to be held exclusively by teachers that can impart skills along with information. The modern society demands that the schools must work with highly skilled professionals who can teach the modern content according to the needs of society. The professionals are ideal for this purpose because they can devise the finest methods of instructing the learners in a way that they can learn skills and attitudes along with information (Arends, 2004). After the teacher the second most important thing to consider is the method which can be used to teach science. Traditionally lecture method is prevailing in our education system as the only method being used to teach almost all subjects of arts and sciences as well. It is an instructional technique which is used by the teacher to develop interest among learners and impart new information, ideas, knowledge and techniques which will then enable the learner to critically analyze that content (Iqbal, 2010).

Worldwide it is the most common method being used because it is useful in instructing several students at a time. Researchers are emphasizing on the fact that this method alone is not enough especially in teaching sciences as it only uses the theoretical flow of knowledge from the beginning till the end. So, the other ways of instructions must be explored which involve an equal participation of the learners as well (Behr, 2006).

Activity based learning can be used as an alternative of the traditional lecture method as it involves the learners to take part in the learning process as active participants rather than being passive listeners. It makes the learners to critically think how to solve a problem by using the information presented to them in different activities. They do not only just learn content but learn different problem-solving techniques and skills. And for problem solvers the content will not be a big thing for them to learn (Churchill, 2003). Researchers in the area of science education have come to a consensus that to get maximum from a science classroom we must move from 'imitating to innovating' ensuring teaching learning quality (Shukla & Agarwal, 2005).

Several researches have shown that students cannot retain knowledge which have been presented to them in traditional way. Such types of activities cannot only help the students to retain knowledge but also motivate the students to participate in the teaching learning process. Science is not something that can be learnt only by listening it is a process which involves doing, reflecting, analyzing, critically thinking, evaluating and it all can only be done when the first step of "doing" will be completed and activity based learning is the only method which provides a chance of doing. Therefore, it is obvious that science- teaching is nothing without activities.

Statement of Research Problem

The aim of this research was to investigate the efficacy of activity-based teaching methods in helping elementary school students to understand the science concepts which is lacking in students of elementary schools due to prevailing traditional teaching practices.

Delimitations

The research was conducted on the 6th grade students. It was focused only on investigating students' ability of understanding General Science concepts.

Objective:

More specifically the objective of this research was,

- 1- To check the effect of lab-based teaching approach on students' ability of concept building in the subject of general science at elementary level.

Research Questions

- 1- Does activity-based teaching approach help in improving the students' ability to understand the general science concepts?
- 2- Does activity-based teaching approach help in improving the students' ability to memorize the general science content?

Significance of Study

The results of this study will be beneficial for both teachers and learners of elementary school students in terms of improving the methods of teaching leaning methods.

It would also be helpful for curriculum developers and course designers to incorporate maximum of activities in the science syllabi.

Teachers training programs would be benefitted in preparing teachers in a manner that they would be able refine their teaching methodologies.

Methodology

The procedure opted for this study was posttest-only control group research design. The sample was comprised of 6th grade students of FG School No. 3 (Girls) Wahcantt. The students were not from very well socioeconomic background. 50 students were randomly selected from 6th grade as sample of study. These students were randomly distributed into two groups of 25 students each. Both the groups were taught the same topic with different teaching methods. Control group was taught with traditional teaching method while experimental group received activity-based instruction. Posttest was designed to check the effect of activity-based teaching method. Posttest was composed of two sections, one to check the students understanding of the concept and second to analyze their ability to memorize the taught information. T-test statistics was used for analysis of data.

Data Analysis

Table 1

Comparison of Posttest Scores of Control Group and Experimental Group in Concept Based Questions:

	Post-Test Mean	SD post test	df	t-value
Control Group N=25	10.72	1.13	48	5.06
Experimental Group N=25	12.72	1.63		

The mean score of control group in the posttest designed to check the students' ability to understand the concepts was 10.72 while the experimental group have average score of 12.72.

The mean score of both the groups was compared through t-test having value 5.06 at df 48 which is statistically significant.

Table 2

Comparison of Posttest Scores of Control Group and Experimental Group in Rote Memorization Questions:

	Post-Test Mean	SD post test	df	t-value
Control Group N=25	4.52	1.12	48	2.26
Experimental Group N=25	3.56	1.8		

The means score obtained by control group in the post test demanding the rote memorization ability of the students was 4.52 while in experimental group it was 3.56. The t-value was 2.26 at df 48 which is statistically significant.

Findings

Activity based learning is a new paradigm in science education and it is in great opposition to the traditional method of learning being used from centuries by making the students active learners rather than being passively taught. The results of this study show that activity-based learning proved very effective in teaching general science at elementary level. The experimental group performed significantly better in overall performance especially in concept-based questions demanding a deep understanding of the concept and a power to analyze the topic and synthesize new ideas based on the content being taught to them.

The mean score obtained by the students of experimental group in this test was 12.72 as compared to mean score of 10.72 obtained by the control group. The t-value obtained was 5.06 at df 48 i.e. statistically significant. These results are in line to the previous researches of Schmidt *et al.*, (2006), Hung *et al.*, (2008), Ates and Eryilmaz, (2011) and Khan *et al.*, (2012) who found that the performance of experimental group was significantly higher than control group in terms of concept understanding. Freedman (1997) and Turpin’s (2001) also reached on a conclusion that teaching science with hands on activities produced significantly better results than their counterparts. It may be because the students of experimental group had a real time chance of experiencing the events themselves as they performed all the activities as compared to control group students who just listened passively what was being taught. Also, the students of experimental group had a lot of questions and queries during the activities as they did not lose interest in whole period of teaching learning process.

But when it comes to writing content in the test demanding the rote memorization ability the students of control group completely outperform the students of experimental group. The mean score of control group in this domain was 4.52 as compared to the mean score of 3.56 with t-value of 2.56 at df 48 which is statistically significant. This was because as the students of control group were taught by lecture method in which they only got a chance of questioning their doubts at the end of the lecture so they could not understand the underlying concept. As they had not completely understood the topic, so they went for cramming the content and performed better than students of experimental group in this domain.

As for experimental group is concerned the students although did understand the topic completely and performed best in conceptual type question so they paid less attention to learning

content for the purpose of writing it. Such kind of results were also examined by McCarthy (2004) who studied the effect of activities as compared to textbook taught students. The results showed that the experimental group may have performed better in laboratory assessment, but the control group equally performed in the written type of exams. Likewise, Lieux, (2001) and Zumbach *et al.* (2004) could not find any significant effect in the results of students of active classrooms and those who were taught traditionally. Similarly, Gallagher and Stepien, (1996), when took the short-term retention test could not find any difference in the results of both groups. These results are also in agreement with the results of Bristow *et al.*, 2000 who found no significant effect of activity-based learning in 6th grade science students' academic achievement but found that students were more motivated toward learning when taught with this method.

Conclusion

The results of this study revealed that activity-based teaching methods proved very effective in concept building of the science students. The results showed that the students of experimental group had a better understanding of the content but they did not memorize it for written purpose that's why performed good in concept based questions but loose marks in memory demanding questions where relative material along with examples and explanation was required. From the results it is concluded that using only activity-based teaching strategies cannot produce fruitful results in our education system as our examination system requires the students to both understand the concept and memorizing it for written purpose. Therefore, attention must be paid to not only activity-based learning and helping the students to make their concepts but also to make them learn and memorizes the content up to the requirement so that they can easily write what they have studied along with suitable examples and explanation. So, to get better results, it is necessary to incorporate the activity-based teaching strategies with the traditional teaching methods as both have their own significance in respective examination.

Recommendations

- 1- The role of activity-based teaching learning is well acknowledged; therefore, it is recommended that this approach must be adopted and incorporated in science classrooms along with traditional teaching methods.
- 2- It would be valuable in helping students in concept building which is necessary especially in case of science
- 3- This study should be replicated to all courses from primary level till university level.

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