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ORIGINAL CONTRIBUTION

Effectiveness of Science Textbook Activities for Conceptual Understanding of Students

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Abstract— This research is attempt to check the effectiveness of science textbooks activities for conceptual understanding of learning. The main objective of the study was to develop the conceptual knowledge about science in students. For this purpose, use textbooks activities and different instructional aids for enhancing the conceptual understanding of learners. This study was quantitative in nature. Quasi Experimental research was used to check the effectiveness of use of textbook activities for conceptual understanding of learner at elementary level, which were measured through pre and post-test. An action research was conducted in a public sector, high school in Rawalpindi. Students of grade five were selected to conduct a study. Intervention was carried out throughout whole weak. Pre-test and post-test were taken to collect data and analyzed, by using mean and t-test. The study found a significant difference between teaching of science through traditional method and using textbooks activities as well as other additional instructional aids. In post-test students perform very well as compared in pre-test. It was concluded that intervention has positive effects on students learning performance. This study act as model and guideline for science teachers at elementary level to make their teaching effective and long-lasting during science lesson. This will contribute to better science teaching in schools.

Index Terms— Textbooks activities, Conceptual understanding, Public sector, Elementary school, Intervention, Science textbooks, Learning.

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Introduction

Education is the basic need of every person. It is something that makes an individual self-reliant and selfless. It is ongoing process we learn from our mistakes and experiences.it is not a preparation for life, rather it is the living. Education is the process of living through a continuous reconstruction of experiences. It is the development of all those capacities in the individual which will enable him to control his environment and fulfill his possibilities. According to (Alsop & Hicks, 2013) 'The influence of the environment of the individual to produce a permanent change in his habits of behavior, or cognitions and attitude'.

Children's conceptual understanding of science has been a focus of work at Leeds for many years. Theoretical and practical insights have both developed from and feedback into practice through collaborative work with teachers (Leach et al., 2001).

Conceptual understanding, where children can grasp ideas in a transferable way, can help students take what they learn in class and apply across domains. Rote memorization and traditional methods of teaching science are becoming considered insufficient for real-world

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learning The traditional teaching approach is defined as teaching is entirely depend on textbooks where the teacher teaches the content and students just sit, read, do assignments and taking notes (Ates & Eryilmaz, 2011; Kanwal, Shahid, & Jabeen, 2022).

Traditional classes look like a one-person show where usually controlled by direct and one-party instruction (Abida & Muhammad, 2012). It seems like students are here just to listen and students are not responding to the teacher, they are just receiving what teacher is conveying. In this way, students don't make their effort to learn new things in practical form and they couldn't form new ideas. Attitudes are the ability to handle with and manage the feelings, assignments and it plays a role in leading human's behavior during the learning process (Kaya & Boyuk, 2011). Science teachers have realized that learning through activities helps pupils to gain maximum understanding of the scientific concepts. Pupils having the opportunities to investigate, explore and drawing conclusion learn faster than those who lack these opportunities (Hussain, 1998).

Importance of activities

According to Lave and Wenger (1991) activities help students for long lasting learning. In an activity system, regular and recurring patterns of activity are called its practices. People who know how to participate in the same shared practices are called a community of practice. When individuals want to join a community of practice, at first they do not know how to participate in these shared practices. Student cannot take interest in theoretical learning or lecture based learning when teacher taught through activity then they show interest in their studies and its make their learning long lasting. Consequently, at first they are peripheral members of the community, and their learning trajectory gradually leads them toward participating more fully in the community's practices. Practical work means "…learning experience in which students interact with materials or with secondary sources of data to observe and understand the natural world" (Lunetta, Hofstein, & Clough, 2007).

Instructional aids

Instructional aids are also know as teaching material, it is the collection of many things like animated objects and many other resources that teacher used during their learning duration. Instructional aids is defined as 'resources that organize and support instruction, such as textbooks, tasks etc (adapted from Remillard & Heck, 2014).

Problem statement

I have observed during my practicum that the teachers used traditional method to teach science. I chose this topic due to the lack of facilities in government schools, teachers only taught theoretically which is not considered enough for the understanding of concepts of science, so teacher may use any interesting, motivating and effective method of teaching and enhance the learning of the students. Due to the lack of facilities, teachers can teach their students by using the textbook activities and clear their concepts. Students will be able to apply the concepts of science in daily life if taught with the help of activities.

The textbook activities should be considered helpful which are designed or written in accordance with the aims and objectives of science teaching. Such book activities can provide help to the teacher and students in numerous ways. By making use of science textbooks activities, it becomes possible for the teacher to make students understand fundamental concepts and principles of science easily and quickly.

Purpose of study

The purpose of this study is to find out the effect of textbook activities on the learning of students and to find out at what extent the use of textbook activities is effective for students at elementary level.

Objectives

The following were the objectives of the study:

- To find out the effect of textbook activities on students' performance.
- To compare the performance of students before and after the implementation of given textbook activities.

Significance of the study

This study helps the teacher to teach science more effectively and students will take interest in understanding science concepts through using the activities given in the book. The outcomes of this research develop the importance of textbook activities to teach science at elementary level.

Literature Review

The traditional teaching approach is defined as teaching is entirely depend on textbooks where the teacher teaches the content and students just sit, read, do assignments and taking notes (Ates & Eryilmaz, 2011).

Traditional classes look like a one-person show where usually controlled by direct and one- party instruction (Abida & Muhammad, 2012). It seems like students are here just to listen and students are not responding to the teacher, they are just receiving what teacher is conveying. In this way, students don't make their effort to learn new things in practical form and they couldn't form new ideas. Attitudes are the ability to handle with and manage the feelings, assignments and it plays a role in leading human's behavior during the learning process (Kaya & Böyük, 2011).

The word Science comes from Latin word Scientia meaning knowledge or to know."It is a systematic Knowledge-Based or prescriptive practice capable of resulting in predication science can also be science tells people how the world operates. The term science is defined in many ways by many people in every area. According to Memon, (2007) "Science is a cumulative and endless series of empirical observations which result in the formation of concepts and theories, with both concepts and theories being subject to modification in the light of further empirical observations. Science is both a body of knowledge and the process of acquiring it." Concepts are considered as 'the glue that holds our mental life together … in that they tie our past experiences together to our present interactions with the world'(Gennaro, 2007).

Teaching methods for science

There are varieties of methods that a teacher can use for teaching science. However, the choice of a method depends on the objectives of education and the conditions under which learning is to take place, Yitbarek (2012), classified all the teaching methods in to the three categories:

- Oral Method
- Observation Method
- Practical Method

Effective science teaching depends on the three-factor Teaching, equipment, and material. Locally produced low-cost equipment, teaching aid, or models can serve the needs of the teacher , the students and the curriculum more effectively and is easier to maintain (Simo, Fernandez, Algaba, Salan, Enache, Albareda-Sambola & Rajadell, 2010).

Research Method

Quantitative method is used for his research. It focuses on gathering numerical data and generalizing it across groups of people or to explain a particular phenomenon. An interventions was carried out to use the textbook activities in teaching science.

Research approach

To collect the data for this particular research study, quantitative method has been used. Methods of investigating phenomenon which involve the collection and analysis of numerical data. Such methods are particularly associated with surveys and experiments.

Research design

The design of this study was action research. Action research is an interactive inquiry process that balances problem-solving actions implemented in a collaborative context with data driven collaborative analysis or research to understand underlying causes enabling future predictions about personal and organizational change (Reason & Bradbury, 2001) According to the researcher, it was the most appropriate method to answer the research questions.

Data collection procedure

Data was collected by using quantitative approach through pre-test and post-test. Pre-test was conducted to check the prior learning and conceptual understanding of students in Science and then to check the effectiveness of research study, post-test was conducted.

Population

The population of the study was the students studying General Science in Government School of Rawalpindi. The audience was the students of grade 6th. Total students were 30 and they belong to same school and same section.

Sampling technique

The sample was taken from defined population i.e. Students. As a sample there are 30students in the class. As 30 students were the participants so first of all, researcher took pre-test from the students. In second step, the researcher gave the treatment and at the end to check the effect of the treatment, researcher took the post-test.

Instrument of the study

A close ended pre-test and post-test type was used as a tool of the study which is construction the basis of student's mental level.

Pre-test

Pre-test is used to check the previous knowledge of the test. The researcher used the pretest in research study to check the prior knowledge of students of 6th class about science. The total marks of the test were 15.

Use of activities

The activities that were given in the textbook were used to teach the students. The charts and models were used to teach the students. Few other things were brought from home that was shown to students to make their concepts more clear and concise. After teaching, on the same day, work sheets were distributed to students for their assessment. On final day, post-test was taken.

Post-test

Post-test is used to check the effect of a treatment on specific group. Researcher check the effect of using textbook activities for conceptual understanding of the students. After taking the pre-test, the researcher taught science by using textbook activities for more clarification of student's concepts.

Data collection

After getting permission and support letter from Fatima Jinnah Women University, a government school was selected. The data was collected from the school and the school was same as in which I have done my teaching practicum. The researcher selected the 6th grade. Pre-test and post-test were used for the collection of data. Pre-test and post-test were consist of one chapter of Science in which the researcher taught two topics. For the research study, pre-test was taken to check the previous concepts of the students and post-test was taken to check the effect of the treatment.

Data analysis

After the collection of data, the data was analyzed through SPSS by using T-Test. SPSS software has been used to analyze the data that has been collected through pre-test and post-test. Hence to derive the results.

Ethical consideration

The study was conducted by few ethical considerations. After getting the permission from the University, the researcher visited the school and requested to Principal to give the permission for the collection of data for research study. The study was conducted to strictly follow the ethical values. There were no element of favoritism and biasness in analyzing the test scores of the students.

Results

The study is about to use textbook activities for conceptual understanding of students in Science. In this study, the focus of the researcher was on the textbook activities that how teachers can implement textbook activities in the classroom for conceptual understanding of students. Data was calculated in SPSS, where t-test was applied to determine the difference between mean score of pre-test and post-test. The results were measure after teaching for a week. The result was calculated to find the mean score difference between pre-test and post-test. As the result of post-test was higher than the pre-test and hence in this way, it shows the clear effect of the study.

Table I
Brief description of data used in study

	Pre-Test	Post-Test
Total Students	30	30
Total Marks	15	15
Minimum	4	9
Maximum	9	15
Mean	5.77	12.63
Standard Deviation	1.382	1.377

The table above is indicating the comparison between the results of pre-test and post-test. The total students were 30. The test was of 15 marks. The minimum of the pre-test and post-test was 4 and 9 respectively. The maximum of the pre-test and post-test was 9 and 15 respectively. There is the significant difference between the mean scores of pre-test and post-test.

Mean difference between students' performance

Both the pre-test and post-test were conducted on the experimental group. Pre-test was taken before without any treatment and the strength of the participants were 30. After the treatment, post-test was taken and the no. of participants were same as in the pre-test. The table given below is indicating the mean difference between pre and post-test scores and also the minimum and maximum scores of students of pre-test and post-test.

Table II
Mean difference of Pre and Post-test

	N	Minimum	Maximum	Mean
Pre-Test	30	4	9	5.77
Post-test	30	9	15	12.63

The above table indicates the no. of students in the pre-test and post-test. The minimum and maximum scores of both of the pre-test and post-test. This table is also indicating the mean score of both pre-test and post-test. The minimum of the pre-test was 4 and maximum of pre-test was 9. In the post-test, the minimum was 9 and the maximum of the post-test was 15. The mean for the pre-test was 5.77 while the mean for post-test was 12.63. The difference among the results of the pre-test and post-test indicates that some learning has occurred after the treatment.

Analysis of data according to Objectives

Data was analyzed according to the research objectives. The focus was on the conceptual understanding of students by using textbook activities. Post-test shows the effect of study on student's learning.

Table III
Paired sample statistics

Paired difference	Mean	Std.Deviation	Std.Error	T	DF	Sig.(2-tailed)
Pre-test						
Pair 1	-6.867	1.634	.298	-23.012	29	.000
Post-test						

Table 3 indicates the paired sample statistics. The table indicates that there is a significant difference between the scores of pre-test and post-test. The mean score of pre-test was 5.77 while the mean score for post-test was 12.63. The standard deviation of pre-test was 1.382 and standard deviation of post-test was 1.377.

Findings of the study

The findings of the analyzed data were organized according to research questions of the study. Findings of the present study are discussed in relevance to the research question. The findings of the study show that the treatment had positive effect on the students' learning. The post-test indicated that the learning of students got better and the interest of students also increased in learning science by using textbook activities.

Findings related to first research objectives:

First objective of the study was: To find out the effect of textbook activities on students' performance.

With the help of the students' scores before and after the use of textbook activities, it is found that the use of textbook activities are useful for students learning and for their conceptual understanding. This study revealed that use of textbook activities help to develop students' interest in science subject because most of the teachers use lecture and traditional methods which do not attract students towards learning process. Textbook activities engages student in the learning process and instruct them better than traditional learning. It also helps to enhancing their knowledge.

Findings related to second research objective:

Second objective of the study was: To compare the performance of students before and after the implementation of given textbook activities.

The students' scores before and after the teaching indicated that use of textbook activities had positive effect on students' learning. The mean scores of post-test indicated that students performed better after the intervention. Before the use of intervention, the score pre-test of the students were low. The mean of the pre-test score was 5.77 which shows that students' scored low in the pre-test. On the other hand, after the intervention, scores of the students got increased. The mean of the post-test score of experimental score was 12.63 which shows that the students' scored high after the intervention. This study shows that the use of this target method improves students' learning.

Discussion

The study was designed to analyze the use of textbook activities in teaching science. Findings indicate that activities has positive influence on students learning. The sample of 30 students were taken from targeted school. Pre-test and post-test was designed for collection of data.

With the help of the students' scores before and after the use of textbook activities, it is found that it is useful for students learning. This study revealed that activities given in the books help to develop student's interest in science subject because most of the teachers use traditional methods which only includes lecture and it does not attract students towards learning process (Waheed, & Jam, 2010). To teach students by using activities of the book engages student in the learning process and hence in this way their concept develops and concept become more cleared. As learning by doing has more long lasting effect on students' learning. Students can experience the science through real-life things.

The students' scores before and after the teaching indicated that performing textbook activities had positive effect on students' learning. The mean scores of pre-test and post-test indicated that students performed better after the intervention. Before the use of intervention, the score of the students were low. The mean of the pre-test score was 5.77 which shows that students' scored low in the pre-test. On the other hand, after the intervention scores of the students got increased. The mean of the post-test score was 12.63 which shows that the students' scored high after the intervention.

According to Yitbarek (2012) it focused on the practical based learning or activity based learning, study of Yitbarek support my results because textbooks activities enhance the understanding level of the student, and develop their interest in their studies.

Conclusion

Current study aimed to use textbook activities for conceptual understanding of students' for teaching science. The significance of the study was to teach science by using textbook activities to provide clear concept to students. This research delivered thoughtful findings the will help to improve science learning and teaching and make learning meaningful.

The study was conducted to identify the effectiveness of textbooks activities for conceptual understanding of students to teach science the study concluded that the we teach students very effective through activities method. When we use tradition method on the students their results were not affective but we use intervention (using activities to teach) its results are effectives and it bring a long last learning. Use of textbook activities for conceptual understanding of students to teach science had positive effect on the students learning. It was helpful for student. The performance of students was improves by using textbooks activities. Student showed their involvement and they actively participating in science by performing activities given in the book. By using textbook activities, students concepts were developed and become clear and concise. It also helped students to participate in class and share their ideas. Students also learn that how to work in groups with cooperation and collaboration. During activity performance, they also follow the rules of class.

Delimitations

Following were the delimitations of this study:

- The focus of study was only on one chapter of science.
- The time limit was one week only.
- The study was delimited to the public school at elementary level of the Punjab government located in Rawalpindi city.

Recommendations

On the basis of the findings and conclusion of the study, it is recommended that teacher need to focus on textbook activities and make models of requires activities for students and make the subject interesting and enhance the level of student's understanding:

- The teachers may try to provide the learning environment according to the needs of the students in which they can perform the activity easily in groups or individually.
- School should provide more opportunities and facilities to teachers and students to that they avail the resources and students learn more.

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