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A STUDY TO EXPLORE THE LINK BETWEEN DEMONSTRATION TEACHING METHOD IN PHYSICS AND STUDENT'S LEARNING ACHIEVEMENT AT SECONDARY LEVEL IN QUETTA DISTRCT.

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Abstract

The aim of this research work was to explore the impact of demonstration teaching method on secondary student's academic achievement in physics at Quetta. In this study two teaching methods demonstration teaching method and traditional teaching method (bookish method) were used. Here main objective was to give message with practical proof to the science teachers that which teaching method gives better results for learning physics in secondary classes. For this study experimental research design found suitable. Therefore, experimental research design was selected for this research study.

The study was conducted at Govt: boys high school satellite town Quetta. Because this school has suitable student strength and classrooms, which were the needs of this research study. Fifty students were randomly selected from the 9th grade section A. These fifty students participated in an objective test which was prepared from grade eight text books of general science. On the bases of this objective test scores these students were divided into two groups which were experimental group and control group. This division took place in such a way that the both groups have approximately the same academic achievement level.

After this pre-test was conducted, this test was prepared from text book of physics grade nine. Then treatment process started, in this process the experimental cluster was

tutored by demonstration pedagogy and the control cluster was tutored by traditional and bookish method. In this process ten lessons were delivered to experimental group and same ten were delivered to control group. After treatment post-test was conducted. The marks of experimental cluster and control cluster in pre-test and post-test were collected /tabulated as data of the study.

Data was analysed by the application of independent sample t-test (mini tab version 19). The analysed data expressed that the achievement of the experimental cluster in post-test was extremely high when contrasted with control cluster. This result revealed that demonstration teaching method was best and effective for teaching physics in secondary classes as compared to lecture and bookish method.

***Key words**: - Demonstration teaching strategy, Academic achievement, Learning, Performance, Conceptual understanding.*

(1) Introduction

Teaching is an active, well- organized and logical presentation of principles, laws, facts, ideas and skills to students. It emphases on maximize the learning practices. Selection of most appropriate teaching method is very important for effective teaching. When we talk about teaching of science it requires particular and the most appropriate teaching methods. Learning of scientific principles and concepts require conceptual understanding and the application of scientific theories in real life (Ainsworth, 2006). These teaching methods must create interest, active learning, active participation, and application of scientific knowledge (Tytier, 2003).

The important teaching methods for the teaching of science prevalent in the world are activity based method, inquiry based method, problem-solving method and demonstration method. However, unluckily most teachers are using traditional methods of teaching during teaching science subjects in their classrooms (Mazur, 2008). This traditional teaching does not nurture science learning in students and consequently they have to depend upon memorization. This situation creates problems in learning science. In science, physics is the comparihred difficult subject as well as for teachers and also for students. Therefore, many countries facing the problem of low interest to study the science and deficiency of passion to select physics as subject at school.

In this situation Educationists, psychologists and philosophers worked hard and developed some strategies and techniques that are helpful for teachers to find the solution of problems in science learning. In this regard American philosopher John Dewey (1934) presented his famous philosophy ‘’Learning by doing.” This principle seems the best for learning scientific terms and laws. The demonstration teaching method which is very helpful for teaching science is based on this principle.

Beasley (1982), stated that demonstration makes the class environment learning oriented because it provides direct observation and examples that boost lectures and students involve in hands-on, problem-solving tasks. Demonstrations can be used effectively to involve students positively in the lesson, and these are important for capturing student’s attention. Visual illustrations of nonconcrete concepts offer a chance to explain the scientific method and to guide the students to relate experimental observation to scientific principle. It makes the learning of physics interesting and enjoyable. Effective demonstrations are absolutely crucial for supporting pupils to relate the concepts of physics with daily life. Well planned demonstrations have the power of being unforgettable. This teaching method is appropriate for classes of all sizes and content area. But it is most effective in science teaching.

The teaching and learning of science has great importance in world's economic, social and financial development. In this regard world's developed countries have done a lot of work on the procedure of instructing and acquiring science. One of the reasons behind this development of advanced countries is based on the experts of highly qualified planners. These professional made clear and long term educational policies. They have developed their curricula, text books and teaching strategies after research which fulfill the needs of this modern and technology based world. For implementation of such curricula, they have introduced modern instructional strategies and provided all necessary facilities to teachers which were essential for quality teaching (Sparkes, 1992).

In the developed countries like USA, Britten, France, Germany etcetera a specific term is used 'science and technology based economy' which connotes that invest money in teaching of science and technology today and get its benefits tomorrow. These highly qualified people were worried about their bright future and wanted to rule over the world by their development in science and technology (Krige & Dominique, 2003).

Pakistan is lying in the list of developing countries and its education system is not very effective. Educational policies are not clear and these policies were changed after short time period. There is a lack of long term and research based educational policies. Due to these reason we have no need based curriculum, text books and instructional strategies. Which make our teaching and learning of science ineffective. There are many reasons for this worse situation but an important reason behind is use of traditional teaching methods, during teaching science subjects. This situation leads towards poverty and poor economy.

Our province Balochistan which has a small but scattered population. In this province like other departments, Education department has lack of adequate budget. In this small budget a large number of teachers have no chance to participate in professional development and capacity building programs. Therefore, these teachers have no awareness about modern instructional strategies. Mostly they are using bookish method. This method has no capacity to use more sense organs of students in learning process and give conceptual understanding in learning different concepts of science. This situation leads towards low quality teaching. This problem become more severe when the available budget is not properly used and we have to face very difficult situations like shortage of physical and human resources. When we do not have fully equipped laboratories, professional science teachers and effective teaching methods, we cannot teach science subjects specially physics practically and effectively.

Quetta the provincial capital of Balochistan has amazingly same conditions of teaching and learning science, here mostly schools have no proper laboratories, well

trained teachers and modern instructional strategies. Majority of teachers are using chalk talk and bookish method. These teaching methods are unable to give conceptual understanding of different concepts of physics to students. In this situation science students do not show any interest and motivation towards physics learning. They feel bore and frustrated and try to just memorize these concepts without any understanding.

In these conditions we are producing those science personals, who do not have fully command and deep understanding of different concepts of physics. Which indicate that in future we will have no quality science teachers, doctors, scientists, engineers and technical experts.

(2) Literature Review

Most of the studies on demonstration teaching method highlighted that this teaching method is very effective in teaching science subjects and has the capacity to give conceptual understanding and create interest in students, although some researchers found that demonstration teaching method is not so effective and some time it is used just for fun.

Demonstrations offer a solid visual way which is very helpful to explain a science topic. They also increase student involvement in the lecture. Demonstrations are effective for recapture student's attention. Graphical examples of abstract topics offer a chance to explain scientific method and to teach the learner to make connection of experimental observation with scientific theory. Therefore, in demonstration lessons learning of physics become easy and enjoyable. Demonstration lessons are vital tools for encouraging learners to connect physical concept with daily life. A well performed demonstration is visual productive way to explain concepts and maximize student's interest in physics. It is a fact students want to see physical examples of laws theories and principles, without demonstration they remain nonconcrete and cut off from daily life. Demonstrations can be resolve students misconceptions in physics and effective in stimulating. A good demonstration can clarify a term or concept in such way that without demonstration it is impossible to convey it (Odem & Bell, 2015).

Demonstration is a practically showing or giving presentation of an act to clarify the basic laws theories and principles. Teaching with the help of demonstration is a beneficial instrument for a teacher and it is very important for teaching different skills, a demonstration become productive if it should closely repeat by students for strengthens the learning. The effectiveness of demonstration is the students get the real involvement

of what they are reading. Demonstrations make the students more focused and attentive (Kimweri, 2004).

Chiappetta and Koballa (2002) concluded that a well-planned and accurately presented demonstration has the capability to improve the student understanding of physics concepts. In the same way (Hofstein & Lunetta, 1982) remarked that demonstrations have the ability to boost up the understanding, motivation and interest. Gardner (1978) found that demonstrations are the opportunities for students of concrete experiences and these experiences increase the curiosity and improve thinking and reasoning skills.(Gerber, Cavallo and Marek, 2001) concluded that Teacher's demonstration are academically more productive than learners own experimentations. (Hofstein and Lunetta, 2004, and Clough, 2007) Worked on the usefulness of demonstrations, and they concluded that use of demonstrations in teaching of physics gave better results to teach physics. (Buncick, Betts, 2001) conducted a study on college introductory course and reached on the conclusion that demonstration boost the understanding because they stimulate the active involvement of the students. A high level of learners' participation and interest in tasks also showed by students for demonstrations used in high school physics courses. (Meyar et al, 2003) found that demonstrations enhance learner's participation, since demonstrations are not teacher oriented and they give a chance to learners to create questions and show interest in the process of learning. It also motivates learners to deeply observe and give a chance of deep learning to students, because it supports the students to make links among new knowledge and prior knowledge. Furthermore, Meyer et al. described that learners can show passion by seeing the teacher as he thinks how students better understand the concept, and he makes questions that require thinking and explanation of the topic. It may test learners existing knowledge and enhance the conceptual understanding of the students.

(Middendorf and Kalish 1996) viewed that mostly student show interest when a teacher presents these demonstrations. These well organize demonstrations support the teacher to change the pace of the lesson and try the students fully concentrate on the lesson. These demonstrations can function as key of a lesson for clutch learner's attention. But due to importance of science education it needs to do more than giving proof of scientific laws and concepts of text book. Another important point is that these demonstrations can has the ability to engage the students in lesson and function as the initial step for observing, collecting, processing, analysing and generating scientific information. A science demonstration can play an important role in building a sense of community when instructor and students begin a search to describe the amazement created in science demonstration. (Julian 1995; Roth et al.1997; Laws 1998; Crouch et al. 2004) have discussed on different methods of giving demonstrations and their importance

in helping students understanding of science topics. Hence, students feel pleasant during demonstrations, but there are some examples that only observing the demonstration is not enough for mostly students.

(Meiner H. F. 1970) viewed that we can acquire more information during well planned demonstration of physics experiment. Here we get real knowledge of laws, concepts, terms and theories of physics. It provides a chance to us where we can analyse procedure and facts of nature. The knowledge obtained from experimentation is very productive and well-remembered for a lengthy period. This experimentation creates attentiveness in learning subject, because students have a good opportunity to look comprehensively at the experiment. These demonstrations grow wish to study thing linked to the studied phenomenon actively and deeply. These experiments support to additional emphasize on learning and not teaching, significance of energetic studies and not educator given information. Hence, experiments support to find important problem of physics teaching.

Milne and Otieno (2007) found demonstrations significant in building strong relationship between teacher and pupils, especially for those students who are belonging to demoted groups. In this situation the presence of lecture demonstration formed greater student engagement at the time of introducing and explaining the principles and concepts. Demonstrations give a chance to learners to develop thinking skill like comparison analysis, and evaluation. Watching a surprising incident prompt learners to wonder, to inquire, to probe questions, to examine and reach on a decision that describe what was watched.

Shakhashiri (2011b) also suggests that the Science demonstrations have vital role in teaching and learning of different scientific concepts. Scientists want to describe the world by investigation and discovery, in the same way science teachers want that their students employ this scientific knowledge in their lives, connect scientific law and principals with daily life and find out the wonderment of science world. This teaching method provides a chance to science teachers to describe and exemplify the science laws ideas and theories in an effective and interesting way. He also suggests use of demonstrations is important to improve students learning by firming interpersonal relations.

Fagen (2003) reached on the conclusion that pupil's assessment recommend that demonstration do help to amuse and include the students in the lecture. In another study he found that students like demonstrations very much when it used in undergraduate physics. But there is less proof showing that demonstrations help students to comprehend the scientific laws and theories. Although teacher and students have the same claim that

pupils understand better from demonstrations and there is little definite data in favour of this statement. Swanson (1999) states that demonstrations are occasionally crucial alternates for students' laboratory experience. But Watson (2000) believes that demonstrations have instructional value and are not an end point, demonstrations are only one of various teaching strategies and should not be used for their own sake.

However, on the other hand many researchers suggested that this teaching strategy is not supportive in learning different scientific concepts.

(Straits and Wilke 2006) thought there is some uncertainty that good planned demonstrations are very important in teaching and learning science. Sometimes these demonstrations lead to grow confusion. Sometimes after observing a demonstration, learners have some understanding that is away from what the teacher wished for learners, this creates problem and confusion in learning process.

(3) Methodology and Equipment

For exploring the impact of demonstration strategy in physics (secondary classes) at Quetta this research study was conducted. After study the different research designs the researcher found that experimental research design was suitable. Therefore, experimental research design was selected for this research study. The study was conducted at Govt: boys high school satellite town Quetta.

For collecting data following research instruments were developed.

(a) Test for separation of sample into experimental cluster and control cluster.
(b) Test before treatment (pre-test).
(c) Test after treatment (post-test)

Data collection and analysis.

The scores of both tests (pre and post) worked as data for this research study, for discovering the difference in performance of two groups taught by demonstration teaching method and traditional teaching method.

To determine the contrast in performance of both groups, the application of independent sample t-test with minitab version 19 was used.

Table 1

Analysis of mean scores of both clusters on pre-test.

Test	Group	N	Mean scores	S.D	t-value	P
Pre	Exp	25	38.28	6.88	0.78	0.439
Pre	Cont	25	36.84	6.14		

Critical value of t at 0.05 = 1.96 df=118

The data in table 1 indicates that

The control cluster mean score (36.84) is nearly equal to the experimental cluster score (38.28), and the t value 0.78. At level 0.05 (0.78<1.96), the measured value of t is less than the tabulated value. This indicates that the mean scores of the both clusters on pre-test performance are not substantially different. This indicates that academic achievement level before the treatment was nearly the same.

Table: 2

Analysis of mean scores of both clusters on post-test.

Test	Group	N	Mean scores	S.D	t-value	P
Post	Exp	25	76.92	5.96	18.32	0.000
Post	Cont	25	45.96	5.98		

Critical value of t at 0.05 = 1.645

The experimental cluster mean score 76.92 is bigger than control cluster score 45.96 at t value 18.32. And there is substantial difference between the mean scores of both clusters. The above data expresses that after treatment the academic achievement of both groups is not same. The students of experimental group showed excellent result in post-test. While the performance of the control cluster is low as compared to experimental group.

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Pie chart showing the relationship in marks of pre and post-test obtained by control cluster and experimental cluster.

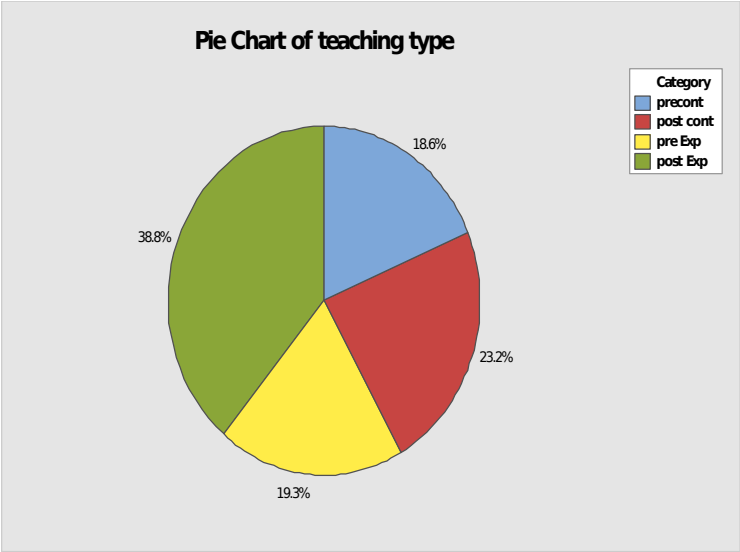

Figure 1

The above pie chart has four sectors. Blue sector is representing mean scores of control cluster in pre-test which is 18.6 % and yellow sector is the representation of mean scores obtained by experimental cluster which contains 19.3 % area of the circle.

The red sector is representing the mean sores of post-test obtained by control cluster which is 23.2 % of the pie chart. While the green sector which has the area of 38.8 % is the mean scores of post-test obtained by experimental cluster. There is a large difference in the sizes of these sectors. The larger green sector shows that experimental cluster gave excellent results in post-test.

(4) Findings

(a) In table 1 the mean scores (M = 36.84) of control group is nearly equal to the mean experimental group scores (M= 38.28) of 0.78 in the pre-test of physics. This finding suggested that the performance of the students of these two groups was approximately same.

(b) Table 2 indicates that the mean scores of experimental group in physics (M = 76.92) are higher than the mean scores of the control group (M = 45.96) for post-test of physics and t-value is 18.32. This result expresses that the post-test (after treatment) output of experimental group students is extremely higher than that of control group students.

(c) In Fig. 1 the red sector displaying the mean scores of the post-test control group has a small area (23.2%) compared to the green sector with an area (38.8%)

reflecting the mean scores of the post-test experimental group. This finding shows that the degree of achievement in post-test of experimental group is exceptional.

(5) Conclusions

1. Demonstration teaching method is very effective for teaching physics to grade 9th students as compared to traditional teaching methods.
2. Demonstration teaching method helps to improve conceptual understanding in physics at secondary level.
3. Demonstration teaching method supports to inculcate scientific attitude among science students.
4. Demonstration teaching method develops conducive learning atmosphere in classrooms for learning physics.
5. Demonstration teaching method combines theory with practical, which provides proofs of scientific law of physics.

(6) Recommendations

1. For giving conceptual understanding to students, demonstration teaching method should be included as instructional strategy for teaching physics in secondary classes.
2. For decreasing rote memorization, the demonstration instructional strategy should be used as teaching strategy in teaching of physics.
3. PITE and other teacher training institutions should design training programs which are focused on demonstration teaching strategy.
4. The curriculum designers are suggested to design the curriculum according to demonstration teaching strategy.
5. Text books writer are also suggested writing such materials which should be taught by demonstration teaching method.
6. Due to effectiveness of demonstration instructional strategy this strategy is recommended for primary, middle and secondary classes of Government and public schools.
7. In science labs and classes all facilities should be provided so that science teachers can apply demonstration teaching strategy without any difficulty.
8. NGOs and other private organization are suggested / requested to plan training programs for giving awareness to teachers regarding demonstration teaching method for effective teaching.

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