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The Effectiveness of Teaching Physics through Project Method on Academic Achievement of Students at Secondary Level -A Case Study

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Abstract

The aim of this study was to examine the effect of teaching Physics through project method on academic achievement of secondary schools students in the subject of Physics. In this study, an achievement test (pre-test/post-test) covering eight chapters were used as measuring instrument. Depending upon pre academic achievement test scores, eighty (80) science students of 10th class were divided into two equal groups named as experimental group and control group. The experimental group was taught through project method and the control group was taught by traditional lecture method. Both the groups were taught for a period of six weeks (40 minutes period per day). The Post test was administered at end of treatments. The marks obtain in Pretest and Posttest of both groups served as data of this study. The analysis of data revealed that on whole, experimental group showed better performance than controlled group. Furthermore the experimental group performed significantly better than control group in learning domain (knowledge, comprehension, and application and skill developments). The results this study indicated that teaching Physics through Project method was more effective as compared to traditional lecture method at secondary level.

Keywords: Physics teaching, Project method, traditional teaching lecture method and academic achievements

1. Introduction

Project teaching method is special kind of teaching. In this method knowledge skills are learnt by students through practical handling of problems in natural setting. Many educators have defined the project approach in their own words. Kilpatrick (1925) defined the project as a "hearty purposeful act" and also says “a project is a whole hearted purposeful activity that proceeds in social environment” (Kilpatrick 1935, p. 162). According to Cremin and Knoll(1961,1993a) the Kilpatrick based project concept is rooted in Dewey‘s theory of experience. The students were getting experience and knowledge by solving practical problems in social situations. It should be noted that Kilpatrick was heavily influenced by Edward L. Thorndike's psychology of learning, even more than by Dewey's theory of experience (Kilpatrick, 1918). According to Thorndike's "laws of learning," an action for which there existed an "inclination" procured

"satisfaction" and was more likely to be repeated than an action that "annoyed" and took place under "compulsion." From this, Kilpatrick concluded that the "psychology of the child" was the crucial element in the learning process. Children had to be able to decide freely what they wanted to do; the belief was that their motivation and learning success would increase to the extent to which they pursued their own "purposes."J. A. Stevenson says "A project is a problematic act carried to completion in its natural setting" these definition shows that a project is activity accomplished under pupil motivation.

According to Laffey et al. (1998) problems based learning is a form of contextual instruction on learner problem, finding and framing which carried out over absolute duration of time. Apel and Knoll say that the project is one of standard methods. The students can develop independence, responsibility, practice social and democratic of modes of behavior. It is genuine product of American progressive education movement and became known worldwide (Church & Sedlak, 1976; Cremin 1961). Kabba &Colley (2008) claim that the project based science instruction is most appropriate for 7-12 graders and is quite helpful for enhancing the understandability of science concepts.

The role of teacher in project method is to facilitate advice, guide and monitor the students. The role of students is to be an active learner who contributes to learning process. The classroom is a dynamic learning environment in which roles constantly change, the teacher becomes a student and the students become teachers. During presentations of students' project work, for example, the teacher does not instruct, but listens and learns about students' science process and product. Students on the other hand, assume the role of the teacher during this part of the project. In this method lessons planning focus on area of study, identifying the learning environments and process, selecting resources and time required, identifying possible learning challenges and selecting the appropriate formative and summative methods assessing learning outcomes (Colley& Kabba 2008)

2. Research Methodology

The purpose of study was to examine the effect of project method, as an instructional approach on academic achievements of male students in subject of Physics. In order to test relative effectiveness of independent variable (instruction through project), the choice of most suitable design for this experiment was the basic step. Keeping in view the various factors affecting the internal and external validity of experimental design, pre academic achievement test and post academic achievement test equivalent group design was considered a suitable research design for this study. In order to conduct this study eighty 10^{th} grade science students of Government Centennial Model Secondary School for boys Abbottabad were divided into equivalent halves on the basis of marks obtain in pre academic achievement test by matching random sampling technique. One group was regarded as experimental and other as control group. Both groups had almost equal means .Pre- academic achievement test Post test design was used in study.

The pre academic achievement test/post academic achievement test was constructed after a thorough review of techniques of construction. This test covered five chapters (Waves and oscillation, Sound, Reflection of light, Refraction of light and static electricity) selected from text book of Physics for 10^{th} Class K P K. The test comprised of 100 objectives items 25 questions related to knowledge ability ,25 questions for application ability, 25 questions ,25 questions comprehension ability and 25 questions skill development ability. The instrument was validated by pilot testing of science students of grade 10 in Government High school No: 3 (EM) Abbotabad as well as by expert judgmental validation. For the purpose of the reliability of test, split-half method was used and reliability of test was 0.86.

For treatment purpose, twenty four lessons plans were prepared for Project teaching method and twenty four lessons plans were prepared for traditional teaching lecture method. The research was carried out for period six weeks July 2010 to August 2010.

Control group was given the traditional treatment i.e. lecturing method and experimental group was given a treatment of Project teaching method. The treatment lasted for four weeks. The control group was taught

in class room and experimental group were taught in science laboratory. All available science apparatus and low cost teaching material were given to experimental group.

In each lesson for experimental treatment, the teacher himself instructed topic and set targets for students to achieve by performing different activities in science laboratory. Then students were divided into heterogeneous five groups (each group having five to eight students) to perform different activities in Physics laboratory in the guidance of teacher. Each group had to come with findings and inferences in a specified time and they had to present it before the whole class for concluding lesson of the day. After treatment of six weeks, the post academic achievement test was administered to both groups. It is important to note that all the instructions in experimental and control groups were delivered by the same teacher. The students' scores on pre academic achievement test and post served as data of study. The data were tabulated and analyzed by means, standard deviation; independent t-test was also used to calculate any change or the significant difference between the two means at 0.05 levels by the application of statistical package for social science (SPSS) version 16.

3. Null Hypotheses of Study

The following hypotheses were tested to achieve the objective of research study:

H_{O1}.There is no significant difference between achievement scores of students in the subject of physics taught through project teaching method (PTM) and those taught by traditional teaching lecture method (TTLM) at secondary level.

H_{O2}.There is no significant difference between achievement scores of students in the subject of physics in cognitive domain (knowledge ability) taught through project teaching method (PTM) and those taught by traditional teaching lecture method (TTLM) at secondary level.

H_{O3}.There is no significant difference between achievement scores of the students in the subject of physics in cognitive domain (application ability) taught through project teaching method (PTM) and those taught by traditional teaching lecture method (TTLM) at secondary level.

H_{O4}. There is no significant difference between achievement scores of the students in the subject of physics in cognitive domain (comprehension ability) through project teaching method (PTM) and those taught by traditional teaching lecture method (TTLM) at secondary level.

H_{O5}. There is no significant difference between the achievement scores of students in the subject of physics in psychomotor domain (skill development ability) taught through project teaching method (PTM) and those taught by traditional teaching lecture method (TTLM) at secondary level.

5. CONCLUSIONS

The project method of teaching Physics creates an ideal situation for teaching science subjects and specially Physics. In the project method of teaching Physics class, students are actively involved in hands-on experiences and get chance to relate abstract ideas and theories with concrete observations which helps them to make deep understanding of scientific knowledge and concepts. Students' group discussion about scientific concepts and theories after observation of concrete facts enables them to reconstruct and refine their scientific knowledge. Thus project method of teaching Physic is very effective for constructing scientific knowledge, developing deep understanding of scientific concepts and application of scientific knowledge in various situations in our daily life.

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Table 1. Comparison of mean scores of experimental and control groups on pre academic achievement test

Learning Domain	Group	*N*	*M*	*SD*	*t*
	Experimental	60	43.41	4.68	
Academic achievement					0.29
	Control	60	43.32	4.71	
	Experimental	60	14.95	1.32	
Knowledge ability					0.28
	Control	60	15.27	5.32	

	Experimental	60	13.27	3.01	
Comprehension ability					0.30
	Control	60	13.63	4.87	
	Experimental	60	11.22	3.19	
Application ability					0.08
	Control	60	11.32	3.98	
	Experimental	60	3.50	1.65	
Skill developments ability					0.18
	Control	60	3.41	1.65	

Critical value of t at 0.05 = 1.96

Table 1 show that there was no significant difference between mean scores of experimental and control groups (t <1.96 at level 0.05) in the learning domain of knowledge, comprehension, and knowledge application and skill development as well as over all academic achievement in the subject of Physics on pre academic achievement test. Thus both the groups were at the same level of achievement in the subject Physics before treatment. The status of both the groups is well depicted through graphical representation.

Table 2. Comparison of mean scores of experimental and control groups on post academic achievement test

Learning Domain	Group	N	Mean Score	SD	t
	Experimental	60	72.77	11.07	
Academic achievement					5.17
	Control	60	52.13	15.22	
	Experimental	60	21.88	2.88	
Knowledge ability					3.01

	Control	60	17.27	5.87	
	Experimental	60	24.31	5.45	
Comprehension ability					5.29
	Control	60	15.22	5.99	
	Experimental	60	21.04	5.84	
Application ability					3.62
	Control	60	15.00	5.25	
	Experimental	60	6.13	1.72	
Skill developments ability					2.46
	Control	60	5.99	1.84	

Critical value of t at 0.05 = 1.96

Table 2 reflects that there was a significant difference in mean scores for learning domain of knowledge, comprehension, knowledge application and overall academic achievement of experimental and control groups in the subject of Physics academic achievement. The results of this study in term of test of hypotheses indicate that on post academic achievement test, mean score of experimental group (72.77) was greater than the mean score of control group (52.13) and t=8.5.Thus the hypothesis H_{O1}.There is no significant difference between academic achievements students taught Physics through project teaching method (PTM) and those taught by traditional teaching lecture method (TTLM) at secondary level was rejected in the favor of experimental group. Similarly, mean scores of experimental group in the domain of knowledge, comprehension, and knowledge application on post academic achievement test (21.27,24.31,21.04 and 6.13 respectively) were greater than mean scores of control group in these domains (17.27,15.22,15.00 and 4.12 respectively) and calculated t- values 5.46,8.7,6.0 and 8.5. Hence the hypothesis H_{O2}.There is no significant difference between academic achievements in cognitive learning domain (knowledge ability) students taught Physics through project teaching method (PTM) and those taught by traditional teaching lecture method (TTLM) at secondary level, H_{O3}.There is no significant difference between academic achievements in learning (application ability) students taught Physics through project teaching method (PTM) and those taught by traditional teaching lecture method (TTLM) at secondary level , H_{O4}. There is no significant difference between academic achievements in cognitive learning domain (comprehension ability) of students teaching Physics through project teaching method (PTM) and those taught by traditional teaching lecture method (TTLM) at secondary level and H_{O5}. There is no significant difference between academic achievements in psychomotor learning domain (skill development ability) of students teaching Physics through project teaching method (PTM) and those taught by traditional teaching lecture method (TTLM) at secondary level were rejected.

The results of study show that the project method of teaching Physics is better than traditional teaching method at secondary level.

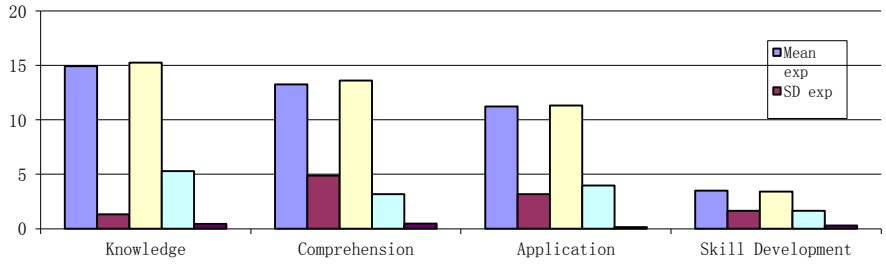

Figure 1.Comparison of pretest mean scores of experimental and control group.

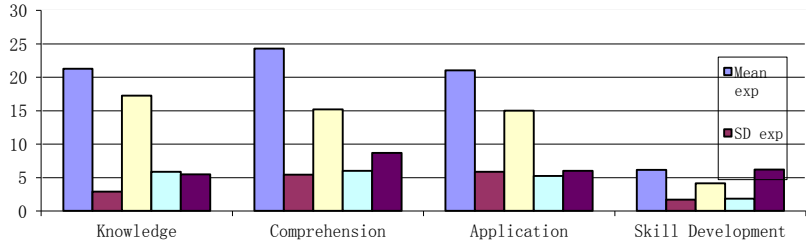

Figure 2. Comparisons of posttest mean scores of experimental and control group