EUROPEAN ACADEMIC RESEARCH
Vol. II, Issue 12/ March 2015

Impact Factor: 3.1 (UIF)
DRJI Value: 5.9 (B+)

ISSN 2286-4822
www.euacademic.org

Effect of Inquiry Teaching Method on Academic Achievements of Male Students in Subject of Physics: A case study

Dr. SHAFQAT HUSSAIN
Dr MANZOR HUSSAIN SHAH
Hazara University Mansehra
Pakistan

Abstract:

This study was designed to find the comparative effects of teaching Physics through inquiry method and traditional lecture method. The objective of the study was find the effect of teaching Physics through Inquiry Teaching Method (ITM) on academic achievement of male students Five null hypotheses were tested in order to achieve the objective. One twenty (120) science students of Grade 9, from two schools were taken as sample of the study. Students of each school were divided into two equivalent groups i.e. control and experimental group on the basis of Pre-test of academic achievement. Experimental groups were taught through inquiry method and control groups by traditional lecture method for ten weeks. Post-test of academic achievements was administered after treatment to assess the difference in performance of all groups. The data obtained were tabulated and analyzed by computing mean, standard deviation and t-value. The data collected by Pre-test of academic achievement, Post-test academic achievement were analyzed by applying t-test. The performance of the experimental group on Post-test of academic achievement was significantly better than pre-test of academic achievement. The conclusion of study were the Inquiry teaching method (I.T.M) is more effective as compared to traditional teaching lecture method (T.T.L.M) for teaching Physics and inquiry method improves different learning domains such as knowledge ability, comprehension ability, application ability and skill development ability of students.

Key words: Inquiry Teaching Method, Lecture Teaching Method, Learning Domain, Student Achievement in Physics

Recent advances in science and technology have changed the structure and education system of societies (Akkoyunlu, 1996). In teaching of science, one of the main objectives is to develop problem solving capacities. Science gives us an opportunity of critical thinking, and integrates man's concepts of natural environment, and benefits of the environment. Physics is considered a difficult subject by students and teachers, because they face many difficulties in teaching and learning process. In the last two decades, a numbers of studies have been launched in different areas of Physics and its teaching. The traditional teaching lecture method of science, neither produces good results, nor produces good science graduates. Traditional lecture method focuses on the teacher on how to teach Physics in the classroom. In this method, the teacher imparts knowledge to students. In the traditional teaching lecture method, students are passive (Hake, 1998). The traditional lecture method has almost the same meaning, as lecture and question answer method (Sungur & Tekkaya, 2006). In science education, inquiry has two meanings, the first one is related to method of teaching of science subjects, and second one is science as inquiry (Tamair, 1985; Elinge, 1993). It involves the sources through which students get knowledge, it includes developing skill of inquiry, for example identification and investigation of problem, formulation of hypothesis, collection, analysis and interpretation of data, then drawing the conclusion. As Brew, Jenkins, et.al (2003), stated that teaching science subjects by engaging students is means of increasing knowledge, enhancing motivation and academics of students. Inquiry is an active process of teaching and learning. Students are involved in learning and understanding, meanings and knowledge. Inquiry method in learning and teaching Physics, promotes students centre philosophy, in which the teacher's

role is as a guide or facilitator, and teachers leave the students or learner to discover solutions of scientific problems themselves (Galileo Educational Network, 2004). The inquiry has equally a learning goal and a teaching approach. The students are engaged in learning the inquiry method, which is helpful for increasing their learning in scientific concepts, positive reception of how students know, what to know in science subjects and their nature, skill, its application and attitude towards science subjects. The goal of inquiry learning contains abilities to understand the science subject by inquiry method (NRC, 2006). According to Avanzo and McNeal (1997), this gives a different approach of inquiry based teaching, and is characterized in three categories.

- Guided inquiry: In guided inquiry, the teacher gives tasks and questions, then prompts and by applying the teaching techniques on students to find the solution to the given problems.
- Open ended inquiry: In an open ended inquiry, the role of the teacher is a facilitator for students, to select their questions and inquiry approaches.
- Teacher-collaborative inquiry: In this type of inquiry, the teachers and students are working together, and select the questions and their strategies, to find the answer of the questions which is initially unknown to the students.

McDermott et al. (1996) stated that teachings of science through inquiry method are student-centered approaches. The teaching of Physics through inquiry method is very suitable for understanding and learning concepts of Physics, in which students acquire knowledge by searching and discovering, instead of memorizing, inquiring instead of presenting, open investigation, small group discussion, and discussion between students and teachers. The teacher creates interest so that active participation of student takes place. Tolman (2001) says that teaching of science by inquiry method has given confidence

to students to work on projects and plays an active role in science education. Buck, et.al (2008), says that the need for inquiry in science is well documented and is a must for learning and understanding the scientific domain. According to Haury (1993), that essence of inquiry teaching, is to engage students in investigation, to create the curiosities, which satisfies the students to explain the learning experience, Inquiry is a way of thinking, and investigation, to attain the desired results in science education, and it is the core of science lessons. Hackling (2005) quoted Jones et al, (1992) that in science education, there is vital role of inquiry method in the form of activities, by which students find the solution of any problem (Jones, Simon, Fairbrother, Watson, & Black, 1992).NSTA (2004), describe that "inquiry is a powerful way of knowing science subjects, students learn how to ask questions" and to find the solution of questions by applying evidence. Wenning (2005) describes that "learning techniques of scientific inquiry, students should prepare for completing an investigation, collection of facts, ideas from different means and compile data and draw a conclusion". The application of scientific inquiry varies from subject to subject.

Objectives of Study

1. To explore the effectiveness of teaching Physics for Grade 9 through inquiry teaching method (ITM) on academics achievements of students.
2. To find the effectiveness of teaching of Physics for Grade 9 through traditional teaching lecture method (TTLM) on academics achievements of students.
3. To find comparative effectiveness of teaching Physics for Grade 9 through inquiry teaching (ITM) and traditional teaching lecture method (TTLM) on academic achievement of students.

Null Hypotheses

H_{O1}. There is no significant difference between academic achievements of male students taught Physics through inquiry teaching method (ITM), and those taught by traditional teaching lecture method (TTLM) at secondary level.

H_{O2}.There is no significant difference between academic achievement in cognitive learning domain (knowledge ability) of male students taught Physics Grade 9 through inquiry teaching method(ITM), and those taught by traditional teaching lecture method (TTLM) at secondary level.

H_{O3}.There is no significant difference between academic achievement in learning (application ability) of male students taught Physics Grade 9 through inquiry teaching method (ITM), and those taught by traditional teaching lecture method (TTLM) at secondary level.

H_{O4}.There is no significant difference between academic achievement in cognitive learning domain (comprehension ability) of male students taught Physics Grade 9 through inquiry teaching method (ITM), and those taught by traditional teaching method (TTLM) at secondary level.

H_{O5}.There is no significant difference between academic achievement in psychomotor learning domain (skill development ability) of male students taught Physics Grade 9 through inquiry teaching method (ITM), and those taught by traditional teaching method (TTLM) at secondary level.

Methodology

All secondary school science students of district Abbottabad KPK (Pakistan) during session 2009-2010 were population of this experimental study. Pre-test and post design was use in this study. Two schools Govt. High School No: 3 boys Abbottabad and G.C.M.S.S boys Abbottabad were randomly selected from district Abbottabad. One twenty (120) students of

Grade 9 were randomly selected (60 from each school) as sample of the study. The study spanned over ten weeks in four schools. The control group was taught in the science classroom through lecture method, and experimental group was taught in laboratories through inquiry teaching method respectively. The researcher was a Physics teacher having a M.Sc. (Physics) M.Phil (Education) so the researcher taught both experimental and control groups. On the basis of Pre-test of academic achievement scores, the classes were divided into two groups with nearly equal mean scores. One group was termed as experimental or treatment group, and the other was called control group. Data for this research was collected by administering Pre-test of academic achievement and Post-test of academic achievement. To find out difference in academic achievement between the experimental and control groups, the independent sample t-test was used to find out the significance difference between the mean scores at selected probability level (0.05) were applied. To test the null hypotheses were accepted or rejected on basis of comparison of t-calculated and tabulated values. The data was analyzed by the application of statistical package for social sciences (SPSS version 16).

Result

Comparison of mean scores of experimental and control group (boys) on Pre-test of academic achievement

Learning Domain	Group	N	Means scores	S.D	t-values	p
Academic achievement	Exp	60	27.33	6.44	0.36	0.719
	Con	60	26.95	5.17		
Knowledge ability	Exp	60	6.40	3.35	0.22	0.826
	Con	60	6.53	3.26		
Application ability	Exp	60	4.26	2.53	0.74	0.458
	Con	60	5.17	2.38		
Comprehension ability	Exp	60	7.50	3.24	0.78	0.439
	Con	60	7.08	2.61		
Skill development ability	Exp	60	7.60	2.73	0.96	0.341
	Con	60	7.12	2.21		

Critical value of t at 0.05 =1.96

Table shows that mean scores in overall achievements (knowledge ability, application ability, comprehension ability, skill development ability) of experimental group boys and control groups approximately equal to control groups (boys).The calculated value of "t" less than that the tabulated value of "t" at 0.05 level , therefore there is no significant difference in the mean scores of the experimental groups (boys) on Pre-test of academic achievement. The result shows that both the groups were the same in achievements before the treatment.

Comparison of Mean Scores of Experimental and Control Group (boys) in Post-test of Academic Achievement

Learning Domain	Group	N	Means scores	S.D	t-values	p
Academic achievement	Exp	60	79.77	5.22	28.28	0.000
	Con	60	50.92	5.94		
Knowledge ability	Exp	60	17.27	1.74	13.15	0.000
	Con	60	12.22	2.42		
Application ability	Exp	60	19.77	2.20	16.85	0.000
	Con	60	12.55	2.49		
Comprehension ability	Exp	60	20.97	3.24	17.54	0.000
	Con	60	13.67	2.10		
Skill development ability	Exp	60	22.07	2.15	19.20	0.000
	Con	60	12.87	3.02		
Critical value of t at 0.05 =1.96			d_f= 118			

The data in table shows that:
Mean score of experimental group boys ($\underline{M}$ =79.77) is greater than that of control group boys ($\underline{M}$ = 50.92) and t-value is 28.28. The calculated value of "t" is greater than the tabulated value at 0.05 level (28.28>1.96). Therefore, there is significant difference between the mean scores of both the groups on Post-test of academic achievement. The result shows that both groups are not equal with respect to academic achievement.
Thus the null hypothesis i.e

H_{O1}. (There is no significant difference between academic achievements of male students taught Physics through inquiry teaching method and those taught by

traditional teaching lecture method at secondary level") is rejected. It proved that the experimental group –performed better than the control boys group as a result of treatment.

Knowledge ability of experimental group (M =17.27 is greater than that of control group boys (M = 12.23) and t-value is 13.15. The calculated value of "t" is greater than the tabulated value at 0.05 level (13.15>1.96). Therefore, there is significant difference between the mean scores in knowledge ability of both the groups on Post-test of academic achievement. The result shows that both groups are not equal with respect to knowledge ability. Thus the null hypothesis i.e.

H_{O2}. *There is no significant difference between academic achievement in cognitive learning domain "knowledge ability" male students taught Physics Grade 9 through inquiry teaching method and those taught by traditional teaching lecture method at secondary level* is rejected. Hence the experimental group performed better in knowledge ability than the control boys group as a result of treatment.

Application ability of experimental group (M =19.78) is greater than control group (M =12.55) and t-value is 16.85. The calculated value of "t" is greater than the tabulated value at 0.05 level (16.85>1.96) .Therefore, there is significant difference between the mean scores in application ability of both the groups on Post-test of academic achievement. The result shows that both groups are not equal with respect to application ability. Thus the null hypothesis i.e.

H_{O3}. *There is no significant difference between academic achievement in learning "application ability" of male students taught Physics Grade 9 through inquiry teaching method and those taught by traditional teaching lecture method at secondary level* is rejected. Hence the experimental group boys perform in application ability better than control group boys as result of treatment.

Comprehension ability of experimental group boys (M =20.97) is greater than that of control group boys (M = 13.67)

and t-value is 17.54. The calculated value of "t" is greater than the tabulated value at 0.05 level (17.539>1.96). Therefore, there is significant difference between the mean scores in comprehension ability of both the groups on Post-test of academic achievement. The result shows that both groups are not equal with respect to comprehension ability. Thus the null hypothesis i.e.

H_{O4}. *There is no significant difference between academic achievement in cognitive learning domain "comprehension ability" of male students taught Physics Grade 9 through inquiry teaching method, and those taught by traditional teaching method at secondary level* is rejected. Hence the experimental group boys perform better in comprehension ability than control group boys as a result of treatment.

Skill developments ability of experimental group boys ($\underline{M}$ =22.07) is greater than that of control group boys ($\underline{M}$ = 12.87) and t-value is 19.20. The calculated value of "t" is greater than the tabulated value at 0.05 level (19.20>1.96). Therefore, there is significant difference between the mean scores in skill developments ability of both the groups on Post-test of academic achievement. The result shows that both groups are not equal with respect to skill developments ability. Thus the null hypothesis i.e.

H_{O5}.*There is no significant difference between academic achievements in psychomotor learning domain "skill development ability" of male students taught Physics Grade 9 through inquiry teaching method and those taught by traditional teaching method at secondary level* is rejected. Hence the experimental group boys perform better in skill development ability than control group boys as a result of treatment.

Conclusions

Inquiry teaching method (I.T.M) is more effective, as compared to traditional teaching lecture method (T.T.L.M) for teaching Physics to Grade 9 students at secondary level. Teaching Physics through inquiry method improves different learning domains such as knowledge ability, comprehension ability, application ability and skill development ability students. In order to discourage rote learning, the Inquiry Teaching Method (ITM) maybe used excessively for different subjects at secondary and other different levels. Being an effective instructional strategy, Inquiry Teaching Method (ITM) may be included in the teacher training as an integral part, especially for science teachers. Working science teachers may be encouraged to use Inquiry Teaching Method (ITM) and the department of education may conduct the refresher courses, training, programs and workshops in order introduce to Inquiry Teaching Method (ITM).

REFERENCES

Akkoyunlu, B. (1996). Bilgisayar okuryazarlığı yeterlilikleri ilemevcut ders programlarının kaynaştırılmasının öğrenci başarı ve tutumlarına etkisi. Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 12, 127-134

Avanzo. D, & McNeal. A. P. (1997). Research for all Students: Structuring Investigation into Firstyearcourses. Student-Active Science: Models of Innovation in College Science Teaching. A.

Brew, A (2003) Teaching and Research: new Relationships and their Implications for Inquiry-based Teachingand Learning in higher education, Higher Education Research & Development 22(1), 3-18.

Buck, L., Bretz, S., & Towns, M. (2008). Characterizing the Level of Inquiry in the Undergraduate Laboratory. Journal of College Science Teaching, 38(1), 52-58.

Eltinge, E. M. & Roberts, C. W. (1993). Linguistic Content Analysis: A method to Measure Science as Inquiry in textbooks. Journal of Research in Science Teaching, 30(1), 65- 83.

Galileo Educational Network. (2004). What is inquiry? Inquiry & ICT. Retrieved July 12, 2004, from http://www.galileo.org/inquiry-what.html.

Hackling,M.(2005).Working Scientifically: Implementing and assessing open investigation work in science, Western Australia Department of Education and Training.

Hake,R.(1998).Interactive Engagement Versus Traditional Methods: A six-Housandstudent Suvery of Mechanics Test data for Introductory Physics courses. American Association of Physics Teachers. 66, 64-74.

Haury,D.L.(1993).Recommended Curriculum Guides. Millwood, NY: Kraus International Publications.

Hofstein, A., Levi Nahum, T.,&Shore, R. (2001). Assessment of the Learning Environment of Inquiry type Laboratories in high School Chemistry. Learning Environment Research, 4, 193–207. .

Jones, A, Simon, S, Fairbrother, R, Watson, R & Black, P.J (1992). Development of Open Work in School Science, Association for Science Education, Hatfield, UK.

Jones, A, Simon, S, Fairbrother, R, Watson, R & Black, P.J (1992). Development of Open Work in School Science, Association for Science Education, Hatfield, UK.

McDermott, L. C.(1996).The Physics Education Group at the University of Washington. Physics by Inquiry. Vol. 1,2. New York: John Wiley and Sons, Inc.

National research Council. (2006). Investigation in High School Science. Washington DC: The National Press Academies Press.

National Science Teachers Association (NSTA). 2004. NSTA Position Statement: Scientific Inquiry.

Sungur, S, & Tekkaya, C.(2006). Effects of Problem-Based Learning and Traditional Instruction on Self-Regulated Learning. The Journal of Educational Research. 99, 307-317.

Tamir, P. (1985). Content Analysis Focusing on Inquiry . Journal of Curriculum Studies, 17(1), 87-94.

Wenning, C.J. (2005a). Levels of inquiry: Hierarchies of pedagogical practices and inquiry processes. Journal of Physics Teacher Education Online, 2(3), February 2005, pp. 3-11.

Figure 1: Graphical representation for Mean scores, S.D, t-values and p-values of experimental and control in overall academic achievements, knowledge ability, application ability, comprehension ability and skill development ability on Pre –test of academic achievements.

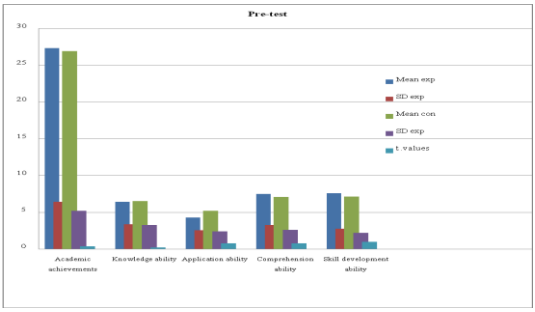

Figure 2: Graphical representation for Mean scores, S.D and t-values of experimental group and control group in overall academic achievements, knowledge ability, application ability, comprehension ability and skill development ability on post-test of academic achievement