A COMPARISON OF THE EFFECTIVENESS OF USE OF TRANSMITTER OF KNOWLEDGE AND INDUCTIVE INQUIRY MODELS ON STUDENTS ACADEMIC ACHIEVEMENT

By
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Abstract

This research study sought to compare the effectiveness of use of the transmitter of knowledge and the inductive inquiry models on students academic achievement. The study was conducted on secondary students in one secondary school of Rawalpindi city, Pakistan. The pretest, posttest control group design was used in this study. The sample of the study consisted of 90 students who were chosen on the basis of their pretest scores through matching who were randomly assigned to two experimental groups and one control group. The subject of Pakistan Studies taught to the two experimental groups and one control group. The duration of the treatment was eight weeks. The data was analyzed by using mean, SD, Coefficient of variation, ANOVA, Scheffee test and Tukey's test. The major conclusions of the study were that the experimental group taught through inductive inquiry model, did better on academic achievement in the comparison of the experimental group taught through transmitter of knowledge model and the control group taught through conventional teaching.

Keywords

Effectiveness, Teaching, Transmitter of knowledge model, Inductive Inquiry model, Achievement Pak Studies

Introduction

Teaching consists of a set of actions by the teacher to induce learning and achievement in the students. Models of teaching play important role in the academic achievement of the students. Teaching is an art and skill to be learnt. It requires the knowledge of subject content, method, techniques and teaching aids to be used appropriately for making teaching interesting and effective. This, in fact, is the main purpose of education towards which pupils are helped to grow socially, intellectually and emotionally. For this end in view, the teachers need a variety of teaching approaches (Singh, 2005). According to Shahid (2000), a model of teaching is defined as an instructional design which describes the process of specifying and producing particular environmental situation that inspires the students to interact in such a way that anticipated changes occur in their behavior. The most important aim of any model of teaching is to improve the instructional effectiveness in healthy atmosphere (Siddique and Khan, 1991). Models of teaching are gaining popularity in education throughout the world and are applied for teaching various subjects at the elementary, secondary and college level.

According to Sprinthall and Sprinthall (1990), probably the most common teaching model, and certainly the one with the longest tradition, is that which views teaching as the transmission of knowledge. This view assumes that there exists a well known and organized

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body of knowledge from which the teacher selects certain facts and concepts to pass on to pupils. This model emphasizes the need to give pupils basic facts and information before they can be expected to think for themselves. They must learn what is already known before they can come up with any new ideas that might fit in with the existing knowledge. It assumes that learning new information is essentially in linear step-by-step sequence. The teachers' expertise is needed to arrange both the content material to be mastered and the method of presentation. Probably, the most obvious distinguishing characteristics of this model is the high degree of structure employed. Several approaches to teaching through the 1960's to 1970's were based on a transmission model of teaching and learning. The view was of a teacher with authority who disseminates knowledge largely through lectures and verbal exchanges. The lecturer represents the principles of the subject, followed by a tutorial where the students practice the application of the knowledge which they are taught. This model in extreme, becomes a set of boring monotonous lectures followed by tutorials. Also the students are asked to derive corollaries from the given facts and principles. (Rao and Reddy, 1992)

Another common teaching model, according to Sprinthall and Sprinthall, (1990) came into vogue in the 1960's suggests that the teacher's role is to reveal or unveil the fundamental structure of a discipline. The idea is to teach concepts or the process of inquiry, not facts. For example, in a social studies class, pupils are no longer asked to memorize the principal cities and products of a state. Rather, they might be given a blank map showing topographical features such as hills, mountains, valleys, rivers and lakes, and then be asked to figure out where cities might be located. In other words, they go through an inquiry process that helps them understand why big cities grow in certain locations. By the use of this model, teacher produces mini-scholars in the various disciplines. The discovery model of teaching is based on this model. In discovery learning, students are confronted with the challenges and left to work out the solution of their own (Bruner, 1961; French, 2006). The teacher, by analyzing material and asking questions, but not by giving answers, spurs the pupils to learn by helping them discover the answer. Inductive enquiry as defined here is a thought process where one is made to conclude some generalization from a number of facts, events, objects or process. It is a technique in which a teacher presents a set of data or a situation and then asks the students to derive a conclusion. This technique requires more thinking on the part of students in order to find pattern in the data set. This model is designed to reduce the communication gap between the teacher and the students to develop critical thinking. Of course, the model to be used depends on the nature of the discipline and the resources available. Most of the time, this model requires a lot of time and effort. (Landmark College, 2005). According to this model, the sheer intellectual excitement of discovering the reason behind event. For example, the logic a historian or a mathematician actually uses motivates the pupils to further activity and exploration. Teaching and learning resemble an archaeologist's uncovering of one fragment after another of some mysterious object. The archaeologist's curiosity about the fragments naturally makes him or her want to make sense of the puzzle; this curiosity produces both activity and excitement. There is a variety of specific methods that enhance discovery learning, such as the inductive strategy of Hilda Taba, the inquiry training method of Richard Suchman, and the scientific inquiry technique of Joseph Sehwab. These models are related to John Dewey's original project method, which emphasized the process of inquiry rather than content acquisition as central to learning. In each case, the teacher arranges material i.e., open ended in order to stimulate the process of asking questions and exploration by the pupils. It is, of course, possible to overemphasize learning by discovery. It

can be exasperating to never have any of four questions answered. It is not necessary to discover everything for yourself in order to learn the most important. However, it is difficult to know, especially at the elementary level and in junior high, exactly how much the pupils genuinely understand about the structure of a discipline taught in this way. The idea of the structure is itself abstract and, therefore, beyond the comprehension of the concrete stage of thinking in which most of the children are. To understand such concepts and processes, substantial cognitive sophistication is necessary. (Sprinthall and Sprinthall, 1990).

Shaffer (1989) compared inductive and deductive approaches to teaching foreign languages. Who found that inductive approach appeared to be more useful in learning the foreign language. This point of view is also supported by Kranshan (1987) who argues that only simple rules can be consciously learned and remembered. To him, comprehensible input and the affective state are the true causes of language acquisition and there is no necessity for previous conscious knowledge of a rule. Farrell and Hesketh (2000) investigated an inductive approach to teaching the topic of Heat and Mass transfer to the engineering students at college level. The results of this study indicate that inductive approach was better than traditional approach. Prince and Felder (2006) provide a broader analysis of inductive method in different forms. They cite studies reporting a robust positive effect of learning through problem solving on development of a variety of problem solving skills, conceptual understanding, ability to apply meta-cognitive and reasoning strategies and team work skills, which ultimately influence learning achievement of the students.

These models either in isolation or in combination, intentionally or unintentionally, might be under some use in our educational institutions, but a systematic enquiry into the deliberate use and their effect upon students learning and achievement has yet less been explored. The systematic studies to compare the effectiveness of these models in isolation and in combination have perhaps not been carried out in Pakistan. Therefore, the research on teaching effectiveness generally follows the paradigm of comparing one method of teaching with another. In this study, the same paradigm was followed by comparing effectiveness of transmitter of knowledge model with inductive inquiry model on students' academic achievement.

The main objectives of the study were:

1. To teach the first experimental group to the transmitter of knowledge model, the second experimental group to the inductive inquiry model and the control group to as usual, conventional teaching.
2. To compare the academic achievement of the control and experimental groups after the treatment in order to judge the relative superiority of transmitter of knowledge model or inductive inquiry model over conventional teaching.

To achieve the above objectives, the following null hypotheses were tested:

1. There is no significant difference between the mean pre-test achievement scores of the experimental groups taught through transmitter of knowledge model and inductive enquiry model and control group taught through the conventional teaching.
2. There is no significant difference between the mean post-test achievement scores of the experimental groups taught through transmitter of knowledge model,

inductive enquiry model and control group taught through the conventional teaching.

3. There is no significant difference between the mean post-test achievement scores of students exposed to the transmitter of knowledge model and inductive enquiry model.
4. There is no significance difference between the mean posttest achievement scores of students exposed to the transmitter of knowledge model and those taught through conventional teaching.
5. There is no significant difference between the mean posttest achievement scores of students exposed to the inductive inquiry model and those taught through conventional teaching.

Method and Procedure

The target population for this study was 2088 students of 10^{th} class, studying in Govt. High Schools, located in Rawalpindi City which is 15 miles away from Islamabad, the capital city of Pakistan. The size of accessible population was 253. The study sample consisted of 90 students who were chosen out of the accessible population. In order to measure academic achievement of the sample in the subject of Pakistan Studies, before and after the experiment, an achievement test was designed. It contained fifty multiple choice items. The content covered in the test was new subject matter which was taught during the experiment. Thus, all 50 items were related to new material. The reliability of the test was found out through Kuder Richardson formula (KR 20 or 21). The reliability of the test was found to be 0.7 which seems to be quite reasonable for achievement tests. The instrument's content validity was ensured by preparing a table of specifications. The material in this study consisted of lesson plans that were prepared separately on each topic, as per requirement of each teaching model. The four chapters were taught during the experiment. The lesson plans were developed in the light of the model used in teaching and Hunter's following seven lesson planning steps: Anticipatory set, Objectives and purposes step, Instructional input, Modeling, checking for understanding, guided practice and independent practice. The design, used to conduct the study, was pretest posttest control group design which according to Gay (1996) is one type of true experimental designs. Three groups were randomly formed through matching the subjects in terms of their pretest achievement scores. The symbolization of the design is described as:

R	O_1	T_1	O_2	
R	O_3	T_2	O_4	
R	O_5	-	O_6	(Gay, 1996)

The pretest was administered on students of 10^{th} class in order to obtain their pretest scores. The three groups were randomly assigned to experimental groups and control group. The first experimental group was taught to transmitter of knowledge model and second experimental group was taught through inductive inquiry model while the control group was taught through conversational teaching. All the groups were taught by the researchers themselves in order to control such teacher variables as the teacher qualification, experience and skills. Each group was taught daily. Timings were alternated in order to equate to the timing factor for the comparison groups. The subjects were taught for the same amount of time each day under almost similar environmental conditions. The teaching content was also the same for all groups. The duration of the experiment was spread over eight weeks. The amount of the time was same for the pretest and posttest and testing conditions were kept the same.

The collected data were analyzed by using Mean, SD, coefficient of variable, ANOVA, Scheffee test and Tukey's test.

Results

Table – 1
Mean and standard deviation of pretest scores of two experimental groups and the control group

Group	N	Mean	S.D	Coefficient of Variation
Experimental-I	30	22.53	2.99	13.2
Experimental- II	30	22.40	3.13	13.9
Control Group	30	22.30	3.14	14.0

The above table indicates that the mean pretest scores of comparison groups and the spread of individual scores around their respective means. When their variability was tested through the coefficient of variation, the control group was found to contain a bit more individual variation within the group (14.0) than two experimental groups, (13.2,13.9), the individual differences among the experimental group 1 being the least which means that the experimental groups were more homogenous than the control group. The equality on pretest scores, among comparison groups was also statistically determined through Simple ANOVA, as given in the next table.

Table – 2
Significance of difference between mean pretest scores of the comparison groups

Source of Variation	Sum of Squares	Df	Mean Squares	F ratio	p
$SS_{between}$	0.82	2	0.41	0.04	<.05
SS_{Within}	1008.97	87	11.60		
SS_{Total}	1009.79	89			

$F_{.05} = 2.72$

The above table shows that the obtained F ratio = 0.04 is less than the critical F ratio of 2.72 at 0.05 level. The obtained F ratio is, therefore, statistically non-significant at 0.05 level of confidence. Therefore, the null hypothesis No 1, that is no significant difference between the mean pre-test achievement scores of the experimental groups taught through transmitter of knowledge model and inductive enquiry model and control group taught through the conventional teaching, is retained. This implies that the comparison groups were not different in their average performance on the pretest.

Table – 3
Mean and standard deviation of posttest scores of experimental groups and the control group

Group	N	Mean	S.D	Coefficient of Variation
Experimental – I	30	36.40	3.4	9.34
Experimental – II	30	38.97	3.0	7.71

Control	30	34.13	3.3	9.40

The above table indicates that the experimental group 2 taught through inductive inquiry model showed highest average achievement (38.97) and control group showed the lowest average achievement (34.13) on the posttest. The coefficient of variation (v) with respect to experimental group 2 taught through inductive inquiry model was the least, meaning thereby that there was less individual variation among the members of this group on academic achievement.

The difference in posttest achievement among the comparison groups was also statistically determined by simple ANOVA, as shown in the next table.

Table – 4
Significance of difference between mean posttest scores of the comparison groups

Source of Variation	Sum of Squares	df	Mean Squares	F ratio	p
S.S Between	228.87	2	114.435	10.42	<.05
S S within	955.63	87	10.984		
Total SS	**1184.5**	**89**			

$F_{.05} = 2.72$

The above table shows that the obtained F ratio is 10.42 which is much greater than the critical F ratio of 2.72 at .05 level of significance. The obtained F ratio is therefore, statistically significant. Therefore, the null hypothesis No 2 that there is no significant difference between the mean post-test achievement scores of the experimental groups taught through transmitter of knowledge model and inductive enquiry model and control group taught through the conventional teaching, is rejected which implies that there was real difference among the posttest means of comparison groups. In order to find out which two groups differed in their mean posttest scores, Scheffe test and Tukey's test was applied as given in the next six tables.

Table – 5
Comparison of the experimental group (I) and experimental group (II) on the mean posttest scores, through Scheffe test

Group	Mean	F Ratio	p
Experimental-I	36.4	4.5	<.05
Experimental-II	38.9		

Df = (1, 58) $F_{.05} = 4.00$

The above table indicates that mean posttest scores of the experimental group I (transmitter of the knowledge model) and the experimental group II (inductive inquiry model) were significantly different at .05 level of significance, group II being superior in posttest performance than group I. Therefore, the null hypothesis No 3, that there is no significant difference between the mean post-test achievement scores of students exposed to the transmitter of knowledge model, and inductive enquiry model is rejected in favour of Group II.

Table – 6

Comparison of the experimental group (I) and experimental group (II) on the mean posttest scores through Tukey's w test

Group	Mean	Mean Difference	p
Experimental –I	36.4	2.57	>.05
Experimental-II	38.9		

Df = (3, 87) Tukey's w at $_{.05}$ = 2.05

The table 6 shows that the obtained difference between the mean posttest scores of the experimental group I (Transmitter of knowledge model) and experimental group II (Inductive inquiry model) was significantly higher at .05 level of significance. Thus group II was found superior in posttest performance to group I. Thus, the results obtained through application of Scheffee in table 7 were confirmed through Tukey's w test. Therefore, the null hypothesis No. 3 that there is no significant difference between the mean posttest achievement scores of students exposed to the transmitter of knowledge model and inductive inquiry model, is rejected in favour of Group II.

Table – 7
Comparison of the experimental group (i) and the control group on the mean posttest scores through Scheffe test

Group	Mean	F Ratio	p
Experimental –I	36.4	1.10	>.05
Control	35.1		

Df = (1, 58) $F_{.05}$ = 4.00

Entries in the above mentioned table show that mean posttest scores of the experimental group I (Transmitter of knowledge model) and control group were not significantly different at .05 level of significant. Therefore, both the comparison groups were not found significantly different in their posttest performance. Thus, the null hypothesis No. 4, there is no significance difference between the mean posttest achievement scores of students exposed to the transmitter of knowledge model and those taught through conventional teaching was retained.

Table – 8
Comparison of the experimental group (i) and the control group on the mean posttest scores through Tukey's w test

Group	Mean	Mean Difference	p
Experimental –I	36.4	1.27	<.05
Control	35.1		

Df = (3, 87) Tukey's w at $_{.05}$ = 2.05

The above table shows that the mean difference on the posttest scores of the experimental group I (Transmitter of knowledge model) and Control group was not significantly different at .05 level of significance. Therefore both the comparison groups were not found really different in their posttest performance. Thus, the results obtained through the application of Scheffe test were confirmed through Tukey's w test. The null hypothesis No. 4, that there is no significant difference between the mean posttest achievement scores of students exposed to the transmitter of knowledge model and those taught conventional teaching, was retained.

Table – 9
Comparison of the experimental group (II) and the control group on the mean posttest scores through Scheffe test

Group	Mean	F Ratio	p
Experimental –II	38.97	10.07	<.05
Control	35.13		

Df = (1, 58) $F_{.05} = 4.00$

The entries in above table indicate that the mean posttest scores of the experimental group II (inductive inquiry model) and the control group were significantly different not only at .05 level of confidence also at .01 level of significance. It means that both the comparison groups were much different in posttest performance. Therefore, null hypothesis No. 5, there is no significant difference between the mean posttest achievement scores of students exposed to the inductive inquiry model and those taught through routine method was rejected.

Table – 10
Comparison of the Experimental Group (II) and the Control Group on the mean posttest scores through Tukey's w test

Group	Mean	Mean Difference	p
Experimental –II	38.9	3.84	>.05
Control	35.1		

Df = (3, 87) Tukey's w at $_{.05} = 2.05$

The above table shows that the obtained difference between the mean posttest scores of the experimental group II (Inductive inquiry model) and the Control group were significantly different at .05 level of confidence. Thus group II was found to be superior in posttest performance to the group III. Thus, the results obtained through application of Scheffe test were confirmed through Tukey's w test. Therefore, null hypothesis No. 5 that there is no significant difference between the mean posttest achievement scores of students exposed to the inductive inquiry model and those taught through conventional teaching, was rejected.

Conclusion

It was concluded that the students taught through inductive inquiry model did better than the students taught through transmitter of knowledge model. The students exposed to transmitter of knowledge model and those taught through conventional teaching did not differ in their achievement scores on posttest. The overall conclusion derived from the study findings was that inductive inquiry model was found to be more effective for teaching of Pakistan Studies to 10^{th} class students than transmitter of knowledge model and conventional teaching.

Discussion

In this study, inductive inquiry model was found to be more effective than the transmitter of knowledge model and conventional teaching. The result of this study are consistent with Shaffer's (1989), Farrell and Hesketh's (2000), and Prince and Felder (2006). Shaffer (1989). But, the result are not in line with Nagata (1995), Rose and Fong (1997), Kalia (2005) and Nina Pargunen (2007). As no experimental study in social and behavioral sciences can be perfect and flawless, this study, when looked into critically contained possible flaws in designing the present study. In order to control the extraneous teacher variable, it was thought convenient to provide treatment to the experimental groups and control group by the researcher herself. This step might have influenced the results of the study due to the unconscious bias of the researcher (John, Henry's effect) against the transmitter of knowledge model and more so against conventional teaching, as both are similar to each other. As we know, whenever a new method or technique is adopted, it influences the students positively and leading for better achievement. The inductive inquiry model and the transmitter of knowledge model both were new for the students. Therefore, improved performance was visible among the student of experimental groups as compared to the students of the control group. Newness of the method of instruction and newness of teacher might have positively influenced the results. In Pakistani classrooms, questioning- answering technique is not very common and main teaching focus is upon telling the new information to the students. It was a different experience for groups of students taught through approaches which were new for them. The novelty and variety in the use of methods might have made students more attentive. Therefore, when the inquiry model was used, punctuated frequently by a series of questions, the relevant group of students paid more attention, were allowed more wait time for thinking after the questions. Their level of understanding might have been much superior to other comparison groups. However, transmitter of knowledge model as well as conventional teaching improved students performance. Both transmitter of knowledge model and conventional teaching appeared to show improvement in their performance of the students but slightly less than inductive inquiry model.

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