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Effectiveness of Constructivist Approach in Science Learning at Elementary School Stage

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Abstract : *The present study seeks to assess the effectiveness of constructivist approach on Science learning at elementary school stage. For this purpose, non equivalent control group design was followed. The subjects of experiment consisted of 40 students each in experimental and control groups. The results of the study revealed that the constructivist learning approach has significant impact on the achievement of learners in science.*

Keywords: *Constructivist Learning, Experimental Design, Academic Achievement.*

Introduction

Teaching is no more concerned with the mere process of imparting knowledge rather it is the process of generation of knowledge through the active interaction of children among themselves and the teacher as a facilitator. The traditional model of teaching based on objectivist paradigm has been shifted towards constructivist paradigm with the assumption that knowledge is subjective and children construct knowledge themselves in a free and fearless environment.

The pioneers in the field of constructivism like Piaget, Vygotsky and Novak have propounded different theories on constructivism. According to Piaget children construct knowledge individually, Vygotsky believes that children construct knowledge through social interaction and according to Novak children construct knowledge through classroom interaction. Analysis of all these viewpoints reveal that knowledge construction is beyond from imposition of pre fixed ideas rather it is the free interplay of ideas and feelings about concepts. Constructivism is not a way of teaching rather it is a theory of learning based on the proposition that the children learn actively by means of creating, interpreting and reorganizing knowledge in a collective way. Here interaction among the children is the main focus. The teachers have to provide a very authentic learning situation where the children can be involved in inquiry activities, problem solving discussions with peers and discovery etc. Now in our country teachers are focusing on it since it has been highlighted by national Council of Educational Research and Training (NCERT) in its National Curriculum Framework (NCF) in terms of a paradigm shift from rote memory to Learning by understanding. Very few research evidences are there with regard to the application of constructivist learning approach in Indian classroom set up. Padmanabhan and Rao (2011) in their study reported the positive impact of constructivist approach in enhancing the

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problem solving ability of class 7th students in science. But this area need a very urgent attention of all because it can go a long way in proving real education to the children and we can regain the fame that our Indian brains are superior to others.

Objectives of the Study

The objectives of the present study are as follows;

1. To study the impact of teaching of science through constructivist learning approach on academic achievement of the seventh class learners.
2. To study the impact of teaching of science through traditional method of teaching on academic achievement of the seventh class learners.

Hypotheses

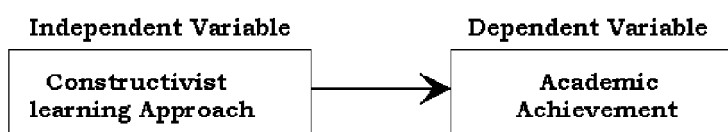
The study proceeded with the following hypotheses:

H₀₁ There exists significant difference on the impact of teaching of science through constructivist learning approach on academic achievement of seventh class learners.

H₀₂ There exists significant difference on the impact of teaching of science through traditional method of teaching and academic achievement of seventh class learners.

Research Design

The design of the study was non-equivalent control group design of the quasi-experimental type. This design has been employed to study the impact of teaching of science through constructivist learning approach on academic achievement of seventh class learners of district Burnpur(West Bengal).



Sample

Out of 200 secondary school of Burdwan(West Bengal) district the investigator purposively selected ten secondary schools those were more or less apparent in nature with regard to their nature of management, infrastructure, teacher strength, student strength, year of establishment and student result etc. Out of these ten apparently equivalent schools the investigator randomly (by lottery method) selected two schools for the purpose of experimentation. As such the seventh class learners of the Subhash Palli Vidya Niketan, Burnpur, were taken as the subjects of the experimental group and seventh class learners of Shanti Nagar Vidyapitha, Burnpur were taken as subjects of control group. The number of subjects of the experimental group and control group was 40 and 40 respectively.

Tools

In the present study the investigator used parallel forms of self made achievement test in the subject of science. The two parallel forms of the achievement test were directed to experts checking and confirmation for getting their approval regarding its authenticity and classroom applicability. Each parallel forms of self developed achievement tests constitute three parts covering a variety of items.

Treatment

In the present study the investigator took two groups i.e. experimental and control group. Both of experimental group and control group were pre-tested and their scores were analyzed. After the

conduction of pretest the treatment is given to experiment group. The students of Subhash Palli Vidya Niketan, Burnpur, i.e. the experimental group were taught by the investigator through constructivist leaning approach. The treatment of teaching through the respective approaches, to both the experimental group and control group were conducted by the investigator and the regular subject teacher of the controlled school respectively. The investigator herself did not taught the subjects of the control group in order to avoid the carry over effect. The investigator supervised the teaching of the regular teacher. The detail of pretest, treatment and post test to both the experimental and control groups are discussed in succeeding section.

Table 1-Design of the teaching programme on the science subject and testing to both the experimental and control groups

Pre test	Content	Post test
Achievement test in Science (Developed by the investigator) Part I–Multiple choice Type of questions. Part II–Open ended question. Part III–Concept Mapping based questions.	1. Heat 2. Fibre to Fabric 3. Physical and Chemical changes 4. Electric Current and its effects 5. Water : A precious Resource 6. Animal Respiration 7. Plant Respiration 8. Living and Non-Living beings 9. Magnet	Achievement test in science (Developed by the investigator) Part Part I - Multiple Type choice of questions. Part II – Open ended question. Part III – Concept Mapping based questions.

Procedure of Data Collection

Shanti Nagar Vidyapitha, Burnpur was taken as the control group for present investigation. All the 40 students of class seventh of this school constituted the sample of control group. The achievement test was administered to control group to assess their status just at the beginning of the experiment. On the same day in the afternoon session same achievement test was administered to 40 students of Subhash Palli Vidya Niketan, Burnpur taken as experimental group. After the conduct of pre-test, from the next day, control group was taught through old traditional method of teaching by their regular classroom teacher. As per the request of investigator the regular class teacher prepared lesson plans on five chapters for implementation. These lesson plans were verified by investigator prior to implementation. From the same day 40 students of the Experimental group were taught by investigator through constructivist learning approach. One period of school time table was devoted to teach each topic. As such, as a whole eighteen teaching days were spent to teach all the topics under the respective five chapters. At the end of teaching the post-test was administered to both groups. A minimum gap of four weeks was maintained between the successive administration of pre-test and post-test.

Statistical Techniques Employed

The collected data were analyzed with regard to finding out the initial difference if any between the pre-test scores of both the groups on each dependent variable. In order to test the normality of distribution of the data at the pre-test level the descriptive measures of statistics like Mean, Median, Mode, Skewness, Kurtosis were applied and to test the impact of the independent variables the inferential statistical measure ‘t’ test technique was used.

Analysis and Interpretation

A. Analysis of pre-test scores on academic achievement of both the control and experimental groups

To consider the nature of distribution of pre-test scores on academic achievement of both the control and experimental groups there descriptive measures like mean, median, mode ,standard deviation, skewness and kurtosis were calculated and Such measures are presented in table-2

Table- 2 : Descriptive measures of the pre-test scores on academic achievement of both the control and experimental groups.

Groups	N	Mean	Median	Mode	SD	Skewness	Kurtosis
Control	40	43.95	44.5	45.6	13.57	-1.75	0.278
Experimental	40	44.1	44.5	45.3	13.70	-1.15	0.274

An observation of the descriptive measures of the pre-test scores of the subjects of control and experimental groups indicate that the values of mean, median and mode of both the groups are very close to each other indicating the scores to have been distributed almost normally. Moreover, the obtained values of skewness and kurtosis in case of the control group being -1.75 and 0.278 respectively are very close to such values needed in case of a normal distribution of scores, that is, 0 and 0.263 respectively. Therefore, the investigator can safely conclude that the groups are more or less equivalent in nature and the construct value is approximately normally distributed in the sample.

On the other hand the pre-test scores of the experimental group on academic achievement show the values of mean, median and mode to be 44.1, 44.5 and 45.3 respectively. Such values indicate that though both the mean and median values appear to be almost very close to each other but the value mode seems to deviate slightly. However, the skewness and kurtosis values of the distribution being - 1.15 and 0.274 respectively appear to be very close to the corresponding values as required in case of a normal distribution.

From the forgoing discussion it may be concluded that the pre-test scores on academic achievement of the control and experimental groups are almost normally distributed. Hence, the statistical technique of ‘t’ test may be applied to study the significance of difference between the means of the control and experimental groups. The results of the pre-test scores concerning the difference in the academic achievement of the subjects of control and experimental groups obtained through t test are presented in table-3.

Table-3 : Significance of mean differences of pre-test academic achievement scores of both control and experimental groups

Groups	Tests	N	Mean	SD	SED	df	t
Control	Pre-test	40	43.95	13.57	3.04	79	0.04
Experimental	Pre-test	40	44.1	13.70			

An analysis of the data reveals the t value of 0.04. In the present case the obtained ‘t’ value being 0.04 is found not to be significant at 0.05 level. Therefore, it may be interpreted that the initial mean differences that exist between the control and experimental groups with regard to academic achievement is not significant. As such, both the groups may be considered to have almost equal level of academic

achievement. In other words, both the groups may be considered to be equivalent so far as their academic achievement is considered.

B. Impact of constructivist learning approach on academic achievement of experimental group

The following table shows difference of mean scores, standard deviation and ‘t’ value of experimental group at pre-test and post-test level.

Table 4 : Significance of difference of mean scores on academic achievement of experimental group at pre-test and post-test level

Test	N	Mean	SD	SED	‘t’
Pre-test	40	44.1	13.70	2.86	2.36*
Post-test	40	50.85	11.89		

* Significant at 0.05 level

From the above table 't' value for the pre-test and post-test of experimental group was found to be 2.36 which is more than table value of 't' i.e. 2.02 at 0.05 level of significance for df 39. Thus the obtained value of 't' is significant at 0.05 level of confidence. Thus it shows that learning with the help of constructivist approach has positive impact upon academic achievement and as such the hypothesis i.e. "There exists significant difference on the impact of teaching of science through constructivist learning approach on academic achievement of seventh class learners" is accepted.

C. Impact of traditional approach of teaching on academic achievement of control group

The following table shows difference of mean scores, standard deviation and 't' value of control group at pre-test and post-test level.

Table 5 : Significance of difference of mean scores on academic achievement of control group at pre-test and post-test level

Test	N	Mean	SD	SED	‘t’
Pre-test	40	43.95	13.57	2.98	0.15(NS)
Post-test	40	44.4	13.11		

NS- Not Significant

From the above table 't' value for the pre-test and post-test of control group was found to be 0.15 which is less than table value of 't' i.e. 2.02 at 0.05 level of significance for df 39. Thus the obtained value of 't' is not significant. It shows that teaching through traditional approach does not put any impact on the academic achievement of control group that means the hypothesis i.e. "There exists significant difference on the impact of teaching of science through traditional method of teaching on academic achievement of seventh class learners" is rejected.

D. Comparative Impact of Constructivist Learning Approach and Traditional Approach on Academic Achievement

The following section deals with the comparative impact of constructivist learning approach and traditional approach of teaching on dependent variable academic achievement. As such the scores obtained in case of the post test of both the control and experimental group have been presented in the following table-6

Table-6 : Significance of difference of post-test mean scores on academic achievement of both experimental and control group

Group	Test	N	Mean	SD	SED	't'
Control	Post-test	40	44.4	13.11	2.79	2.31*
Experimental	Post-test	40	50.85	11.89		

It is evident from the above table that the obtained 't' value is 2.31 which is more than the table value of 't' i.e. 1.99 at 0.05 level of confidence for df 79. Thus, the obtained 't' value is significant at 0.05 level of confidence. This indicates that the traditional and constructivist learning approach has significant impact on the academic achievement of the students of both experimental and control group.

Major Findings of the Study

From the analysis of the obtained data we can conclude that;

- i) The constructivist learning approach has significant impact on the academic achievement of the learners.
- ii) The traditional method of teaching has no significant impact on the academic achievement of the learners.

Educational Implications of Constructivist Learning Approach

Some of the educational implications of the study are:

- i) It is believed that learners-centred instruction can achieve many positive outcomes in students and faculty both due to their involvement and commitment in the activities in students and commitment in the activities designed. Yet inculcation of motivation for the task in both teachers as well as students requires a mammoth task of changing mindset. Sustained commitment, open-mindedness and willingness to experiment on the part of faculty are the core issue. Another important aspect, of teachers about constructivism and learner centred approach to teaching. Keeping in view the large number of institutions and faculty a mechanism need to be developed so that orientation and regular updating of all is made possible.
- ii) The teachers should;
 - a) accept and encourage student initiation of ideas and use student thinking, experiences and interests to drive lessons.
 - b) encourage students to suggest causes for events and situations and encourage them to predict consequences.
 - c) seek student ideas before presenting teacher ideas or before studying ideas from text books or other resources.
 - d) inquire about students understandings of concepts before their own understandings about the concepts with them.
 - e) encourage students to engage in dialogue, both with the teacher and with one another.
 - f) encourage students' inquiry by asking thoughtful, open ended questions and by encouraging students to ask questions to each other.
- iii) The curriculum should be enriched to provided for over all development remain text book centric.

Conclusion

It can be concluded that constructivist learning is more effective for the development of academic achievement than traditional lecturing methods. It also shows that constructivist learning approach is one of the potent ways of imparting science education and communicating science and technological advancements in the integrated and holistic manner.

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