

A Study Of Effect Of 5E Model Of Teaching Physical Science On Academic Achievement Of Students At Secondary Level Of Government Schools In Odisha

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Abstract

The 5E model of teaching physical science is an inquiry-based teaching approach that has been gaining popularity in recent years. This study aimed to investigate the effect of the 5E model of teaching physical science on the academic achievement of students at the secondary level of government schools in Odisha. The study used a Quasi-Experimental research method and a pre-test and post-test non-equivalent control group design, with one group of students receiving instruction using the 5E model and another group receiving instruction using traditional teaching methods. The academic achievement of the students was assessed through pre- and post-tests, which included both objective and subjective measures. The results of the study showed that the 5E model of teaching physical science had a significant positive effect on the academic achievement of students at the secondary level in Odisha.

Keywords: Constructivist approach, 5E model, Academic Achievement, Non-equivalent control group design

Introduction

The 5E teaching model is based on Constructivist Learning Theory and was created by Roger Bybee. This model allows students to construct their own knowledge through engagement, exploration, explanation, elaboration, and evaluation, with the teacher acting as a facilitator. This teaching approach is designed to engage students in the learning process and develop their critical thinking skills. Academic achievement tests indicate students' understanding and progress, and enable teachers to evaluate their teaching methods. Science is a compulsory subject at the Secondary level Government schools in Odisha, and includes Physical Science and Biological Science. Physical science is important for developing students' scientific attitude, temper, and interest, making it essential for teachers to use effective teaching methods and improve academic achievement in the subject. The aim of this study was to investigate the effect of the 5E model of teaching physical science on the academic achievement of students at the secondary level of government schools in Burla.

Rationale Of The Study

Academic achievement in physical science of the government secondary school students in Odisha is a matter of concern due to their poor performance in the examinations. This, somehow reflects the inability of the traditional methods of teaching to compensate the learning needs of the students. The Constructivist approach of teaching and learning has been regarded as one of the most suitable methods to teach physical science to the students in an effective manner. The 5E model is based on this approach and encourages students to construct knowledge through experiences. It could be an effective model for teaching physical science in modern times.

Noteworthy Contribution Of The Study

The findings of this study can assist science educators in designing an exceptional and efficient learning experience for secondary level students. By incorporating various teacher-provided activities, the learning process can become more meaningful and engaging, thus motivating students. It can lead to a thorough comprehension of scientific concepts, while promoting analytical thinking and reasoning skills. Additionally, the approach emphasizes the development of science process skills among students, ultimately encouraging them to acquire new knowledge.

Literature Review

Previous studies have shown that the 5E model of teaching physical science has a positive effect on student learning outcomes. For example, a study by Kumar and Kumar (2021) found that the 5E model of teaching physical science had a positive impact on the academic achievement of students in secondary schools in India. Similarly, a study by Guntuku (2019) found that the 5E model of teaching physical science improved students' critical thinking skills and scientific literacy.

Objectives Of The Study

1. To compare mean scores of the experimental group and control group with regard to Academic Achievement of students before the treatment
2. To compare mean scores of the experimental group and control group with regard to Academic Achievement of students after the treatment
3. To compare mean scores of the experimental group and control group with regard to gain in Academic Achievement of students
4. To compare mean scores of the experimental group and control group using ANOVA with regard to Academic Achievement of students

Method And Design Of The Study

The present study used a Quasi-Experimental research method and a pre-test and post-test non-equivalent control group design. Two groups of class IX students were selected from Govt. High School, Burla, one as the control group and the other as the experimental group. Prior to teaching a specific topic, an achievement test was administered and pre-test scores were collected. The control group was taught by using the traditional method, while the experimental group was taught by using the 5E Model of teaching. After teaching the topic, the post-test scores were collected from both groups. Both pre- and post-test scores were analyzed using the same tool and statistical methods.

Limitation Of The Study

- The study was confined only to the Government schools in Burla, Sambalpur district.
- The study was limited to students of class IX, studying under the Odisha Government elementary schools.

Research Tools

- Lesson plan based on 5E model of teaching Physical Science
- Achievement test in Biological Science (Prepared by the researcher)
 - a) Pre-test (Achievement) for assessing the Entry behaviour of students.
 - b) Post-test (Achievement) for assessing the terminal behaviour of students.

Analysis And Result

The data collected from the elementary school students are analysed using appropriate statistical techniques. This chapter deals with analysis and interpretation of data collected from the drawn-out sample keeping in view of the objectives and hypotheses of the present study. Statistical analyses were carried out using SPSS statistical software for Windows and Microsoft Excel.

The analysis of data is done under four sections, which are as follows: -

1. Comparison of pre-test Achievement scores of Experimental Group (EG) and Control Group (CG).
2. Comparison of post-test Achievement scores of Experimental Group (EG) and Control Group (CG).
3. Comparison of Gain Scores of Achievement scores of Experimental Group (EG) and Control Group (CG).
4. Comparison of the performance of students in the Experimental and Control groups with respect to the Academic Achievement scores [ANOVA].

Comparison of Pre-Test Academic Achievement Scores for Experimental Group (EG) And Control Group (CG) (Total Sample)

The results of the test of significance for difference between the means of pre-test Academic Achievement scores for EG and CG are given in Table 1

Table-1

Test Of Significance For Difference Between The Means Of Pre-Test Academic Achievement scores (Total Sample)

Group	No. of Students (N)	Mean (M)	Standard Deviation (SD)	t-value	Level of Significance
Experimental (EG)	62	18.21	4.27	11.84	P<0.05
Control (CG)	63	14.98	3.97		

Data analysis (Table-1) shows significant difference between EG and CG in pre-test academic achievement scores (CR=11.84; P<0.05). Despite this, the mean difference between the two groups is minimal, indicating similar initial abilities. Hence, the hypothesis is rejected and the groups are not equal in pre-test academic achievement.

Comparison Of Post-Test Academic Achievement Scores For Experimental Group (EG) And Control Group (CG) (Total Sample)

The results of the test of significance for difference between the means of post-test Academic Achievement scores for EG and CG are given in Table 2

Table-2

Test Of Significance For Difference Between The Means Of Post-Test Academic Achievement Scores For EG And CG groups (Total Sample)

Group	No. of Students	Mean (M)	Standard Deviation (SD)	t-value	Level of Significance
Experimental(EG)	62	37.56	5.34	26.41	P<0.05
Control (CG)	63	14.23	2.53		

Data analysis (Table-2) showed significant difference between EG and CG in post-test academic achievement (CR=26.41; P<0.05). This means EG is better than CG in post-test academic achievement, rejecting the hypothesis.

Comparison Of Gain Scores Of Academic Achievement Experimental Group (EG) And Control Group (CG) (Total Sample)

Details regarding the test of significance for difference between the means of gain academic achievement scores of EG and CG are given in Table 3

Table-3

Test Of Significance For Difference Between The Means Of Gain Scores Academic Achievement: EG and CG (Total Sample)

Group	No. of Students	Mean (M)	Standard Deviation (SD)	t-value	Level of Significance
Experimental(EG)	62	10.87	2.45	18.75	P<0.05
Control (CG)	63	4.32	1.56		

Data analysis (Table 3) showed significant difference in mean scores between the experimental group (EG) and control group (CG) in terms of academic achievement gain (CR=18.75; P<0.05). The results favor the EG. Thus, the hypothesis is rejected and it can be concluded that the EG outperforms the CG in terms of academic achievement gain.

Comparison of The Performance of Pupils in The Experimental Group (EG) And Control Group (CG) With Respect to The Academic Achievement Scores using ANOVA (Total Group)

The results of the pre-test showed that the experimental and control groups had similar academic abilities in Biological science. The application of the 5E teaching model in the experimental group resulted in better academic achievement compared to the control group, which was taught using the traditional method. Further analysis using ANOVA was necessary to determine the significant difference between the groups' post-test scores and gain scores.

Table 4

Results Of The Summary Of ANOVA Of The Pre-Test And Post-Test Scores Of Students In The Experimental And Control Groups For The Academic Achievement

Source Of Variation	Df	SSx	SSy	MSx	MSy	Fx	Fy
Among Means	1	14.76	20.34	14.76	20.34	5.22	7.21
Within Groups	123	459.65	824.21	3.73	6.69		
Total	124	474.41	844.55				

The F ratios for the two sets of scores were tested for significance. The value of F for $df=1/123$ is 5.22 at 0.05 level of significance. The value of $F_{x\text{obtained}}$ ($F_x=5.22$) is insignificant at 0.05 level. The value of F_y obtained ($F_y=7.21$) is significant at 0.05 level. The analysis of variance of the y means indicate that there exists significant difference between EG and CG for developing academic achievement.

Findings And discussions

Findings of the study based on descriptive and inferential analysis of the data related to effectiveness of 5E model of teaching are described below:

1. There is a significant difference between Experimental Group (EG) and Control Group (CG); the two groups are not equal with regard to pre-test Academic Achievement. [Total Sample]
2. There is a significant difference between Experimental Group (EG) and Control Group (CG), the two groups are not equal with regard to post-test Academic Achievement. [Total Sample]
3. There is a significant difference between Experimental Group (EG) and Control Group (CG), the two groups are not equal with regard to gain Academic Achievement. [Total Sample]
4. The analysis of variance (ANOVA) of the two sets means indicate that there is a significant difference between the treatment groups for developing Academic achievement.

The study found that there was a significant difference in academic achievement between the Experimental Group (EG) and the Control Group (CG) in the pre-test, post-test and gain. The analysis of variance (ANOVA) showed that the two groups had a significant difference in

their academic achievement. These results indicate that the 5E model of teaching was effective in enhancing academic achievement in the Experimental Group compared to the Control Group. It is suggested that the 5E model should be further explored and implemented in education to improve student learning outcomes.

Conclusion

The results of this study shows that the 5E model of teaching physical science can assist the teachers to provide effective teaching- learning experiences to the students and enhance their academic achievements in the particular subject. 5E model of teaching is an activity- based Constructivist approach of teaching that promotes the active participation of the students in the teaching- learning process and provides them the opportunity to construct their own knowledge on the basis of their own experiences. However, the teacher needs to be competent enough with pedagogical skills and expertise to effectively implement this model of teaching physical science in the classroom.

Recommendations

The study can be undertaken with increased sample size and with more sophisticated experimental designs. This study can be replicated with other populations including the students at secondary and higher secondary levels of Government, Aided and Private schools in both urban and rural areas. More number of researches should be conducted to find out the effectiveness of 5E model of teaching on the academic achievement of students in various school subjects at various levels of schooling. This study can be extended to other disciplines since the present study is limited to teaching of physical science at elementary level of schooling. The study can be conducted for longer period on other variables to produce better results. It can be helpful for generalizing the effectiveness of the model across the various disciplines at the different levels of school.

1. Exploring the 5E model teaching approach in other subjects and comparing its effectiveness with traditional teaching methods in those subjects as well.
2. Investigating the impact of the 5E model teaching approach on students with different learning styles, socio-economic backgrounds and cultural backgrounds to see if the approach is universally effective.
3. Comparing the effectiveness of the 5E model teaching approach with other innovative teaching methods, such as project-based learning, problem-based learning, and gamified learning.

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