

## Impact of 5E Constructivism on Students' Learning Approaches towards Science

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### Abstract

Education is the ingredient that can bring about a makeover towards a progressive society. Quality of education depends on the quality of instruction. Students Learning Approaches range from a surface to a deep learning strategy. The present study on Grade 8 Students from SSC Board, Mumbai, Maharashtra, was aimed to find out the impact of 5E Constructivism on Students' Learning Approaches in Science understanding. The study was conducted in three phases, a pre-test in the first phase followed by interventions, and a post-test. In the second phase, the independent variable was 5E Constructivism whereas the dependent variable was Student's Learning Approaches in Science understanding. The mean values of the pre-test and post-test findings for surface learners were found to be 198.153 and 181.38 respectively; the mean values of the pre-test and post-test findings for deep learners were found to be 204.57 and 211 respectively. The Baseline Pre-test had maximum students with a score range from 0 to 3 and the Post Test showed maximum students in the 7 to 10 range. This marked shift in the Students' Learning Approaches revealed that the 5E Constructivism Approach was effective for enhancing the surface learners into deep learners. A semi-structured interview was also conducted with the pre-test and post-test to qualitatively analyze the impact of the interventions. With a Constructivist Approach, students synthesize new understanding from prior learning and new information. As learning becomes an interesting activity, it becomes meaningful and sustainable.

*Keywords: 5E Constructivism, Learning Approaches, Science, Surface Learning, Deep Learning.*

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### Introduction

A learning strategy like constructivism dapples with the learners existing knowledge, beliefs, and skills. A learner can synthesize new understanding from prior learning and new information. A constructivist teacher sets up problems and monitors student

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exploration, guides student inquiry, and promotes new patterns of thinking. Working mostly with raw data, primary sources, and interactive material, constructivist teaching asks students to work with their data and learn to direct their explorations. Ultimately, students begin to think of learning as accumulated, evolving knowledge. Constructivist approaches work well with learners of all ages, including adults.

The 5 E's can be used with students of all ages, including adults. Each of the 5 E's describes a phase of learning, and each phase begins with the letter "E": Engage, Explore, Explain, Elaborate, and Evaluate. The 5 E's allows students and teachers to experience common activities, to use and build on prior knowledge and experience, to construct meaning, and to continually assess their understanding of a concept.

5E Constructivism is a considerable pathway to learning because it allows students to:

- ✓ Manage their thought process
- ✓ Manage their interactions to develop a range of experiences
- ✓ Manage their reflection through their written expression
- ✓ Manage their real-life linkages to their learning.

### **Learning Approaches**

The commonly referred approaches drawing reference in this research are the "deep" and "surface" approaches. Those who adopted a "deep" approach are known to engage in an active approach to learning. Those who adopted a "surface" approach to learning focused on rote learning and not reaching the depths of their learning. To provide further elucidation, a summary of the differences in motivation and study process of surface and deep approaches to study is provided in Table 1.1 below:



Approach	Motivation	Strategy
Deep	<ul style="list-style-type: none"><li>✓ Personal Understanding</li><li>✓ Interest in the subject</li></ul>	<ul style="list-style-type: none"><li>✓ To discover meaning by reading widely</li><li>✓ Inter-relating with previous relevant knowledge.</li></ul>
Surface	<ul style="list-style-type: none"><li>✓ Course completion</li><li>✓ Fear of failure</li></ul>	<ul style="list-style-type: none"><li>✓ to limit the target to bare essentials</li><li>✓ Reproduce content through rote learning.</li></ul>

Table 1. Summary of the differences between Motivation and Strategy seen in Surface and Deep Learning Approach

## Methodology and Methods

The research methodology that was followed for this study is the embedded mixed method. The study was divided into 3 phases.

In the first phase, the study adopted a primarily quantitative method where data from the preliminary questionnaire and the baseline was analyzed quantitatively to acquire the status of surface and deep learners in Science learning. In the second phase, the study intended to apply the 5E Constructivist Approach and find the impact on their learning approaches using an experimental design. The post test results using the same questionnaire and a baseline test was compared to know the overall impact of the interventions. In the third phase, the researcher analyzed quantitatively as well as qualitatively the impact of Constructivism on Learning Approaches in Science from a relatively small number of participants.

Over the past years, many studies have been undertaken to prove the impact of 5E constructivism on learning. Some researchers have proved it across different subjects using quantitative and qualitative methods. Very few studies have explored the possibility of an impact of Constructivism towards learning approaches that is why the researcher of this study explores the same quantitatively and qualitatively using a mixed-methodology design.

The objective of this study was to find out about the impact of 5E constructivism on learning approaches in science. Sometimes the information obtained from a questionnaire may not be sufficient and inadequate as the students may not know or understand the items in the questionnaire or may merely respond to the alternatives in a non-committed manner.



But along with the questionnaire, a baseline test and a semi-structured interview is also taken of the students a holistic and comprehensive angle to it.

### **Quantitative Research**

Quantitative research, according to Creswell (2008), is defined as an investigation process that can be used for exploring trends and explaining the relationship among different variables. A quantitative research approach depends on quantitative data such as survey questionnaires or focuses on testing a hypothesis confirmation (Johnson & Christensen, 2000; Wiersma & Jurs, 2009). Here, the focus of the quantitative research was determining the study process and their achievement scores using a baseline test

### **Qualitative Research**

Qualitative research is an umbrella term for several research strategies (Bogdan & Biklen, 2007). It refers to the collection, analysis, and interpretation of comprehensive narrative and visual data to gain insights into a particular phenomenon of interest (Springer, 2010). As the purpose of this study is to understand the effectiveness of applying 5E constructivism, a focussed group analysis seemed to be appropriate as a part of this mixed-methods research.

### **Sample & Sampling Method**

For the study, students of St. Paul's High School, Dadar, Mumbai are taken. The distribution of our sample was with respect to grade of study and a science subject. For the qualitative study, data was collected from a relatively small number of participants (N=10) and for the quantitative study data was collected from 50 participants.

### **Instruments of Data Collection**

Following research tools will be used for this study

1. Modified Biggs Questionnaire: The Revised Two Factor Study Process Questionnaire for assessing the amount of Surface and deep learners developed by the researcher



2. Baseline test on the Chapter Air from the SSC Science textbook for assessing the number of surface and deep learners based on their scores developed by the researcher.

The data was collected using the following steps-

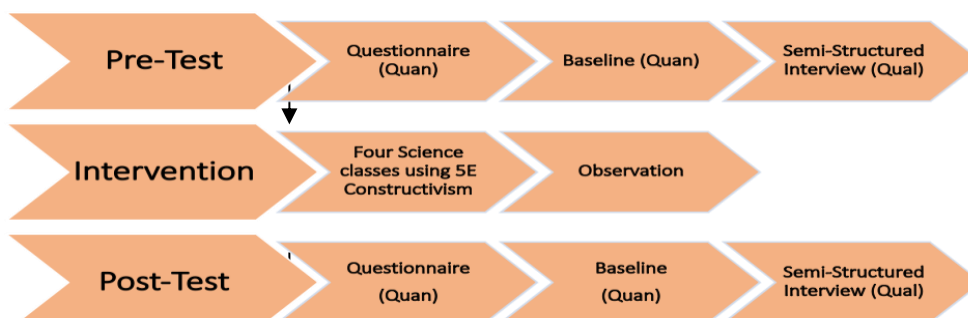


Figure 1. Procedure of Data collection

## Analysis and Discussion

### Mean Scores of Data on the basis of Surface and Deep Learning

Deep learning		Surface learning	
Pre-Test	Post-Test	Pre-Test	Post-Test
56.15	57.92	50.50	46.23

Table 2. Mean Scores of Data on the basis of Surface and Deep Learning

From the table, it is evident that in the post-test, the mean scores for deep learners has increased as compared to the pre-test. The opposite is seen in the case of surface learning where the mean scores have decreased in the post test from the pre-test. Thus, we can say from the table that students have moved towards being more of deep learners than surface learners.

### Student's Scores from the Baseline Test

Range	Pre-test	Post-test
<b>0-3</b>	33	3
<b>4 to 6</b>	15	12
<b>7 to 10</b>	2	35

Table 3. Student's Scores from the Baseline Test



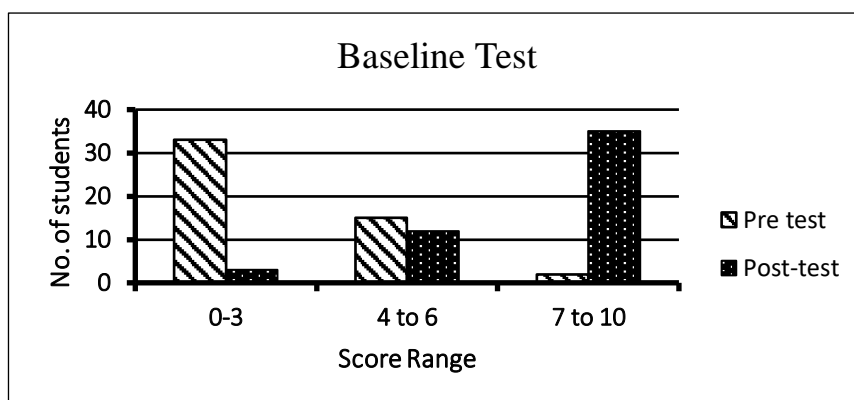
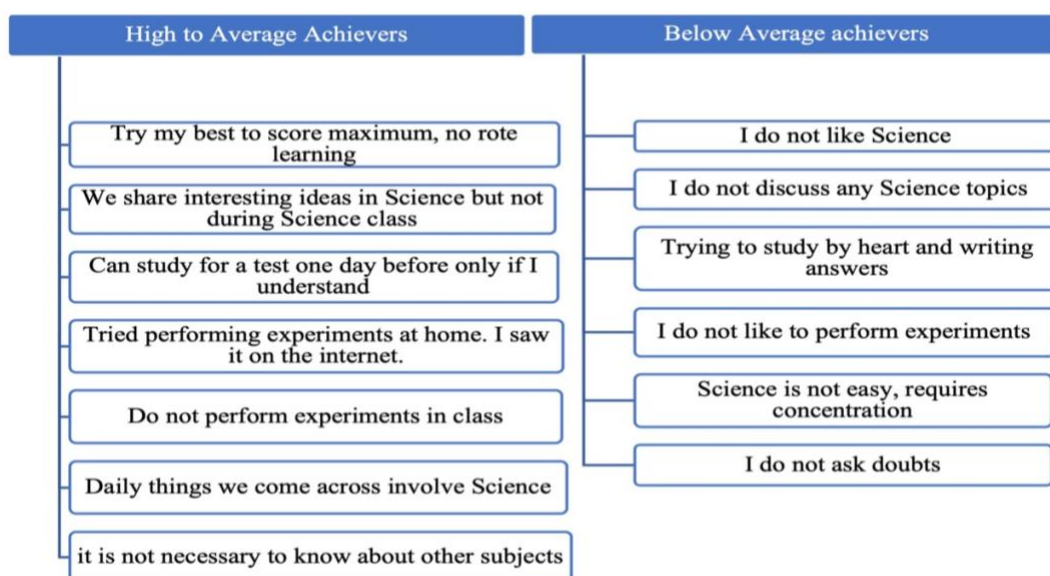


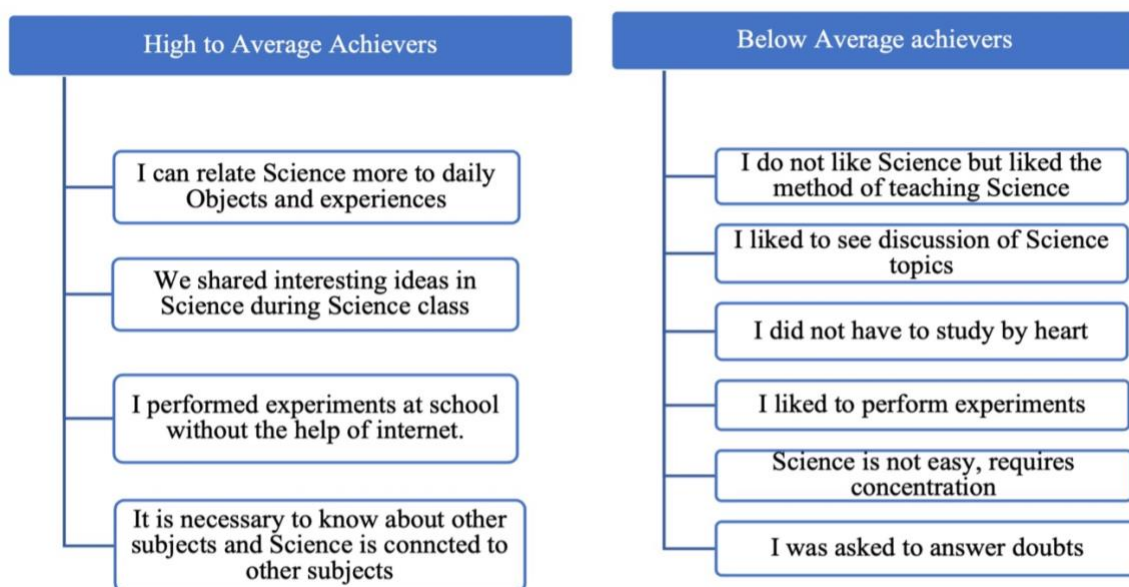
Figure 3. Student's Scores from the Baseline Test

The above graph tabulated from the scores of the Baseline Content Test by the researcher shows the students' score range comparing their scores obtained from pre-test and post-test. From the table and the graph it is evident that in the post-test, the number of students scoring above 7 is much more than it was in the pre-test. The same but in the opposite stands for the scorers with less than 3 being more during the pre-test and less than 5 students scoring in that range for the post-test. The middle range remains more or less the same. This graph simple, reiterates the impact of 5E Constructivism on student learning where students are actively involved in constructing their understanding over concepts with time.

### Summary of Semi-Structured Interview : Pre Intervention Program



## Summary of Semi-Structured Interview : Post Intervention Program



From the above analysis, average achievers who did not seem to like science, or discussion on any science topic there was a positive change in attitude where after the interventions they seemed to like the method of teaching that was adopted. The baseline post-test did not require them to study “by heart” as against the pre-test but they could answer the questions with ease since they understood the topic covered. From having no fond memory of learning science to making a start with recalling one of the experiments performed as a part of the Explore from the 5E Constructivism Approach, there was a change of attitude and a shift in addressing the subject. However, more interventions and exposure to such a set up will be required to change their notion about Science being “not easy” and their resistance to ask doubts in class. For the High to Average Achievers, the impact of 5E constructivism was seen in the area of encouraging a class discussion on the topic. These students also went a step ahead and got exposure to performing experiments in class as opposed to merely trying out videos watched on the internet at home. One major change was seen in the mindset of recognizing the importance of knowledge of other subjects and keeping a multi-disciplinary approach. Thus, a major change was observed in Below Average Achievers compared to the Higher Achievers.

## **Summary of Findings**

The following conclusions can be drawn from the findings:

1. It can be seen that there is a significant increase in the mean scores of all the parameters in the pre-tests and post-tests after the interventions were administered.
2. There was a significant increase in the Baseline test taken after the interventions.
3. The extent to which the students showed interest in Science and its dimensions after the interventions was higher than it was before the interventions.
4. There is a significant increase in the amount of deep learners from surface learners.

At the start of the study, the students had low Baseline scores and were found to have more of a Surface Learning Approach. The findings revealed that there is an increase in the mean values of the pre-test and post-test conducted after the interventions. The mean values of the parameters used to determine the effectiveness of 5E constructivism on student learning approaches (deep and surface) the pre-test and post-test showed a significant increase from surface learning to deep learning. Learning Approaches in Science understanding is positively influenced by the application of Constructivist Approach in the classroom. The 5E's helped to change the Learning Approaches of these students. The study also suggests that Achievement In science is enhanced through 5E Constructivism. The student responses received on their shift in their view about different dimensions about Science learning also showed a significant difference positively.

## **Findings of the Qualitative Data**

The interview finding were analysed from the responses recorded from their pre and post-test. A change was noted in the response during the post-test interview phase. The students who were below average showed a glimmer of change in their attitude towards the subject of Science. They seemed to develop a liking towards the new method of 5E Constructivism. They also appreciated the strategies that were used during the interventions. The higher achievers appreciated the model of 5E constructivism and showed a shift in attitude with respect to multi-disciplinary needs to understand science





## **Conclusion**

It can be seen that there is an increase in the Baseline test taken after the intervention. This increase can be justified through the impact of the interventions which followed the 5E Constructivism. There was an increase in the mean scores of all the parameters in the pre-tests and post-tests after the interventions were administered. This shift in the students moving from a surface learning approach to a favourable deep learning approach is due to the engaging and exploring nature of 5E Constructivism. The extent to which the students showed understanding after the interventions was higher than the understanding before the interventions. There is an increase in the interest level, confidence level, motivation and orientation towards understanding the subject after administering the interventions. When you use the 5E Instructional Model, you engage in practices that are different from those of a traditional teacher. In response, students learn in ways that are different from those they experience in a traditional classroom. The change in attitude of students shows that there is a difference before and after the interventions. Through the present study, it is revealed that 5E Constructivism facilitates the development of Learning Processes in Science understanding. As Constructivist Approach is process oriented, learning through Constructivist Approach allows students to use their Skills and knowledge. While transacting curriculum, it becomes imperative for teachers to engage their students in the process of learning. For this, teachers themselves should have awareness on 5E Constructivism. Moreover, science teachers should be given in service training for process oriented teaching. More effective instructional strategies based on 5E Constructivism should be developed and used for the enhancement of Learning Approaches.

## **Recommendations for Further Research**

The main focus of this study was on the impact of 5E constructivism towards learning approaches of students in science understanding and how this model affects their attitudes and classroom behaviour. Similarly, it was the researcher's intention to find out if 5E constructivism can help change surface learners into deep. In addition, to narrow the scope of the study, only secondary school students were participants.

Further research can be conducted on:

1. A study to see if other models can influence students towards deep learning



- a. The influence of 5E Constructivism in other subjects
- b. Study can be conducted on the feasibility of 5E constructivism across all boards
- c. 5E constructivism workshops can be conducted for a longer duration say for a week for pre and in service teachers

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