

Effect of Constructivist Approach on Achievement in Mathematics In Relation To Self-Efficacy

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ABSTRACT

This study examined the relationship between achievement in Mathematics and Self-Efficacy. Two hundred and sixty (260) students of 9th class in Amritsar city selected for the study. Three hypotheses were used. For this study author selected constructivist approach. The research is experimental in nature. The results show there exists no significant interaction effect of instructional strategies and self efficacy on achievement in mathematics was accepted. Also, no significant difference was also obtained between constructive and conventional group. The paper recommends that teacher should find ways of enhancing Self- Efficacy in student and should place emphasis on student's confidence to succeed in Mathematics achievement.

I. INTRODUCTION:

CONSTRUCTIVISM

Constructivism is a impend toward teaching that be acquaints with that information can be conveyed but understanding depends upon the learner. Constructivism is child-centered; it proposes hat studying environments must support multiple perspectives or interpretations of reality, recognizing construction, context-rich, practice-based totally activities. Constructivism focuses on proficiency construction, now not cognition imitation. The mind is influential and crucial in deciphering events, gadgets, and view sat the base that is unique and individualistic. Our outlook of the out of doors international differs from others because of our exceptional set of studies. Constructivism is a theory which is basically based on inspection and scientific revise about how humans research. It deals with assibilation of once own knowledge, which is based on their pervious experiences and ideas. When we bump into something new, we

ought to bring together it with our prior thoughts and practice, can be translating what we agree with or may be disposal the fresh information as inappropriate. In any case, we're full of life creators of our personal expertise. To try this we have to ask questions, travel round and price what we know. Constructivist classroom is based on the assumption that inexperienced persons actively create and streamline information in highly man or woman ways, through reviews. It emphasizes the finale of information, ideals and abilities that the person brings to the prevalence of studying. It identifies the construction of new understanding as a grouping of prior getting to know, new facts and eagerness to learn. In the most fashionable sense, it usually way encouraging students to use lively techniques (experiments, actual-world aggravate solving) to create extra knowledge after which to return on and speak approximately what they are performing and how their understanding is changing. The instructor makes positive she comprehends the students' prior present conceptions, to expose that the pastime to address them and then construct on them.

The 5Es academic model represents the 5levels of series for teaching and learning within the lesson plan was:

- Engage
- Explore
- Explain
- Elaborate
- Evaluate

ACHIEVEMENT IN MATHEMATICS

Achievement may be described as “a product which may be measured by achievement test” (Van den Aardweg, 1988). It is the quantity of information and capabilities

obtained after certain preparation or training inside the associated subject. Reber(1985) has explained accomplishment as “triumphment or the attaining of a goal.” Teaching of all the subjects starts off evolved with a few instructional and goal. These pursuits are achieved after the teaching of positive content of that subject. Students’ mathematical achievements in secondary faculty have an influential effect on their performance in university and their future careers.

SELF-EFFICACY

The time period self-efficacy became propounded with the aid of Albert Bandura in social cognitive idea. It was published in the research paper “Social Foundation of Thought and Action: A Social Cognitive Theory (1986)”. Social Cognitive Theory: Social cognitive idea laid exceptional emphasis over cognition. It indicates that cognition of an person has a outstanding area in his behavioral functioning in actual situation. This theory make clears that people conduct aren't forbid danced by using environmental forces as an alternative of these are controlled with the aid of internal impulses and also indicates that people are self-organizing, proactive self-reflective and self-regulative (Pajares, 2006).

II. REVIEW OF RELATED LITERATURE:

Lumbantoruan, Jitu Halomoan and Natalia, Stevi (2021): n

This study aims to produce a constructivist-based statistics module product. The Statistics module development is carried out to assist triumph over students' understanding of the concepts of Statistics. This research uses the Research and Development (R&D) research method, which refers to Robert Maribe Branch's development. The validation of textile experts, learning experts, teachers, small and large scale trials, and student responses and test results shows that the constructivist-based statistics module is feasible.

Juan Jin, Kyung-Eun Hwang and Inhan Kim(27 July 2020):

The purpose of this study is to verify the effectiveness of the constructivism education theory in building information modeling (BIM)/integrated project delivery (IPD) collaboration education by determining education methods that are most relevant to collaboration in the interaction course. After evaluating and analyzing the pace up in collaboration level and

satisfaction, the results were derived for the hypothetical model of the “Constructivism Collaboration Process (CCP)” and the facts that can have a positive impact on BIM/IPD education.

Ghodrat Ebadimanas , frouze sephrianazar and rashid jamei (2021):

The Effect of Teaching Biology Based on the Constructivist Approach on Students' Self-Efficacy and Academic Achievement Motivation Low self-efficacy and not having enough academic achievement motivation could be one of the factors of stress in the students. For this reason the aim of the present study was to investigate the effect of constructivism training way on self-efficacy and educational achievement motivation of students in biology course. Therefore, it can be concluded that teaching by constructivist method increases students' self-efficacy and academic achievement motivation. Based on the results of this study, biology teachers are advised to use the constructivist method in the biology teaching process.

The to be had overview of literature on the gift have a look at consists of the idea that there is robust co-relation between constructivist approach and mathematical success. From the appraisals concluded that the mean achievement score with constructive technique were significantly better than conventional method. The available overview of literature on the gift observe consists of the idea that there is powerful co-relation among mathematical achievement and self efficacy.

III. OPERATIONAL DEFINITIONS

3.1 CONSTRUCTIVISM

Constructivism is child centered approach in which firstly teacher provides knowledge to the pupils and later than that pupils will construct their own new knowledge with the help of previous knowledge and experiences.

3.2 ACHIEVEMENT IN MATHEMATICS

Mathematics achievement means the quantity of knowledge attained in Mathematics after the instruction or study. It is the gain obtained by the students in mathematics trial.

3.3 SELF-EFFICACY

Self-efficacy is once competency or capacity to do the task. In this study Investigator want to know that the students’ who have the facility and potentiality to do the task more effectively and easily means they have lofty self-efficacy. Is high efficacy helpful for achievement in Mathematics or not.

IV. DELIMITATION

The study will delimit with respect to following aspects.

1. The study confined to 9th class mathematics students in English medium from Amritsar city affiliated to P.S.E.B only. The study took from limited senior secondary and higher senior secondary schools of Amritsar only. 260 numbers of students selected as sample for the study.
2. The main purpose for this study to see the effect of Constructivist approach on achievement in mathematics. So constructivist approach and traditional method of testing taken in mathematics for selected units only.
3. This study also pays awareness towards two variables that is self-efficacy. The investigator selected these two variables saw the effect of the achievement of students in mathematics who have high, average and low self efficacy.

V. OBJECTIVES OF THE STUDY:

1. To compare the achievements of groups in mathematics will teach through constructivist approach and conventional method of instructions.
2. To compare the achievement of high and low group of students on self-efficacy.
3. To study the interaction effect of instructional strategy and self-efficacy on achievement in mathematics.

VI. HYPOTHESES OF STUDY:

The study will design the following hypotheses in the study:

1. There exists no significant difference between constructivist approach group and conventional group on achievement in mathematics.
2. There exists no significant difference between high, average and low self-efficacy groups on achievement in mathematics.
3. There exists no significant interaction effect of instructional strategy and self-efficacy on achievement in mathematics.

VII. SAMPLE

The present study was conducted on sample of 260 students of 9th class of English medium school of Amritsar city affiliated to Punjab school education board. Out of the total schools of Amritsar city, five schools were randomly selected. After selecting the schools, the student sample was drawn randomly.

VIII. DESIGN :

The present study designed to study the “Effect of constructivist approach on achievement in mathematics in relation to self-efficacy”. The present study was experimental in nature. In this study achievement in mathematics is dependent variable. Self-efficacy is independent variables. A post test employed. In order to analyze 2X3 factorial design analysis of variance was used. One group was treated as experimental group and the second group was treated as conventional group. The experimental group was taught through constructive based instruction and conventional group was taught same topics with traditional method of teaching. The study covered two independent variables such as instructional treatment, self efficacy. The variable of instructional treatment was studied at two levels, namely constructive based instruction and traditional method of teaching. The variable of self efficacy was studied at three levels such as high, average and low. The main dependent variable was achievement in Mathematics, which was calculated as the difference in post-test and pre-test scores for the subject.

IX. . TOOLS

The following tools will use for collecting data.

12 lesson plan based on constructivist approach from selected topics of mathematics developed by Investigator.

1. A mathematical knowledge test by Dr. Kawaljeet Kaur (2017) employed by Investigator to measure the achievement of students in mathematics.
2. Self-efficacy test by Dr. Arun Kumar Singh and Dr. Shruti Narain(2014) administered.

X. PROCEDURE

Firstly the Investigator made necessary arrangements with the Principals of schools selected for the experiment. Secondly Investigator divided the students into two groups with randomization. Randomization means that every subject has an equal chance of being assigned. Investigator will write the name of students on the slips of papers and Investigator will put the slips into a bowl and she will pick the slips in front of students. The first designated no of students will place in one group and rest assigned under another group. Thirdly Problem self-efficacy scale administered for classification of students. Fourthly the treatment furnished to the students in the form of constructive approach. 12 lesson based on constructivist approach on some topics of mathematics prepared. The students taught through the same topics of mathematics with constructive

approach and traditional method to the experimental and conventional group respectively. After the completion of course, achievement test of mathematics administered simultaneously. The experimental and conventional group score compared according to their post test score.

XI. STATISTICAL TECHNIQUES

The following statistical techniques will use to test the hypotheses

1. Descriptive statistics technique like mean, standard deviation used to see the nature of distribution of the scores.

2. A three way Analysis of Variance (2x3) employed on the gain achievement scores to test the hypotheses related to the strategies of teaching and self-efficacy.
3. For the significant F- ratio, t-test employed so as to find out the significance difference between means related to different groups and variables.\
4. Graphical techniques were used for descriptive analysis and visual perception of the data.

XII. ANALYSIS AND FINDINGS

Table 12.1 Tests of Between-Subjects Effects

Dependent Variable: achievement in Mathematics

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	290034.930	1	290034.93	2705.17	<.001
exp	300.831	1	300.831	2.806	.095
s.e3	12944.233	2	6472.117	60.366	<.001
exp * s.e3	75.821	2	37.910	.354	.703

The table 12.1 reveals that the F-ratio for difference in mean gain achievement scores of different instructional strategies was 2.806, which in comparison to the table value were found highly significant at 0.01 levels of significance. It shows that the experimental and control groups are different beyond the contribution of chance. Hence, the null hypothesis H_1 : There exists no significant difference between experimental and control group on achievement in mathematics, was not accepted.

The result indicates that the achievement of group taught through constructive approach is much higher than that of traditional teaching strategy in mathematics.

In order to probe deeper, the F-ratio was followed by t-test. The values of t-ratio for different combinations of mean gain scores of experimental and control groups for different teaching strategies have been presented in table12.2.

Table 12.2: t- ratio for various combinations of different instructional strategies

Variable	Experimental Group			Conventional Group		
	N	Mean	SD	N	Mean	SD
	130	40.8846	11.728	130	35.23	13.56
Experimental Group						
N	130	40.8846	11.728	---	3.593	
Mean						
SD						
Conventional Group						
N	130	35.23	13.56	---	---	
Mean						
SD						

(Critical Value 1.97 at 0.05 level and 2.59 at 0.01 level, df 258)

The mean gain achievement scores of experimental and conventional groups have been depicted through bar diagram in fig 12.3.

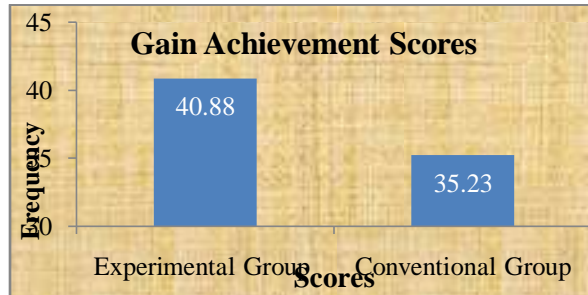


Fig: 12.3: Bar diagram showing comparison of mean gain achievement scores of experimental and control groups

The table 12.2 and fig 12.3 show that the mean gain achievement scores of experimental group- I taught through constructive approach was 40.88, which is higher than the corresponding mean gain score of 35.23. The t-value testing the significance of mean difference on achievement in mathematics of experimental group and conventional group in comparison to the table value was found significant at 0.05 and 0.01 levels of significance. The result indicates that the students taught through constructive approach perform significantly better than that of traditional strategies that is conventional group.

The table 12.1 shows that the F-ratio for difference in the mean gain student engagement

scores of different critical thinking groups was 60.336, which in comparison to the table value was found significant at 0.01 levels of significance. Thus, the null hypothesis **H₃: There exists no significant difference between the high, average and low self efficacy groups on student achievement in mathematics, was rejected.** The result indicates that high, average and low problem solving ability groups were different on achievement in mathematics.

To investigate further, F-ratio is followed by t-test. The values of the t-ratio for different combination have been given in the following table 12.4.

Table 12.4: t-ratio for different self efficacy groups on gain student engagement scores

Variables	High self efficacy			Average Self efficacy			Low Self efficacy		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
	77	48.53	7.424	105	35.77	10.920	78	30.79	13.40
High Self efficacy									
N	Mean	SD	8.859			10.177			
77	48.53	7.424							
Average Self efficacy									
N	Mean	SD	2.768						
105	35.77	10.920							
Low Self efficacy									
N	Mean	SD	---			---			
78	30.79	13.40							

* Significant at 0.05 level

** Significant at 0.01 level

(Critical Value 1.97 at 0.05 and 2.60 at 0.01 level, df 180)

(Critical Value 1.97 at 0.05 and 2.60 at 0.01 level, df 181)

(Critical Value 1.98 at 0.05 and 2.61 at 0.01 level, df 153)

A bar diagram has been drawn to depict the mean gain student engagement scores of high, average and low self efficacy group has been presented in fig 12.5.



Fig 12.5: Bar diagram showing comparison among mean gain student engagement scores of different self efficacy groups

It is evident from the table 12.4 and fig 12.5 that the mean gain scores of high self efficacy group was 48.53, which is higher than the corresponding mean gain scores of 35.77 for the average self efficacy group. The t-value testing the significance of mean difference of high and average self efficacy group of students was 8.859, which in comparison to the table value was found significant at 0.01 levels of significance. Hence, the hypothesis of no significant difference was rejected in case of high and average self efficacy group irrespective of grouping across other variables. The result indicates that high self efficacy group of students perform significantly better than that of average self efficacy group with regard to achievement in mathematics.

It is clear from the table 12.4 and fig 12.5 that the mean gain scores of high self efficacy group was 48.53, which is higher than the corresponding mean gain scores of 30.79 for the low self efficacy group. The t-value testing the significance of mean difference of high and low self efficacy groups of students were 10.177, which in comparison to the table value was found significant at 0.05 levels of significance. Hence, the hypothesis of no significant difference was rejected in case of high and low self efficacy irrespective of grouping across other variables. The result indicates that high self efficacy group of students perform significantly better than that of low self efficacy group with regard to gain student engagement scores in mathematics.

It is observed from the table 12.4 and fig 12.5 that the mean gain score of average self efficacy group was 35.77, which is higher than the corresponding mean gain score of 30.79 for low self efficacy group. The t-ratio for difference in gain scores of average and low critical thinking group was 2.768, which in comparison to the table value was found significant at 0.05 levels of significance. Hence, the hypothesis of no significant difference was rejected in case of average and low self efficacy irrespective of

grouping across other variables. The result indicates that average self efficacy group of students perform significantly better than that of low self efficacy group with regard to achievement in mathematics.

Interaction between Instructional Strategies and self efficacy (A × C)

Table 12.1 shows that the F-ratio for interaction between teaching strategies and self efficacy group was .354, which in comparison to the table value was not found significant at 0.05 levels of significance. The result indicates that different teaching strategies do interact with the self efficacy group to yield no significant difference in respect of gain achievement scores in mathematics. Hence, the null hypothesis **H₅: There exists no significant interaction effect of instructional strategies and self efficacy on achievement in mathematics, was accepted.** The result indicates that there is a no significant difference in gain scores on achievement in mathematics due to interaction effect of teaching strategies like constructive approach based teaching or traditional methods of teaching and self efficacy.

To ascertain significance of difference among means of various combination groups, t-ratios were calculated which have been shown in table 12.6.

Table 12.6 : t-ratio for difference in mean gain achievement scores of instructional strategies and different self efficacy groups

Variables			Experimental Group						Conventional Group					
			C ₁		C ₂		C ₃	C ₁		C ₂		C ₃		
Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
49.45	5.99	38.03	9.79	29.20	11.99	46.73	9.51	33.28	11.63	31.50	14.04			
Experimental Group	High efficacy	Self												
	N	Me	SD	---	7.176	9.787	1.535	9.354	8.432					
	51	49.45	5.99											
Experimental Group	Average efficacy	Self												
	N	Me	SD	---	---	3.401	---	2.727	2.804					
	55	38.03	9.79											
Experimental Group	Low efficacy	Self												
	N	Me	SD	---	---	---	---	---	---					
	24	29.20	11.99											
Conventional Group	High Efficacy	Self												
	N	Me	SD	---	3.768	5.750	---	5.453	4.998					
	26	46.73	9.51											
Conventional Group	Average efficacy	Self												
	N	Me	SD	---	---	1.399	---	---	.701					
	50	33.28	11.63											
Conventional Group	Low efficacy	Self												
	N	Me	SD	---	---	.697	---	---	---					
	54	31.50	14.04											

Here C₁ Stands for High Self efficacy group, C₂ Stands for Average Self efficacy group and C₃ Stands for Low Self efficacy group

A bar diagram has been drawn to substantiate the results and has been given in fig 4.19.

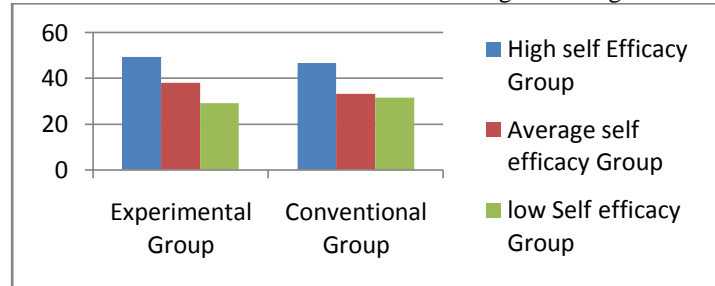


Fig 12.7: Bar diagram showing mean gain achievement scores for self efficacy groups of experimental and conventional groups

Table 12.6 and fig 12.7 indicates that the high self efficacy of experimental group performs significantly better than that of average self efficacy of conventional group.

Table 12.6 and fig 12.7 indicates that the high self efficacy of experimental group performs significantly better than that of low self efficacy of conventional group.

Table 12.6 and fig 12.7 indicates that there exist no significant difference between high self efficacy of experimental group and high self efficacy of conventional group.

Table 12.6 and fig 12.7 indicates that the high self efficacy of experimental group performs significantly better than that of average self efficacy of conventional group.

Table 12.6 and fig 12.7 indicates that the high self efficacy of experimental group performs significantly better than that of low self efficacy of conventional group.

Table 12.6 and fig 12.7 indicates the average self efficacy of experimental group performs significantly better than that of low self efficacy of experimental group.

Table 12.6 and fig 12.7 indicates that the average self efficacy of experimental group performs significantly better than that of average self efficacy of conventional group.

Table 12.6 and fig 12.7 indicates that the average self efficacy of experimental group performs significantly better than that of low self efficacy of conventional group.

Table 12.6 and fig 12.7 indicates that the high self efficacy of conventional group performs significantly better than that of average self efficacy of experimental group.

Table 12.6 and fig 12.7 indicates that the high self efficacy of conventional group performs significantly

better than that of low self efficacy of experimental group.

Table 12.6 and fig 12.7 indicates that the high self efficacy of conventional group performs significantly better than that of average self efficacy of conventional group.

Table 12.6 and fig 12.7 indicates that the high self efficacy of conventional group performs significantly better than that of low self efficacy of conventional group.

Table 12.6 and fig 12.7 indicates that there exists no significant difference between average self efficacy of conventional group and low self efficacy of experimental group.

Table 12.6 and fig 12.7 indicates that there exist no significant difference between average self efficacy of conventional group and low self efficacy of conventional group.

Table 12.6 and fig 12.7 indicates that that there exist no significant difference between low self efficacy of conventional group and low self efficacy of conventional group.

XIII. EDUCATIONAL IMPLICATIONS OF THE FINDINGS

- Some children failed to show any understanding of certain concepts necessary for meaningful learning in formal method. Constructivism takes care of students prior knowledge. So, they can be benefitted.
- Constructivism provides opportunity to the students for independent learning. So, it is useful to the students.
- By and large from the same group different individuals appeared to learn by the formal method at different times. So, teacher should be aware, wait and promote necessary actions towards formalization.

- The capability of students varies. So, teacher should provide the task and environment according to students' ability.
 - Constructive based instructions were found to be effective in increasing students' achievement as compared to traditional method of teaching. So, teachers must integrate constructive instructions in their teaching learning process.
 - The teacher education institution must incorporate constructivism in the training programme for the pre-service and in service teachers.
- d. The study can be conducted to investigate the effectiveness of constructive based instruction on the basis of gender.
 - e. Research can be conducted to investigate the effectiveness of constructive based instruction in relation to other variables like anxiety, creativity etc.
 - f. These methods may be much valuable for students with special needs.

XIV. SUGGESTIONS FOR FURTHER RESEARCH

The following suggestions are for undertaking further studies in the area:

- a. The present study was confined to teaching of mathematics. So, it can be conducted to determine the effect of constructive based instruction for other teaching subjects
- b. For wider application of the research findings a similar study with more schools from different ecological zone can be conducted.
- c. Similar empirical study may be conducted at different levels of schooling (Lower Secondary and senior Secondary Levels).

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