REVIEW OF RESEARCH

EFFECT OF CONSTRUCTIVIST BASED APPROACH OF TEACHING MATHEMATICS IN IMPROVING CRITICAL THINKING OF IX STANDARD STUDENTS

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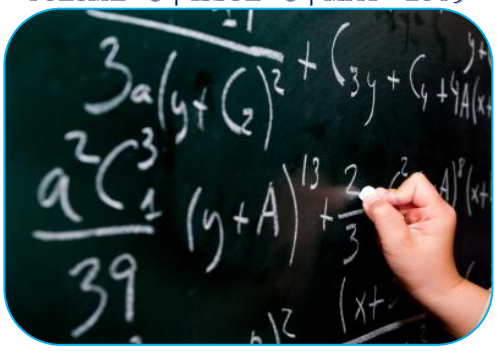

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ABSTRACT:

The purpose of the study is to find out the effect of constructivist based approach of teaching mathematics in improving the critical thinking of IX standard students. Experimental method is appropriate for this study, to avoid difficulty in conducting experiment two intact class divisions of IX standard were selected for the study. The investigator randomly selected 50 students from IX standard of 'A' division/section and 50 students from IX standard of 'B' division/section. Then the investigator randomly assigned one section ('A' division) as experimental group and other section as ('B' division) the control group.

The constructivist approach is new trend in teaching of mathematics by many enthusiastic teachers in many countries. Constructivist approach/pedagogy does not consist of a single teaching strategy. Instead, it has several features that should be attended to simultaneously in a classroom. It has been asserted that for a successful constructivist strategy the teaching has not only to be student centred and the teacher a mere facilitator but the teacher has the added responsibility to create an advantageous classroom environment. Research has established that constructivist methods of mathematics teaching have been much more successful than the traditional methods. The results shows that the constructivist based approach is more effective as it enhanced critical thinking in mathematics. Students who learn through constructivist based approach are found to be better in improving critical thinking than the students' critical thinking through traditional method.

KEYWORDS: *constructivist approach and critical thinking*

INTRODUCTION:

To think critically is an essential part of life, current literature reveals that explicit information in and practices of, critical thinking strategies in the high school classroom can improve student academic performance. Adoption of critical thinking strategies help the students in developing the skills necessary to compete economically in the present environment of the society. There are various means to develop thinking skills in teaching learning process such as collaborative learning, co-operative learning, multimedia and constructivism learning.

Constructivism is a theory of knowledge i.e., epistemology and a theory of learning. It is not a particular pedagogy. Constructivists believe that human beings are active information receivers. They use their existing experience to construct understanding that makes sense to them. Humans assimilate and accommodate new knowledge and build their own understanding knowledge is viewed as personal subjective.

Students' previous knowledge and their active participation in problem solving and critical thinking all play a vital role in the formation of knowledge. One of the most important goals of constructivism is to develop students' "critical thinking skills",

which is possible only in a conducive learning environment in the class. The teacher may have to improvise the day's lesson or change the sequence of activities, depending on the needs of the students or due to any other unexpected development. Such flexibility is said to be a valuable quality of a positive learning environment. Mathematics content teaching is the narrower goal as compare to creating mathematical learning environments.

The content areas of mathematics addressed in our schools do offer a solid foundation, while there can be disputes over what gets taught at which grade and over the level of detail included in a specific theme, there is broad agreement that the content areas (arithmetic, algebra, geometry, mensuration, trigonometry, data analysis) cover essential ground.

What can be leveled as a major criticism against our extant curriculum and pedagogy is its failure with regard to mathematical processes. We mean a whole range of processes here: formal problem solving, critical thinking, use of heuristics, estimation and approximation, optimization, use of patterns, visualization, representation, reasoning and proof, making connections, mathematical communication. Giving importance to these processes constitutes the difference between doing mathematics and swallowing mathematics, between mathematisation of thinking and memorizing formulas, between trivial mathematics and important mathematics, between working towards traditional teaching and constructivism teaching.

In school mathematics, certainly emphasis does need to be attached to factual idea, procedural fluency and conceptual understanding. New idea is to be constructed from experience and prior knowledge using conceptual elements. However, invariably emphasis on procedure gains ascendancy at the cost of conceptual understanding as well as construction of idea based on experience. This can be seen as a central cause for the fear of mathematics in children.

Here the investigator made an attempt to study the effect of constructivist based approach of teaching mathematics in improving critical thinking of IX standard students.

OBJECTIVES OF THE STUDY:

1. To study the effect of constructivist based approach of teaching mathematics in improving critical thinking of IX standard students.
2. To compare the critical thinking of the IX standard students based on gender.
3. To develop an instructional plans(lesson transcripts) on the teaching of selected units in mathematics at class IX standard based on the constructivist based approach and traditional teaching method.

HYPOTHESES:

The following hypotheses have been formulated.

1. There is no significant difference between pre-test and posttest critical thinking scores of IX standard students in control group.
2. There is no significant difference between pre-test and posttest critical thinking scores of IX standard students in experimental group.
3. There is no significant difference between control and experimental group with respect to pre-test and post-test critical thinking scores of IX standard students.
4. There is no significant interaction effects of groups(control and experimental) and gender on improvement or changes scores in critical thinking of IX standard students from pre-test to post-test.

METHODOLOGY:

Experimental method was adopted for the present study. The two sections namely A and B of IX th standard were identified as experimental group and control group.

SAMPLE:

The random sample method was adopted for the present study. The sample of the study consists of 100 students studying in IX standard in Ballari city.

Sample	Experimental group	Control group	total
Boys	25	25	50
Girls	25	25	50

TOOLS USED:

The following tools were prepared by investigator to collect data.

1. Lesson transcripts (plans) for traditional method of teaching mathematics.
2. Lesson transcripts (plans) for constructivist based approach of teaching mathematics.
3. Critical thinking test which was developed and validated by the investigator.

PROCEDURE OF THE STUDY:

Experimental design was adopted. Before starting experimentation, the investigator conducted critical thinking test in mathematics to both the experimental group and control group and found there is no significant difference in their mean scores. The students of the experimental group were taught using constructivist based approach and the control group using traditional method of teaching. After the treatment the post test was administered to both the groups. The collected data was subjected to the statistical analysis (Dependent t test & ANCOVA) and the results obtained were interpreted.

ANALYSIS AND FINDINGS:

Hypothesis1: There is no significant difference between pretest and posttest critical thinking scores of IX standard students in control group.

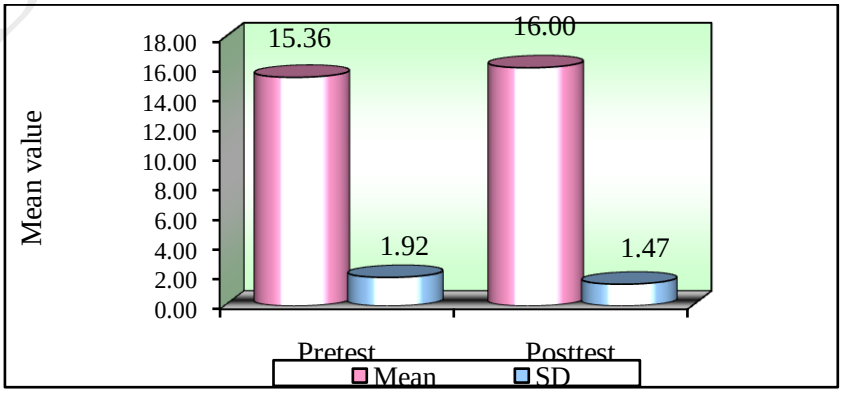
To accomplish the above assumption (hypothesis), the dependent t-test was applied and the results are presented in the following table.

Table1: Comparison of between pretest and posttest critical thinking scores of IX standard students in control group

Test	Mean	SD	Mean Diff.	SD Diff.	Paired t	P-value
Pretest	15.36	1.92				
Posttest	16.00	1.47	-0.64	1.51	-2.9998	0.0042

From the results of the above table, it can be seen that the there is a significant difference was observed the pretest and posttest critical thinking scores of IX standard students in control group ($t=-2.9998$, $p<0.05$) at significance level of 5 percent. Hence, the null hypothesis is rejected and alternative hypothesis is accepted. It means that, the pretest and posttest critical thinking scores of secondary school students in control group are different. The mean scores of pretest and posttest critical thinking of IX standard students in control group are also presented in the following figure.

Figure: Comparison of pretest and posttest critical thinking scores of IX standard students in control group



Hypothesis2: There is no significant difference between pretest and posttest critical thinking scores of IX standard students in experimental group.

To accomplish the above assumption (hypothesis), the dependent t-test was applied and the results are presented in the following table.

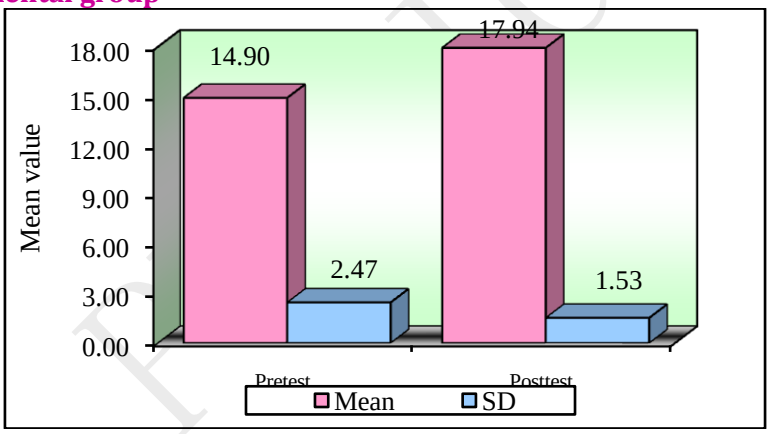
Table2: Comparison of between pretest and posttest critical thinking scores of IX standard students in experimental group

Test	Mean	SD	Mean Diff.	SD Diff.	Paired t	P-value
Pretest	14.90	2.47				
Posttest	17.94	1.53	-3.04	2.61	-8.2345	0.0001*

*p<0.05

From the results of the above table, it can be seen that the there is a significant difference was observed the pretest and posttest critical thinking scores of IX standard students in experimental group (t=-8.2345, p>0.05) at significance level of 5 percent. Hence, the null hypothesis is rejected and alternative hypothesis is accepted. It means that, the pretest and posttest critical thinking scores of IX standard students in experimental group are different. It means that, the posttest critical thinking scores of IX standard students are higher as compared to pretest critical thinking scores of IX standard students in experimental group. The mean scores of pretest and posttest critical thinking scores of IX standard students in experimental group are also presented in the following figure.

Figure: Comparison of between pretest and posttest critical thinking scores of IX standard students in experimental group



Hypothesis3: There is no significant difference between control and experimental groups with respect to pretest and posttest critical thinking scores of IX standard students.

To accomplish the above assumption (hypothesis), the Analysis of covariance (ANCOVA) (pretest scores as covariate) technique has been applied and the results are presented in the following table.

Table 3: Comparison of between control and experimental groups with respect to pretest and posttest critical thinking scores of IX standard students by Analysis of covariance (ANCOVA)

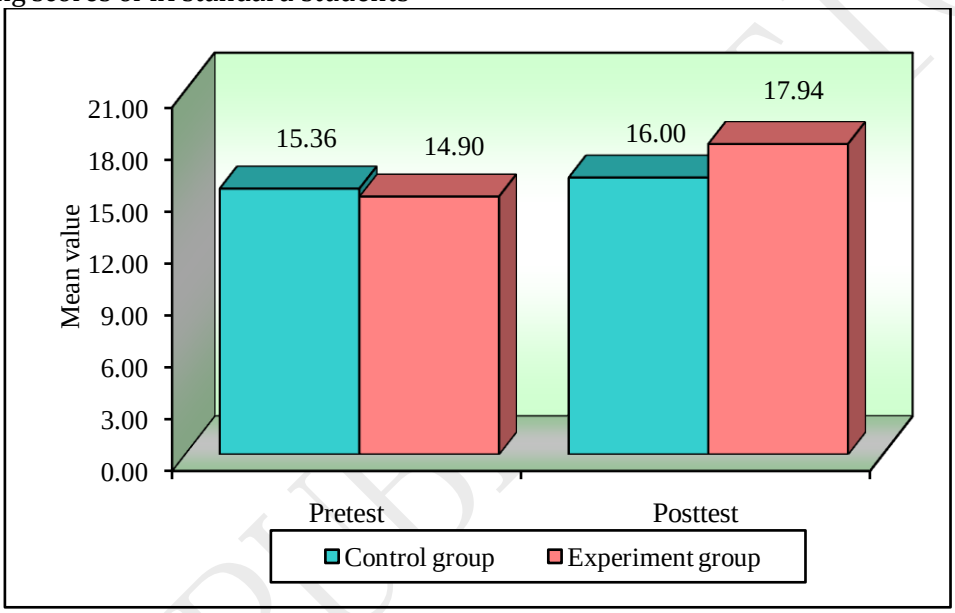
Groups	Pretest		Posttest		
	Mean	SD	Mean	SD	Adjusted mean
Control group	15.36	1.92	16.00	1.47	15.939
Experiment group	14.90	2.47	17.94	1.53	18.001
F-test	1.0800		54.6007		
P-value	0.3013		0.0001*		

*p<0.05, @one way ANOVA applied, # ANCOVA applied

The results of the above table clearly show the following:

- The control and experimental groups do not differs significantly with respect to pretest critical thinking scores of IX standard students (F=1.0800, p>0.05) at significance level of 5 percent. It means that, the pretest critical thinking scores of IX standard students are similar in control and experimental group.
- The control and experimental groups differs significantly with respect to posttest critical thinking scores of IX standard students (F=54.6007, p<0.05) at significance level of 5 percent. Hence, the null hypothesis is rejected and alternative hypothesis is accepted. It means that, the posttest critical thinking scores of IX standard students are different in control and experimental groups. It means that, the posttest critical thinking scores of IX standard students are significantly higher in experimental group as compared to control group. The mean scores of pretest and posttest critical thinking scores of IX standard students are also presented in the following figure.

Figure: Comparison of between control and experimental groups with respect to pretest and posttest critical thinking scores of IX standard students



Hypothesis4: No significant interaction effects of groups (control and experimental) and gender (male and female) on improvement or changes scores in critical thinking of IX standard students from pretest to posttest

To accomplish the above assumption (hypothesis), the two factor analysis of variance with interaction design was performed and the results are presented in the table given below.

Table: Two factor analysis of variance for interaction effects of groups (control and experimental) and gender (male and female) on improvement or changes scores in critical thinking of IX standard students from pretest to posttest

Sources of variation	Degrees of freedom	Sum of squares	Mean sum of squares	F-value	p-value
Main effects					
Groups	1	142.80	142.80	30.9536	0.0001*
Gender	1	1.28	1.28	0.2765	0.6002
2-way interaction					

effects					
Groups x Gender	1	1.28	1.28	0.2765	0.6002
Error	96	442.89	4.61		
Total	99	588.25			

*p<0.05

From the results of the above table, it can be observed that,

- The main effect of groups (control and experimental) on improvement or changes scores in critical thinking of IX standard students from pretest to posttest is found to be statistically significant (F=30.9536, p<0.05) at significance level of 5 percent. Therefore, the H_0 is rejected and H_1 is accepted. It means that, the IX standard students belongs to control and experimental groups have different improvement or changes scores in critical thinking from pretest to posttest.
- The main effect of gender (male and female) on improvement or changes scores in critical thinking of IX standard students from pretest to posttest is found to be statistically not significant (F=0.2765, p>0.05) at significance level of 5 percent. Therefore, the H_0 is accepted and H_1 is rejected. It means that, the male and female IX standard students have similar improvement or changes scores in critical thinking from pretest to posttest.
- The interaction effects of groups (control and experimental) and gender (male and female) on improvement or changes scores in critical thinking of IX standard students from pretest to posttest is found to be statistically not significant (F=0.2765, p>0.05) at significance level of 5 percent. Therefore, the H_0 is accepted and H_1 is rejected. It means that, the male and female IX standard students belongs to control and experimental groups have similar improvement or changes scores in critical thinking from pretest to posttest.

Further, to know the pair wise comparisons of interaction effects of groups (control and experimental) and gender (male and female) on improvement or changes scores in critical thinking of IX standard students from pretest to posttest by applying the **Tukeys multiple posthoc procedures** and the results are presented in the tables given below:

Table: Interaction effects of groups (control and experimental) and gender (male and female) on improvement or changes scores in critical thinking of IX standard students from pretest to posttest

Interactions	Males in control	Females in control	Males in Experiment	Females in Experiment
Mean	0.42	0.88	3.04	3.04
SD	1.39	1.62	2.84	2.42
Males in control	-			
Females in control	p=0.8794	-		
Males in Experiment	p=0.0003*	p=0.0037*	-	
Females in Experiment	p=0.0003*	p=0.0037*	P=1.0000	-

*p<0.05

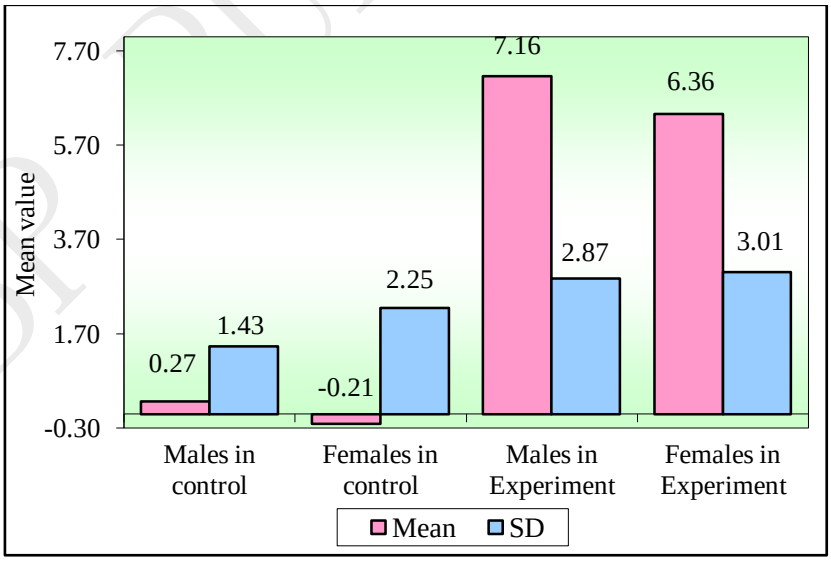
From the results of the above table, it can be seen that,

- The male students of IX standard in control group and female students of IX standard in control group do not differ significantly with respect to improvement or changes scores in critical thinking from pretest to posttest at significance level of 5 percent. It means that, the male students of IX standard in control group and female students of IX standard in control group have similar improvement or changes in critical thinking from pretest to posttest.
- The male students of IX standard in control group and male students of IX standard in experimental group differ significantly with respect to improvement or changes scores in critical thinking from

pretest to posttest at significance level of 5 percent. It means that, the male students of IX standard in experimental group have significant higher improvement or changes in critical thinking from pretest to posttest as compared to male students of IX standard in control group.

- The male students of IX standard in control group and female students of IX standard in experimental group differ significantly with respect to improvement or changes scores in critical thinking from pretest to posttest at significance level of 5 percent. It means that, the female students of IX standard in experimental group have significant higher improvement or changes in critical thinking from pretest to posttest as compared to male students of IX standard in control group.
- The female students of IX standard in control group and male students of IX standard in experimental group differ significantly with respect to improvement or changes scores in critical thinking from pretest to posttest at significance level of 5 percent. It means that, the male students of IX standard in experimental group have significant higher improvement or changes in critical thinking from pretest to posttest as compared to female students of IX standard in control group.
- The female students of IX standard in control group and female students of IX standard in experimental group differ significantly with respect to improvement or changes scores in critical thinking from pretest to posttest at significance level of 5 percent. It means that, the female students of IX standard in experimental group have significant higher improvement or changes in critical thinking from pretest to posttest as compared to female students of IX standard in control group.
- The male students of IX standard in experimental group and female students of IX standard in experimental group do not differ significantly with respect to improvement or changes scores in critical thinking from pretest to posttest at significance level of 5 percent. It means that, the male students of IX standard in experimental group and female students of IX standard in experimental group have similar improvement or changes in critical thinking from pretest to posttest. The mean scores are also presented in the figure given below.

Figure: Comparison of Interaction effects of groups (control and experiment) and gender (male and female) on improvement or changes scores in critical thinking of IX standard students from pretest to posttest



CONCLUSION:

Successful teaching and learning of Mathematics involves practice of critical thinking skills with identification of how they fit together as the part of strategy or process. Using array of Constructivism based approach is a useful means to develop critical thinking among the students.

The study revealed that the effect of constructivist based approach of teaching mathematics in improving critical thinking of IX standard students. The results shows that the constructivist based approach is more effective as it enhanced critical thinking in mathematics. Students who learn through constructivist based approach are found to be better in critical thinking than the students' critical thinking through traditional method.

REFERENCES:

Best, J.W., & Kahn, J.V. (2006). Research in Education (10th ed.). New York, United States of America: Pearson Education Inc.

Broadbear, J. (2007). Critical thinking dispositions among undergraduate students during their introductory health education. Course. Health Education, 37, 87-150.

Harish, G.C. (2011). "Need for integrating critical thinking skills in mathematics instruction". Journal of Educational Research and Extension.

http://www.criticalthinking.org