

EFFECTIVENESS OF FLIPPED CLASSROOM ON PRACTICAL SKILLS, ANALYTICAL SKILLS AND CREATIVE SKILLS OF STUDENTS IN MATHEMATICS AT SECONDARY SCHOOL IN INDIA

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Paper Received On: 21 JUNE 2021

Peer Reviewed On: 30 JUNE 2021

Published On: 1 JULY 2021

Content Originality & Unique: 73%

Abstract

Flipped classroom is a strategy in which students are given their initial exposure to ideas via instructional videos that they are told to view at home, freeing up in-class time to engage students in other student-centered activities. Although the impact of flipped classroom in higher education has been documented, it is necessary to investigate the impact of flipped classroom in K-12. As a result, a quasi-experimental research on the effectiveness of the flipped classroom strategy in mathematics is being undertaken in a secondary school in India. Flipped classroom has been proven to increase students' practical skills, analytical skills, and creative skills. Keywords: flipped classroom, secondary education, mathematics, K-12 setting, practical skills, analytical skills, creative skills



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Introduction

Flipped classroom Strategy is a technology driven method of teaching in classrooms that emphasizes peer-instruction and deep learning (Abeysekera & Dawson, 2015; Bishop & Verleger, 2013). The first exposure to the content is given to the students through the mini-video lectures before the face to face class. This helps to recuperate the class time for the active learning student-centered activities (Bishop & Verleger, 2013; Lo, Hew, & Chen, 2017). Now-a-days Flipped classroom strategy is increasingly being used around the world due to its plethora of benefits like personalized learning (Davies et al., 2013), better engagement (Butt, 2014) and better performance (Tune et al., 2013). Though numerous

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studies have been conducted on flipped classroom in various disciplines, Lo et al. (2017) found that very few studies have been conducted in mathematics subject at secondary school level.

Objective of the Study

Although the research shows that using a Flipped Classroom Strategy has a beneficial impact, its influence in K-12 mathematics has yet to be investigated. As a result, the purpose of this study was to look at the effectiveness of using a Flipped Classroom Strategy in India's secondary schools.

Objectives:

1. To compare adjusted mean scores of Practical Skills in Mathematics of students belonging to Treatment Group and Control Group where the covariate was pre-test scores
2. To compare adjusted mean scores of Analytical Skills in Mathematics of students belonging to Treatment Group and Control Group where the covariate was pre-test scores
3. To compare adjusted mean scores of Creative Skills in Mathematics of students belonging to Treatment Group and Control Group where the covariate was pre-test scores

Hypotheses

1. There is no significant difference in adjusted mean scores of Practical Skills in Mathematics of students belonging to Treatment Group and Control Group where the covariate was pre-test scores.
2. There is no significant difference in adjusted mean scores of Analytical Skills in Mathematics of students belonging to Treatment Group and Control Group where the covariate was pre-test scores.
3. There is no significant difference in adjusted mean scores of Creative Skills in Mathematics of students belonging to Treatment Group and Control Group where the covariate was pre-test scores.

Methodology

Research Design

The researchers used a quasi-experimental pretest-posttest control group technique.

Participants

Total 179 students of Class IX, from DAV Public school of Jharsuguda were selected as per the purposive technique of sampling. This sample included the individuals, accessible to the researcher. This sample further consisted of 90 in experimental group and 89 in control group.

Materials and Procedure

An experimental study was carried out for 24 weeks where total 7 chapters in CBSE class IX NCERT mathematics book were taught. The traditional class was taught the chapter and was assigned the exercise from the textbook as homework. In the flipped classroom concepts were taught via YouTube videos in computer lab and then students were engaged in active learning strategies. They had to complete the math exercise from the textbook in the classroom by discussing with their peers. Teacher facilitated them during their classwork. Then they were given 4 analytical questions to solve and 2 had to develop 2 creative questions. Pre-tests and post tests were developed and administered by the investigator for the collection of data.

Data Analysis

To characterise trends in the data, descriptive statistics such as mean and standard deviation were calculated. For better visibility, the data was also displayed visually. The Practical, Analytical and Creative skills of the control and experimental groups were compared using ANCOVA as an inferential statistical approach, where the covariate was pretest scores. It was able to control variance among the groups by accounting for any initial disparities in pretest measurements.

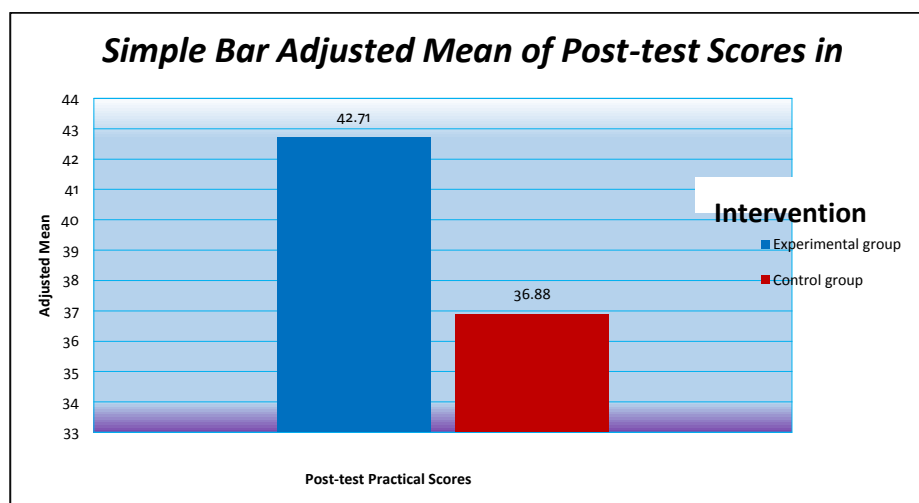


Figure 1: Adjusted mean of post-test practical scores

Hypothesis 1: There is no significant difference in adjusted mean scores of Practical Skills in Mathematics of students belonging to Treatment Group and Control Group where the covariate was pre-test scores.

1148.84 is the corrected F-Value. At $df= 1/176$, it is significant at 0.01 level. It indicates that the adjusted mean scores of Practical Skills in Mathematics of students belonging to Treatment Group and Control Group differ significantly where the covariate was pre-test scores. Thus the null hypothesis that - There is no significant difference in adjusted mean scores of Practical Skills in Mathematics of students belonging to Treatment Group and Control Group where the covariate was pre-test scores is rejected. Further from Figure 1, it is evident that the adjusted mean scores of Practical Skills in Mathematics of students belonging to Treatment Group is 42.71 is greater than the adjusted mean scores of Practical Skills in Mathematics of students belonging to Control Group that is 36.88. Thus, it can be concluded that the flipped classroom strategy outperformed the traditional method in terms of increasing students' practical math skills where the covariate was pre-test scores.

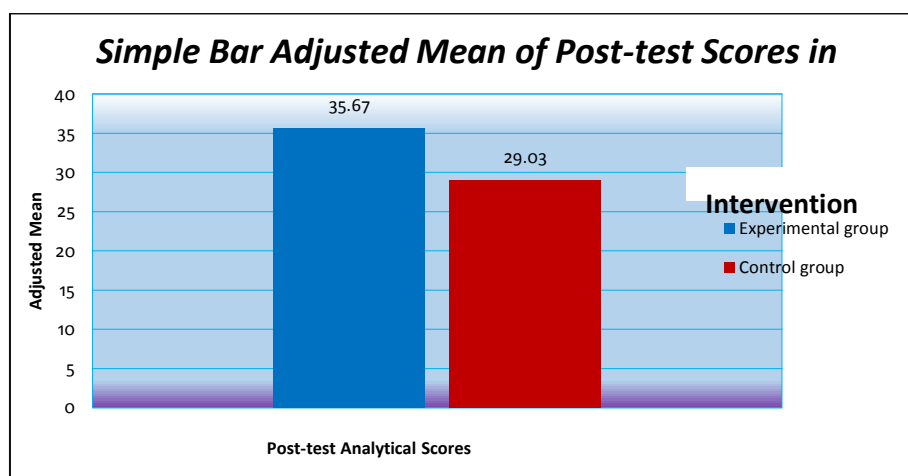


Figure 2: Adjusted mean of post-test analytical scores

Hypothesis 2: There is no significant difference in adjusted mean scores of Analytical Skills in Mathematics of students belonging to Treatment Group and Control Group where the covariate was pre-test scores.

1148.84 is the corrected F-Value. At $df= 1/176$, it is significant at 0.01 level. It indicates that the adjusted mean scores of Analytical Skills in Mathematics of students belonging to Treatment Group and Control Group differ significantly where the covariate was pre-test scores. Thus the null hypothesis that - There is no significant difference in adjusted mean

scores of Analytical Skills in Mathematics of students belonging to Treatment Group and Control Group where the covariate was pre-test scores is rejected. Further from Figure 2, it is evident that the adjusted mean scores of Analytical Skills in Mathematics of students belonging to Treatment Group is 35.67 is greater than the adjusted mean scores of Analytical Skills in Mathematics of students belonging to Control Group that is 29.03. Thus, it can be concluded that the flipped classroom strategy outperformed the traditional method in terms of increasing students' analytical math skills where the covariate was pre-test scores.

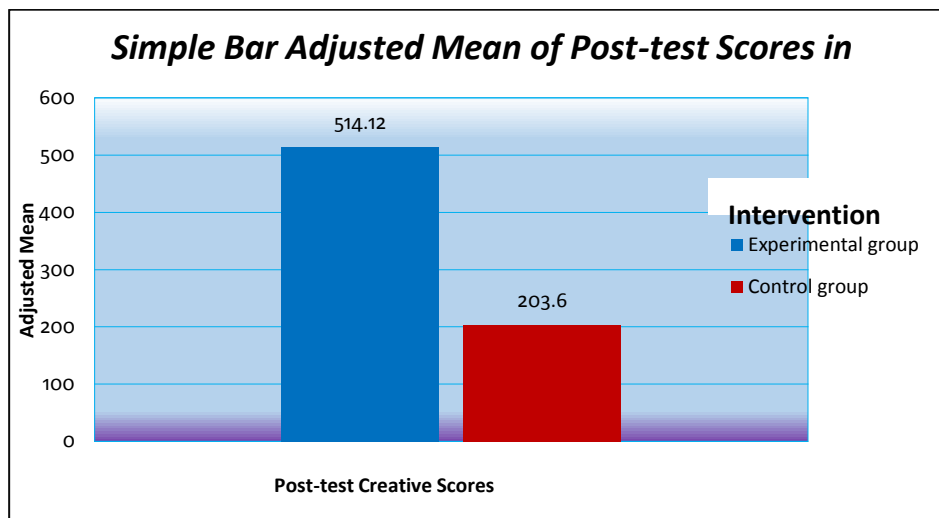


Figure 3: Adjusted mean of post-test creative scores

Hypothesis 3: There is no significant difference in adjusted mean scores of Creative Skills in Mathematics of students belonging to Treatment Group and Control Group where the covariate was pre-test scores.

67550.04 is the corrected F-Value. At $df= 1/176$, it is significant at 0.01 level. It indicates that the adjusted mean scores of Creative Skills in Mathematics of students belonging to Treatment Group and Control Group differ significantly where the covariate was pre-test scores. Thus the null hypothesis that - There is no significant difference in adjusted mean scores of Practical Skills in Mathematics of students belonging to Treatment Group and Control Group where the covariate was pre-test scores is rejected. Further from Figure 3, it is evident that the adjusted mean scores of Creative Skills in Mathematics of students belonging to Treatment Group is 514.12 is greater than the adjusted mean scores of Practical Skills in Mathematics of students belonging to Control Group that is 203.60. Thus, it can be concluded that the flipped classroom strategy outperformed the traditional method in terms of increasing students' creative math skills where the covariate was pre-test scores.

Findings

- The flipped classroom strategy outperformed the traditional method in terms of increasing students' practical math skills.
- The flipped classroom strategy outperformed the traditional method in terms of increasing students' analytical math skills.
- The flipped classroom strategy outperformed the traditional method in terms of increasing students' creative math skills.

Discussion and Conclusion

In this study, the students in flipped classroom performed better than the conventional class. This echoes with the findings of some researchers who found that students performed better in flipped classrooms than in traditional classrooms (e.g., Ziegelmeier & Topaz, 2015; Mattis, 2015; Charles-Ogan and Williams, 2015). The findings of the study are contrary to others who found that the treatment and control groups performed equally well (e.g., Saunders, 2014) and a few others who reported that traditional class students outperformed their peers (e.g., Kennedy et al., 2015).

Though there are few evidences against the effectiveness of the flipped classroom, but most of the studies reviewed have reported a positive impact of the innovative strategy. Thus it can be concluded that Flipped Classroom is an effective strategy as found in the study.

The Study's Limitations and Recommendations

There are a few limitations in the research. First and foremost, the study was done in mathematics, therefore the same findings cannot be anticipated for other disciplines. One of the study's drawbacks was that it was done in a K-12 setting. The study may be conducted in higher level mathematics, with students' opinions collected and a comparison done between the two contexts. More questions might be included to have a deeper understanding of the benefits and limitations of the Mathematical Flipped classroom Strategy.

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