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Impact of Inverted Classroom Approach on Academic Achievement and Learning Satisfaction of Secondary School Learners

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Abstract :

Inverted classroom approach is reversing the conventional approach of a classroom- the lessons viewed through e-content or pre-recorded videos at home and achieving mastery over the content through activities and experiences with peers in the classroom under the supervision of the instructor. The purpose of the inverted classroom is to develop the learners' higher-order thinking skills, reach the learner's satisfaction levels, and improve the learners' academic achievement. The researcher developed conventional and inverted teaching-learning strategies for teaching selected units from the secondary education curriculum and conducted experiments in the experimental and control group of learners randomly chosen from five schools. Simultaneously, data on learning satisfaction of the learners following conventional and inverted classroom strategies were collected. Data analysis revealed a marked improvement in academic achievement and learners' learning satisfaction following the inverted classroom approach. The results depicted the success of inverted classroom approach and educationally implies applying the same from school to higher education level to achieve superior learning outcomes.

Index Terms :

Redesigned Modules, Inverted Classroom, Academic Achievement, Learning Satisfaction, Secondary School Learners

I. INTRODUCTION

1.1 Background of the Study

An inverted classroom, also known as the flipped classroom, is one in which the conventional teaching-learning process is reversed, i.e., the in-class activities of conventional classroom are practised outside the classroom and vice-versa. Bergmann and Sams popularized the Inverted Classroom concept (*Exploring The Bergmann & Sams School of Flipped Learning – Flipped Classroom Workshop*, n.d.).

An inverted classroom is such a pedagogical approach that shifts the classroom from passive to active learning, focusing on higher-order thinking skills such as evaluating, analyzing, and developing students' creative learning skills (Rotellar and Cain, 2016). The approach relies on focusing both on knowledge acquisition and active engagement of learners. Learners are given opportunities to take greater responsibility for their learning. The sessions are focused more on providing significant learning opportunities, providing feedback through various pedagogical strategies and ensuring a complete understanding of the concept (Milman, 2012). An increase in the active learning period focuses on exploring the meaning and applying acquired knowledge by adopting an inverted classroom approach.

When teachers use a flipped classroom model, classroom events are reversed. Learners can view lecture materials, read a text, or do research as their homework before class. Classroom activities include peer-to-peer learning, focus group discussions, role-plays, game-based learning, brainstorming or collaborative work.

1.2 Review of Related Literature :

The Flipped Learning Network reports that 71% of teachers who flipped their classes claimed improved grades, while 80% reported improved student attitudes as a result. Also, 99% of teachers who flipped their classes stated they would flip their classes again the following year.

Nouri(2016) conducted a study examining students' perceptions of flipped classroom education among final year university course in research methods. The results revealed that most of the students had a positive attitude toward the flipped classroom, which strongly correlated with increased motivation, engagement, and effective learning. **Blazquez et al. (2019)** used the flipped classroom as an active learning approach to determine university students' academic performance in social work, using a mixed-method approach. Compared with the Lecture methodology, the Flipped teaching methodology proved to be a much effective tool regarding academic performance in Social Work Education at the university level. A meta-analysis of 114 studies was conducted comparing flipped and non-flipped classrooms in secondary and post-secondary education level. A small positive effect was found on learning outcomes, while no effect was detected on student satisfaction regarding the learning environment(**van Alten et al., 2019**). **Fisher et al.(2017)** explored students' perceptions of learning engagement, satisfaction and learning outcomes with a flipped approach in a third-year core subject at an Australian university. Findings revealed that students preferred the flipped approach over the traditional approach and reported increased engagement, learner satisfaction, and learning outcomes due to the flipped classroom approach.

Academic Achievement is the extent of achieving the goal of educational fulfilment of the learners in a said context. In the present research, Academic Achievement refers to the extent the learners of the experiment achieves on being exposed to the conventional or inverted approach in Language, Social Science and Science and the score obtained in the researcher-developed achievement test focusing on all levels of Bloom's taxonomy.

Learning satisfaction is a multifaceted attitude of the learner towards learning environment and conditions, learning experiences, learning outcomes and the peer relationships in learning. A scale on measuring the learners' learning satisfaction was devised by the researcher comprising 15 statements on the learning environment, learning experiences and self-efficacy of the learning outcomes. The scale was administered to the learner groups to know about their satisfaction in learning.

1.3 Significance of the Study

Though several pieces of research have been conducted on the inverted (flipped) classroom approaches, most experiments have been done at undergraduate and postgraduate levels. The present research considers that the researcher has adopted secondary-level learners and inverted classroom strategies in Language, Social Science and Science. This will help teachers to understand the potentialities of the learner on reversing the conventional model. Also, the school administration will train teachers to plan lessons accordingly. This will benefit the learner community, especially slow learners, to learn at their own pace and discover the joy of learning equipped with technological skills.

1.4 Objectives

O_1: To determine whether significant differences exist between pre and post-test achievement scores of the group taught through conventional classroom approach in Language, Social Science and Science.

O_2: To determine whether significant differences exist between pre and post-test achievement scores of the group taught through the inverted classroom approach in Language, Social Science and Science.

O_3: To investigate whether significant differences exist between the means of the groups taught through the conventional and inverted classroom approach on learners' learning satisfaction.

1.5 Hypotheses

The study was designed to test the academic achievement and learning satisfaction of secondary level learners with the following hypotheses:

$H_0$1: There is no significant difference between the pre-test and post-test achievement scores of the group taught through conventional classroom approach in Language.

$H_0$2: There is no significant difference between the pre-test and post-test achievement scores of the group taught through conventional classroom approach in Social Science.

$H_0$3: There is no significant difference between the pre-test and post-test achievement scores of the group taught through conventional classroom approach in Science.

$H_0$4: There is no significant difference between the pre-test and post-test achievement scores of the group taught through the inverted classroom approach in Language.

$H_0$5: There is no significant difference between the pre-test and post-test achievement scores of the group taught through the inverted classroom approach in Social Science.

$H_0$6: There is no significant difference between the pre-test and post-test achievement scores of the group taught through the inverted classroom approach in Science.

$H_0$7: There is no significant difference between the means of the groups taught through the inverted classroom approach and conventional classroom approach on learners' learning satisfaction.

II. RESEARCH METHODOLOGY

Sampling was done using simple random sampling. The investigator prepared lesson plans on three purposively chosen units from the secondary level curriculum followed by CBSE in Language, Social Science and Science. The investigator took up the experimental method to report pre and post-test scores for conventional and inverted classroom strategies. Simultaneously, the investigator devised a Learning Satisfaction Scale for the learners who were the part of the experiment. Pilot study was conducted to standardize the Learning Satisfaction Scale, and reliability of the final draft of the scale was calculated as 0.82.

2.1 Sample

A sample of 150 learners was chosen first from around five CBSE schools in Bengal and Raven's Progressive Matrices Test was administered to all of them. At the end of the scoring of the test, 100 learners were chosen for the experiment. Further, they were classified into two homogenous groups of 50 each. The groups were named Conventional and Inverted Approach groups.

The sample is tabulated as follows:

	Conventional Approach Group	Inverted Approach Group
School A	10	10
School B	10	10
School C	10	10
School D	10	10
School E	10	10
Total	50	50

2.2 Procedure

The experimental study has been conducted in the following phases :

Firstly, a group of 150 learners from the secondary classes was chosen randomly. Raven's progressive matrices test was administered to all of them, for homogenous classification of the learners into two groups. The test was scored under the researcher's able administration and two groups, namely, the experimental and control groups with 50 learners each, were created for the application of the experiments. The researcher devised achievement tests based on all the levels of Bloom's taxonomy in advance to examine the knowledge and skills developed among learners.

Secondly, the achievement tests developed by the researcher taught in Language, Social Science and Science were administered to the experimental and control groups. The tests were scored to obtain information regarding the previous knowledge of the learners of both groups.

Thirdly, inverted classroom treatment was given to the experimental group in all three subjects. Three lessons based on the inverted classroom model in Language, Social Science and Science were taught to the learners. On the contrary, the control group was taught the same topics through the conventional teaching model. The two groups were taught for about ten days in each school. The module designing for both approaches is presented in Table 1.

Fourthly, after completing the experiment, same achievement test and learning satisfaction scale in Language, Social Science, and Science were administered simultaneously as post-test to both the groups of learners. The answer scripts were scored with the help of scoring key. The scores of experimental and control groups were compared according to their pre-test and post-test achievement scores. Learning satisfaction scores were also compared.

2.3 Teaching-Learning Strategy Adopted By the Researcher: Table 1

Subject	Topic	Conventional Classroom Strategy	Inverted Classroom Strategy
Language	Report Writing	The instructor explained what a report is, provided the students with a format for writing and gave homework to complete an assignment on report writing	Pre-recorded videos with clear presentation slides were uploaded in the Google classroom for the purpose and clear infographics on report writing format and several printed newspaper reports. Role-plays were set up to show an occurrence, pick up the significant points from such an occurrence, and write a report based on those points.
Social Science	The Physical Features and Drainage of India	The instructor explained the main physical features of India, including the rivers. Each of the physical features was pointed out on a large map of India, and a home assignment was to complete a blank map of India, pointing out all the physical features of India.	Pre-recorded videos with clear presentation slides were uploaded in the Google classroom created for the purpose. Also, clear infographics on the different physical features of India were provided as study notes through Google classroom. Brainstorming discussions were done in groups in the classroom along with self-exercises on map pointing. The discussions and map-pointing exercises were later made into group projects.
Science	Structure of An Atom	The instructor defined the main terms like atom, molecule, valency. The postulates of the atomic models proposed by various scientists were drawn on the blackboard. The pattern of writing electronic configuration was explained. A home assignment was given to draw atomic models for elements with atomic numbers 1-20 along with finding their valencies.	Pre-recorded videos with clear presentation slides were uploaded in the Google classroom, and clear infographics on the different atomic models were supplied. Games on the electronic configuration of elements and finding valency were done interactively in the classroom.

2.4 Data Tabulation and Analysis

The pre-test and post-test achievement scores of both conventional and inverted groups in selected units of Language, Social Science and Science curriculum at the secondary level were tabulated in Microsoft Excel along with their learning satisfaction scores. The results were analyzed using Data Analysis software Jamovi version 1.2.27 using Descriptive Data Analysis for reporting Mean and SD. At the same time, Inferential Data Analysis was done using Independent for comparing Learning Satisfaction of the Conventional and Inverted Approach groups. Paired Samples t-tests were employed for comparing pre-test and post-test achievement scores of both groups taught using conventional and inverted teaching-learning approaches in Language, Social Science and Science.

III. RESULTS AND DISCUSSION

Table 2: Descriptives for the Learner Group following Conventional Teaching-Learning Approach in Language, Social Science and Science

	N	Mean	SD	SE
Pre-test (Language)	50	11.6	1.59	0.225
Post-test (Language)	50	11.4	1.46	0.206
Pre-test (Social Science)	50	12.0	1.48	0.210
Post-test (Social Science)	50	12.0	1.51	0.214
Pre-test (Science)	50	11.7	1.37	0.193
Post-test (Science)	50	11.9	1.09	0.154

Table 3: Paired Samples t-test for the Learner Group following Conventional Teaching-Learning Approach in Language, Social Science and Science

		t	df	p
Pre- test	**Post-test (Language)**	0.973	49.0	0.335
Pre- test	**Post-test (Social Science)**	0.645	49.0	0.522
Pre- test	**Post-test (Science)**	-1.098	49.0	0.278

The interpretation of the researcher about the results are as follows :

For $H_0$1, the results of the t-test (Table 3) show that the calculated t-value of conventional teaching group in Language is $t_{(49)}$= 0.973 and p-value is 0.335 (p>0.05). Hence, t-value is not significant; therefore, $H_0$1 is retained. It can be concluded that there is no significant difference between the pre-test and post-test achievement scores of the group taught through conventional classroom approach in Language.

For $H_0$2, the results of the t-test (Table 3) show that the calculated t-value of conventional teaching group in Social Science is $t_{(49)}$= 0.645 and p-value is 0.522 (p>0.05). Hence, t-value is not significant; therefore, $H_0$2 is retained. It can be concluded that there is no significant difference between the pre-test and post-test achievement scores of the group taught through conventional classroom approach in Social Science.

For $H_0$3, the results of the t-test (Table 3) show that the calculated t-value of conventional teaching group in Science is $t_{(49)}$= -1.098 and p-value is 0.278 (p>0.05). Hence, t-value is not significant; therefore, $H_0$3 is retained. It can be concluded that there is no significant difference between the pre-test and post-test achievement scores of the group taught through conventional classroom approach in Science.

The conventional teaching approach had almost no impact on the learners' academic achievement, clear from Table 3. The learners exposed to the conventional teaching approach for teaching selected units of the secondary curriculum of Language, Social Science and Science had almost the same pre-test achievement scores. There had not been much change in the post-test achievement scores, even after the researcher taught them through the conventional teaching-learning approach.

Table 4: Descriptives for the Learner Group following Inverted Teaching-Learning Approach in Language, Social Science and Science

	N	Mean	SD	SE
Pre-test (Language)	50	11.4	1.828	0.259
Post-test (Language)	50	17.2	1.148	0.162
Pre-test (Social Science)	50	12.1	1.517	0.215
Post-test (Social Science)	50	17.6	0.851	0.120
Pre-test (Science)	50	11.7	1.371	0.194
Post-test (Science)	50	18.1	1.015	0.144

Table 5: Paired Samples t-test for the Learner Group following Inverted Teaching-Learning Approach in Language, Social Science and Science

		t	df	p
Pre- test	**Post-test (Language)**	-30.0	49.0	0.00
Pre- test	**Post-test (Social Science)**	-32.5	49.0	0.00
Pre- test	**Post-test (Science)**	-51.4	49.0	0.00

The interpretation of the researcher about the results are as follows :

For $H_0$4, the results of the t-test (Table 5) show that the calculated t-value of inverted teaching approach group in Language is $t_{(49)}$= -30.0 and p-value is 0.000 ($p<0.05$). Hence, t-value is significant; therefore, $H_0$4 is rejected. It can be concluded that there is a significant difference between the pre-test and post-test achievement scores of the group taught through the inverted classroom approach in Language.

For $H_0$5, the results of the t-test (Table 5) show that the calculated t-value of inverted teaching approach group in Social Science is $t_{(49)}$= -32.5 and p-value is 0.000 ($p<0.05$). Hence, t-value is significant; therefore, $H_0$5 is rejected. It can be concluded that there is a significant difference between the pre-test and post-test achievement scores of the group taught through the inverted classroom approach in Social Science.

For $H_0$6, the results of the t-test (Table 5) show that the calculated t-value of inverted teaching approach group in Science is $t_{(49)}$= -51.4 and p-value is 0.00 ($p<0.05$). Hence, t-value is significant; therefore, $H_0$6 is rejected. It can be concluded that there is a significant difference between the pre-test and post-test achievement scores of the group taught through the inverted classroom approach in Science.

The researcher interprets from the results that the designed inverted classroom strategies in selected topics in Language, Social Science and Science from the secondary curriculum has been much effective for the learners. They have shown a marked improvement in academic achievement over the pre-test achievement scores after being taught through the inverted classroom approach.

Results from Learners' Learning Satisfaction Scale

Table 6: Descriptives for the Learning Satisfaction of the Learners of both groups

	Experimental Group	Control Group
Number of learners	50	50
Mean	64.2	38.5
SD	1.65	1.78
SE	0.234	0.251

Table 7: Independent Samples t-test results for Learning Satisfaction

	t	df	p
Learning Satisfaction Scale	-75.0	98	0.01

Interpretation of Results from Learning Satisfaction Scale

For $H_0$7**,** Table 7 shows a significant difference between the means of the groups taught through the inverted classroom approach and conventional classroom approach on learners' learning satisfaction. The t-value is $t_{(98)}$= -75.0 and p-value is 0.01($p<0.05$). Thus, $H_0$7 is rejected. The researcher interprets that the learner has developed motivation, technological skills and satisfaction and has reached the learning outcomes desired through the inverted classroom approach.

Also, the results shown in Table 6 depicts that the mean of learning satisfaction of the experimental group, i.e., the group to which inverted classroom module was applied is 64.2 which is much higher than the mean of learning satisfaction of the control group 38.5, who were taught the same units using conventional classroom approach.

This indicates the success rate of the inverted classroom approach developed by the researcher and enhancing the learners' confidence levels in applying the learned concepts.

IV. CONCLUSION

The experiment conducted on learners at the secondary level after planning lessons in Language, Social Science and Science yielded noticeable results in learners' academic achievement using inverted classroom approach. The results were in complete contrast with learners following conventional classroom approach. Consequently, it can be well understood that the inverted classroom approach is technology-cum-activity-based, and this has been a boon in increasing the learners' learning satisfaction.

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