



Research Article

Impact of Blended Teaching Strategy on Learning Achievement and Retention of Knowledge

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Abstract

Integration of advanced technological developments in education has emerged new era of digital educational world especially after pandemic where blended teaching strategy has been proved to be highly beneficial in which both traditional and technology based teaching are fused together for advanced, attractive, efficient and impactful teaching learning process. The present experimental study explored impact of blended teaching strategy on learning achievement and retention of knowledge in science for high school students of rural areas. Two randomly selected groups of students 25 in each, Experimental and control, were treated with blended and traditional teaching strategy, respectively and achievement and retention in knowledge are observed based on test scores of students after treatment. Comparison between experimental and control group is made based on Mean, Standard deviation and t- test statistical tool. The findings based on Mean and t-test depicted higher learning achievement in students of experimental group in compare to control group validating effectiveness of blended teaching. Retention of knowledge in control group found to be almost similar to post treatment however, students in experimental group expressed higher retention than post treatment achievement. For control and experimental group, retention in experimental group is found to be quite impactful than control group in maintaining knowledge for long time via increasing attraction, motivation and self-engagement towards digital tools.

Keywords

Blended Strategy, Learning Achievement, Retention, Digital Technology

1. Introduction

Entanglement of advanced Information and communication technologies (ICT) in education has revolutionized teaching and learning environment in terms of e-learning, Blended strategy, Artificial intelligence (AI), Augmented reality (AR), Virtual reality (VR), Gamification, Open learning platforms, Learning management systems (LMS), Modular object-oriented dynamic learning environment (Moodle) and many more especially after pandemic [1-6]. Blended

mode of teaching and learning is hybrid form of traditional classroom and technology integrated with advanced digital teaching applied mainly in concern to science branch subjects like physics, chemistry, mathematics, biology, environment and others to achieve educational goals. The broad area of research in blended strategy is focused on learning achievement of knowledge. Shurygunet al. observed better self regulation and academic performance in students treated

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with blended approach in compare to traditional teaching [7]. Wang et al. explored economic benefits of blended teaching strategy in college revealing pedagogical and economic promise integration in technology and education [8]. Banihasham et al. discussed post pandemic education in terms of attitude, emotions and perception for blended teaching mode in teachers and students [9]. Bindara et al. explored blended learning approach as pedagogical model for science education in terms of context, technology and pedagogy by using flexible interactive and immersive technologies [10]. Different blended learning models in science education depicted better academic achievement in learners [11-18]. The observed research outcomes for blended strategy recommended advanced technology utilization in education to meet tomorrow needs. The present study explored impact of blended teaching strategy in science education for high school students in terms of academic achievement and retention of knowledge based on pre-post treatment test experimental design.

2. Experimental Design

Pre-post test methodology was applied during present experimental research work in order to find out impact of Blended teaching strategy in science for high school students of rural area in terms of learning achievement and retention of knowledge. Two groups of students 25 in each were randomly selected from Govt. High School, Sunaury (Khaira) Lalitpur (U.P.) named as Experimental and Control group, respectively. The traditional teaching was applied to control group however, Blended teaching treatment was given to

experimental group. A Blended module of three High School science topics photosynthesis, human digestive system and human respiratory system was designed using digital text, audio, video, images etc. for effective Blended strategy in experimental group. The achievement in learning was observed based on scores obtained in post treatment test. Both experimental and control group students were exposed to study material in terms of traditional and Blended format respectively and then after 15 days, retention of knowledge in both groups was studied based on scores of retention test. Mean, Standard deviation and t- test were used as statistical tools for analysis and interpretation of data to express achievement and retention of knowledge in students.

3. Result & Discussion

3.1. Learning Achievement Analysis Between Experimental and Control Group

Learning Achievement after blended and traditional teaching treatment for experimental and control group, respectively is expressed in terms of scores obtained by students of both groups.

1. Null Hypothesis (H_0) – The achievement scores mean difference between experimental and control group is zero.
2. Alternate Hypothesis (H_1) - Achievement scores mean of experimental group differs with mean of control group significantly.

Table 1. Post treatment statistical and t-test parameters for experimental and control group.

Group Statistics					
Group	N		Mean		Std. Deviation
Experimental Group	25		18.2		5.55
Control Group	25		13.48		4.93
t-test for equality of Mean					
	t	df	Sig. level	Critical value (t)	Mean Diff.
Equal variance assumed	3.11	48	0.05	2.011	4.72

Table 1 and Figure 1 represent group statistics and t-test parameters for both experimental and control group after treatment was given. The observed mean value of experimental group (M_E) in which blended teaching strategy was applied is 18.20 significantly higher than mean value (M_C) 13.48 of control group where traditional teaching treatment was applied. The results revealed that blended teaching approach is impactful in learning achievement and engagement

in compare to traditional teaching. Standard deviation of experimental group (SD_E) 5.55 is slightly higher in compare (SD_C) 4.93 of control group depicting dispersion of scores in experimental group.

The observed t-value for comparison in both groups 3.11 at significant level of 5% is significantly higher in compare to two tailed student table critical t-value of 2.011 at 48 degree of freedom depicting rejection of null hypothesis and

acceptance of alternate hypothesis verifying M_E mean achievement of experimental group significantly higher in compare to control group M_C governing effectiveness of

blended teaching strategy in compare to traditional teaching method.

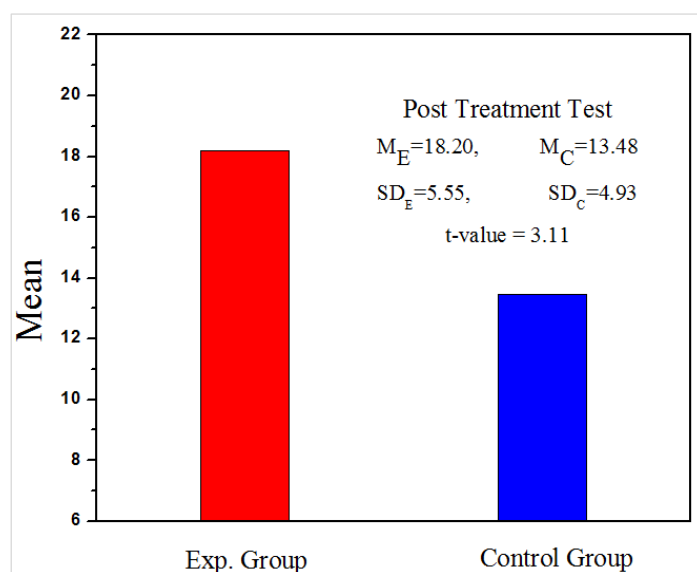


Figure 1. Post treatment statistics for Experimental and Control group.

3.2. Retention Achievement Study of Control Group

Retention of learning in control group was analyzed based on retention test scores after 15 days of post treatment using both inferential statistics and paired t-test.

1. Null Hypothesis (H_0) - The learning achievement scores mean difference between post treatment and retention is equal to zero.
2. Alternate Hypothesis (H_1) - There is significant difference between mean scores of post treatment achievement and retention achievement.

Table 2 and Figure 2 depicted group statistics and paired t-test parameters of control group for both post treatment and

retention achievement test. The observed value of achievement mean score in retention test of control group M_{RE} 14.92 is slightly higher in compare to M_{PT} 13.48 of post treatment achievement indicating almost similar engagement and motivation during both observations. Standard deviation of retention test scores is smaller in compare to post treatment indicating minimization of dispersion in achievement and shifting towards central value. Paired t-value for both observations in control group 2.03 is smaller than critical t-value of 2.064 at 5% significant level at 24 degree of freedom accepting null hypothesis revealing traditionally taught control group has almost similar post treatment and retention achievement.

Table 2. Inferential statistics and paired t-value for both post treatment and retention achievement observations of control group.

Group Statistics						
Observation		N	Mean		Std. Deviation	
Post Treatment		25	13.48		4.93	
Retention		25	14.92		1.41	
t-Value for equality of Mean						
Mean of diff.	Std. Dev. Of Diff.	t	df	Sig. level	Critical value (t)	Mean Diff.
1.44	3.535	2.03	24	0.05	2.064	1.44

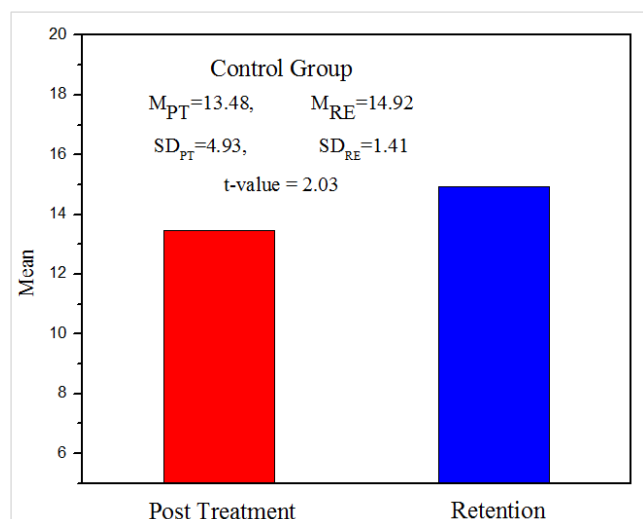


Figure 2. Control group statistics for both post treatment and retention observations.

3.3. Retention Achievement Analysis of Experimental Group

The experimental group treated with blended approach was exposed to all learning materials in form of digital text, images, audios, videos and youtube links for students and instructed to study in blended mode and after 15 days of post

treatment, retention of learning was analyzed via inferential statistics and paired t-test to compare both post treatment and retention observations in experimental group.

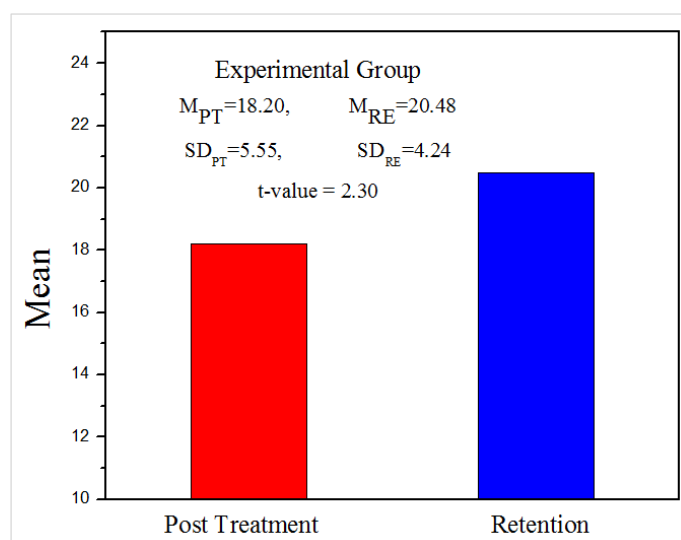


Figure 3. Experimental group statistics for both post treatment and retention achievement.

Table 3. Inferential statistics and paired t-test parameters for post treatment and retention achievement of Experimental group.

Group Statistics						
Observation		N	Mean		Std. Deviation	
Post Treatment		25	18.2		5.55	
Retention		25	20.48		4.24	
t-Value for equality of Mean						
Mean of diff.	Std. Dev. Of Diff.	t	df	Sig. level	Critical value (t)	Mean Diff.
2.28	4.94	2.3	24	0.05	2.064	2.28

1. Null Hypothesis (H_0) – Mean scores difference in experimental group between post treatment and retention achievement is equal to zero.
2. Alternate Hypothesis (H_1) – Post treatment and Retention achievement mean scores in experimental group differ significantly.

Table 3 and Figure 3 represent group statistics for both post treatment and retention observations for experimental group. Retention achievement mean value for experimental group M_{RE} 20.48 is comparatively better to M_{PT} 18.20 of post treatment depicting improved retention of knowledge in leaning via digital tools and platforms. Standard deviation

4.24 in retention test is smaller in compare to 5.55 of post treatment scores. The paired t-value for both observations in experimental groups 2.30 is greater than critical value of 2.064 at 5% significance level and 24 degree of freedom rejecting null hypothesis and accepting alternate hypothesis validating better retention of learning in experimental group.

3.4. Retention Achievement Analysis Between Control and Experimental Group

Retention achievement analysis between control and experimental group is studied by both inferential statistics and

independent t-test.

1. Null Hypothesis (H_0) – The difference between retention achievements mean score of experimental and control group is equal to zero.
2. Alternate Hypothesis (H_1) – There is significant difference between retention achievements mean of experimental and control group's students.

Table 4 and Figure 4 showed group statistics and independent t-test parameters of retention test for both experimental and control group. Higher retention achievement scores mean 20.48 for experimental group was observed in compare to 14.92 for control group indicating students in experimental group got better improvement by blended teaching approach. Students represent much interest in digital audios, video contents and engage themselves for digital study. Blended teaching also generates attraction and motivation in students depicting better retention of knowledge in experimental group. The observed independent t-value for retention analysis in both experimental and control groups is 6.1, greater than critical t-value of 2.011 at 5% significance level, 48 degree of freedom depicting retention means of both experimental and control group are significantly different validating alternate hypothesis. It emphasizes that blend-

ed teaching learning significantly influences achievement and retention level of students in science.

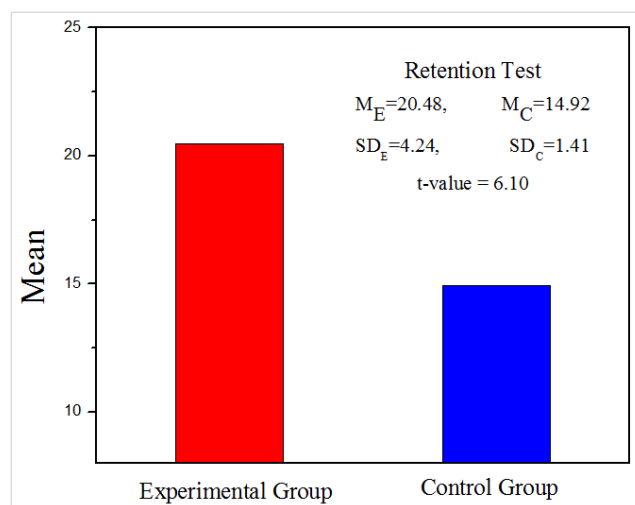


Figure 4. Retention mean score and t- parameters for experimental and control group.

Table 4. Retention achievement comparison of control and experimental group.

Group Statistics					
Group	N	Mean		Std. Deviation	
Experimental Group	25	20.48		4.24	
Control Group	25	14.92		1.41	
t-Value for equality of Mean					
	T	df	Sig. level	Critical value (t)	Mean Diff.
Equal variance assumed	6.10	48	0.05	2.011	5.56

4. Conclusions

Technological involvement in education has enforced better teaching and learning for next generation via utilization of digital resources in form of images, audios, videos, web links and various platforms especially in Blended teaching learning approach making it more attractive, effective and impactful for enhanced learning experiences. Impact of blended teaching for learning achievement and retention of knowledge was studied in two groups of 25 high school students each from Govt. High School, Sunaury (Khaira), Lalitpur named as Experimental and control group treated with blended and traditional teaching, respectively in science. Blended module of three topics Photosynthesis, Human digestive system and human

respiration system was designed using digital texts, images, audios, videos, youtube links for experimental group. Both inferential statistics and t-test were applied for analysis of learning achievement and retention of knowledge. The post treatment achievement scores of students in experimental group depicted significantly better learning in compare to control group indicating blended teaching strategy as more effective, attractive, efficient and engaging towards digital tools. A retention test after 15 days was applied to both groups for retention analysis of knowledge in students. Control group students represent almost similar retention of knowledge as observed in post treatment test however significant improvement in retention of knowledge is observed for experimental group. Blended taught experimental group has significantly higher retention achievement in compare to control group indicating blended teaching learning more impactful in maintaining

knowledge for long time in students via increasing motivation, self-engagement, attraction towards digital tools and generating interest via digital audios, videos for enhanced learning outcome.

Abbreviations

M _E	Mean Experimental Group
M _C	Mean Control Group
SD _E	Standard Deviation Experimental Group
SD _C	Standard Deviation Control Group
M _{PT}	Mean Post Treatment
M _{RE}	Mean Retention
SD _{PT}	Standard Deviation Post Treatment
SD _{RE}	Standard Deviation Retention

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Conflicts of Interest

The authors declare no conflicts of Interest.

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