Modulation of Learning Achievement in Science via Blended Teaching Strategy

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Abstract:
Integration of technology in education has proven its importance for effective and efficient teaching learning methodologies especially for blended teaching learning strategy where both online and offline teaching learning are fused together for benefit of educational empire in terms of learning achievement. The present study explored role of blended teaching strategy for modulation in learning achievement in rural areas. Two groups of students named as experimental and control group were randomly selected at high school level. Blended teaching and traditional teaching were imposed as treatment for both groups respectively and achievement in learning was obtained based on post treatment test scores of students. The finding revealed better learning outcome along with attraction, engagement and motivation in students of experimental group in compare to control group depicting effectiveness of blended teaching approach in students at rural areas.

Keywords: *Blended teaching strategy, Traditional teaching, Learning achievement*

1. Introduction

Technology coordination in the world of education governed a pivotal force in emergence of teaching and learning for better tomorrow. Educational technology signified use of multiple digital resources like images, audios, videos, animations, 3D models and others with prime objectives to improve teaching and learning process for better learning outcomes. Various digital platforms and online libraries allowed multiple accesses to educational resources providing valuable support to academic research and innovation favoring sustainability by reducing environmental issues. Integrating artificial intelligence (AI), Virtual reality (VR), Augmented Reality (AR), Information and communication technology (ICT) and Gamification in education has boosted every dimension in education for efficient and effective teaching and learning [1-7]. Blended mode of teaching leaning has emerged as a result of technology utilization in education as an institutional approach where both traditional face to face classroom and online teaching in form of images, videos, animations, chats, social media, webinar etc. are combined together for quality education to all. Blended learning is also known as hybrid learning, mixed mode learning or technology enhanced learning. Blended learning is mixture of instructional modalities or combination of instructional methods or fusion of online and face to face approaches. Blended learning integrates traditional teaching and web-based learning by combining several pedagogical approaches [8-10].

Lots of research work on Blended teaching learning reflected its importance in current modern scenario especially after covid-19. Alsalhe et al. (2019) studied effect of blended learning on 9th grade students for attitude and achievement in science. An achievement test and questionnaire were designed for validity and reliability of study. The findings revealed that students of experimental group have more attitude and achievement depicting better performance in compare to control group students [11]. Ciftci (2020) studied achievement and persistency of blended learning at social studies lession. Experimental group was given treatment by blended leaning and control group by face to face learning method respectively followed by pre test and post test design. The data showed persistency of knowledge in blended learning

method was more effective than face to face teaching [12]. Hussain (2021) also studied english language proficiency of 12th grade students using blended learning model and found favourable impact of blended model in student's english achievement [13]. Mutya and Apreyll-rose (2023) investigated extend of blended learning in senior secondary school science education as to content, communication, technology, pedagogy and assessment via students' academic achievement. The data were analyzed by descriptive and inferential statistics. The finding revealed that student performance in science was outstanding in blended leaned experimental group which showed significant relation in content and assessment for academic achievement implementing blended learning towards new normal education [14]. Alshahrani (2023) explored influence of chatGPT in blended learning as artificial intelligence for sustainable education. The data represented that integrating AI chatbots like chatGPT may provide education accessibility, inclusive and equitable education, student's engagement, motivation and self directed learning [15]. Nguyen et al. (2023) studied formative assessment model in blended learning approach for students of higher education. The data revealed in this experimental study that students of experimental group have significantly higher motivation and engagement in compare to control group depicting importance of designing and assessment activities in blended learning [16]. Zheng (2023) studied effect of learning management system (LMS) on student engagement and academic performance during covid-12 pandemic. The data strongly favored higher student engagement for better academic performance with different blended learning formats focusing on social interaction with teachers and peers during period of social restrictions [17]. All above studies explored better engagement, motivation and achievement in learning outcomes for blended teaching learning strategy. The present study focused on impact of blended teaching in science for students of rural areas in terms of effective learning achievement.

2. Research Design

Experimental research is carried out to study effectiveness of Blended teaching strategy for students of science in rural areas based on pre and post test methodology. Two groups of high school students 25 in each were selected randomly from Govt. high school, Sunaury (Khaira) Lalitpur (UP), one named as experimental and another control group respectively. A Blended module for three science topic Photosynthesis, Human Digestive system and Human Respiration system involving digital text, images, audios, videos and animations was self designed for treatment of experimental group however tradition teaching was applied in control group. The achievement in science for both group's students is expressed in terms of scores of self made pre and post treatment test. Mean, standard deviation and t-test were used as statistical tools for analysis and interpretation of data in present research.

3. Result and discussion

3.1 Pre-Treatment comparison of Experimental and Control group

Initially, Knowledge level of students in both experimental and control group were examined based on score of a self-made science achievement test before treatment. Inferential statistics and independent t-test were used for comparison between experimental and control group.

Null Hypothesis (H_o) - There is no significant difference between mean of experimental and control group before treatment.

Alternative Hypothesis (H_1) - The mean of experimental and control group differs significantly. Table 1 depicts inferential statistics and t-test value parameters for both experimental and control group before treatment. The observed mean value for experimental group is 9.04 which is slightly higher in compare to mean value of control group 8.52 indicating almost similar mental level of students towards science achievement in both experimental and control group. Standard deviation for both experimental and control group are 3.194 and 3.367 respectively depicting almost similar dispersion of data in both groups. Independent t-test was applied to both groups' comparison at predetermined significance level of 5%.

Table 1- Inferential Statistics and t- test parameters before treatment for both experimental and control group

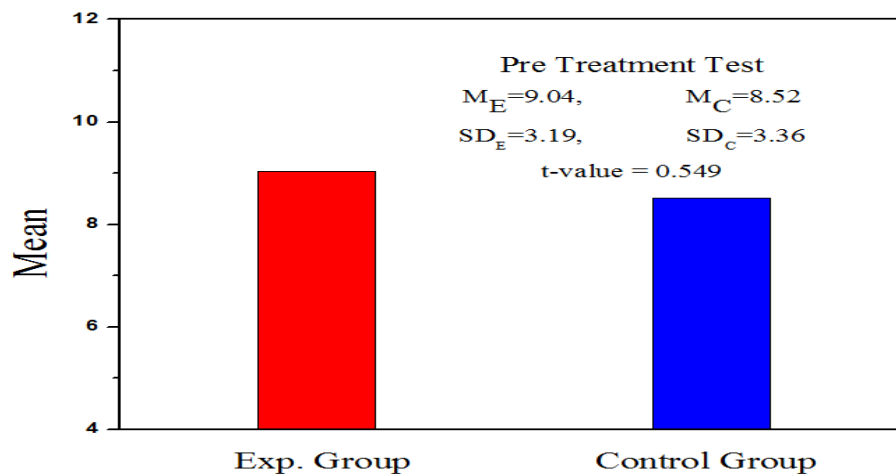| Group Statistics						
	Group		**N**	**Mean**		**Std. Deviation**
	Experimental Group		25	9.04		3.194
	Control Group		25	8.52		3.367
	t-test for equality of Mean					
			t	**df**	**Sig. level**	**Critical value (t)**	**Mean Diff.**
	Equal Variance Assumed		0.549	48	0.05	2.011	0.52

Figure 1: Pre treatment comparison between Experimental and Control group with t-parameters

The t value calculated for equality of mean is 0.594 which is smaller than critical t value of 2.011 taken from student table of two tailed test at 48 degree of freedom. It resulted that null hypothesis is accepted i.e. there is no significant difference in mean between both experimental and control group before treatment indicating knowledge level of students towards science achievement in both groups are similar. The slightly difference observed in mean is due to sampling error and alternative hypothesis is rejected. Figure 1 also depicted sample statistics for both experimental and control group indicating almost similar mean value for both group. It states that knowledge level for science in students is almost same in both groups before treatment.

3.2 Post treatment comparison between Experimental and Control group
A treatment in terms of blended teaching strategy of selected topics in science was implemented to experimental group and traditional teaching treatment was given to control group of students. Both inferential statistics and parametric independent t-test were applied for comparison between experimental and control group.

Null Hypothesis (H₀) – The achievement score mean difference between experimental and control group is zero.

Alternate Hypothesis (H$_1$) - Achievement score mean of experimental group differs with mean of control group significantly.

Table 2 represents group statistics and t-test parameters for both experimental and control group after treatment was given. The observed mean value of experimental group in which blended teaching strategy was applied is 18.2 which is significantly higher than mean value 13.48 of control group where traditional teaching was applied as treatment. The results expressed that blended teaching approach indicated better learning achievement in compare to traditional teaching. It is observed during experimentation that students of experimental group in blended teaching depicted much better engagement and attraction towards digital tools of teaching in compare to control group. Standard deviation of experimental group is 5.55 which is slightly higher in compare 4.93 of control group depicting much dispersion of scores in experimental group. The independent t-test was applied to compare both groups after treatment. The calculated t-value in comparison to both groups is 3.11 at significant level of 5% which is significantly higher in compare to two tailed student table critical t-value of 2.011 at 48 degree of freedom.

Table 2: Post treatment statistical and t-test parameters for experimental and control group

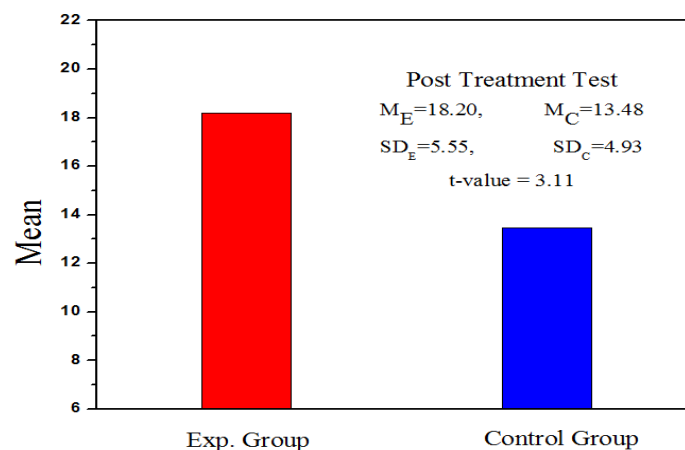|	Group Statistics					
	Group	**N**		**Mean**		**Std. Deviation**
	Experimental Group	25		18.2		5.55
	Control Group	25		13.48		4.93
	t-test for equality of Mean					
			t	**df**	**Sig. level**	**Critical value (t)**	**Mean Diff.**
	Equal variance assumed		3.11	48	0.05	2.011	4.72

Figure 2: Post treatment statistical parameter of both Experimental and Control group

Thus, Null hypothesis is rejected based on t-test results and alternate hypothesis is accepted verifying that mean achievement of experimental group is significantly higher in compare to control group. It proved effectiveness of blended teaching strategy in compare to traditional teaching method. Figure 2

shows statistical parameters of both experimental and control group after treatment is given. Significantly higher value of mean in experimental group indicated greater achievement level in science for experimental group after treatment.

4. Conclusion

Blended teaching learning, a reflection of Integration of technology in teaching strategies in attractive, effective and influencive manner for enhanced learning experiences, is hybrid form of offline and online learning where digital tools of learning are employed with traditional classroom teaching using ICT support. Blended teaching and traditional teaching were used as treatment for randomly selected experimental and control group. Almost similar knowledge level in science for both group's students is observed before treatment via scores of pre treatment test. Significant difference in achievement level is depicted between both groups after treatment was given. The achievement scores of students in post treatment test depicted significantly better learning of experimental group in compare to control group indicating blended teaching strategy as more effective and efficient in compare to traditional teaching method. Students in experimental group are highly attracted and engaged towards digital tools and platforms of learning. Blended teaching learning is impactful in maintaining of knowledge in students via increasing motivation, self-engagement, attraction towards digital tools and generating interest via digital audios, videos for enhanced learning outcome.

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