Effectiveness of Blended Learning among Undergraduate Physics Students

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Abstract

This research aimed at investigating the effectiveness of using a blended learning program in second-year undergraduate level Physics subjects in the unit 'viscosity' consisted of 80 students of Government, Self-financed Arts and Science colleges of Salem District of Tamil Nadu State in 2021-2022. The researchers designed an achievement test with forty items. The blended learning program was used in teaching the experimental group of twenty students, while the traditional method was used the control one of twenty students. The experiment lasted for eighteen weeks and the findings revealed that there were significant differences at 0.05 level in the mean scores of the test in favor of the experimental group after implementing the blended program in favor of the post-application and it was attributed to the blended learning program in the teaching of Physics. From this study, the researchers concluded that they supported blended learning more than the normal class setting.

Keywords: Blended Learning, Effectiveness, EDMODO, Physics.

Introduction

The teacher education program must be competent enough to use new technologies in the field of education to meet the expectation of the learners in this century. To meet these educational demands of learners, teachers who know how to impart knowledge, and ensure their achievement in the future. Hence teachers should be equipped with relevant pedagogical practices with appropriate content knowledge and specified skill with the inclusion of a technology environment, which can be acquired by continuous training. This will strengthen the quality of the teaching and learning process, the education system is challenged with pressure to adopt innovative pedagogical practices that reflect new ways of classroom teaching which makes the learner more independent. These independent learning activities will enable individual learners to achieve their learning goals and outcomes and are supported by the integration of technology with their conventional teaching and it can strengthen the planning of teaching-learning strategies. This integration is called Blended Learning. Blended Learning is the integrated combination of traditional learning with online approaches, the combination of media and tools employed in an e-learning environment. (Whitelock and Jefts, 2003).

Review of Related Studies

It is observed from the related studies that most of the Blended Learning studies are focused on the area of higher education and analysis was carried out through quantitative methods in these studies (Nachimuthu, 2020; Akhila, 2013; Radhika, 2013; Dhanya Krishnan, 2011; Yen and Lee 2011). Very few researches were conducted on the effectiveness of the Blended Learning Programme on academic achievement. Nachimuthu (2020) conducted a study on the effect of the Blended Learning strategy on achievement in biology and the social and environmental attitude of students at the secondary level. She analyzed the effect of the Blended Learning strategy on achievement in the biology of secondary school students. She compares the environmental attitude of secondary school students based on a demographic variable. The results showed that the majority of the teachers responded that the Blended Learning strategy develops the ability to appreciate the scientific phenomenon through the various learning experience.

Akhila (2013) conducted a study on the Blended Learning package for the mathematics group. It is found that the treatment with a Blended Learning Package has enhanced the achievement of students of the experimental group in Mathematics more than the conventional instruction in the control group. Radhika (2013) conducted a study on the effectiveness of Blended Learning in automobile units concerning Caterpillar India Limited in the Thiruvallur district. She worked out the job performance and training results and focused on the application of Blended Learning in an industrial area. She concluded that Blended Learning in the manufacturing unit concerning Caterpillar India Limited is effective at a different level and the learning outcomes are predicted as job performance.

Dhanya Krishnan (2011) studied the effect of the Blended learning strategy on higher-order thinking and learning science among secondary school students. And she concluded the Blended learning strategy had a positive effect on the critical thinking, problemsolving, science process skills, and science achievement of students. Yen and Lee (2011) studied the problem-solving patterns and their impact on learning achievements in a Blended Learning environment. Among the hybridoriented group, the technology-oriented group, and the efficiency-oriented group, the third group performed better than the other two groups in task-oriented and problem-solving abilities.

Methodology

For quantitative data analysis. academic achievement test questions were constructed to conduct pre, post, and retention tests for experimental and control groups. The quasi-experimental approach is used for quantitative research. The experimental and the control groups are assigned as the participants of the study. The research includes three variables a blended learning program, the achievement in the teaching of physics, and the student's attitude toward the Blended Learning program. The experimental group was taught the teaching of physics using the Blended learning program, while the control group was taught the same course through the conventional method.

Sample for the Study

The population of the study is the secondyear Physics students of Government, and selffinanced Arts and Science colleges of Salem and Namakkal District of Tamil Nadu State. In total 80 second-year Physics students as the sample size for this study. The two colleges with the provision of a technology-rich environment used EDMODO as a learning management system in the experimental group and control group where EDMODO as a learning management system was not used.

Tools for the Study

Two different types of tools were constructed and validated by the investigator with the help and guidance of the research supervisor and review of related studies. That two tools are; the achievement test in the teaching of physics; and the students' attitude scale in the blended learning program. The achievement test consists of one mark for correct response and zeroes for wrong response. The sum of the scores of each question gives the Pre-test score of the individual. The maximum score is 100 and the minimum score is zero. The researcher used the same question paper to conduct a post-test to remove the effect of testing.

Reliability and Validity

For the achievement test, The difficulty level and discrimination power were calculated for an achievement test for students, after the item analysis of test items sixteen items were recommended to reject for the final drafting of the achievement test, and the remaining 84 items were recommended to administer pre and post-test for experimental and control groups. The reliability value of Kuder & Richardson was found to be 0.8582 and that of Cronbach's Alpha is 0.8539 for the achievement test. Hence, the constructed tool was found to have acceptable measures of reliability. On the students' attitude scale of blended learning in Physics, there were 50 items with a five-point Likert type. Each statement was assigned weightage ranging from +2 as Strongly disagree, +1 as Disagree, 0 as Neutral, -1 as Agree, and -2 as Strongly agree. Content validity was established by experts from Periyar University and Arts College Professors of Physics who were exposed to online learning platforms.

Based on their suggestions, seven items were deleted and 40 items were retained in the attitude scale. The reliability of the developed tool was estimated using Cronbach's Alpha. Cronbach's alpha coefficient was found to be 0.9234 and hence the attitude scale was found to be an excellent measure of reliability. The achievement tool with 100 items and the attitude scale with 50 items were presented to a panel of experts which include teacher educators and internal and external doctoral committee members and two Professors of Physics. The panel scrutinized both tools and expressed satisfaction with the content of the tools. Some of the items were restructured and refined based on the suggestions of the experts and the face validity and content validity were established. The final tool of the Achievement test consists of 84 items and the attitude scale consists of 40 items that were used for data collection.

Design of the study

Blended Learning Programme was designed, developed, and implemented using a design suggested by the Al-Jazar (2002) model. The Al-Jazar model follows a scientific approach to thinking and a logical sequence for analyzing learners' characteristics. The model consists of five phases; study and analysis, design, production, evaluation, and usage. In this study, the procedure of developing and designing a Blended Learning Programme consists of five phases viz; Analysis, design, development, implementation, and evaluation (ADDIE).

During the pilot study, the researchers carried out intervention in arts and science colleges in Tamil Nadu for two weeks. Topics from teaching the second-year undergraduate Physics paper were selected and implemented for the students with EDMODO online learning platform. The researcher oriented on the use of the Blended Learning Programme, login procedure, and how to interact with the members in the group, and necessary guidelines were given to the students. Conventional classroom teaching includes lecture demonstration and explanation. This pilot study helped the researcher to gain experience to research the experimental group using Blended Learning Programme.

EDMODO is an open-access learning management system that was used as the teaching Learning platform for the implementation of the Blended Learning program. It is a free and safe platform for teachers and students to connect and work together. This platform enables the teacher to conveniently blend different learning activities using constructivist practices. The investigator created a group (Physics group) for the purpose and distributed the group code to the experimental group students. With the help of group code, students joined the online learning group named 'AR' Physics group and enriched their profiles by adding their details and uploading photo. The researchers interacted with the students in the discussion forum. Materials were posed for reference and classes are preplanned in the Edmodo planner. Interactivity is one of the main components of the Blended Learning Programme. It provides an opportunity for all the participants to interact with the teacher in a safe and secure platform.

Analysis of the study

The hypothesis, there will be no significant mean difference between the pre and post-test scores of the experimental group in their achievement in the teaching of the second year of Physics was accepted. This result indicates that using the Blended-learning program is effective in the teaching of physics. The result is also similar to Nachimuthu et al., (2021) that Blended Learning Programme using video-based blogs is an effective approach for learning English as a second language to speaking effectively and efficiently.

It is shown that there is no significant difference in the mean scores of the Experimental and Control group at the 0.05 level in the pre-test ('t'=0.94038, p=0.3509 >0.05) was accepted overall, and there is a significant difference between the mean scores of the Experimental and Control group at 0.05 level in the post-test ('t'=9.04156, p=0.00001 <0.05) was rejected in over-all. This shows that the creative and innovative technology used in the classroom has enhanced their ability. The results indicated that the second-year Physics students of Government colleges, the experimental group which was exposed to the Blended Learning Program showed significant improvement in their academic achievement compared to the control group which was taught through the conventional method ('t' = 6.84812 and p=0.00001<0.05).

Test	Group (N=20 each)	Mean	S.D	't' value	p-value	0.05 Level
Pre –test (over-all)	Control	10.200	2.988	0.94038	0.3509	Accepted & No Significance
	Experimental	11.260	4.060			
Post –test (over-all)	Control	10.230	2.580	9.04156	0.00001	Rejected & Significance
	Experimental	18.640	3.263			
Post –test (Govt. Col.)	Control	07.752	2.392	6.84812	0.00001	Rejected & Significance
	Experimental	12.610	2.084			
Post –test (Self - Finance. Col.)	Control	06.653	1.487	8.87740	0.00001	Rejected & Significance
	Experimental	12.920	2.787			

Table: Analysis of Blended Learning Concepts in Physics with different tests

Effect size analysis was carried out to find the effectiveness of the Blended Learning Programme over the conventional teaching method. Cohen's effect size for the control group and experimental group to the mean scores for pre-test is Cohen's d=0.0895, r=0.0428 and for post-test is Cohen's d=1.0099, r= 0.437. Hence it is concluded that the large effect size is due to the implementation of the Blended Learning Programme in the experimental group. This means that the effect is significant.

There will be no significant mean difference in the pre and post-test scores of second-year Physics students in the experimental group in their attitude about the Blended Learning Programme was rejected. Wilcoxon signed-rank test for attitude scores in the control group shows the test statistic (Z) value as (-1.68) and its associated p-value is (0.06) greater than (0.05) and the hypothesis is accepted. So, it is concluded that the control group does not have a remarkable improvement in the attitude scores in the post-test as compared to the pre-test.

The test statistic (Z) values are (-3.6927), (-4.0717), (-3.7221), (-4.3938), (-4.4099) and (-4.4394) concerning dimensions general, interactivity, knowledge creation, course content, technology benefit, and overall satisfaction and associated probability value for each dimension is less than (0.05). Hence, there is statistical evidence that the scores of the students for various dimensions are effectively improved in the post-test as compared to the pre-test significantly. Therefore the null hypothesis is rejected.

Conclusion

In general, there is no significant difference in the achievement scores of the experimental and control group in the teaching of physics ('t'=8.8774, p=0.00001<0.05) was rejected. The mean value shows that students in the experimental group performed better than the control group. This result shows that the Blended Learning program is effective in improving the achievement scores of students in the teaching of physics particularly in 'Viscosity'.

Discussion of the Study

Blended learning is not a mere mix of online and face-to-face mode, but it refers to a well-planned combination of meaningful activities in both the modes. The blend demands consideration of several factors, mainly focussing on learning outcomes and the learner-centered instructional environment. An appropriate pedagogy approaches with suitable infrastructure facilities will enable and empower teachers and students to achieve desirable learning outcomes. During the Covid time, many exams were forced to be conducted in an online mode. These were supported by variety of tools which came into being in recent times and were based on proctoring through some software tools. The findings of the study showed that the program developed the

performance of the experimental group and the results were in favor of the post-test. Even retention tests of the experimental group also favor blended learning concepts in Physics. Among the following five models viz., face-toface driver; rotation; flex; online lab; selfblend, and online-driver models, the researchers used the al-azeer model of blended learning.

The study concluded that there were significant differences at 0.05level in the mean scores of the test in favor of the experimental group. The results also pointed out that there were statistically significant differences at 0.05 level in the second-year Physics students' achievement level before and after implementing the blended program, and in favor of the post-application. This was resulted and attributed to the blended learning program in the teaching of Physics. The researcher recommended that education stakeholders should adopt blended learning in teaching Physics, and hold educational courses.

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