



A STUDY OF EFFECTIVENESS OF BLENDED LEARNING ON SCIENCE ACHIEVEMENT OF GRADE IX STUDENTS

Dr. Tasneem Khan,

Assistant Professor, Centre for Distance and Online Education

Punjabi University, Patiala, 147002 Email ID- tasneemkhan1966@gmail.com

Abstract The present study was designed to compare the effectiveness of blended learning and traditional method of teaching on science achievement of Secondary School Students. The Quasi-experimental pre-test-post-test Non-equivalent group design was adopted for the experimental study. The sample for the study was consisted of 82 students of grade IX from private school, CBSE, Mohali. The students were placed into experimental group and the control group. Experimental group was taught with blended learning and the control group was taught with traditional method of teaching. A criterion referenced science achievement test was constructed and standardised by the investigator and was used it as for pre-test and post-test. The hypothesis were analysed by means of ANCOVA. The results of the study showed that students taught with blended learning improved their scores significantly with mean score of 58.61 as compared to those who were taught by traditional method of teaching whose mean score was 48.48. On the comparison of performance of the students across gender group, the non-significant gain in the mean achievement scores of the boys and girls showed that gap between the gender groups in learning science has been disappeared. Based on the findings, it is recommended that teachers can consider this blended learning strategy in his teaching to bridge an achievement gap of the students and achieve educational goals.

Keywords: *Teaching Methods, blended learning, Science Achievement.*

INTRODUCTION

The growth of the nation is dependent on sound education and strength of the education system. For centuries, there was only one method of teaching that was practiced in the schools i.e. traditional method of teaching. This method of teaching is still prevalent in most parts of our nation. Teachers still use the chalkboard and chalk to explain the concept to the students and students still follows the same pattern of writing the content from the chalkboard and memories the notes (Mehta,2020)

Traditional method of teaching that are still followed in some of the areas where classes are strictly organised, teacher-centred learning, no discussion, focused on clearing the examinations and passive learning environment. However, it has many advantages like in rural areas, this method of teaching is still used as it is not as expensive as modern methods. It forms the strong bond and more interaction among the teachers and the students. Moreover, subjects like Physics, Chemistry and Biology are easy to teach via chalkboard method because the explanation of difficult topics can be easily understood well when teacher explained it on the board (Mehta, 2020).

We are living in the 21st century where the scope of the knowledge in the field of science and technology has been diversified and the tendency of the human to grasp the knowledge is increasing with time. Mehta (2020) explained further that the grasping and understanding of the concept is must as it leads the students towards meta-cognitive knowledge. Therefore, there is immense need to shift the learning from teacher centred approach to student centred approach and the introduction of the innovative approaches in teaching and learning in order to cope up with modern world and knowledge driven era.

Blooms (1968) proposed an instructional strategy (Learning for Mastery) to fulfil the gaps between the achievement level of the students. It is a group based individual strategy of the teaching and learning and focused on the high level of students' understanding and capability.

To achieve the high level of education and to fill the gaps between the levels of the achievement of the students, innovative approaches should be inculcated in the teaching –learning process. Blended learning is an innovative educational programme (formal or non-formal) that combines the traditional teaching with online digital educational material. It requires some of the elements that control over time, pace, path and place.

Different strategies have been applied to enhance an effective learning where learning is an inherent and social process (Strobl, 2007). During pandemic, (Covid-19) blended learning was a foremost technology where teachers have already applied in the teaching- learning process. This rapid shift in education brought focus on skill development and learning outcomes of the students. To keep the balance between face-to-face learning and online learning via computer-mediated activities, blended learning approach act as icing on cake (Strauss, 2012). This can also be called as combined technology with pedagogical principles for the sake of students and their learning outcomes (Garrison and Kanuka, 2004; Hoic-Bozic et al., 2009).

Williams et al., (2008) defined blended learning as the combination of traditional learning and distributed learning. He further described the distributed learning, a model in which student receive their lecture and content at different location so that learning can take place at its own time and pace. Because every individual has its own preferences, needs and learning styles. These types of model in pedagogy encourage the students to learn in collaborative environment at their own pace and time (Bonk and Graham, 2006; Saltzberg and Polyson,1995).

Blended Learning Structure in Education

There are many factors that are to be considered when choosing this approach ‘how to blend face-to-face learning with online teaching and learning activities. The approach when used, should be like as it fits best with their circumstances, age and above all learning needs. The blended learning approach includes the flexibility regarding watching videos, completing assignments and downloading reading material. The most important thing is to be kept in mind is that students are able to learn well with every teaching that is to be taught either online or offline (UGC, 2021).

In blended learning, the teachers act like the one as coaches and manage their teaching, as it is best suited to the subject or the learner. Below are the sample configurations that can be implemented in the blended learning teaching situation and can be fit into any teaching and learning process. The models of blended learning approaches are explained given below and given by Powell et al. 2015 and UGC 2021.

- Blended face-to face class - in this approach, use of technology is along with traditional teaching so the learning outcomes of the students can be enhanced. Face-to-face method is the main mode of teaching and the use of technology is supplement resources to it. For example- reading, quizzes, discussion and group projects can be used along with face-to-face mode of teaching
- Blended online class - it is inverse of the blended face-to-face class. The class is conducted in the labs or in the lecture room labs, where facility for the presentation and the activities related to the subject is available and presentable during online delivery mode.
- The flipped classroom - it is inverse of traditional mode of teaching where assignments, reading material, projects, activities, video lectures has to be done at home at their own pace before class or before interaction with the teacher. It is sub-model of blended face-to-face and online class.
- The rotational model - in this approach, students in the course rotate with various modalities, one of which is online learning. There are many sub-models such as station rotation is usually used in elementary schools where teacher divide/rotate the students into groups for discussion, collaborative activities, projects, learning the content. It has fixed schedules for example –online learning.
- Lab Rotation - like a station and rotation, it has also a fixed schedule. In case of online learning, a teacher can rotate the class into the computer labs, English labs, Maths/Science lab etc.
- Individual rotation - in this model, individual student is rotated through learning modalities on a customised schedule or set by teacher.
- A La Carte model - it enables student to take course online with online teacher. It provides more flexibility over their schedules as compared to rotation and station.
- The self-blended model - it is a programme level model where learner enrolled in school and participates in the course online in addition to their traditional teaching.
- The blended MOOC - it is form of flipped learning where material is already available for the students and they can access openly outside their classroom and actively participate in the discussion, meetings and competitions.
- Flexible-mode course - it allows the students to take course according to their ability and attend the class at their own pace.

Why it is important to blend?

The integration of blended learning in the teaching learning process brings the active engagement of the students for learning. The research which, explains that learning does not occur but is embedded and enriched when students go beyond their level of knowledge and become active learner. Active learners facilitate their skills, concepts and learn to collaborate with others also. They transfer their learning from passive to active mode. Therefore, the integration of blended learning is necessary because collaborative learning is based on the social constructivism theory. This theory of learning discusses the individual learning and it take place through the interaction (Bath and Bourke, 2010).

Students generally remember and are able to do as such as shown below:

Active Learning

- 90% what they do (presentations, simulation, experience).
 70% say and write (collaborative activities/ participation in the class).
 50% see and hear (demonstrations, discussions, competitions, workshops, exhibitions).
 30% what they see (videos, views and diagrams).
 20% what they hear (hear).
 10% they know what to read.

Passive Learning

Therefore, it is concluded by the Bath and Bourke (2010) that the interaction among the students, develops the ability to evaluate their ideas, synthesis their ideas and build deeper understanding of the concept 'what they learn'. This approach brings the ability to analyse their ideas, critical thinking and reasoning.

This approach illuminates the mind of the students to see beyond their level of learning because students often depend on the activities to be done in the class and their assessment in the exams. To bring the higher order thinking skills of the students, Churches (2008) declared that blended learning is suitable strategy to fulfil the learning outcomes as framed by Bloom's Taxonomy in 1956. Bloom gave the hierarchical taxonomy with different objectives that are particularly set for the students.

HOTS

- Creating - Generating new ideas, ways or concepts
 Evaluating - Justify the concepts and relations
 Analysing - Breaking information into parts and explore the relationship
 Applying - Using this understanding in further concepts
 Understanding- Explain their own ideas and concepts
 Remembering - Recall the previous concepts

LOTS

Therefore, it is concluded that the integration of blended learning in teaching learning process brings the paradigm shift and enhance the meaningful learning. Krause (2007) defined blended learning is an effective integration of different modes of teaching, models of teaching and styles of learning that can be used or adopted with face-to-face mode of teaching.

Blended Learning and Teachers

Blended learning shifts the role of teacher from knowledge provider to coach and mentor. With the integration of blended learning into teaching learning process, teachers have profound influence on the students' learning (UGC, 2021). A professional scientist is one who builds on the work of others, he designs it, verify it and redesign it if needed and at the end shares it. Therefore, it helps in building of practical knowledge among the students or in their fields (Laurillard, 2012).

Teacher should be aware of an increase of workload, when he shifts his teaching to online from conventional method of teaching. Here, blended learning provides an optical balance between online and offline teaching and offers technology based learning, pacing and privacy. It helps to keep the students busy, engaged and motivated (UGC, 2021).

OBJECTIVES OF THE STUDY

1. To study the effect of blended learning on the science achievement of grade IX secondary school students.
2. To study the interaction effect of blended learning and gender on science achievement of grade IX secondary school students.

HYPOTHESIS OF THE STUDY

1. There will be no significant gain in mean achievement scores of science achievement of grade IX secondary school students either taught by blended learning or by traditional method of teaching.
2. There will be no significant interaction effect of treatment (i.e. blended learning and traditional method of teaching) and gender on science achievement of grade IX secondary school students.

METHOD AND PROCEDURE

In the present study, investigator has employed the quasi-experimental method. In order to determine the effectiveness of the blended learning and traditional method of teaching on science achievement of grade IX secondary school students, investigator has developed the various tools.

- Construction and standardisation of achievement test in science for assessing the science achievement of grade IX secondary school students.
- Development of instructional material based on blended learning and traditional method of teaching in science of grade IX secondary school students.

SAMPLE OF THE STUDY

In the present study, the sample of grade IX secondary school students has been collected from the private school, affiliated to C.B.S.E, New Delhi. The medium of instruction of the grade IX secondary school students is English. The description of the sample is given in the table

Table 1
Description of the Total Sample for the Experimental Study

	Gender → Group ↓	Boys	Girls	Total
Experimental Group	Blended Learning	27	14	41
Control Group	Traditional Method of Teaching	22	19	41
	Total	49	33	82

DESIGN OF THE STUDY

In the present study, experimental method was used to conduct the further proceedings. The design was on the lines of pre-test-post-test Non- equivalent group design.

Table 2
Non-equivalent Pre-test-post Control Group Design

Experimental Group	Blended Learning	Pre-test	Treatment (Blended Learning)	Post-test
Control Group	Traditional Method of Teaching	Pre-test	Traditional Method	Post-test

PROCEDURE OF THE STUDY

In the present study, experiment was conducted in 3 phases.

- **Phase 1:** In the first phase, the investigator administered the science achievement test of Grade IX secondary school students as the pre-test to the experimental group i.e. blended learning and the control group: traditional method of teaching. Along with pre-test, Raven's Progressive Matrices (Non-verbal intelligence test) was also administered in order to see the point of equivalence of both groups.
- **Phase 2:** In the second phase, treatment was given to the both groups by using the lesson plans based on blended learning and traditional method of teaching developed by the investigator. Content of the lesson plans was same for all the both groups.
- **Phase 3:** In the third phase, post-test was administered in order to see the effectiveness of treatment given to the same groups.

ANALYSIS AND INTERPRETATION OF DATA

The analysis and the interpretation of the data are the two major steps in the research. Analysis is the study in which the data is collected and organised in order to find the facts and meaning related to the study. In the present study, the main objective is to compare the study of effectiveness of blended learning and traditional method of teaching on science achievement of secondary school students. The analysis and interpretation of data is given below:

A. EFFECTIVENESS OF BLENDED LEARNING AND TRADITIONAL METHOD OF TEACHING ON ADJUSTED MEAN SCORES OF SCIENCE ACHIEVEMENT OF GRADE IX SECONDARY SCHOOL STUDENTS

The comparison of both groups i.e. blended learning and traditional method of teaching has been carried out by means of ANCOVA (Analysis of Co-variance). ANCOVA has been employed to test the significance of the differences in the mean of science achievement of grade IX secondary school students. "Through covariance analysis one is able to effect adjustments in final or terminal scores which will allow for differences in some initial variables" (Garrett & Woodworth, 2008, p.295).

The mean score of pre-test, post-test and adjusted mean scores of post-test on science achievement of grade IX secondary school students is given in table 3.

Table 3
Adjusted Mean Scores of Science Achievement of Grade IX Secondary School Students among the Groups of Blended Learning and Traditional Method of Teaching

Groups	N	M_x (Pre-test)	M_y (Post-test)	M_{y.x} (Adjusted)	M_D	t-value
Blended Learning	41	20.96	58.47	58.61	10.13	4.83**
Traditional Method of Teaching	41	21.64	48.62	48.48		
General Mean		21.30	53.54	53.54		

$p < 0.01$

The table 3 shows that the mean of the pre-test of science achievement of blended learning group is 20.96 and the traditional method of teaching group is 21.64. After given the treatment, the mean of the post-test on science achievement of blended learning group is 58.47 and the traditional method of teaching group is 48.62. The table 3 further shows the adjusted mean score (My.x) of blended learning group is 58.61, which is increased from the mean score of the post-test i.e. 58.47. The adjusted mean score of traditional method of teaching (My.x) is 48.48, which is decreased from the mean score of the post-test i.e. 48.62. The mean difference between the adjusted mean score is 10.13. The table further shows the general adjusted mean i.e. 53.54 and t-value testing the significance of difference between the means came out to be 4.83. The difference found between the mean is statistical significant at 0.01 level. This indicates that group of blended learning of grade IX secondary school students have performed significantly better as compared to traditional method of teaching.

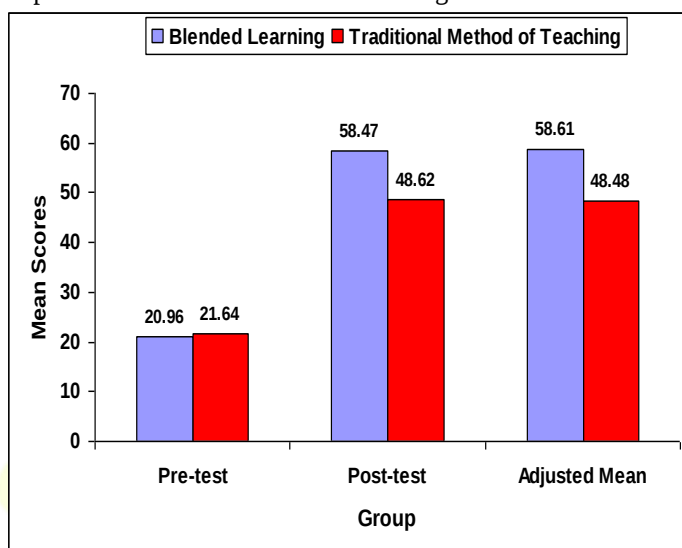


Figure 1 : Comparison of Mean Achievement Score of Pre-test, Post-test and Adjusted Mean Score of Science Achievement among the Groups of Blended Learning and Traditional Method of Teaching of Grade IX Secondary School Students

From figure 1, it may be observed that mean gain scores in science achievement of grade IX secondary school students, when exposed to blended learning is significantly higher than the mean gain scores of grade IX secondary school students, when exposed to traditional method of teaching.

Therefore, it can be concluded that H_1 is rejected, since the results of the present study indicates that there is a significant gain in the mean achievement scores of grade IX secondary school students on science achievement, when taught by blended learning as compared to traditional method of teaching.

B. INTERACTION EFFECT OF THE TREATMENT i.e. BLENDED LEARNING AND TRADITIONAL METHOD OF TEACHING AMONG BOYS AND GIRLS

In the present study, the interaction of the difference of the treatment (i.e. blended learning and traditional method of teaching) with gender group is carried out with use of ANCOVA (Analysis of Co-variance). The results of ANCOVA were worked out separately for boys and girls group of grade IX secondary school students.

The adjusted mean scores of both boys and girls of grade IX secondary school students on science achievement is given in the table 4.

Table 4
Adjusted Mean Scores of Boys and Girls with Respect to Blended Learning and Traditional Method of Teaching

Group → Gender ↓	Blended Learning (My.x)	Traditional Method of Teaching (My.x)	Mean Difference
Boys	57.92	46.82	11.10
Girls	60.99	49.74	11.25

The table 4 shows the adjusted mean scores of boys and the girls of grade IX secondary school students among the groups of blended learning and traditional method of teaching. The adjusted mean score of boys of blended learning group is 57.92 and the girls are 60.99. The adjusted mean score of boys of traditional method of teaching group is 46.82 and the girls are 49.74 respectively. The mean difference found among boys group is 11.10 and the girls are 11.25.

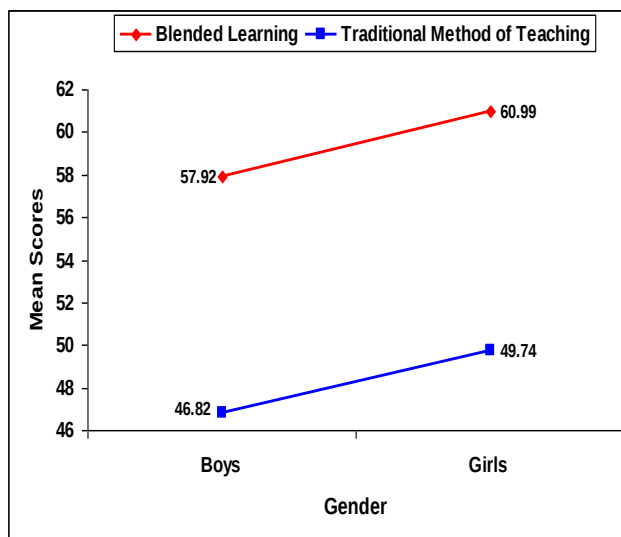


Figure 2 : Interaction Effect of the Treatment i.e. Blended Learning and Traditional Method of Teaching with Gender Group

- From figure 2, it may be observed that there is no gender difference in the performance of:
 - In blended learning group
 - In traditional method of teaching group
 - Blended learning group is better than traditional method of teaching both at par
 - Boys
 - Girls
 - There is no interaction of blended learning with gender on science achievement of grade IX secondary school students.
- Thus, it can be concluded that H_2 is accepted i.e. there is no significant interaction effect is found among the two groups of boys and girls of grade IX secondary school students on science achievement, one taught by blended learning and other taught by traditional method of teaching.

DISCUSSION OF THE RESULTS

- There is a significant gain in mean achievement scores of science achievement of grade IX secondary school students, when exposed to blended learning as compared to traditional method of teaching**

In the light of the above results of the effectiveness of blended learning over traditional method of teaching, it is concluded that there is a significant gain in the mean achievement scores of grade IX secondary school students in science achievement.

Blended Learning

The main reason to advocate blended learning in teaching and learning is due to learning gap found among the students. Blended learning provides constructivism-learning environment among students and turns the classroom environment into creative and inductive and therefore it enables students to perform better at their own pace (Makkar, 2022).

It is also observed that use of blended learning helped to improve the scores of the students with special needs like Deaf and Dumb (Long et al., 2007). According to Driscoll (2002) and Graham (2006) the features of blended learning are

- “It is the combination of teaching with technology and face-to-face teaching and learning.
- There are multiple theories such as constructivism and behaviourism, which are involved in teaching and learning.
- It is the combination of different types of technology based on internet in order to achieve the goals of education.”

In the light of above explanation of blended learning is better as compared to traditional method of teaching as it contributes to the development of high order thinking skills among students and fosters self-direction to learning (Rix, 2011) and it promotes critical thinking, problem solving as well as develop cognitive skills among students (Krishnan, 2011).

These results are lined with (Utami et al., 2018; Harahap et al., 2019; Mandal, 2019; Vahora, 2020; Aziz et al., 2021; Olatunde-Aiyedun & Adams, 2022 and Mehra, 2023).

Hence, it may be concluded that higher mean gain scores of grade IX secondary school students on science achievement of blended learning group showed that blended learning is better as compared to traditional method of teaching.

- There is no significant interaction effect of treatment (i.e. blended learning and traditional method of teaching) and gender on science achievement of grade IX secondary school students**

The present study has been done to see the interaction of the treatment (i.e. blended learning and traditional method of teaching) and gender on science achievement of grade IX secondary school students. In the analysis, it is found that there is no significant gain in the mean achievement of the boys and girls when either taught by blended learning or by traditional method of teaching.

However, blended learning is better as compared to traditional method of teaching. It is due to reason that blended learning enhances the achievement of students significantly. It develops critical thinking, problem-solving ability among the students.

It is also noticeable that use of blended learning helped the students with Attention Deficit Hyperactivity Disorder

(ADHD) (Gupta, 2020) and enhance the students' interest to learn and motivate them to achieve their goals in education (Demier and Sahin, 2013).

Bonk and Graham (2006) explained blended learning as the convergence of synchronous and asynchronous modes of setting. Synchronous mode of setting is characterised by face-to-face mode of delivery whereas asynchronous mode of setting includes human interaction with information and communication technology (ICT) to work independently.

Interaction effect of the treatment (blended learning and traditional method of teaching) and gender group

Despite of this fact, blended learning is equally effective in case of gender group of grade IX secondary school students as both boys and girls have performed equally well under experimental conditions and these results are consistent with Gambari et al. (2017) and Jibril et al. (2022) reported the non-significance of gender difference in performance of undergraduates students in education technology. Similar studies have been done by Belanger (2018) and it was found that non-significant difference in mean achievement scores of boys and girls in mathematics and AlManafi et al. (2023) has also found that there was no significant interaction effect across gender group.

Thus, it may be concluded that the non-significant gain in mean achievement scores of boys and girls showed that both the groups have performed equally well under the experimental conditions.

Conclusion

1. It may be concluded that there is a significant gain in mean achievement scores of science achievement of grade IX secondary school students, when exposed to blended learning as compared to traditional method of teaching.
2. There is no significant interaction effect of treatment (i.e. blended learning and traditional method of teaching) and gender on science achievement of grade IX secondary school students.

References

- AlManafi, A. O. S., Osman, S. Z. M., Magableh, I. S. I., & Alghatani, R. H. H. (2023). Effect of blended learning on the primary stage EFL students' reading comprehension achievement in Libya. *International Journal of Instruction*, 16(2), 703-718.
- Aziz, M. A. A., Talib, O., Tajularipin, S., & Kamarudin, N. (2021). Effects of blended learning towards students' performance in electrochemistry topic among secondary school students in Malaysia. *International Journal of Academic Research in Progressive Education and Development*, 10(2), 67- 78.
- Bath, D., & Bourke, J. (2010). *Get started with blended learning*. Griffith Institute for Higher Education, Griffith University.
- Belanger, M. P. (2018). *Effects of blended learning and gender on mathematics assessment in elementary fourth and fifth grade students* (Ph.D. thesis). Grand Canyon University, Arizona.
- Bloom, B. S. (1956). *Taxonomy of educational objectives*. Boston: Allyn and Bacon.
- Bloom, B. S. (1968). Learning for mastery. *Evaluation Comment*, 1(2), 1-12.
- Bonk, C., & Graham, C. (2006). *Handbook of blended learning*. USA, Jossey-Bass: Inc.
- Churches, A. (2008). *Bloom's digital taxonomy*. Retrieved from <http://edori.gami.wikispaces.com/file/view/bloom%27s+Digital+taxonomy+v3.01.pdf>.
- Demirer, V., & Sahin, I. (2013). Effect of blended learning environment on transfer of learning: An experimental study. *Journal of Computer Assisted Learning*, 29(6), 518-529.
- Driscoll, M. (2002). *Blended learning: Lets' get beyond the hype*. IBM Global Services. Retrieved from [https://www-07.ibm.com/services/pdf/blende d-learning.pdf](https://www-07.ibm.com/services/pdf/blende%20d-learning.pdf).
- Gambari, A. I., Shittu, A. T., Ogunlade, O. O., & Osunlade, O. R. (2017). Effectiveness of blended learning and e-learning modes of instruction on the performance of undergraduates in Kwara state, Nigeria. *Malaysian Online Journal of Educational Sciences*, 5(1), 25-36.
- Garrett, H. E., & Woodworth, R. S. (2008). *Statistics in psychology and education*. Delhi: Surjeet Publications.
- Garrison, D. R. & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *The Internet and Higher Education*, 7(2), 95-105.
- Graham, C. R. (2006). Blended learning systems: definitions, current trends and future directions. In C. J. Bonk & C. R. Graham (Eds.). *Handbook of blended learning and global perspectives, local designs* (pp. 3-21). San Francisco, CA: Pfeiffer.
- Gupta, R. (2020). *Effect of blended learning strategy on critical thinking and social skills of students with attention deficit hyperactivity disorder* (Ph.D. thesis in Education). Panjab University, Chandigarh.
- Harahap, F., Nasution, N. E. A., & Manurung, B. (2019). The effect of blended learning on student's learning achievement and science process skills in plant tissue culture course. *International Journal of Instruction*, 12(1), 521-538.
- Hoic-Bozic, N., Mornar, V., & Boticki, I. (2009). A blended learning approach to course design and implementation. *IEEE transaction in Education*, 52(1), 19-30.
- Jibril, M., Issa, A. I., Onojah, A. O., Aderele, S. O., & Onojah, A. A. (2022). Effect of blended learning on students' performance in educational technology concept. *Asean Journal of Educational Research and Technology*, 1(1), 59-70.
- Krause, K. (2007). *Blended learning strategy*. Retrieved from www.griffith.edu.au/data/assets/pdf_file/0004/267178/Getting_started_with_blended_learning_guide.pdf.

- Krishnan, D. (2011). *Effect of blended learning on high order thinking and learning science among secondary school students* (Ph.D. thesis in Education). University of Mysore.
- Laurillard, D. (2012). *Teaching as a design science: building pedagogical patterns for learning and technology*. New York and London: Routledge.
- Long, G., Vignare, K., Rappold, R. P., & Mallory, J. (2007). Access to communication for deaf, hard of hearing and ESL students' in blended learning courses. *International Review of Research in Open and Distance Learning*, 8(3), 423-435.
- Makkar, N. (2022). Effect of blended learning on academic achievement in mathematics among IX grade students. *International Journal of Indian Psychology*, 10(2), 1348-1357.
- Mandal, M. (2019). Effect of blended learning strategy for secondary school science students. *International Journal of Research and Analytical Reviews*, 6(1), 381-387.
- Mehra, S. (2023). Impact of blended learning in science learning. *Journal of Emerging Technologies and Innovative Research*, 10(2), 534-540.
- Mehta, S. (2020). *Modern teaching methods- its' time for the change*. Retrieved from <https://eduvoice.in/modern-teaching-methods>.
- Olatunde-Aiyedun, T. G., & Adams, S. O. (2022). Effect of blended learning models on students' academic achievement and retention in science education. *Eurasian Journal of Sciences and Environmental Education*, 2(2), 35-42.
- Powell, A., Watson, J., Staley, P., Patrick, S., Horn, M., Fetzer, L., Hibbard, L., Oglesby, J., & Verma, S. (2015). *Blended learning: The evolution of online and face to face education from 2008-2015*. Promising Practises in Blended and Online learning series. International Association for K-12 online learning: iNACOL.
- Rix, R. W. (2011). Blended learning: Perspectives on mixing online and offline communities of enquiry. *E-Learning and Digital Media*, 8(4), 423-433.
- Saltzberg, S., & Polyson, S. (1995). Distributed learning on the world wide web. *Syllabus*, 9(1)10-12.
- Strauss, V. (2012). Three fears about blended learning. Retrieved from https://www.washingtonpost.com/blogs/answer-sheet/post/three-fears-about-blended-learning/2012/09/22/56af57cc-035d-11e2-91e7-2962c74e7738_blog.html.
- Strobl, J. (2007). Geographic learning. *Geo Connexion International Magazine*, 6(5), 46-47.
- University Grant Commission (UGC). (2021). Blended mode of teaching and learning: concept note. Retrieved from <https://www.ugc.ac.in/pdfnews/6100340-concept-note-blended-mode-of-teaching-and-learning.pdf>.
- Utami, N. P. N. N., Santyasa, I. W., & Suswandi, I. (2018). The influence of blended learning model based on problems of physical learning achievements by students of class x Science in SMA 6 Denpasar Academic Year 2017/2018. *Indonesian Review of Physics*, 1(1), 1-6. doi: <https://doi.org/10.12928/irip-v111.253>.
- Vahora, S. A. (2020). *Effectiveness of blended learning programme on achievement in chemistry at class IX* (Ph.D. thesis in Education). Sardar Patel University, Gujarat.
- William, N. A., Bland, W., & Christie, G. (2008). Improving student achievement and satisfaction by adopting a blended learning approach to inorganic chemistry. *Chemistry Education Research and Practice*, 9, 43-50.

