Library Progress International
Vol.44 No. 3, Jul-Dec 2024: P.1635-1646

Print version ISSN 0970 1052
Online version ISSN 2320 317X

Original Article

Available online at www.bpasjournals.com

Effect of Blended Learning on Academic Achievement of Student Teachers in Bijnor

[1*]Dr. Sunil Kumar Joshi, [2]Dr. Nida Khan

[1]Professor, Dept. of Teacher Education,
Vardhaman College, Bijnor, U P, India
sunil.dr.joshi@gmail.com
[2]Asst. Professor, Dept. of Teacher Education,
Vardhaman College, Bijnor, U P, India
nidashueb@gmail.com

How to cite this article: Sunil Kumar Joshi, Nida Khan, (2024) Effect of Blended Learning on Academic Achievement of Student Teachers in Bijnor, 44(3), 1635-1646

Abstract:
Scientific and technological advancements will be shifting the focus of the learning system from instructors to learners. Scientific advancements have significantly transformed the learning system by introducing innovative technologies and tools that enhance educational experiences. These developments not only make learning more interactive and engaging but also support individualized education tailored to each student's needs. Thus, the purpose of this study is to analyse the impact of blended learning on the academic performance of B.Ed. students. The researchers selected 200 students studying in six different B.Ed. colleges of Bijnor using purposive sampling. According to the study's findings, blended learning is preferred since there are notable distinctions between the instructional approaches in terms of achievement test scores. This suggests that students who experienced blended learning performed better on the achievement test compared to those who did not. Blended learning is a teaching strategy that merges conventional classroom instruction with online learning elements. Usually, it combines online exercises like interactive modules, multimedia presentations, and virtual discussions with traditional classroom Instructions. The combination of these methods allows for flexibility, personalized learning experiences, and increased student engagement. The findings suggest that implementing blended learning in B.Ed. programs can positively impact students' achievement. It may be beneficial for educators and institutions to consider incorporating blended learning approaches into their teaching practices to enhance student outcomes and foster positive attitudes towards learning.

Keywords: Blended Learning, Flipped Learning, Effectiveness and Academic achievement.

INTRODUCTION

The educational system is dynamic and ever changing in nature. It keeps on changing with the requirement of the learner, society, policies of ruling class as well as the contemporary situation. In terms of history of Indian Education system, we can categorize it from Gurukul system to today's era of digital learning. With advancement of time and technology the teaching and learning style of the society demanded further makeover. Student centric teaching and learning styles prevailed over the teacher centric teaching learning styles. Discovery of Computers and Internet in early 90s has brought a complete change in education system.

The educational system is currently evolving from traditional formats to online models, driven by factors such as the Covid-19 pandemic, varying individual needs, and suboptimal pupil-teacher ratios. Thus, to cater the learners' individual needs we are adopting new technologies in education, but due to untrained teachers, lack of infrastructural resources, and proven benefits of face-to-face learning we are not in a state to completely withdraw traditional mode of teaching/education. Also, learners are in dual state of mind, some prefer traditional mode and some give importance to online mode. Therefore, there is a dire need to find a new approach of teaching which

meets the needs and demands of present and futuristic education.
The National Education Policy 2020 (NEP 2020) for the sake of student centricity demand for both ICT enabled and traditional teaching learning methods as well. NEP 2020 highlights the value of a blended learning model that merges online and offline instruction. It advocates that such a hybrid approach can broaden educational access and guarantee that students have access to top-notch educational resources and materials.
The NEP 2020 recommends the utilization of technology-enabled blended instructional approach to provide flexibility in learning and promote personalized and self-paced learning. It suggests that blended learning can also help in addressing the issue of teacher shortage by leveraging technology to enable students to learn from the best teachers in the country. The policy encourages the applications of digital infrastructure to reinforce blended learning, including online and offline content, digital libraries, and e-learning platforms. The policy also highlights the importance of equipping teachers with training to effectively incorporate digital technology into their teaching and learning practices.
Consequently, 'Blended Learning' has emerged as a key component of the Education 4.0 system. While the concept itself is not entirely new, Blended Learning essentially involves integrating digital or online tools with traditional in-person teaching and learning methods.

1.1 Blended Learning

Blended learning is that instructional approach which combines digital and in-person activities to offer students a flexible and personalized educational experience. The definition of "blend" according to the Oxford Dictionary is "mix (a substance) with another substance so that they combine together." Singh and Reed (2001), defines blended learning as an educational approach that incorporates multiple delivery methods to enhance learning outcomes and optimize program delivery costs. Blended learning can be characterized as integrating traditional in-person teaching with online or distance education." This approach integrates various learning theories, methodologies, and techniques within a single framework, while also enhancing classroom instruction by incorporating a variety of online tools. (Rossett,2002; Discroll,2002; Singh, 2003). According to Throne (2003), "the blended learning is an education model which can integrate e-learning which has improved in parallel with new and technologic developments with traditional learning which provides the interaction in classroom". "The concept of blended learning is rooted in the idea that learning is not just a onetime event, but rather, is a continuous process" (Garrison & Kanuka, 2004). "Blending provides various benefits over using any single learning delivery medium alone" (Singh, 2003).
"Blended learning should be viewed as a pedagogical approach that combines the effectiveness and socialization opportunities of the classroom with the technologically enhanced active learning possibilities of the online environment, rather than a ratio of delivery modalities" (Ferdig, Cavanaugh, DiPietro, & Black, 2009).

1.2 Blended Learning Models

There are various models of blended learning, each blending online and offline activities in unique ways. Below are some of the most commonly used models:
Flipped classroom: This instructional method involves students accessing lectures or course materials online prior to attending class. During class time, they then engage in interactive and collaborative activities that build on the online content.
Rotation Model: In this setup, students alternate between conventional classroom teaching and online learning activities. For instance, they might split their time equally between attending in-person classes and engaging in online educational tasks.
Flex approach: With this approach, students can move forward at a pace that suits their individual learning speed and have more control on their learning process. To create a more customizable and individualized learning experience, traditional classroom instruction is blended with online learning activities.
Online Lab Model: Using this approach, students complete the majority of their coursework online but visit a physical space, like a computer lab, for particular tasks that call for practical teaching.
Self-Blend Model: In this approach, students can decide which courses they want to take online and which ones they would like to participate in within a traditional classroom setting.
Enriched Virtual Model: In this approach, students primarily fulfill their coursework through online platforms, but they also visit a physical location, such as a learning centre, regularly to check in with their educators and engage in practical learning exercises.
In general, blended learning models are made to offer flexibility, customization, and a mix of offline and online learning activities to fulfil the various needs of learners. Successful learning is dependent on the model utilized by the teacher based on the nature of the topic and the students' understanding. The teacher was given more freedom to employ any model based on location and rhythm.
The majority of learning in a blended mode takes the shape of group activities, which encourages active

participation and the development of knowledge and skills. Students are inspired to learn in a purposeful learning environment through these educational activities. The traditional in-person interactions and the advanced digital learning platforms are seamlessly integrated throughout all learning activities.

1.3 Review of Related literature

By reviewing relevant literature, the researcher was able to identify existing gaps in the research, clearly define key terms, choose suitable methodologies and analytical techniques, and formulate hypotheses.

Muthuraj and Devaki (2015) studied blended learning impact on science teaching. Data analysis showed a substantial difference in the higher secondary school students' science achievement when blended learning was employed. Hence, the study recommended Blended Learning for Science Subject at Higher Secondary Level.

Nair, T.S. and Bindu, R.L. (2016) explored the impact of a blended learning approach on secondary school students' performance in Biology and their social and environmental attitudes in Kerala. The findings showed that blended learning notably enhanced students' Biology achievements and positively influenced their social and environmental attitudes.

Sreekala (2016) performed a study to assess the effect of a blended learning program on the performance of B.Ed. trainees in Physical Science. The results revealed that the experimental group, which experienced the blended learning method, achieved better outcomes compared to the control group.

Yapici, I Umit (2016). investigated the influence of a blended cooperative learning environment on students' performance and satisfaction in biology through both qualitative and quantitative approaches. The findings demonstrated that students achieved significant academic success and expressed a notable level of satisfaction.

Gámiz, Sánchez and Gallego, Arrufat (2016) Researchers create an extensive framework for assessing blended learning methods in higher education. The findings indicate that students perceive this methodology as promoting independent learning and self-regulation. Furthermore, it provides considerable flexibility regarding time and location, enabling access to resources whenever and wherever needed.

Obari, Hiroyuki and Lambacher, Stephen (2016) The study aimed to determine if a blended learning (BL) environment, which included mobile learning (m-learning), could enhance English language skills among Japanese undergraduates. Analysis of TOEIC scores before and after the training showed that the BL activities positively impacted the students' overall English proficiency.

Ho, VT., Nakamori, Y., Ho, TB. et al (2016) explored the impact of a blended learning method for secondary school teachers (in-service) using a quasi-experimental method of research. The group participating in blended learning demonstrated a substantial degree of comprehension of practical techniques and reported a higher level of overall satisfaction with the course.

Amosa Isiaka Gambari et al. (2017) evaluated the impact of e-learning and blended learning pedagogical techniques on undergraduate students' academic performance in Kwara State, Nigeria. The data analysis showed that the experimental group achieved significantly better results compared to the other groups when using blended learning. Also, no notable difference in performance between male and female undergraduates was observed in the e-learning group and blended learning group. Overall, the findings indicate that blended learning significantly enhances undergraduate performance compared to other instructional modes.

Kintu .et al. (2017) examined the impact of a blended learning environment on learning. Researcher also analyzed students' characteristics that influence learning outcomes. Data analysis revealed that specific aspects of students and certain features are important predictors that enhances student success in blended learning contexts.

Homes & Prieto-Rodriguez (2018) conducted a study that included survey method of research. The data was collected from staff and students using interviews and focus groups discussion. The study focuses on participants' evaluations of the LMS usage mainly accessibility and interactivity. There significant differences were found in student and staff perceptions of online content accessibility. Students valuing more to their LMS learning as comparison to staff.

Monicka, M., and Jayachithra, J. (2018) the research assessed the impact of blended learning in improving teaching competency among student teachers. The results demonstrated a significant enhancement in teaching skills. These findings suggest that blended learning is a more effective instructional technique for developing teaching competency.

Singh et al. (2018) investigated the influence and applications of blended learning in educational psychology. Statistical tests were conducted, and the results indicated a significant positive effect of blended learning on the achievements and attitudes of prospective teachers toward educational psychology.

Harahap, F. et al (2019). The research investigated how a blended learning strategy influenced students' performance and science process skills at Universitas Negeri Medan. The findings demonstrated that the blended learning approach markedly exceeded the conventional teaching method in boosting both students' learning outcomes and their science process skills.

Fazal & Bryant (2019) the research explored whether blended learning could enhance 6th grade students' math achievement more effectively than traditional instruction method of face to face interaction. The findings indicated that blended learning significantly facilitated greater progress in mathematical conceptual learning compared to merely meeting passing expectations.
Habib, H. (2019) evaluated the influence of blended learning on student performance and discovered that students viewed blended learning as highly engaging. The findings support the usage of blended learning methods along with traditional instructional approaches.
Seage & Turegun (2020) explored how traditional instructional methods and blended instructional approach affected STEM achievement in elementary school students. The statistical analysis of the data showed that blended learning significantly improved the overall scores in science, technology, mathematics, and engineering compared to traditional teaching methods.
Çiftçi, B. (2020) the study examined the achievement and retention rates of blended learning as compared to traditional instructional method of face-to -ace instruction in social studies. Findings from persistence tests and statistical analysis indicated that the blended learning method was more impactful in comparison to face-to-face instructional approach.
Thangavel and Anbalagan (2021) conducted a normative survey to determine B.Ed. Teacher Trainees' attitudes on flipped classroom. The current study found that there is a substantial variation in attitudes about flipped classrooms between rural and urban students based on gender, location, and marital status.
Musawi and Ammar (2021) the study aimed to develop three blended learning programs for students in the "Introduction to Educational Technology" course. The findings showed notable difference in post-test academic achievement scores. Thus, experimental groups outperformed as compared to the control groups at 0.05 level of significance. This suggests that employing blended learning techniques with different blending ratios can effectively improve teaching and enhance various learning outcomes, such as comprehension and reasoning.
Budhyani et al. (2022) explored the impact of blended learning. Researcher incorporate both synchronized and unsynchronized components, in order to find effect of blended learning on self-efficacy and performance of students. The results indicated that both types of blended learning settings effectively boost students' self-efficacy and improve their learning achievements.
Yudt et al. (2023) A quasi-experimental research study was used to compare the impact of blended learning versus traditional face-to-face instruction on preservice primary teachers' arithmetic achievement and attitudes. The findings indicated that while participants in the blended learning format showed significantly improved attitudes in the post-test compared to those in the face-to-face instruction. Also there were no notable differences in arithmetic achievement of two selected groups.
Cruz (2024), in his dissertation examined K-5 teachers' perceptions of blended learning in a Central Texas school, identifying barriers like technology challenges, lack of resources, and insufficient training. The study, involving ten educators through a phenomenological approach, emphasized the need for a professional learning framework to address these barriers and improve teacher efficacy. The research highlighted the importance of targeted professional development and provided insights for future prospects and research in blended learning.
Shurygin et al. (2024) the research investigated how blended learning influences science students' performance and self-regulation at Kazan Federal University. Through pre-tests, post-tests, and self-regulation questionnaires, it was revealed that students in the blended learning group achieved better exam results and demonstrated greater self-regulation compared to their peers in the traditional instruction group. The study concluded that blended learning significantly enhances students' self-regulation and provided practical suggestions for improving its efficacy.

1.4. NEED AND SIGNIFICANCE OF THE STUDY

When student teachers examine critically, reflect on, and assess their own learning style, they can accomplish the purpose of teacher education. As a result, maximal learning occurs. To obtain the best learning outcomes, teacher education must be innovative. “The OECD innovation strategy states that teaching quality is especially important for improving educational outcomes” (OECD; 2010c). Thus, incorporating an innovative teaching technique makes quality teaching possible.
Blended learning programs are recognized as a teaching strategy that combines in-person instruction with online learning, leveraging technology to boost educational results. This technological integration transforms the educational system from a teacher-centered to a rich, interactive, student-focused approach.
Technology is incorporated into blended learning programs to improve learning outcomes. These programs combine traditional and online learning environments. A fundamental factor in transforming the educational system from a teacher-oriented approach to an engaging, student-oriented environment is the incorporation of technology into teaching practices.
Integrating technology into conventional classrooms increases student involvement in both pedagogical and

learning activities. In a conventional classroom, instructions are presented in a way that is encouraging and well-structured, fostering profound thoughts among student teachers.

The fundamental purpose of the blended learning program, which offers the most effective and efficient learning, is to actively include pupil teachers in the instructional and learning process. This leads to knowledge acquisition experiences that are constructive and socially encouraged, which is important in blended learning. In order to fulfil the demands of future teachers for the classroom, it is necessary to develop innovative teaching strategies and provide them with the necessary training.

Thus, the study on how blended learning affects student teachers' academic performance at the B.Ed. level is significant for a number of reasons. Understanding blended learning's effectiveness in fostering academic success toward teaching and learning among student teachers is important since it is growing in popularity in institutions that provide teacher education. The study can highlight the strengths and challenges associated with integrating blended learning into teacher education and propose methods to enhance its effectiveness. The insights gained can inform the development of evidence-based strategies for implementing blended instructional strategies in the teacher training institutions, thereby improving the standard of teacher preparation programs. By offering empirical proof of blended learning's efficiency in fostering academic success and constructive attitudes toward learning, the study can contribute to the larger area of educational research. The study can serve to direct future research and development in this field and can also influence policy and decision-making on the usage of blended learning in teacher training colleges. Thus, the study on the effect of blended learning on the academic performance of B.Ed. student teachers has important ramifications for teacher preparation, educational research, and policy-making, and it can help raise the standard of instruction for students in the future.

Research reviews highlight a shortage of studies on blended learning approaches usage in teacher training colleges. Therefore, the goal is to develop and implement a Blended Learning Program and assess its effectiveness for student teachers. The study will concentrate on the learning process and evaluate student teachers' perceptions regarding their social interactions, technological proficiency, and comprehensive satisfaction with the technology enabled program.

2. Statement of the problem

Education is a potent weapon for transforming the world. Integrating technology into education can help to ensure that everyone receives a high-quality education. Innovative teaching tactics are critical in improving the learning system. Learning sessions are made more interactive, motivating, and entertaining by using blended learning tactics. People nowadays do not favor a particular technique of knowledge acquisition. To facilitate the instructional and learning process, both students and teacher educators must use a combination of instructional tactics. As a result, it is vital not only for student teachers to become acquainted with Blended Learning, but also for teacher educators to evaluate the effect of blended learning on the academic success of student teachers, which is why the current study entitled “Effect of Blended Learning on Academic Achievement of Student Teachers at B.Ed. Level” is being conducted.

2.1 Objectives of the Study

The current study was to examine the effect of blended learning on academic achievement of B.Ed. student teachers. To achieve this, the study established the following objectives:

1) To find the effect of blended learning on academic achievement of student teachers at B. Ed. Level.
2) To find the effect of Blended learning on academic achievement of Student teachers at B.Ed. Level with respect to gender.
3) To find the effect of Blended learning on academic achievement of Student teachers at B.Ed. Level with respect to socioeconomic status.

2.2 Hypotheses

In accordance with the above-mentioned objectives following hypotheses have been stated for the present study:

1. H0: There is no significant effect of blended learning on the academic achievement of student teachers at the B.Ed. level.
2. H0: There is no significant effect of blended learning on the academic achievement of male and female student teachers at the B.Ed. level.
3. H0: There is no significant effect of blended learning on the academic achievement of student teachers at the B.Ed. level with respect to socioeconomic status.

2.3. Methodology

The study will utilize an experimental approach to evaluate the effect of blended learning on academic accomplishment of B.Ed. student teachers. It will adopt a quasi experimental research design with a pre-test and post-test non-equivalent groups setup. “This design is frequently used in educational research when working with

naturally occurring groups, such as intact classes, which are assumed to be similar" (Best & Kahn,2006). The researcher was unable to randomly assign colleges because the control group should be deprived of the online learning platform accessibility. Otherwise, it may contribute to contamination effect and in turn affect experimental validity. As outlined, the study used a pre-test post-test non-equivalent groups design. Both the experimental and control groups took pre-tests to measure their academic achievement. The experimental group was then taught by using a blended learning approach, while the control group continued with traditional teaching methods provided by the regular instructor. After the instructional period, both groups completed post-tests.

2.4 Population and Sampling

All of the Bijnor first-year B.Ed. student teachers made up the study's population. The undergraduate and graduate institutions offering B.Ed. programs were chosen using a purposive sample technique. For the purpose of the study, 297 student teachers from six B.Ed. colleges in the Bijnor district were selected.

2.5. Tools for the Study

The achievement test will be prepared by the investigators on the selected topics. In the present investigation the sample constitute student teachers of B.Ed. I year, hence an achievement test on 'Teaching as a Complex Activity' i.e., Unit V of Paper 3: Learning and Teaching, which is a part of syllabus of B.Ed. I year implemented by M J P Rohilkhand University, Bareilly with effect from 2015-16 on all of their affiliated colleges running B.Ed. course was constructed and validated by the investigator to evaluate the achievement of student teachers on the abovementioned topic. The test was constructed for five topics of "Teaching as a Complex Activity" such as

- *Concept of Teaching*
- *Phases of Teaching*
- *Levels of Teaching*
- *Basic teaching skills and competencies*
- *Professional ethics and code of conduct for teachers.*

The investigator selected 75 objective type questions out of 100 items based on item analysis. The blue print of the objective type questions consists of knowledge, understanding and application.

2.6 Statistical technique Used

The collected data will be analyzed through various statistical methods, including the calculation of percentages, means, standard deviations, t-tests, and analysis of covariance (ANCOVA).

3. Analysis and Interpretation of the data

To evaluate the effect of blended learning on B.Ed. student teachers' academic achievement, the study systematically analyzes, interprets, and discusses the scores from pre-achievement and post-achievement tests for both the control and experimental groups.

3.1 The effect of blended learning on B.Ed. student teachers' academic achievement

Descriptive statistics

Table 1. Descriptive statistics of academic achievement of control and experimental group

Group	Test	N	M	S D	Min.	Max.	Skewness	Kurtosis
Control Group	Pre-Test	149	27.85	10.48	4	54	0.01	-0.399
	Post-Test	149	35.48	9.87	15	58	0.128	-0.81
Experimental Group	Pre-Test	148	30.58	8.78	11	53	0.44	0.098
	Post-Test	148	47.45	7.84	32	70	0.29	-0.31

Pre-test mean for the experimental group was higher (30.58) than that of the control group (27.85). Experimental groups post-test mean increased more than the control groups (35.48) did, indicating that the intervention or therapy given to the experimental group was successful. The experimental groups post-test results show a lower standard deviation, which suggests that participant performance was less variable and more consistent following the intervention.

The academic achievement of the experimental group was higher than that of the control group. Thus, academic success appears to have been positively and significantly impacted by the intervention, according to the descriptive statistics.

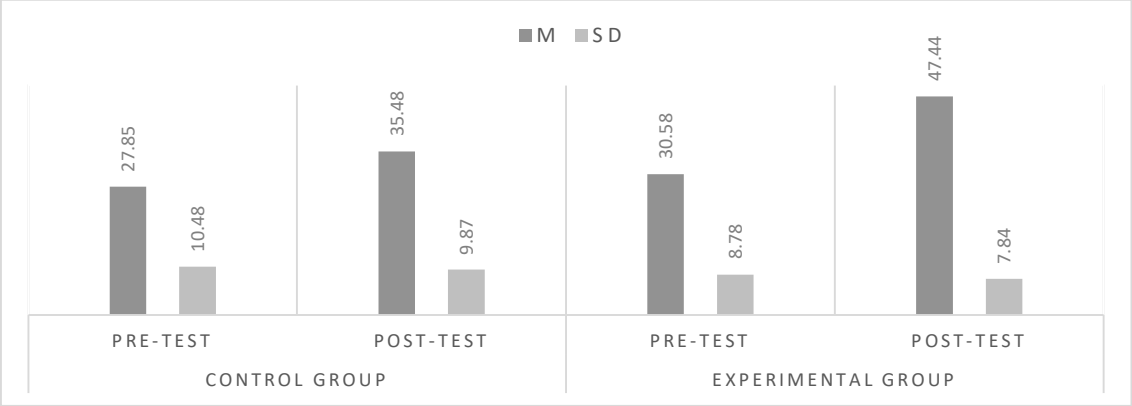

Fig. 1: Chart showing mean and standard deviation of experimental and control group in pre and post Test

Inferential Statistics

The inferential statistics help us to assess the divergence between pre-test and post-test statistical scores for each group and compare these gains statistically to assess the intervention's impact. The analysis of covariance has been applied to test first null hypothesis of this study.

H0: There is no significant effect of blended learning on the academic achievement of student teachers at the B.Ed. level.

Table 2. ANCOVA Summary of post test scores

Source	SS	df	MS	F	P
Adjusted Mean	7030.44	1	7030.44	315.00	2.076
Adjusted Error	6561.69	294	22.32		
Adjusted Total	13592.13	295			

Significant Difference: After correcting the covariate scores (pre-test scores), the ANCOVA findings show a notable difference in the dependent variable (post-test scores) between the control and experimental groups. The experimental group's post-test results were notably affected by the intervention i.e. Blended learning strategy, as seen by the very large F-value (315.00) and the extremely small p-value (2.076).

Effect Size: A large amount of the variance in the dependent variable is attributable to the independent variable, according to the significant sum of squares for the adjusted means (7030.44) compared to the adjusted error (6561.69), revealing a strong influence of the intervention. The findings support the hypothesis that the experimental group's academic performance significantly improved as a result of the intervention when compared to the control group.

Overall, the data supports the conclusion that the intervention significantly boosted the academic performance of the experimental group, thereby validating the effectiveness of the blended learning model for B.Ed. students. As a result, the null hypothesis, which states that blended learning has no discernible impact on B.Ed. student teachers' academic achievement, is rejected. The findings indicate that when compared to the control group, which received education through traditional techniques, the experimental group, which received instruction via blended learning, showed statistically significant improvements in academic performance.

3.2 *The effect of blended learning on academic achievement of male and female student teachers at B. Ed. Level*

Table 3. Distribution of student teachers according to their Gender

	Female	Male	Total
Control Group	115	34	149
Experimental Group	111	37	148
Total	226	71	297

Descriptive Statistics

Table 4. Descriptive Statistics for Academic Achievement Scores of Male and Female Student Teachers

Group	Gender	Test	N	M	S D	Min.	Max.	Skewness	Kurtosis
Control Group	Male	Pre-Test	34	22.85	9.58	6	47	0.478	0.186
		Post-Test	34	32.41	9.24	15	52	0.398	-0.371
	Female	Pre-Test	115	29.33	10.31	4	54	-0.13	-0.24
		Post-Test	115	36.39	9.90	15	58	0.04	-0.83
Experimental Group	Male	Pre-Test	37	29.3	7.72	16	50	0.20	-0.03
		Post-Test	37	46.9	7.69	32	62	0.033	-0.73
	Female	Pre-Test	111	31	9.1	11	53	0.45	0.03
		Post-Test	111	47.6	7.9	32	70	0.36	-0.197

The intervention emerges to have had a more substantial impact on the experimental group, as evidenced by the larger increase in post-test scores. The control group also showed improvement, but to a lesser extent, indicating that factors other than the intervention may have contributed to the score increases. The reduced variability in post-test scores of the experimental group suggests that intervention had a consistent effect across participants.

Inferential Statistics:

Table 5. ANCOVA Summary

Source	SS	df	MS	F	P
adjusted Group (A)	6992.5	1	6992.5	313.28	<.0001
adjusted Gender (B)	73.2	1	73.2	3.28	0.0712
adjusted Group x Gender (AxB)	-29.64	1	-29.64	-1.33	NaN
adjusted error	6517.6	292	22.32		

Group Effect (adjusted A): The F-value (313.28) with a p-value of <.0001 indicates a highly notable difference between control group and experimental group. This means, groups significantly differ in their dependent variable scores after adjusting for covariates.

Condition Effect (adjusted B): The F-value (3.28) with a p-value of 0.0712 suggests that the difference between female and male student teachers is not statistically significant at the 0.05 level, but it is marginal.

Interaction Effect (adjusted AxB): The negative F-value (-1.33) indicates an invalid result for the interaction effect, as shown by the NaN p-value.

The analysis reveals a significant group effect, showing that control group and experimental group differ significantly in their dependent variable scores when accounting for covariates. The condition effect is marginally significant, suggesting a potential but not conclusive difference between female and male student teachers. The interaction effect is not statistically significant which indicates that interaction between group does not significantly affect the dependent variable. The homogeneity of regression slopes has been satisfied, which supports the validity of the ANCOVA findings.

Although blended learning has a significant impact on the academic achievement of student teachers at B.Ed. level but gender-wise academic achievement gained separately by male and female student teachers did not differ significantly. Hence, Null Hypothesis 'There is no significant effect of blended learning on the academic achievement of male and female student teachers at the B.Ed. level' is accepted.

3.3 *The effect of blended learning on academic achievement of student teachers at B. Ed. level with respect to socio-economic status*

In order to evaluate the effect of blended learning on academic achievement of student teachers at B.Ed. level with respect to socio-economic status, the student teachers have been classified in two categories of socio-economic status: Low and High socio-economic status (SES). Student teachers who are eligible and have applied for scholarship were considered as of low SES and others were considered as of High SES.
The analysis of pre- and post-achievement test results for student teachers from both Low SES and High SES backgrounds, across both the experimental group (receiving blended learning) and the control group (receiving traditional instruction), has been conducted. This examination seeks to evaluate the impact of blended learning on the academic performance of student teachers pursuing a B.Ed. degree.

Table 6. Distribution of student teachers according to their SES

Groups	**Low SES**	**High SES**	**Total**
Control Group	74	75	149
Experimental Group	95	53	148
Total	169	128	297

Descriptive Statistics:
Table 7. Descriptive Statistics for Academic Achievement Scores of Student Teachers of Low and High SES

Group	SES	Test	N	M	S D	Min.	Max.	Skewness	Kurtosis
Control Group	Low	Pre-Test	74	24.19	9.052	6	44	-0.227	-0.676
		Post-Test	74	32.38	7.99	15	49	-0.099	-0.834
	High	Pre-Test	75	31.47	10.59	4	54	-0.122	-0.762
		Post-Test	75	38.55	10.61	15	58	-0.133	-1.102
Experimental Group	Low	Pre-Test	95	27.67	7.85	11	52	0.515	0.315
		Post-Test	95	45.24	7.36	32	65	0.046	-0.0
	High	Pre-Test	53	35.79	7.96	20	53	0.574	0.02
		Post-Test	53	51.39	7.14	35	70	0.188	-0.086

Control Group: Both Low and High SES groups show improvements from pre-test to post-test, but the changes are less pronounced compared to the Experimental Group.
Experimental Group: Significant improvements in both SES groups, with higher mean scores and more normal distributions post-test, indicating effective intervention.
The experimental treatment seems to be highly effective, particularly for the Low SES group, which showed the largest improvement. The distribution of scores in the experimental group also became more symmetrical and normal, suggesting a more consistent improvement across participants.
Inferential Statistics:

Table 8. ANCOVA Summary

Source	**SS**	**df**	**MS**	**F**	**P**
Adjusted A	7017.92	1	7017.92	312.78	<.0001
Adjusted B	103.52	1	103.52	4.61	0.0326
Adjusted AxB	-133.22	1	-133.22	-5.94	NaN
Adjusted Error	6551.74	292	22.44		

Adjusted A (Main Effect of Treatment): The significant F-value (312.78) and very low p-value (<.0001) indicate a strong effect of the treatment on the dependent variable.
Adjusted B (Main Effect of SES): The p-value (0.0326) indicates a statistically significant difference in the dependent variable across SES categories, though the effect size may be smaller compared to the treatment effect.
Adjusted AxB (Interaction Effect): The interaction effect between A and B is not significant (p = NaN). This means that the effect of one factor (A or B) on the observed means does not depend on the level of the other factor.
Adjusted Error: Represents the residual variability not explained by the model.
The results suggest that the experimental treatment significantly impacted the dependent variable i.e. Academic achievement, even after controlling for SES. There are also notable differences between the SES groups, but the interaction between SES (A) and SES (B) is not significant, thus concluding the effect of group on observed means is the same for both low and high SES groups. The homogeneity of regression slopes assumption appears to be met, allowing for a valid interpretation of the ANCOVA results.
So, from the above analysis and interpretation it is concluded that blended learning has a substantial effect on the academic achievement of student teachers at B.Ed. level with respect to their socio-economic status. Hence, null hypothesis 'There is no significant effect of blended learning on the academic achievement of student teachers at the B.Ed. level with respect to socio-economic status' is rejected.

4. Conclusion and Future Education

The research indicates that blended learning has emerged as future oriented teaching approach in teacher education by showing that it can raise student teachers' academic achievement. By accommodating a range of learning requirements and preferences, blended learning makes learning more flexible and individualized. Students may become more motivated and engaged using this approach. The advantages of blended approach highlight the necessity of professional development initiatives to equip teachers with the necessary skills for successfull implementation of blended learning tactics. To fulfil the changing needs of 21st century education, educational institutions should think about incorporating blended learning into their curricula, particularly in teacher education programs. Lastly, the findings can inform educational policymakers to include blended learning as a standard practice in curriculum framework and teaching learning process.
The study's results reveal that a blended learning approach can enhance the effectiveness of teacher education programs. Students involved in blended learning gain access to more information through technology, but it's important to note that internet tools cannot fully replace the role of teachers and the relationships they foster during the teaching process. Active engagement and communication are crucial for effective learning.
Initially, teachers provide essential support through face-to-face interactions and supervision. Additionally, students receive increased guidance throughout their training. This indicates that blended learning programs should promote collaboration, helping students learn how to conduct instruction in a cooperative environment with both educators and peers. The goal is to develop key teaching skills, which require cognitive effort rather than just relying on well-designed online resources.
Moreover, research suggests that blended learning initiatives are most effective when grounded in a solid pedagogical framework. A blended learning approach that integrates live online instruction, self-paced study, and in-person classroom sessions can potentially enhance student achievement in teacher education programs. Therefore, such programs should aim to provide student teachers with opportunities to refine both their foundational cognitive concepts and practical skills.

Acknowledgement: we would like to extend our heartfelt gratitude to the Government of Uttar Pradesh, India for the financial support provided to our project entitled 'Effect of Blended Learning on Academic Achievement and Attitude of Student Teachers at B.Ed. Level' under the Research and Development (R&D) program 2021- 22. This review paper is a part of the above-mentioned Project.

References

Çiftçi, B. (2020).The Effect of Blended Learning on Academic Achievement and Attitudes at Social Studies Courses. Center for Open Access in Science https://www.centerprode.com/ojer.html *Open Journal for Educational Research*, 2020, 4(2), 143-150.

Cruz, E. (2024). Examining the Perceptions, Attitudes, and Beliefs of Elementary School Educators on the Use of Blended Learning in the Classroom. In *ProQuest LLC*. ProQuest LLC.

Driscoll M., *Blended Learning: Let's Get Beyond the Hype*, 2002 Available at http://www-07.ibm.com/services/pdf/blended_learning.pdf (accessed on 5 July 2010) Google Scholar Google Preview WorldCat COPAC

Fazal, M., & Bryant, M. (2019). Blended learning in Middle School Math: The Question of Effectiveness.

Journal of Online Learning Research. 5(1), 49-64
Ferdig, R. E., Cavanaugh, C., DiPietro, M., Black, E. W., & Dawson, K. (2009). Virtual schooling standards and best practices for teacher education. Journal of Technology and Teacher Education, 17(4), 479-503.
Gambari, Amosa & Shittu, Tajudeen & Ogunlade, Oyeronke & Osunlade, Olurotimi. (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. Volume 5.
Gámiz Sánchez, V., & Gallego Arrufat, M. J. (2016). Modelo de análisis de metodologías didácticas semipresenciales en Educación Superior [Model for analysing blended learning in higher education]. Educación XXI, 19(1), 39–61.doi: 10.5944/educXX1.13946
Graham C.R. (2006). Blended learning systems: Definition, current trends, and future directions. The Handbook of Blended Learning Global Perspectives, Local Designs. . (Ed: Bonk, C.J. & Graham, C.R.). Pfeiffer. San Francisco
Habib, Hadiya. (2019). Effect of Blended Learning on Student Achievement. *Research Guru*. 12(3). 370-373.
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.
Holmes, K., Prieto - Rodriguez, E. (2018). Student and Staff Perceptions of a Learning Management System for Blended Learning in Teacher Education. *Australian Journal of Teacher Education*, *43*(3), 21–34. https://doi.org/10.14221/ajte.2018v43n3.2
Ho, V.-T., Nakamori, Y., Ho, T.-B., & Lim, C. P. (2016). Blended learning model on hands-on approach for in-service secondary school teachers: Combination of E-learning and face-to-face discussion. *Education and Information Technologies*, *21*(1), 185–208. https://doi.org/10.1007/s10639-014-9315-y
Josephine, M & Sreekala, E. (2016). Effectiveness of a Blended Learning Programme on Academ Achievement in Teaching of Physical Science among Student Teachers of Puducherry. Doctoral Thesis. SOE, Puducherry.
Kanuka, Heather & Garrison, D.. (2004). Cognitive presence in online learning. J Comput High Educ. 15. 21-39. 10.1007/BF02940928.
Kintu, M. J., Zhu, C., & Kagambe, E. (2017). Blended learning effectiveness: the relationship between student characteristics, design features and outcomes. International Journal of Educational Technology in Higher Education, 14(1), 7.
Mertens, M.D. (1998). Research Methods in Education and Psychology: Integrating Diversity with Quantitative and Qualitative Approaches. CA: Sage Publications.
Monicka, M., & Jayachithra, J. (2018). Blended learning effectiveness Pre-service teacher competency. *International Journal of Creative Research Thoughts*, *6*(1), 1223-1226.
Musawi, A. S. A. & Ammar, M. E. (2021). The Effect of Different Blending Levels of Traditional and E-Learning Delivery on Academic Achievement and Students' Attitudes towards Blended Learning at Sultan Qaboos University. *The Turkish Online Journal of Educational Technology*, *20*(2).
Nair, T S and Bindu, R L. (2016). Effect of Blended Learning Strategy on Achievement in Biology and Social and Environmental Attitude of Students at Secondary Level. *i-manager's Journal on School Educational Technology*,11(4), 39-52.
Obari, Hiroyuki; Lambacher, Stephen (2016). Impact of a Blended Environment with m-Learning of EFL Skills, Research-publishing.net, Paper presented at the 2014 EUROCALL Conference (Groningen, The Netherlands, Aug 20-23, 2014)
Rossett, A. (2002). The ASTD e-learning handbook. New York: McGraw-Hill
Singh, H. (2003). Building effective blended learning programs. November – December 2003 Issue of Educational Technology, 43(6), 51– 54.
Seage, S.J., & Türegün, M. (2020). The effects of blended learning on STEM achievement of elementary school students. International Journal of Research in Education and Science (IJRES), 6(1), 133-140.
Shurygin, V., Abdullayev, I., Hajiyev, H., Yakutina, M., Kozachek, A., & Zakieva, R. (2024). Blended Learning: The Effect on Students' Self-Regulation and Academic Achievements. *Novitas-ROYAL (Research on Youth and Language)*, *18*(1), 137–154.
Singh, H., & Reed, C. (2001). A white paper: Achieving success with blended learning. Centr software, 1, 1-11. Retrieved from http://www.leerbeleving. nl/wbts/wbt2014/blend-ce.pdf

Singh, V., Gupta, R., & Kumari, P. (2018). effect of blended learning on achievement and attitude of prospective teachers towards educational psychology. 6, 72–80.

Sreekala, E (2016). Effectiveness of Blended Learning Programme on Academic Achievement of

Student Teachers (April 30, 2016). Available at SSRN: https://ssrn.com/abstract=2772968

Thangavel, A, & Anbalagan, S. (2021). Attitude towards flipped classroom among b.ed. teacher trainees. *PalArch's Journal of Archaeology of Egypt/ Egyptology*, *1567-214X*, 3927.

Throne, K. (2003). Blended learning: How to integrate online and traditional learning. Kogan Page Limited, Britain.

Yapici, İ. Ü. (2016). Effectiveness of Blended Cooperative Learning Environment in Biology Teaching: Classroom Community Sense, Academic Achievement and Satisfaction. *Journal of Education and Training Studies*, *4*(4), Article 4. https://doi.org/10.11114/jets.v4i4.1372

Yudt, K., Sawyer, B., & Shera, S. (2023). Preservice elementary teachers' mathematical achievement and attitudes: A study of blended learning. *Journal of Mathematics Teacher Education*. https://doi.org/10.1007/s10857-022-09565-0