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A Review of Blended Learning Effectiveness in Teacher Education: Insights from M.Ed. Students in Bihar and Jharkhand

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Abstract: ***Blended Learning (BL) integrates traditional face-to-face instruction with digital methodologies, offering flexibility, accessibility, and enhanced learning outcomes. This study examines the effectiveness of BL among Master of Education (M.Ed.) students in Bihar and Jharkhand, focusing on key factors such as learner characteristics, instructional design, technological infrastructure, and socio-economic conditions. A quantitative approach, including surveys and interviews, was used to assess students' attitudes, perceptions, and challenges in BL environments. Findings indicate that while students in Bihar and Jharkhand generally perceive BL positively, digital literacy gaps, internet accessibility issues, and institutional limitations hinder its full potential. Addressing these barriers through improved infrastructure, faculty training, and policy interventions can enhance BL effectiveness in these states. The study underscores the need for targeted strategies to bridge the digital divide and ensure equitable access to quality education. Future research should explore longitudinal studies and regional disparities to develop sustainable BL models for teacher education programs in Bihar and Jharkhand.***

Keywords: Blended Learning, Teacher Education, Digital Infrastructure, Bihar and Jharkhand, Learning Outcomes

I. INTRODUCTION

Blended Learning (BL) has emerged as a crucial pedagogical approach that integrates traditional face-to-face instruction with digital learning methodologies to enhance the flexibility, accessibility, and effectiveness of education [1]. Blended learning is a combination of conventional in-person classroom instruction with online educational activities. This form of learning is gaining popularity in several prestigious colleges globally for enhancing educational standards, elevating test pass rates, providing temporal flexibility, and eliminating geographical constraints [2].The integration of technology into in-person instruction has garnered significant interest and has opened several research opportunities throughout the years. Currently, blended learning is regarded as the most efficient and prevalent instructional method utilized by educational institutions, owing to its perceived efficacy in delivering flexible, timely, and continual learning opportunities. Blended learning encompasses the integration of in-person and technology-facilitated training [3]. The integration of information and communication technology (ICT) into educational settings has significantly influenced the learning experiences of students, particularly in higher education shown in Figure 1 [3]. As institutions worldwide transition to hybrid learning models, teacher education programs have also started incorporating BL strategies to better equip future educators with the skills necessary for a digitally evolving classroom environment [4].

In India, the shift toward BL has been accelerated by increasing internet penetration, advancements in digital infrastructure, and the necessity of remote learning during the COVID-19 pandemic [5]. However, students' acceptance and engagement with BL are influenced by various factors, including digital literacy, institutional support, socio-economic conditions, and regional disparities in access to technology [6], [7]. Understanding these factors is essential for improving BL implementation in teacher education programs, particularly for Master of Education (M.Ed.) students who are expected to integrate technology into their future teaching practices.However, blended learning effectiveness may be dependent on many other factors and among them student characteristics, design features and learning outcomes. Research shows that the failure of learners to continue their online education in some cases has been due to family support or increased workload leading to learner dropout (Park & Choi, 2009) as well as little time for study.

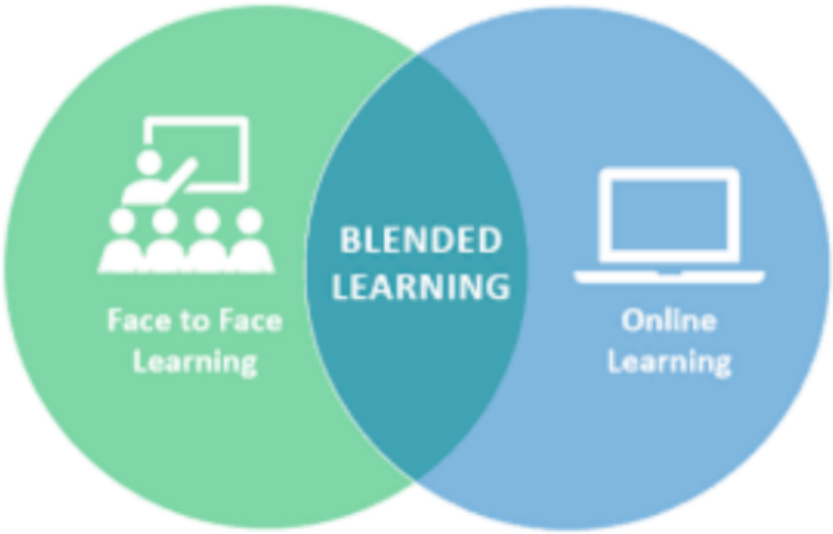

Figure 1. Blended Learning [4]

The previous authors reported the learner characteristics/background and blended learning design features play a part in blended learning effectiveness and some of them are significant predictors of effectiveness. The conceptual model for our study is depicted as follows (Figure 2):

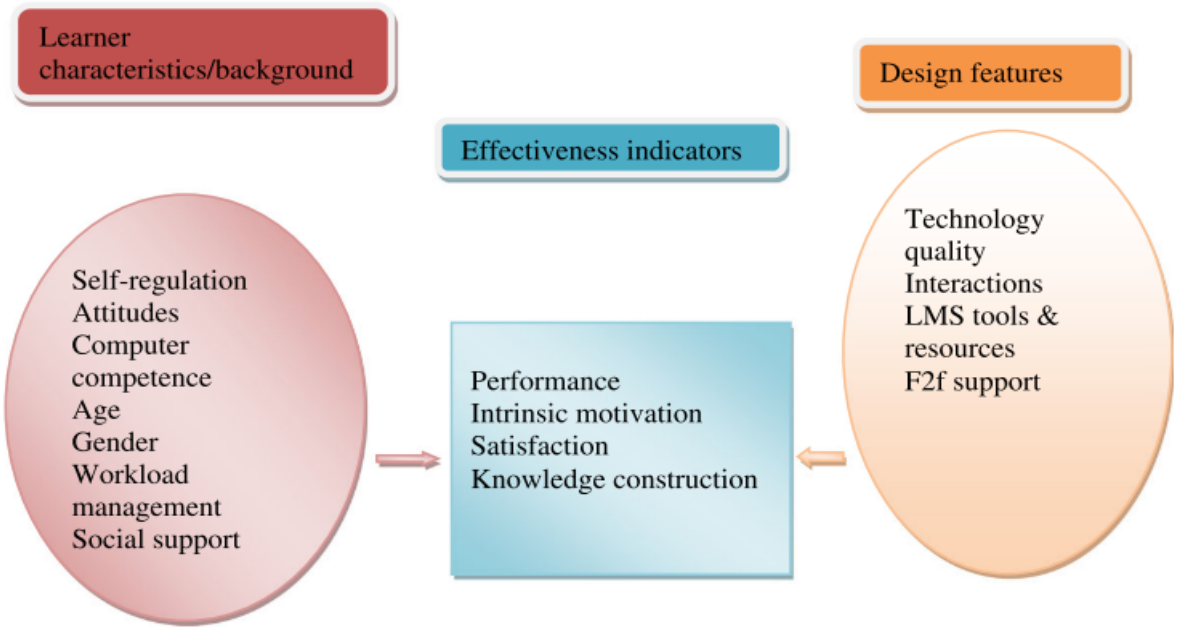

Figure 2. Conceptual model of the current study[5]

While several studies have investigated the impact of demographic factors such as age, gender, and prior experience on BL effectiveness, limited research has explored how social and background aspects influence students' engagement and success in BL environments. Additionally, most existing studies focus on urban and well-equipped educational institutions, with little attention given to regional disparities in access to technology and digital resources.

Bihar and Jharkhand, two states in eastern India, present a unique case for examining the effectiveness of BL among M.Ed. students. The capital cities of these states, Patna and Ranchi, are major educational hubs but differ in terms of digital infrastructure, institutional resources, and socio-economic conditions.

Despite the growing adoption of BL in these regions, there is a lack of comparative research analyzing how students' attitudes, perceptions, and socio-cultural backgrounds influence their engagement with BL.

The present study aims to examine the effectiveness of the blended learning approach by considering key factors such as learner characteristics, blended learning design elements, and learning outcomes. These aspects are explored as significant predictors of the overall effectiveness of blended learning.

II. LITERATURE REVIEW

Initially, we conducted a search in the Web of Science (WoS) electronic database in early December 2018. We selected WoS because it serves as a gateway to all journals indexed in the Social Science Citation Index (SSCI) and the Science Citation Index (SCI). To formulate our search string, we leveraged our expertise in the blended learning domain and consulted relevant literature on the topic. A comprehensive literature review has been conducted on online and blended learning approaches implemented globally. This study includes a country-specific analysis of the adoption of blended learning practices. Various implementation strategies, key observations, and challenges associated with blended learning are examined in detail.

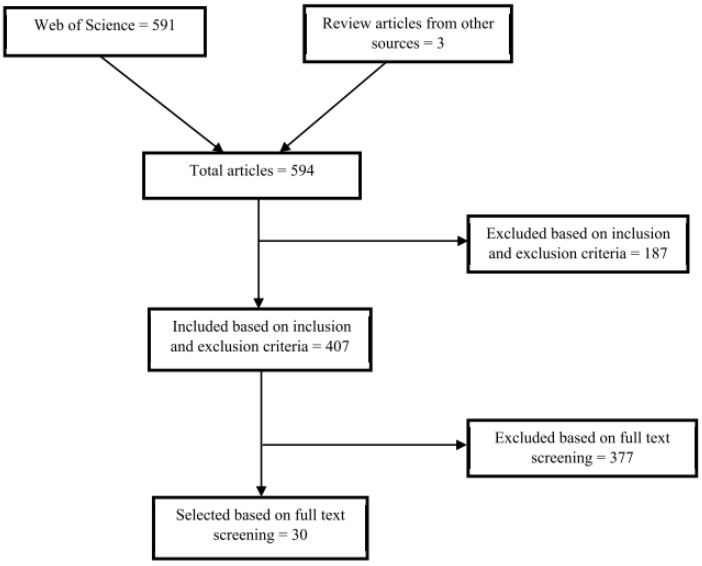

Figure 3. Different sources and article

A. *Concept of Blended Learning*

Blended learning is a pedagogical model that strategically combines face-to-face interactions with online learning activities to improve student engagement and outcomes. The model provides learners with greater flexibility and opportunities for personalized learning experiences.

It has been observed that blended learning is helpful for multiple disciplines. For example, blended learning can be integrated with mobile platforms for engineering and medical disciplines [8]. Like- wise, it is helpful for nursing, engineering, primary school level education, and law courses as well [9, 10]. Further, table 1 gives a comparative analysis of e-learning tools that can be used for blended learning practices. In this table, 16 features are identified to perform a comparative analysis. All of these features are associated with online and blended learning practices that were adopted in recent years. In past, various surveys have been prepared to identify the importance of Blended learning practices in various disciplines. Some of these surveys and their important findings are briefly described as follows.

Barbour et al. [9] surveyed Blended learning policies and procedures followed in different geographical regions. This is a detailed statistical survey over Online and Blended learning for K-12 schools around the world. It has been observed that lack of government policies and clarity in goals over online learning practices are major hindrances in adopting such learning practices. This survey has prepared in-depth parameters that are the major hurdles in implementing Online and Blended learning programs in different regions. Further, a detailed country-wise profile for learning programs is prepared. This profile provides information about private and publication partners, funding sources, challenges, current status, student information, teachers' training programs, and other summarised information over Online and Blended learning programs.

[11] various e-learning studies and practices are explained and examined. These studies explain the online and blended learning practices starting from student and faculty registration to degree certification generation. As compared to traditional learning practices, online and blended learning practices provide more flexibility, content-specific learning, and student-centric learning platforms.

B. Key Factors Influencing Blended Learning Effectiveness

The effectiveness of BL depends on multiple factors, including learner characteristics, instructional design, and technological support. Table 1 summarizes key factors influencing BL effectiveness:

Table 1. Key Factors Influencing Blended Learning Effectiveness

Factors	Description
Learner Characteristics	Includes age, gender, digital literacy, and learning styles [12,13,14].
Instructional Design	The structure of the course, clarity of instructions, and pedagogical approaches used [15,16,17,18].
Technological Support	Availability of reliable internet, learning management systems, and institutional support [19,20,21,22,23].
Socio-Economic Factors	Family background, financial constraints, and accessibility to resources [24,25,26,27,28,29].

C. Comparative Studies on Blended Learning

Previous comparative studies on blended learning have focused on urban and rural differences, gender-based learning outcomes, and technological accessibility. However, studies focusing on regional disparities in India, particularly in Bihar and Jharkhand, remain scarce. Table 2 shows the comparative analysis of traditional, online, and blended learning practices. The comparative analysis shows that all types of learning have their importance, advantages, and disadvantages. For example, online and blended learning practices are found to be useful for learners during pandemic times. However, face-to-face interactions give more benefits to a teacher or subject expert in handling/controlling the class.

Table 2. Comparative analysis of learning approaches.

Component	Traditional Learning	Online Learning	Blended Learning
Classroom	Face to face	Online	A balance between Face to face and online [30,31]
Location for Classroom	Physical presence in the classroom is mandatory	Anywhere (Flexible)	Anywhere (Flexible) [32,33]
Laboratory Experimentation	Face to face	Online	A balance between Face to face and online [34, 35]
Study Material Distribution	Individual Subject Teacher	Individual Subject Teacher Group Subject Teacher	Individual Subject Teacher Group Subject Teacher [36]
Method of Study Material Distribution	Hard Copy, Soft Copy Copy	Soft Copy	Hard Copy, Soft Copy [37]

Online Support	None	Quiz/Assignment submission, lecture delivery, group discussions, Exam conduction, automated and manual answer sheet evaluations and marking	Quiz/Assignment submission, lecture delivery, group discussions, Exam conduction, automated and manual answer sheet evaluations and marking [38]
Use of online Technology and Tools	Not Mandatory	Mandatory	Mandatory
Interactivity with Students	Fully interactive sessions	Partially Interactive	Flexibility to choose fully interactive (using face-to-face interactions) or partial interactive (online) based on contents to be covered. [39,40]

III. RESEARCH METHODOLOGY

The study utilizes a quantitative approach, relying on surveys to assess the attitudes and perceptions of M.Ed. students toward blended learning.

Survey Questionnaires: To assess students' attitudes, perceptions, and challenges faced in BL environments. A structured questionnaire was developed to assess students' attitudes and perceptions toward blended learning. The instrument comprises four sections:

1) Section 1: Demographic Information

This section captures essential demographic details such as age, gender, institution name, and state of study (Bihar/Jharkhand). It also includes information on students' prior experience with blended learning, access to technology, and internet connectivity. These factors provide a contextual background for understanding variations in students' responses.

2) Section 2: Attitude Scale

A 30-item Likert scale (ranging from 1 = Strongly Disagree to 5 = Strongly Agree) was employed to measure students' attitudes toward blended learning. The scale was divided into four subcategories:

- *Positive Attitude Towards Blended Learning:* Items in this category evaluated students' enthusiasm, engagement, and perceived benefits of blended learning.
- *Negative Attitude Towards Blended Learning:* These items assessed students' concerns, anxieties, and perceived difficulties associated with blended learning.
- *Attitude Towards Teachers' Role in Blended Learning:* This section explored students' perceptions of instructors' effectiveness in facilitating blended learning environments.
- *Attitude Towards Learning Outcomes:* This component analysed students' beliefs about the impact of blended learning on their academic performance, research skills, and overall development.

3) Section 3: Perception Scale

A separate 30-item Likert scale was utilized to evaluate students' perceptions of blended learning, categorized into four dimensions:

- Perceived Effectiveness of Blended Learning: This section measured students' understanding of how blended learning enhances their conceptual clarity, critical thinking, and academic performance.
- Perceived Flexibility and Convenience: Items in this category examined the flexibility of blended learning in terms of time management, accessibility of learning materials, and self-paced learning benefits.
- Perceived Technological and Resource Support: This aspect analyzed students' satisfaction with digital platforms, learning resources, and institutional infrastructure supporting blended learning.
- Perceived Challenges in Blended Learning: The final category addressed technological barriers, internet connectivity issues, and students' struggles with adapting to online learning environments.

4) Section 4: Open-Ended Questions

To gain qualitative insights, students were asked three open-ended questions:

What are the major benefits you experience with blended learning?

What challenges do you face with blended learning?

What improvements would you suggest to enhance blended learning?

The responses to these questions provided deeper contextual understanding, highlighting students' personal experiences, specific concerns, and recommendations for improving the blended learning framework

Interviews: Conducted with faculty and students to gain deeper insights into the factors influencing BL effectiveness.

IV. CONCLUSION

This study highlights the significance of Blended Learning (BL) as an effective pedagogical approach for M.Ed. students in Bihar and Jharkhand. The findings indicate that while BL offers flexibility, accessibility, and improved engagement, its effectiveness is influenced by multiple factors, including learner characteristics, instructional design, technological infrastructure, and socio-economic conditions. Students generally perceive BL positively, acknowledging its benefits in enhancing conceptual clarity and learning flexibility. However, challenges such as digital literacy gaps, internet accessibility issues, and limited institutional support hinder its full potential. To maximize the effectiveness of BL, institutions must address infrastructural limitations, provide adequate training for faculty and students, and develop policies that bridge the digital divide. Strengthening digital infrastructure, improving course design, and ensuring personalized learning experiences will enhance student engagement and learning outcomes. Future research should explore longitudinal studies to assess the long-term impact of BL and investigate regional disparities in greater depth.

V. FUTURE RESEARCH

While this study provides valuable insights, future research should explore longitudinal studies to assess the long-term impact of BL on academic outcomes. Additionally, more comparative studies across different states in India can help in formulating national-level strategies for effective BL adoption. Blended Learning has the potential to transform teacher education by offering a flexible, technology-driven pedagogical approach. However, its successful implementation in Bihar and Jharkhand requires addressing the infrastructural, pedagogical, and socio-economic challenges identified in this study. By adopting targeted strategies, institutions can enhance students' learning experiences and ensure that BL becomes an effective and sustainable mode of education.

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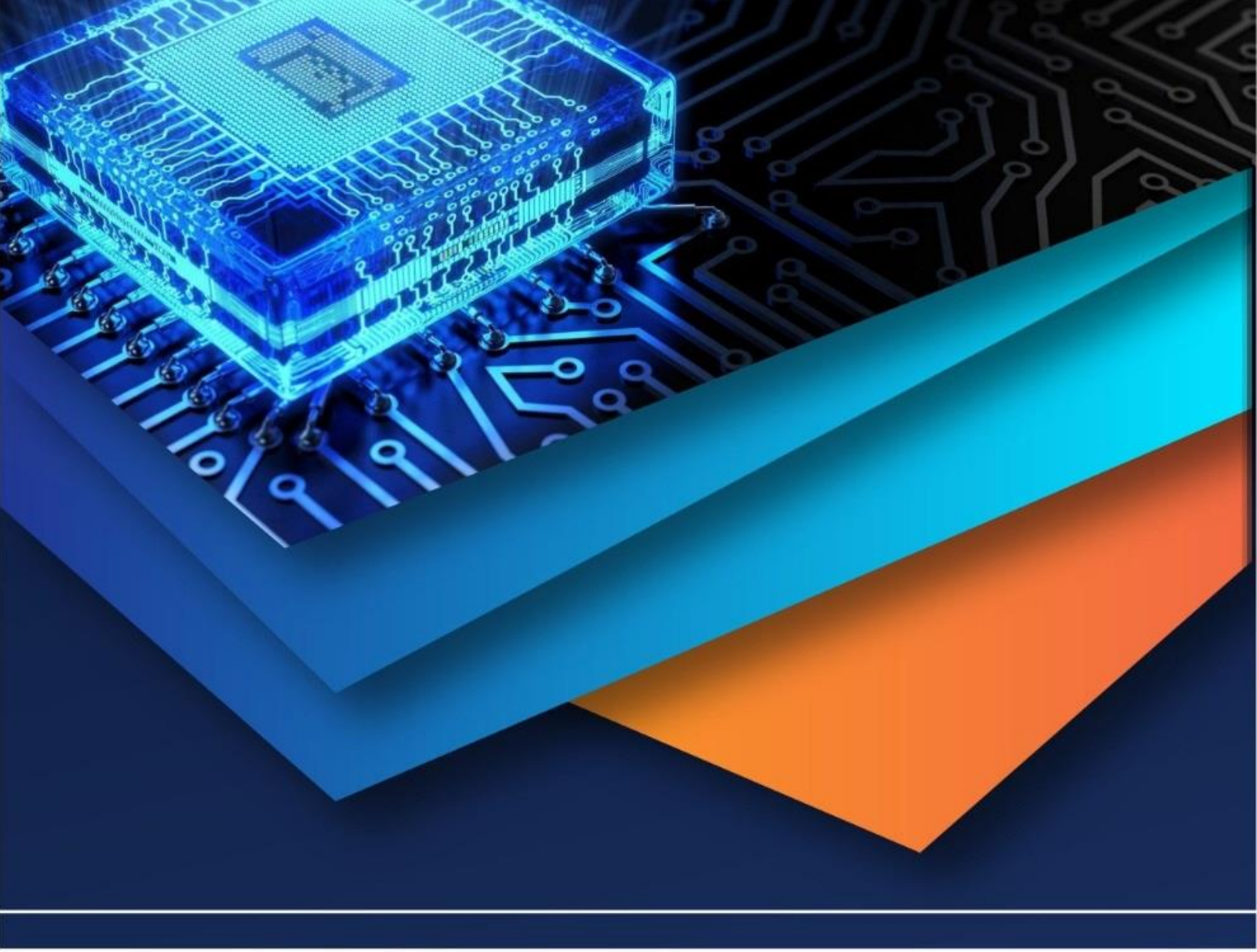

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