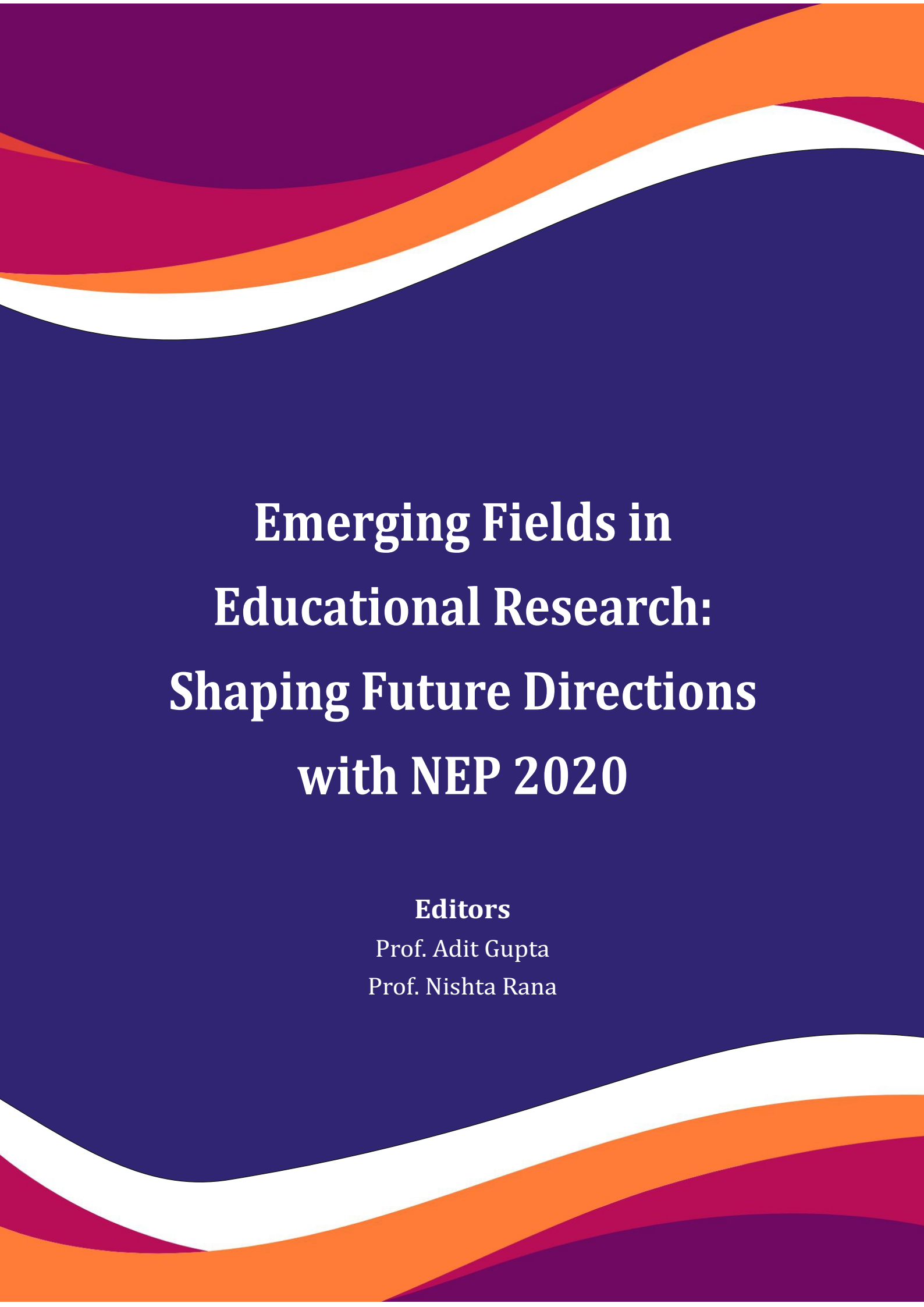




Emerging Fields in Educational Research: Shaping Future Directions with NEP 2020

Editors

Prof. Adit Gupta
Prof. Nishta Rana

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Model Institute of Education & Research

Research and Development Cell

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Preface

This edited volume, ‘Emerging Fields in Educational Research: Shaping Future Directions with NEP 2020’, features a carefully selected collection of papers presented at a national seminar organised by the Research and Development Cell of MIER College of Education (Autonomous), Jammu. The seminar offered a timely platform for discussion on emerging priorities in educational research that have gained renewed importance in the context of the National Education Policy (NEP) 2020.

The chapters collectively explore how India’s education system can adapt to rapid socio-technical changes with academic rigour, equity, and ethical responsibility. Contributors address themes such as blended and technology-enabled pedagogies, digital literacy and digital citizenship, social and emotional learning, competency-based and formative assessment, vocationalisation and skill development, inclusion and learner well-being, sustainable and smart academic libraries, and the growing role of artificial intelligence in teaching, learning, and educational governance. Overall, these contributions present both conceptual arguments and practice-oriented insights that can guide researchers, teacher educators, and institutional leaders.

As editors, we have strived to preserve each author's distinctive voice while enhancing coherence, clarity, and alignment with the volume's central focus. Where necessary, we made revisions to strengthen academic presentation and improve readability for a broader professional audience. The views expressed in individual chapters remain those of the respective authors.

We sincerely thank all contributors for their scholarly work and cooperation during the editorial process. We also express our gratitude to the seminar organising team, the institutional leadership, and all colleagues who supported the preparation of this publication.

We hope this book will be a valuable resource for researchers, teacher educators, practitioners, and policy stakeholders seeking evidence-based pathways for educational improvement in accordance with NEP 2020.

Prof. Adit Gupta
Prof. Nishta Rana

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Chapter One

NEP 2020 AND WOMEN'S LEADERSHIP IN EDUCATION: ALIGNING NATIONAL REFORM WITH GENDER EQUITY GOALS

Aakriti Singh

ABSTRACT

The National Education Policy (NEP) 2020 is a transformative plan for India's education system, emphasising equity, inclusivity, and institutional autonomy. Central to this policy is a focus on gender equality, particularly in ensuring women's access to education and leadership roles in schools and higher education institutions. This paper discusses the NEP 2020's vision for leadership and gender implications, including structural reforms, professional development, open learning pathways, and specially designed gender-support measures such as the Gender Inclusion Fund. It also examines policy suggestions for women's education and leadership—such as gender-sensitive curricula, safe and inclusive classrooms, and capacity-building programmes—and evaluates the current status and implementation of these policies in India. This research argues that NEP 2020 offers significant potential for advancing women's leadership in education, but it requires deliberate strategies for implementation, monitoring, and institutional accountability to realise its full benefits. The paper concludes with recommendations for practice and policy aimed at increasing women's leadership representation, expanding professional development initiatives, and turning NEP 2020's gender equity vision into tangible realities.

Keywords: NEP 2020, Women Leadership, Women Education, Gender equity

INTRODUCTION

Since independence, there have been significant changes to India's educational system, including various policies and reforms aimed at creating an inclusive and equitable education system. The National Education Policy (NEP) 2020 is one such initiative in educational reform over the past three decades. This landmark policy document emphasises holistic development, critical thinking, creativity and scientific temper while giving particular importance to gender equity and women's empowerment in educational leadership.

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Women's involvement in leadership roles across various fields, particularly education, has been studied and adopted as a global policy intervention. In the Indian context, despite notable progress in women's education and workforce participation, leadership roles in educational institutions remain largely male-dominated. The NEP 2020 recognises this disparity and proposes several measures to bridge the gender gap in educational leadership while fostering inclusive and equitable access to quality education.

Women's leadership in education is crucial for reasons beyond mere representation. It involves transforming educational environments, pedagogical methodologies, and institutional cultures to better serve diverse student groups. Research consistently shows that women leaders in education offer unique perspectives, collaborative leadership styles, and a greater emphasis on student welfare and inclusive practices. Nevertheless, structural barriers, cultural constraints, and institutional biases continue to hinder women's advancement to leadership roles within educational institutions.

This paper investigates the connection between NEP 2020's provisions and the wider aims of gender equality and women's leadership development in India's educational sector. By thoroughly analysing policy documents, existing literature, and empirical evidence, this research explores how NEP 2020's framework can be utilised to create meaningful opportunities for women's leadership while tackling systemic challenges that have historically hindered women's progress in educational institutions.

WOMEN'S ROLE IN SOCIETY AND LEADERSHIP: A GLOBAL PERSPECTIVE

The underrepresentation of women in leadership positions remains a systemic issue worldwide. Women comprise about half of the global teaching workforce, yet they are disproportionately scarce in senior managerial and decision-making roles (UNESCO 2021). According to Kuck et al. (2003), this "leaky pipeline" reflects broader gender disparities across various professions, where women face obstacles such as gender stereotypes, limited mentorship opportunities, and an unequal share of caregiving responsibilities. The role of women in society has changed significantly over the past century, with major shifts in educational attainment, workforce participation, and leadership visibility.

Eagly and Carli (2018) explored women and leadership and questioned the traditional metaphor of the "glass ceiling" by introducing the idea of a "labyrinth" that women must navigate to attain leadership roles. This theoretical framework acknowledges the numerous and diverse obstacles women face, such as cultural norms, organisational cultures, and personal challenges with work-life balance.

Women remain underrepresented in executive and senior management roles, particularly in technology and digitalisation sectors, where participation is lowest (Górska & Burlakova, 2025). Female leadership is also becoming increasingly visible, though unevenly, in areas such as politics and law, which have traditionally been male dominated. Helgesen's (1995) seminal study on women's leadership styles identified distinctive traits that enhance organisational performance, including collaborative decision-making, relationship-focused approaches, and inclusive communication. These findings suggest that gender-diverse leadership offers widespread benefits across various cultural contexts.

Women's leadership in education significantly enhances the global development agenda, particularly Sustainable Development Goals 4 (Quality Education) and 5 (Gender Equality). To foster inclusive, equitable, and high-quality education worldwide, UNESCO and UN Women emphasise the significance of gender-balanced leadership (UNESCO, 2019). Leadership training programmes across Africa, Asia, and Latin America have shown that targeted mentoring, capacity-building, and legislative reforms greatly increase the representation and effectiveness of women in leadership roles (Bush et al., 2022). Evidence suggests that women leaders are more likely to possess the vision, intellectual stimulation, and personalised consideration that transformational leaders utilise to motivate their followers (Afriani, 2025). This leadership style has been particularly successful in educational settings, where relationship-building and student-centred approaches are vital for institutional achievement (Schiffecker & McNaughtan, 2022).

WOMEN IN INDIAN SOCIETY: HISTORICAL CONTEXT AND CONTEMPORARY CHALLENGES

The status of women in Indian culture reflects the complex interactions between colonial influences, modern democratic ideals, and traditional cultural norms. Historical references to women's intellectual contributions appear in mentions of learned women and female scholars in ancient Indian texts such as the Vedas and Upanishads. However, during the Middle Ages, women faced restrictions on access to education, and many rigid customs developed to limit their participation in public life.

Sarojini Naidu, Vijay Lakshmi Pandit, and Aruna Asaf Ali were among the notable female leaders of the Indian independence movement who challenged gender norms and demonstrated that women could hold positions of political and social influence. The Indian Constitution adopted in 1950 provided a legal basis for women's empowerment by prohibiting sex-based discrimination and ensuring gender equality.

According to recent studies on women's empowerment in developing countries, Duflo (2012) highlights the importance of economic participation and education in enhancing women's status in society. Even if legal and policy frameworks in India support gender equality, studies by Desai and Andrist (2010) demonstrate how patriarchal systems continue to influence women's educational and career choices.

Crenshaw (1989) introduced the concept of "intersectionality," which is particularly important for understanding women's experiences in India, where gender intersects with caste, class, religion, and regional identity to create complex systems of privilege and disadvantage. Menon's (2012) study explores how these overlapping identities affect women's access to educational and professional opportunities, emphasising the need for nuanced governmental responses.

WOMEN'S LEADERSHIP IN THE INDIAN EDUCATION SECTOR

The education sector in India has traditionally been seen as a suitable professional field for women, yet leadership roles within educational institutions are still largely occupied by men. According to the Ministry of Education, data from 2023 indicates that while women make up about 50% of teachers at the elementary level, this proportion drops markedly at higher administrative levels; fewer than 25% of the posts of principals in government schools are held by women.

Meza-Mejia et al. (2023) highlight certain specific characteristics of women educational leaders, such as an emphasis on instruction and curriculum, collaboration in decision-making, and concerns for the needs of disadvantaged students. These common findings have been supported by studies conducted within an Indian context, where women principals have indeed been found to be concerned with academic achievement, the welfare of students, and community involvement. Additionally, barriers to women's advancement in India's educational leadership are multifaceted and deeply embedded within societal structures. There are a number of key challenges, including limited opportunities for professional development; family responsibilities that restrict mobility, time commitments, and institutional cultures of leaders that favour masculine styles (Kiamba, 2009). Furthermore, informal networks and mentorship systems, which often exclude women, contribute to the underrepresentation of women in leadership positions. Despite growing awareness of gender equality, discrimination remains ingrained in workplace systems and frequently manifests in subtle but significant ways.

Women's leadership in schools is mainly found in urban and private institutions, while rural and government schools remain largely led by male administrators (Sherman, 2000). Women are frequently appointed to roles seen as extensions of teaching, such as headmistresses of primary schools, whereas strategic or policy roles continue to be led by men (Noronha & Aithal, 2020). This uneven presence diminishes gender perspectives and sustains a system that limits the development pipelines of women educators' leadership.

POLICY FRAMEWORK FOR WOMEN'S EMPOWERMENT IN INDIA

Since independence, India's policy framework for women's empowerment has evolved significantly, with numerous national and state-level initiatives aimed at promoting gender equality across all sectors. A comprehensive strategy to address gender disparities in political representation, economic participation, health, and education was established by the National Policy for the Empowerment of Women, adopted in 2001.

Several gender-sensitive provisions were incorporated into the Right to Education Act of 2009, particularly ensuring that girls have access to proper infrastructure, hiring female teachers for schools with a high percentage of female students, and banning gender discrimination in the admissions process and in students' treatment within schools. Although challenges with implementation remain across different states and contexts, these provisions laid a foundation for advancing gender equity in basic education.

Therefore, specific elements have been added to the RMSA and Samagra Shiksha initiatives to promote women's leadership development and girls' education. Initiatives such as constructing separate restrooms for girls, providing female students with bicycles and scholarships, and establishing residential schools in areas with low female literacy rates have all benefited from these schemes. At the higher education level, the creation of the University Grants Commission's gender sensitisation committees and the mandatory enforcement of policies to prevent sexual harassment are key steps towards making educational environments safe and conducive. However, the implementation of these policies has been inconsistent across institutions, with significant variation in effectiveness and institutional commitment (Kulkarni et al., 2023).

THE NATIONAL EDUCATION POLICY (NEP) 2020'S ROLE AND VISION IN ADVANCING WOMEN'S LEADERSHIP IN INDIA

After over thirty years, the National Education Policy (NEP) 2020 replaces the 1986 policy, signalling a significant shift in Indian education. It aims to transform education by fostering inclusivity, quality, and equity. Empowering women and promoting their leadership in education and related fields are key elements of this vision. NEP 2020 prioritises gender inclusion in its reform efforts, recognising women not only as beneficiaries but also as leaders and change agents (Government of India, 2020).

The number of women leaders is still limited in academia and educational governance, despite notable progress in women's education and participation in the labour force. To address structural gender gaps through inclusive policies, leadership development, and institutional transformation, NEP 2020 serves as a transformative framework (Parihar et al., 2024).

GENDER INCLUSION AS A FUNDAMENTAL VALUE

Gender equity and inclusion are emphasised in NEP 2020 as vital elements of national progress. The policy clearly states that all students should have access to high-quality instruction and leadership opportunities, irrespective of their gender or socioeconomic background. More than just ensuring access to education, this vision seeks to promote leadership and active participation in the decision-making processes of educational institutions.

One key policy innovation under NEP 2020 is the Gender Inclusion Fund (GIF), which aims to help governments implement fair policies and leadership development initiatives for women and girls. The fund emphasises safety measures, mentorship, and capacity building in educational institutions. It also encourages community awareness to challenge patriarchal barriers that restrict women's participation in leadership roles and career progression. NEP 2020 recognises, through the GIF, that empowerment begins with structural investment, providing institutional and financial support for women's growth in research, educational management, and policymaking.

STRENGTHENING WOMEN'S REPRESENTATION IN EDUCATIONAL LEADERSHIP

The underrepresentation of women in leadership roles, such as vice-chancellors, directors, deans, and principals, remains a persistent issue in Indian education. Despite encouraging data about women's access to higher education, challenges persist in securing major academic positions at universities, participating in relevant research, and taking on leadership responsibilities (Vieira do Nascimento. Et al., 2021). Women hold less than 20% of vice-chancellor and director roles, even though they represent about 43% of all professors, according to the All-India Survey on Higher Education (AISHE, 2022).

NEP 2020 seeks to bridge this gap by promoting inclusive selection, leadership development, and mentorship programmes for women. According to the University Grants Commission (2021), the policy advocates for the creation of "inclusive institutional cultures" that offer women equal opportunities to advance in their careers. It also suggests transparent nomination processes and gender-sensitive governance strategies—a move from token representation to transformative leadership participation. Moreover, the UGC's Women's Studies Centres, supported by NEP 2020 initiatives, play a vital role in nurturing the next generation of female leaders. By the end of 2020–

2021, 159 Women's Studies Centres had been established across the country at 84 universities and 75 colleges (Ministry of Education, 2021). These centres are key for feminist scholarship, policy activism, and fostering academic leadership.

INITIATIVE FOR LEADERSHIP DEVELOPMENT AND CAPACITY BUILDING

According to NEP 2020, leadership is developed through ongoing institutional and professional support rather than being innate. To achieve this, it recommends that the UGC and the National Institute of Educational Planning and Administration (NIEPA) collaborate to establish specialised leadership programmes for female educators and administrators.

People's social and professional settings have a significant influence on their creativity and individuality (Jun & Lee, 2023). These programmes highlight ethical governance, creativity, and democratic decision-making to foster transformational leadership qualities. By equipping women to assume greater responsibilities within educational institutions, the policy's focus on academic leadership training and faculty development programmes (FDPs) seeks to close the gender gap in academic administration.

Additionally, the NEP promotes flexible career options that address the difficulties faced by women educators in achieving a work-life balance, such as remote participation, part-time leadership roles, and mentorship models (Kausadikar, 2024). Long-standing barriers like professional disruptions caused by family commitments and institutional gender prejudice are directly addressed by these measures (SAC, 2021).

CREATING GENDER-SENSITIVE EDUCATIONAL ECOSYSTEM

The policy's transformative aim highlights cultural change alongside institutional reforms. NEP 2020 stresses the importance of developing safe, inclusive, and gender-sensitive campuses where women can thrive as leaders, educators, and students. To ensure accountability and transparency, it mandates that higher education institutions establish Internal Complaints Committees (ICCs) and implement gender awareness programmes.

Another vital step is integrating gender sensitisation into teacher training. The approach views educators as champions of equity who can influence students' views on equality and leadership by including gender perspectives in courses (Mohan et al., 2024). NEP 2020 also promotes technology-driven education and digital inclusion as ways to boost women's participation. The strategy creates new opportunities for women, especially in rural and disadvantaged communities, to develop skills and engage in academic leadership through online education, open universities, and digital literacy.

NEP 2020'S ALIGNMENT WITH THE GLOBAL GENDER GOALS

The UN Sustainable Development Goal 5 (SDG-5), which aims for achieving gender equality and empowering all women and girls, aligns with the NEP's objective. NEP 2020 situates India's reform initiatives within an international discourse on gender and education by emphasising leadership and participation at all educational levels.

This integration reflects reforms within the context of India's sociocultural realities while emphasising the country's commitment to global parity standards. The policy's focus on capacity

development, resource equity, and diversification of leadership enhances India's standing as a regional leader in gender-responsive education reform.

CHALLENGES THAT WOMEN FACE IN EDUCATIONAL LEADERSHIP:

Institutional and Structural Challenges

Many institutional and structural obstacles entrenched in organisational cultures and practices hinder women's progression to leadership roles within educational institutions. Traditional recruitment and promotion policies often favour candidates with specific networks and backgrounds that have historically excluded women. Women who may have taken time off from their careers to care for their families are disadvantaged by the focus on continuous career advancement.

Many educational institutions still possess cultures that uphold masculine norms and values, which can lead to situations where women's leadership styles are misunderstood or underappreciated. Schools often reinforce gender stereotypes through informal procedures, standards for leadership behaviour, and assumptions about women's dedication and competence (Blackmore, 2013). The absence of flexible working arrangements and family-friendly policies in many educational settings creates additional obstacles for women's career progression (Schwartz, 1996). Unlike the corporate sector, where organisations have increasingly recognised the business case for supporting women's leadership, educational institutions have been slower to adopt systematic approaches to gender equality in leadership development (Górska & Burlakova 2025).

Geographical mobility requirements for career advancement in education pose particular challenges for women, who often face greater constraints on relocation due to family responsibilities and their spouse's career considerations. This challenge is especially acute in the Indian context, where family structures and social expectations may limit women's ability to accept positions in different locations.

Socio-cultural Challenges

The rise of women to leadership roles in educational institutions is severely hindered by sociocultural issues. Traditional gender role expectations continue to shape perceptions of women's suitability for leadership positions worldwide, especially in roles that involve authority over male colleagues and community engagement. Female deans face various challenges, including family responsibilities, limited technological expertise, a lack of interest in pursuing leadership roles, insufficient spousal support, poor time management, and a general absence of spousal backing in Bangladesh (Islam et al., 2023).

Despite the rising number of female leaders in the workplace, which highlights their significant contribution, they still face challenges and barriers when accepting leadership roles across various sectors (Geiger & Kent 2017). Women encounter subtle forms of professional invisibility alongside visible obstacles, such as a lack of mentorship, discriminatory career advancement procedures, and disproportionate family responsibilities. The Matilda Effect, describing the systematic undervaluation or misattribution of women's achievements to their male colleagues, is one example (Rossiter, 1993). This issue is prevalent in educational institutions, where women

often undertake important administrative, academic, and student-support roles, yet their efforts are dismissed as "routine" or "supportive" rather than recognised as leadership work.

In Indian society, the concept of "appropriate" roles for women often conflicts with the demands and expectations of leadership positions in education. Women's career ambitions and willingness to take on leadership roles can be constrained by internalised gender role beliefs, community attitudes, and family expectations (Khan et al., 2025).

Women in educational leadership roles face increased challenges in achieving work-life balance due to significant time commitments, obligations in the evenings and on weekends, and emotional and intellectual demands. Juggling professional responsibilities with domestic duties heightens stress and can limit a woman's desire and ability to take on leadership positions. Opportunities for mentorship and social networking, which are vital for career progression, often occur through informal channels that may exclude or restrict women from senior leadership networks. Furthermore, barriers to women's professional development and career advancement include the dominance of male-oriented professional associations and informal networking spaces (Linehan 2001).

Personal and Psychological Barriers

Women pursuing leadership roles in education may face internal challenges related to confidence, self-efficacy, and imposter syndrome. Socialisation processes can lead to women overlooking their abilities and being reluctant to seek leadership positions, even if they possess the required qualifications and expertise (Sanchez & Lehnert 2019).

The phenomenon known as "stereotype threat," where individuals feel anxious due to negative stereotypes about their group, may influence women's performance and self-perception in leadership roles (Ayyildiz et al., 2024). In environments with few female leaders and where their performance is scrutinised, this psychological pressure can be especially difficult. Due to their fear of failure and the potential damage to their personal and family reputations, qualified women might avoid taking on leadership positions. Despite numerous professional development opportunities and leadership initiatives offered by the government, women still face structural barriers that hinder their advancement into leadership roles.

RECOMMENDATION

The review of NEP 2020 and its impact on women's leadership in education reveals that lasting, meaningful change cannot rely solely on policy intentions. Coordinated, multi-level efforts are necessary to overcome ongoing structural barriers, institutional biases, and sociocultural constraints. Therefore, by implementing concrete actions at the institutional, systemic, and policy levels, the following recommendations seek to bridge the divide between policy and practice. These suggestions aim to enhance opportunities for women's leadership, foster greater institutional accountability, and cultivate a supportive environment in which female leaders can thrive and make significant contributions to India's educational transformation.

Policy recommendation: Achieving NEP 2020's gender equity goals effectively demands targeted policy actions across various levels of the educational system.

- The Gender Inclusion Fund should be put into operation, with clear rules, adequate financial resources, and transparent eligibility criteria that prioritise organisations committed to gender-transformative leadership.
- Introduce the Gender Inclusion Fund to support the training of professionals, establish women's research fellowships, conduct campus gender audits, build mentorship networks, and create institutional innovation labs focused on women's leadership development.
- Introduce family-friendly academic policies such as rules regarding promotions that support maternity and paternity leave, extend tenure clocks, offer flexible timelines, and provide research grant accommodations.
- Annual gender audits should be mandatory, with results linked to the NAAC assessments, NIRF parameters, and institutional accreditation scores to improve accountability.
- Incorporate gender-sensitive leadership competencies into the national professional standards (NPST) and recognise them through leadership certification programmes organised by NIEPA, NCERT, and UGC.
- To eliminate discrimination and foster inclusivity in decision-making, require gender equity training for institutional leaders, administrators, and governing bodies.

Institutional Recommendations

- Establish institutional Women's Leadership Development Centres (WLDCs) that offer professional development courses, leadership incubation activities, mentorship, and training.
- Review hiring and promotion procedures to eliminate gender bias by implementing gender-balanced selection panels, transparent assessment criteria, and structured interviews.
- Promote work-life balance by offering opportunities for remote academic work, secure transport, flexible hours, and on-campus daycare.
- Establish affinity groups and peer support networks so women can co-create solutions, share experiences, and enhance their professional connections.
- Promote safety and wellness measures, including secure transportation systems, a gender-sensitive campus environment, and women-specific mental health counselling.
- Fund training in digital leadership to enhance women faculty members' proficiency with technology, online instruction, data analytics, and academic administration systems.

Systemic Recommendations

- Encourage academic networks and professional associations to establish national forums for policy debate and to foster women's leadership skills.
- Promote interdisciplinary research on women's leadership that highlights intersectionality, institutional culture, geographical diversity, and the effectiveness of leadership initiatives.
- Through awareness campaigns and community engagement, involve communities—parents, local leaders, NGOs—in challenging patriarchal conventions and fostering positive perceptions of women in leadership.
- Promote gender-inclusive ICT projects that provide women educators in both rural and urban areas access to online communities of practice, leadership webinars, and digital resources.
- To guarantee adequate funding for women's leadership initiatives at the state, national, and institutional levels, establish gender-responsive budgeting procedures.
- Establish state-level women's leadership resource centres that collaborate across districts and adapt NEP 2020 targets to local needs.

CONCLUSION

In India's educational system, the National Education Policy (NEP) 2020 holds significant potential to promote gender parity and bolster women's leadership. The strategy provides an effective framework for overcoming long-standing barriers that have hindered women from attaining leadership roles in education by integrating gender inclusion, leadership development, and institutional change. This study shows that NEP 2020 includes mechanisms—such as professional development, autonomy, and evidence-based planning—that create opportunities for innovative and fair leadership pathways, despite still facing substantial challenges.

Policy implementation requires institutional practices and cultural shifts that genuinely recognise and value women's leadership contributions, beyond just policy directives. Research shows that women possess specific talents and perspectives that enhance the quality of education, promote inclusivity, and support a diverse student population. Increasing the number of women in leadership roles can foster positive patterns of representation, mentoring, and institutional change.

To achieve NEP 2020's goal of inclusive and equitable education, gender-focused programmes must be continuously monitored and improved. India can enhance its educational ecosystem and develop institutions that are more innovative, equitable, and responsive to the needs of the twenty-first century by enabling women to fully participate in leadership roles.

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Chapter Two

BLENDED LEARNING AS A TRANSFORMATIVE MODEL FOR THE FUTURE OF HIGHER EDUCATION

Aniruddha Lahiri and Sarabjeet Lahiri

ABSTRACT

Blended learning is a vital pedagogical model that combines traditional face-to-face instruction with digital and online methods. This qualitative research investigates the transformative potential of blended learning in higher education, focusing on how it can engage students more effectively, foster their independence, and improve learning outcomes. It considers the perspectives, experiences, and concerns of students, teachers, and academic administrators from several Indian universities through semi-structured interviews. Many recognise the benefits of flexibility, personalised learning paths, and knowledge creation in collaborative environments provided by blended learning. However, it also faces challenges such as teacher readiness, institutional backing, and access to technology. Therefore, this study emphasises the importance of teacher development, infrastructure alignment, and context-aware design to maximise the advantages of blended learning. It enhances our understanding of the transformative influence of blended learning in higher education by examining the complex interactions between pedagogies, technologies, and learner experiences. The aim is to ensure graduates are well-rounded, adaptable, and proficient in technology. The findings may lead to curriculum reforms, strategic adjustments within institutions, and the formulation of new policies.

Keywords: *Blended Learning, Higher Education, Digital Pedagogy, Learner Autonomy, Educational Technology.*

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INTRODUCTION

Blended learning is an educational approach that combines traditional classroom practices with technology and online resources. Recently, it has gained momentum in colleges and universities to enhance learning and student performance. Its goal is to create an environment that is flexible, personalised for each student, and easily accessible. It achieves this by accommodating different learning styles and needs. Indeed, the integration of technology in classrooms has redefined pedagogies and the methods students use to learn, making the process more interactive and student-centred in the process (Dziuban et al., 2018).

Blended learning is not an entirely new approach; however, it has rapidly gained popularity over the past decade, mainly due to advancements in digital technology and increased online access. Early forms of blended learning usually used online resources to support traditional face-to-face classroom teaching. The model has evolved into a more integrated approach where online and on-campus experiences are designed to complement and inform each other.

The COVID-19 pandemic compelled educational institutions to adopt a blended learning approach. To continue teaching, they were forced to transition to online platforms. This shift highlighted the crucial role of technology and digital skills in implementing blended learning. Since the pandemic, many institutions have continued to embrace blended learning. The flexibility, scalability, and independence it offers students to follow their own educational paths are impressive (Ashraf et al., 2021).

PERSONALISATION AND LEARNER AUTONOMY IN PEDAGOGICAL PRACTICE

Blended learning is an innovative pedagogical approach that combines traditional classroom teaching with digital learning environments in a dynamic way. One of its main benefits is its convenience for students. In traditional settings, students typically must attend classes in person and follow rigid schedules. Blended learning overcomes this limitation by allowing students to access course materials, lectures, and discussions at times that suit them best. This flexible method supports students who need to balance academic work with part-time jobs, family commitments, or other study demands. As a result, education becomes more accessible and adaptable to different lifestyles (Garrison & Vaughan, 2008).

Blended learning not only broadens access to education but also makes it more tailored. The approach is quite different from the "one size fits all" idea, as each learner can progress through the content at their own speed and in a way that best matches their learning style. Adaptive technologies on many digital platforms evaluate a learner's performance and recommend resources or additional activities based on their needs (McCarthy, 2023). This fosters a sense of ownership and agency in students over their learning, thereby encouraging better understanding and intrinsic motivation. The ability to self-direct learning is particularly important in higher education, where intellectual independence is seen as both a goal and a measure of success.

Blended learning also encourages students to become more engaged in the educational process. This approach involves not only passively receiving information but also utilising resources such as films, simulations, discussion forums, and virtual laboratories to foster an active and interactive learning environment. Students engage in deeper cognitive processing of ideas by using different tools and formats, interact with their peers more meaningfully, and retain the material longer when employing a variety of methods (Dziuban et al., 2018). This interactive

approach enhances the classroom experience by combining the immediacy of face-to-face communication with the creative potential of online exploration.

Blended learning not only educates students but also equips them with technological skills, are among the key competencies of the 21st century. Therefore, when students conduct research using technology, communicate, collaborate on virtual platforms, and utilise online learning management systems, they develop skills that will be helpful outside the classroom. These include critical thinking when assessing digital sources, communicating effectively online, and acting appropriately in virtual environments. These skills are essential for success in a world becoming increasingly dependent on technology. Blended learning provides a practical setting for developing these skills. The model offers numerous benefits for businesses and governments alike. It is cost-effective for both higher education institutions and learners, as it reduces the need for physical resources like printed materials, classrooms, and administrative facilities. Universities can increase their enrolments without compromising educational quality, while students save money on transportation and gain access to more classes and instructors. Blended learning is not just another teaching model; it is a sustainable future for higher education that balances academic excellence with fiscal responsibility (Ashraf et al., 2021; Bishop & Verleger, 2013).

Therefore, blended learning transforms our view of education by merging flexibility, discipline, human interaction with technological skills, and accessibility with effectiveness. It provides a teaching approach that is liberated from all time and space limitations; students can then take control of their academic and career growth. This shifts education from a fixed framework to one of ongoing discovery and adaptability.

CHALLENGES AND CONSTRAINTS TO THE IMPLEMENTATION OF BLENDED LEARNING IN HIGHER EDUCATION

Despite the many benefits, blended learning faces several challenges that need to be addressed before successful implementation in higher education. These include technological barriers, such as limited access to reliable internet and digital devices, which make participation difficult for students from rural or economically disadvantaged backgrounds. The digital divide hinders equal access to blended learning. Additionally, faculty preparedness is a concern; many instructors require guidance on how to effectively utilise digital tools in their teaching. Without adequate institutional support, blended learning often does not reach its full potential. Adoption of new methods can be difficult, especially when there is resistance to change, as educators and learners may prefer traditional methods due to familiarity.

Another challenge is the quality and consistency of both online and offline components. Robust mechanisms for evaluation and ongoing monitoring of academic standards become essential (Garrison & Kanuka, 2004). Finally, issues of justice must be addressed, as digital literacy and access can further deepen existing inequities within higher education. For blended learning to be effectively established as a sustainable educational approach, it is crucial to tackle these issues through infrastructure development, professional training, and social policies that promote equity.

LITERATURE REVIEW

An increasing number of studies are highlighting the growing importance of blended learning in higher education, emphasising aspects such as instructional design, student engagement, learning outcomes, faculty development, and equity. Blended learning is effective because of good instructional design; it requires the consistent integration of online and face-to-face components aligned with learning objectives and diverse learner needs (Garrison & Kanuka, 2004). Research has shown that interactive elements like discussions, multimedia resources, and group projects significantly boost student engagement and motivation (Dziuban et al., 2018).

Studies investigating learning outcomes have also highlighted that blended learning enhances academic achievement when students are fully engaged in the process and receive timely, constructive feedback (Ashraf et al., 2021). This model can only succeed if educators are prepared for it. In this regard, ongoing professional development is essential to ensure educators are sufficiently skilled in the necessary technological tools and pedagogical approaches for blended learning environments (McCarthy, 2023). Furthermore, addressing the urgent need to ensure digital equity—since access to technology and digital literacy are vital for inclusive participation and equal educational opportunities—remains critical (Mallikarjuna, 2024). These points indicate that blended learning fosters greater flexibility and engagement in education, but success depends on detailed planning, faculty preparedness, and equal access to platforms for all participants.

The main aim of this research paper is to examine the effect of blended learning on higher education in India. This study uses a qualitative approach to investigate the experiences, perceptions, and issues of students, professors, and academic administrators regarding the adoption and use of blended learning models.

RESEARCH OBJECTIVES

This research aims to investigate various effects that blended learning has had on higher education, focusing on student participation, independence, and academic achievement. It seeks to understand how the integration of online and face-to-face learning environments influences motivation, engagement, and students' ability to study autonomously. An additional key aspect is exploring perceptions and opinions of faculty members regarding the design, delivery, and implementation of blended learning courses. The study also aims to explain pedagogical advantages while highlighting practical challenges faced by educators when adopting this teaching approach.

This paper explores the institutional aspects of blended learning, focusing on the challenges and opportunities faced by educational institutions in establishing an effective framework for blended learning. Additionally, it examines how such models enhance students' digital literacy and other 21st-century skills such as critical thinking, problem-solving, and collaboration. Ultimately, this paper aims to develop comprehensive recommendations for policy, curriculum design, and faculty development to promote blended learning. These recommendations will help bridge the gap between policy and practice, ensuring that blended learning is not only feasible with technology but also an effective pedagogical approach for all learners.

RESEARCH QUESTIONS

The present study is guided by a set of interconnected questions that aim to explore perspectives, challenges, and outcomes related to blended learning in higher education. It therefore seeks to investigate students' perceptions of how blended learning affects their engagement, autonomy, and overall experience as learners in higher education. The study aims to clarify how this pedagogical approach transforms the learner's relationship with knowledge, instructors, and fellow students. The research also includes educators, exploring their perceptions of the effectiveness of blended learning, the challenges faced in implementing this method, and teaching strategies they believe could enhance its effectiveness.

The study examines individual experiences of participants regarding policies, infrastructural support, and administrative preparation that influence the success and sustainability of blended learning programmes. It considers how effectively the blended learning model enhances technological proficiency, collaborative skills, and digital literacy among students to operate in today's increasingly technology-driven environment. The study aims to identify strategies or techniques that could improve blended learning outcomes for all participants in higher education. It seeks to gain a deeper understanding of blended learning as a pedagogical innovation and to provide insights that could inform future educational reform and practice.

RESEARCH METHODOLOGY AND DESIGN

This study employed a phenomenological research approach to explore the lived experiences of students, professors, and academic administrators involved in blended learning at higher education institutions. The qualitative design offers deep insights into how participants perceive, interpret, and respond to the educational, technological, and institutional aspects of blended learning (Braun & Clarke, 2006). The phenomenological approach is particularly suitable for this study, as it focuses on subjective meanings and lived experiences; it provides a detailed understanding of how blended learning is transforming teaching and learning processes in various contexts.

The research involved 25 students, 10 faculty members, and 5 academic administrators from different universities with experience in blended learning approaches. Participants were selected using purposive sampling, ensuring only those with significant exposure and experience in blended learning were included. This enabled consideration of perspectives from multiple stakeholders, namely students, educators, and policymakers.

A range of qualitative methods has been employed to ensure the comprehensiveness and corroboration of the data. In-depth, semi-structured interviews with open-ended questions were carried out to elicit the ideas and feelings of each participant. Two focus group discussions with students helped explore experiences, peer interactions, and common challenges associated with blended learning. This also examined institutional policies, course documents, and digital platform outlines to gain a thorough understanding of the operational and policy frameworks governing blended learning. Data analysis was conducted using Braun and Clarke's thematic analysis method. Transcripts of interviews and conversations were coded multiple times and analysed to identify recurring patterns and themes: student engagement, innovation in teaching methods, faculty preparedness, institutional support structures, and the development of digital literacy skills. Ethical measures of the highest standard were maintained at every stage of the

research. Participants' responses were anonymised to protect privacy. This provided a holistic and detailed insight into perceptions and experiences of blended learning in Indian higher education; consequently, the results obtained were culturally relevant and pedagogically significant.

RESULTS AND DISCUSSION

The aim of this study was to examine the role of blended learning as a transformative model in the higher education sector by exploring the lived experiences of students, faculty, and administrators. The findings, derived from semi-structured interviews, focus group discussions, and institutional documents, suggest that the hybrid mode of instruction is both a technological adaptation and a reorganisation of pedagogical practices. The main themes identified in the data relate to student engagement, the adoption of teaching methodologies, institutional readiness, and the development of digital literacy and collaborative skills.

Students noted that the blended learning classroom was far more enjoyable and interactive than traditional classrooms. They could learn at their own pace, revisit lectures, and access additional materials outside of class, as the programme offers both online and face-to-face classes. Students also said that this freedom made them feel in control of their own learning. Learners were better able to think about and understand complex ideas because they could switch between synchronous and asynchronous activities. This kind of learning encourages autonomy and active engagement, which are vital to meaningful academic growth.

Faculty narratives also supported a concurrent shift in pedagogical philosophy. Many teachers truly appreciated the creative freedom that blended environments provided, allowing them to incorporate digital discussion spaces, interactive assessment tools, and multimedia content. They realised that these modes were effective with all kinds of learners, whether visual, auditory, or kinetic thinkers. Many teachers also noted that doing activities online before class made the live sessions more engaging. This often involves transforming what could have been lectures into discussions or activities where students must figure things out. In fact, some teachers adopted the so-called "flipped classroom," where students take charge of their own learning. However, these benefits came with real-world challenges such as increased time, technology needs, and new planning demands. Many teachers mentioned that the school needed to continue providing support and training in digital pedagogy to maintain quality and motivation.

Indeed, institutional success relied on infrastructure, accessibility of digital tools, and legislative frameworks. Leaders recognised that blended learning would be feasible with sufficient internet connectivity, device access, and the capacity of learning management systems to support the initiative. Digital equity was a significant concern in itself, particularly because it became clear that full participation by children from disadvantaged families faced serious challenges. Students and teachers were more satisfied with institutions that invested in professional development, had clear guidelines for the design of blended courses, and provided support for technical issues throughout the year.

Blended learning has proven effective in enhancing digital literacy and essential skills for the 21st century across its structural and pedagogical aspects. Students felt more confident using online tools, engaging with digital resources, and managing projects at their own pace. Such skills are increasingly vital in academic and professional contexts. Students learned to negotiate,

collaborate, and think critically through group projects and online discussions. This increased their interest in the subject matter and in their peers. Instructors believed these changes showed that blended learning fosters greater employability and adaptability in an ever-changing digital environment.

Of equal importance was the flexibility and opportunities for collaboration that blended models offered. Students enjoyed meeting others from different academic and cultural backgrounds, which helped them better understand perspectives beyond their own. There was even a sense of inclusion for those who could study asynchronously or review courses. This supported those balancing school, work, and family responsibilities. The customisation of learning paths resulted in greater satisfaction and improved academic outcomes.

However, the investigation did find that some concerns still need to be addressed. Key issues include resistance to change among instructors when adopting innovative pedagogies, unstable internet connectivity, insufficient digital infrastructure, and heavy workloads for educators. Other problems raised involved the quality and consistency across different blended formats. The results clearly show these challenges can be tackled through ongoing investment in digital infrastructure, enhanced professional development opportunities for instructors, and policies that promote accessibility and quality assurance.

The final results indicate that blended learning has evolved from being viewed as an interim solution or a corrective measure to becoming a fundamental shift in education. Blended learning combines technology with a focus on students' needs to improve participation, autonomy, collaboration, and diversity. Although challenges remain, their impact can be minimised by institutions through careful planning and the adoption of innovative pedagogies. This research ultimately shows that blended learning is not just a teaching method but a transformative approach to aligning higher education with the evolving intellectual and professional demands of the twenty-first century.

IMPLICATIONS FOR POLICY AND PRACTICE

The report emphasises that every higher education institution should adopt a comprehensive approach to implementing blended learning. The programme needs to be organised so that students receive an appropriate mix of online and face-to-face activities. This would foster independence, learning, and interaction among students. Developing faculty members is equally important. The confidence and competence of instructors in managing blended environments will continue to improve through ongoing updates in digital pedagogy and instructional design. Institutions should continue investing in infrastructure, learning management systems, and technical support to ensure smooth operation and access. To enhance accessibility for all learners, policies must be implemented to address gaps in access and equity, ensuring that all students have equal opportunities to devices and the internet. Finally, regular evaluations of blended learning methods can maintain quality, raise standards, and promote evidence-based adaptations within educational systems.

CONCLUSION

The results of this investigation show that blended learning marks a significant advance in pedagogy at higher education institutions. It can help students become more engaged, independent, and collaborative, while also developing essential skills identified as vital for

success in the 21st century. Blended learning creates learning environments that are flexible, adaptable, and focused on students' needs by combining online and in-person methods. This opens up many academic opportunities. Students, faculty members, and administrators all report that it prepares individuals to be digitally literate, think critically, and solve problems collaboratively, some of the key skills needed for success in a knowledge-based economy. However, effective blended learning relies heavily on its implementation. For integration to succeed, the institution must be highly supportive, faculty need to be well prepared, sufficient technology must be available, and plans for universal access are essential. To fully realise its potential, ongoing issues such as digital inequalities, resistance to pedagogical change, increased workload for faculty, and quality assurance must be addressed systematically.

The study further highlights that blended learning is not merely a technological innovation but a research-based pedagogical model capable of transforming higher education. A strategic, evidence-based approach is essential, one that integrates technology, pedagogy, and planning at the school level to create welcoming, engaging, and future-ready learning environments.

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Chapter Three

EXPLORING GAPS IN THE EFFECTIVENESS OF SOCIAL AND EMOTIONAL LEARNING (SEL) INTEGRATION THROUGH SCIENCE ON ACADEMIC ACHIEVEMENT, ANXIETY, AND SELF-ESTEEM AMONG SECONDARY SCHOOL STUDENTS IN INDIA: A LITERATURE REVIEW

Bhakti Gunesh Sawant and Jayashree Inbaraj

ABSTRACT

Social and Emotional Learning (SEL) is increasingly recognised as an effective method for enhancing students' socio-emotional well-being alongside academic success. Science classrooms, with their focus on inquiry, collaboration, and evidence-based reasoning, provide a promising setting for integrating SEL practices. This literature review compiles findings from international and Indian research on SEL, especially regarding interventions that embed SEL within science instruction and their effects on academic achievement, anxiety, and self-esteem among secondary school students. Evidence from international meta-analyses shows that school-based SEL programmes produce modest to moderate improvements in both academic and emotional outcomes. Nonetheless, research specifically exploring SEL integration through science education remains limited, often qualitative or based on small-scale studies. In the Indian context, although various initiatives and policy frameworks promote SEL, there is a significant lack of experimental evidence linking SEL-through-science interventions at the secondary level with measurable academic improvements and validated mental health indicators. Major challenges include inconsistent measurement methods, variation in implementation, an exam-oriented educational culture, limited teacher training, and a shortage of culturally validated assessment tools. The review concludes by emphasising the need for focused, methodologically rigorous, and contextually sensitive research to bolster evidence on SEL integration within Indian secondary science education.

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Keywords: *Social and Emotional Learning, Science Education, Academic Achievement, Anxiety, Self-Esteem*

INTRODUCTION AND LITERATURE REVIEW

Social and Emotional Learning (SEL) comprises both explicit and implicit approaches that develop competencies such as self-awareness, self-management, social awareness, relationship skills, and responsible decision-making (CASEL, n.d.). Extensive international literature suggests that universal, school-based SEL can improve students' socio-emotional skills, reduce problem behaviours, and fairly enhance academic achievement (Durlak et al., 2011; Taylor et al., 2017). Science instruction — embodied by collaborative investigations, argumentation from evidence and metacognitive reflection — naturally provides opportunities to practise these competencies. Integrating SEL into science aims to achieve two main objectives: to reinforce scientific understanding and to develop socio-emotional skills that support learning and mental health.

This review concentrates on secondary school students (roughly ages 11–18) in India. It summarises and analyses global evidence on SEL effectiveness, examines SEL-through-science studies, and assesses the quantity and quality of Indian research linking SEL, achievement, anxiety, and self-esteem. The main aim is to identify empirical and methodological gaps that impede evidence-based policy and practice in Indian secondary schools.

Global Evidence on SEL Outcomes

Worldwide, meta-analyses have demonstrated positive effects of school-based SEL on various outcomes. Durlak et al. (2011) reported significant improvements in social skills, attitudes, and academic achievement, with an estimated 11 percentile increase. Taylor et al. (2017) observed lasting follow-up effects, indicating ongoing benefits. More recent research continues to highlight consistent advantages but also notes variability across programmes and contexts — with implementation quality, teacher support, dosage, and cultural adaptation influencing results (Cipriano et al., 2024; Learning Policy Institute, 2023).

Effects on internalising symptoms such as anxiety and self-esteem are apparent but tend to be weaker and more variable than effects on externalising behaviours and achievement (Lawson et al., 2019; Fishstrom et al., 2022). The wide variation in measurement tools — ranging from diverse anxiety and self-esteem scales, reliance on self-report, and inconsistent follow-up periods — further complicates efforts to synthesise findings through meta-analytic aggregation.

SEL Integrated Into Science

Growing interest in SEL integration through science has increased due to evidence that socio-emotional competencies are crucial in enhancing complex collaborative problem solving (Bettis, 2023; Ingram et al., 2021). Curriculum briefs and action research suggest development in SEL skills, along with a deepening of conceptual understanding, by deliberately incorporating activities such as teamwork, perspective-taking, and reflective discussions into science lessons (Smithsonian Science Education Center, 2023). However, there is strong empirical evidence that clearly identifies the effect of SEL components within science instruction. Many studies tend to combine the impact of inquiry-based teaching with SEL practices, making it difficult to precisely attribute outcomes to the SEL-specific elements of instruction.

SEL and the Indian Context

India's policy environment (NEP, 2020) emphasises holistic development. NGOs and research groups have also adapted SEL frameworks for Indian classrooms, such as The Teacher Foundation's ISELF. Projects like SEHER (Strengthening Evidence-based School-based Interventions for Promoting Adolescent Health Programme in Bihar, India) provide strong empirical evidence that school-level well-being interventions can influence mental health and some learning outcomes (Shinde et al., 2018). However, peer-reviewed research exclusively evaluating SEL integrated into science at the secondary level in India remains limited. Much of the Indian literature consists of small pilots, qualitative analyses, or programme reports that lack robust control groups and validated outcome measures.

Literature Gaps

Four significant gaps arise from the literature:

1. **Evidence gap for SEL-through-science:** Few large, rigorous trials have examined whether integrating SEL into science lessons improves academic outcomes and mental health beyond standard inquiry pedagogy.
2. **Measurement heterogeneity:** Anxiety and self-esteem outcomes are measured using a varied instrument; many are not validated for Indian languages or cultural contexts.
3. **Implementation constraints:** Readiness of the teacher, curriculum pressure, size of class, and exam orientation impact the viability and reliability of SEL integration.
4. **External validity and equity:** Studies often do not characterise the full range of Indian schools (rural/urban, government/aided/private, linguistic diversity), thereby limiting generalizability.

OBJECTIVES

This literature review addresses the following objectives:

1. To combine international and Indian evidence on the impacts of SEL on academic achievement, anxiety, and self-esteem among secondary school students.
2. To investigate the existing studies and program reports that integrate SEL within science lessons and evaluate reported outcomes.
3. To identify methodological, measurement, and implementation gaps that limit the applicability of findings to Indian secondary education.
4. To suggest actionable recommendations for research, measurement, and practice that can reinforce the evidence base in India.

RESEARCH QUESTIONS

1. According to global evidence, what impacts do school-based SEL programs have on academic achievement, anxiety, and self-esteem among secondary school students?
2. What empirical studies exist in India that have examined SEL when embedded in science, and what are their findings on achievement, anxiety, and self-esteem?
3. What are the frequent methodological and implementation limitations across studies?
4. What research designs, assessment tools, and implementation supports are required to address the existing gaps in India?

METHODOLOGY

Search strategy

An organised search was conducted across academic databases (Google Scholar, ERIC, ResearchGate), organisational repositories (CASEL, Learning Policy Institute, UNESCO), and Indian sources (The Teacher Foundation, Sangath, government reports). Search terms combined keywords: “social emotional learning”, “SEL”, “science education”, “academic achievement”, “anxiety”, “self-esteem”, “India”, “secondary”. References from major meta-analyses and Indian programme reports were used to find additional primary studies through snowballing.

Inclusion/exclusion criteria

Included sources were peer-reviewed experimental studies, systematic reviews or meta-analyses, program assessments, and reliable programme reports that presented results for secondary students (or disaggregated data). Studies focusing solely on early childhood or university students, purely clinical treatment research, or opinions lacking empirical data were excluded.

Data extraction and synthesis

Each included study was analysed for design (RCT, quasi-experimental, pre-post, or case study), sample size and characteristics, intervention description (standalone SEL versus SEL integrated subject teaching), implementation supports (teacher training, materials, fidelity checks), outcome measures (academic assessments, validated anxiety and self-esteem scales), and the key findings. Due to the heterogeneous nature of the studies, a narrative synthesis was used, supplemented by a summary table of representative studies.

RESULTS

Overview of Included Evidence

The international database contains numerous high-quality meta-analyses (Durlak et al., 2011; Taylor et al., 2017) showing positive SEL effects. SEL-through-science literature is limited and mainly consists of action research, curriculum development, and small experimental pilot studies (Ingram et al., 2021; Smithsonian Science Education Center, 2023). Indian data includes high-quality multi-component trials addressing school climate (SEHER), regional pilots of SEL programmes, and several observational studies linking anxiety/self-esteem to academic outcomes.

Effects on Academic Achievement

Meta-analytical studies suggest that universal SEL produces reasonable yet meaningful achievement gains (Durlak et al., 2011), which include improved classroom behaviour, engagement, and self-regulation, all of which support learning. However, there is a noticeable lack of rigorous trials that specifically isolate the impact of SEL integrated into science instruction, particularly components that are thoughtfully incorporated into inquiry-based learning tasks. Existing case studies advocate that SEL can enhance student engagement and teamwork skills; however, there is limited evidence indicating clear improvements in standardised academic achievement directly linked to SEL components.

Effects on Anxiety and Self-Esteem

Evidence suggests SEL can reduce symptoms such as anxiety and improve self-esteem, though the effects are generally smaller and less consistent when compared to externalising behaviours. In India, many studies report relationships between academic anxiety, lower achievement, and reduced self-esteem, often through regional cross-sectional surveys. Nonetheless, large-scale intervention studies that use validated anxiety measures before and after SEL programmes are scarce.

Indian Studies and Examples

- **SEHER (Bihar):** A cluster RCT showed that a multi-component school intervention improved school climate and reduced certain negative outcomes. Although not specifically an SEL-through-science study, the SEHER project (Shinde et al., 2018) demonstrates that well-designed, school-wide interventions can deliver significant psychosocial benefits for Indian secondary students.
- **ISELF and NGO pilots:** Many NGOs have enhanced SEL materials for Indian classrooms and conducted pilot teacher trainings; assessments often show improved classroom climate and student engagement, but they rely on small samples and non-randomised designs.

Measurement, Methodological, and Implementation Gaps

1. **Measurement:** Anxiety and self-esteem measures differ significantly and are often not validated in local languages, while reliance on a single-informant self-report increases the risk of bias.
2. **Design:** Few cluster-randomised trials evaluate SEL integration in subject teaching in India. Many studies employ pre-post designs without controls.
3. **Attribution:** When science teaching methods such as inquiry-based learning or group work are altered alongside SEL components, it becomes difficult to isolate their individual effects without employing factorial or mediation research designs.
4. **Implementation Reliability:** Teacher capacity, monitoring, and reliability measurement are often insufficiently specified; and the practicality of scaling such interventions in typical Indian classrooms with large class sizes and exam pressure remains uncertain.

Table 1. Representative Studies And Key Findings (Summary).

Study	Design / Context	Intervention focus	Key outcomes
Durlak et al. (2011).	Meta-analysis (K–12, international)	School-based SEL programs	Improved SEL competencies, attitudes, behaviour, ~11 percentile gain in achievement
Taylor et al. (2017).	Meta-analysis	SEL programs, follow-up effects	Positive sustained effects on socio-emotional outcomes
Shinde et al. (2018). — SEHER	Cluster RCT, Bihar, India	School health/climate intervention	Improved school climate and student well-being indicators
Ingram et al. (2021).	Action research (STEM classrooms)	STEM+SEL instructional strategies	Improved collaboration, discourse, and small sample
Smithsonian Science Education Center (2023)	Curriculum whitepaper	Models to integrate SEL into 3-D science	Practical strategies; limited causal evidence

(Table summarises representative sources; full reference list below.)

CONCLUSION AND IMPLICATIONS

International evidence shows that school-based SEL programmes enhance social and emotional skills and lead to moderate improvements in academic performance, while effects on anxiety and self-esteem are encouraging but vary. Science classrooms offer excellent opportunities for integrating SEL, as inquiry-based learning naturally supports SEL practices. However, there is limited empirical research in India establishing the specific impact of SEL integrated into science on standardised academic achievement, anxiety, and self-esteem among secondary school students.

Implications for Research

1. **Large-scale, rigorous trials:** Conduct cluster randomised or robust quasi-experimental studies of SEL-integrated science curricula across various Indian school settings, employing standardised academic assessments and validated measures of anxiety and self-esteem.
2. **Measurement work:** Translate, culturally adapt, and validate anxiety and self-esteem instruments for Indian languages and contexts, including multi-informant assessments from students, teachers, and parents.
3. **Component analysis:** Employ factorial designs or mediation analysis to distinguish the effects of inquiry pedagogy from explicit SEL components.
4. **Implementation science:** Examine teacher training models, reliability monitoring, scalability, and cost-effectiveness within real-world constraints such as exam schedules and large classes.

Implications for Practice And Policy

1. **Teacher professional development:** Offer scalable training programmes for science teachers to incorporate SEL within inquiry-based lessons.
2. **Policy alignment:** Use NEP 2020 priorities to incorporate SEL objectives into curricular frameworks and assessments.
3. **Equity focus:** Prioritise trials in underrepresented settings such as rural, government schools, and tribal schools to ensure findings are relevant across India's diverse context.

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Chapter Four

ARTIFICIAL INTELLIGENCE ENABLED PERSONALISED LEARNING FOR NEURODIVERGENT CHILDREN IN EDUCATION

Bharti Tandon and Dev Priya

ABSTRACT

Artificial Intelligence (AI), defined as computer systems capable of performing tasks that typically require human intelligence, is increasingly influencing educational practices, particularly in the area of personalised learning. Personalised learning seeks to tailor educational experiences to individual learners' strengths, preferences, and challenges. Traditional instructional approaches often fall short in addressing the diverse needs of neurodivergent children, including learners with autism, ADHD, and dyslexia, who engage with information and learning in varied ways. AI-driven platforms offer adaptive, data-informed learning pathways that respond to individual learner profiles, thereby enhancing inclusion. This paper examines the potential of AI to support inclusive education for neurodivergent students by reviewing tools such as intelligent tutoring systems, adaptive learning environments, and emotion-recognition technologies. These tools can improve engagement, reduce cognitive overload, and facilitate communication. Within the Indian context, the National Education Policy 2020 emphasises equity, inclusion, and technology-enabled learning, goals that are supported by AI-based personalisation. However, the paper also highlights ethical and pedagogical concerns, including data privacy, algorithmic bias, and diminished human interaction. It positions AI as a complementary tool that supports teachers rather than replacing them and underscores the importance of collaboration among educators, parents, and specialists. Overall, the paper situates AI within a broader inclusive education framework aligned with NEP 2020.

Keywords: *Artificial Intelligence, Personalised Learning, Neurodivergent Children, Inclusive Education, NEP 2020.*

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INTRODUCTION

Education systems worldwide are evolving swiftly due to digital technology, evolving social expectations, and an improved understanding of student diversity. Neurodivergent children, such as those with autism, ADHD, and dyslexia, often face difficulties in traditional classrooms. These settings typically have fixed pacing, limited flexibility, and rely predominantly on verbal instruction. Consequently, they may not accommodate the sensory needs, communication styles, attention variations, or emotional requirements of neurodivergent students.

AI technologies address these issues by personalising learning based on each student's progress, preferences, and needs (Holmes et al., 2019). AI monitors students' progress in real time, observes their engagement, identifies learning patterns, and adjusts the difficulty or sensory aspects of tasks. Emotion-recognition tools detect when a student feels frustrated or overwhelmed and give teachers insights they might otherwise miss (D'Mello & Graesser, 2015).

The integration of AI in education requires a balanced approach. While AI systems can support personalised learning, they cannot replace the social, emotional, and ethical judgment that teachers provide. Educators remain crucial for contextualising AI-generated suggestions, offering empathy, and interpreting behaviours that algorithms may mistake. As emphasised in NEP 2020, technology should act as a facilitator of equity rather than a substitute for human relationships in learning (Government of India, 2020).

This paper explores how AI, personalised learning, and neurodiversity integrate within inclusive education. It explains how AI can collaborate with teachers to support neurodivergent students. The aim is to enable these students to participate, gain independence, and progress academically. The paper also stresses the importance of following ethical and teaching standards.

NEED AND SIGNIFICANCE

The study aims to investigate how AI can effectively support personalised learning for neurodivergent children by aligning teaching strategies with their cognitive, emotional, and behavioural profiles. It concentrates on adaptive learning platforms, intelligent tutoring systems, natural language processing tools, and emotion-recognition technologies that offer various forms of support.

It identifies how AI can best support personalised learning for neurodivergent children by matching teaching methods to their cognitive, emotional, and behavioural needs. It explores adaptive learning platforms, intelligent tutoring systems, language tools, and emotion-recognition technologies that provide different types of support. learner-centred educational environments (Holmes, Bialik, & Fadel, 2019).

For example, an AI reading assistant can offer immediate help to dyslexic students with word decoding. Adaptive platforms can modify lesson speed and style for students with ADHD. Emotion-aware AI can detect stress triggers in autistic students, enabling teachers to intervene at the appropriate moment.

The study is significant for its educational implications and alignment with NEP 2020, which promotes the use of technology to address diverse learning needs, reduce barriers, and ensure equitable access to quality education (Government of India, 2020). By emphasising human–AI

collaboration, the study highlights the importance of ethical use and teacher involvement in creating meaningful learning experiences.

METHODOLOGY

This study employs a theoretical analysis. It consolidates research on AI in education, inclusive teaching, neurodiversity, and cognitive science. This method offers a deeper understanding of how AI can support neurodivergent students. The approach uses personalised and adaptive learning strategies. Research from 2015 to 2025 was reviewed, focusing on:

- AI applications in personalised learning
- Educational needs of neurodivergent learners
- Ethical issues arising from AI adoption
- Policy frameworks related to inclusive and technology-enabled education
- NEP 2020 guidelines on technology integration

The study employs constructivist learning theory, Universal Design for Learning (UDL), and human–AI teamwork to guide the research (Vygotsky, 1978; CAST, 2018; Holmes et al., 2019). These approaches demonstrate how AI can broaden learning opportunities while maintaining vital human qualities such as empathy, support, and teaching within context.

THEORETICAL FRAMEWORK

Three theoretical perspectives guide the analysis:

Constructivist Theory

Constructivism views learning as an active, socially mediated process in which students build knowledge through interaction and guided exploration (Vygotsky, 1978). AI can support this process by providing adaptive feedback and personalised scaffolding. Each learner's zone of proximal development can be targeted. For neurodivergent children, AI can identify when extra guidance or reduced cognitive demands are needed.

Universal Design for Learning (UDL)

UDL encourages adaptable learning settings that cater to different learning styles by offering various means of representation, engagement, and expression (CAST, 2018). AI systems implement UDL by automatically modifying content formats, such as providing visual aids for autistic learners or speech-to-text for dyslexic students.

AI Collaborative Framework

This approach views AI as a teaching partner that works alongside teachers, not replaces them (Holmes et al., 2019). AI offers information about student performance, while teachers utilise their understanding and emotional skills. NEP 2020 endorses this approach, advocating for ethical and fair use of technology (Government of India, 2020).

REVIEW OF RELATED LITERATURE

The neurodiversity movement regards neurological differences as normal human variation rather than problems (Singer, 1999; Armstrong, 2012). From this point of view, inclusive education strives to create learning environments where neurodivergent students can thrive. NEP 2020 and UNESCO (2021) also endorse education that centres on the learner and values diverse abilities.

AI improves personalised learning by using adaptive algorithms, predictive analytics, and intelligent tutoring systems (Holmes, Bialik, & Fadel, 2019). Studies indicate that AI boosts motivation, comprehension, and memory through instant feedback, diverse support options, and customised instruction (Chen, Chen, & Lin, 2020).

For neurodivergent learners, AI technologies provide specific advantages:

- Emotion-recognition tools help interpret feelings that autistic learners may struggle to express (Grynszpan et al., 2014).
- Assistive technologies improve communication for learners with speech or language impairments.
- Gamified learning platforms engage learners with ADHD through interactive, task-oriented challenges.
- Adaptive reading tools support dyslexic learners with decoding and fluency difficulties.

Even with these benefits, experts warn against using AI without careful thought. Main concerns include:

- Data privacy risks (UNESCO, 2021)
- Algorithmic bias (Williamson & Piattoeva, 2022)
- Reduction of human interaction (Selwyn, 2019)

Teachers should remain central in interpreting AI results and making teaching decisions. Neurodiversity emphasises the use of students' unique strengths and ways of thinking (Armstrong, 2012). Inclusive education aims to give everyone equal learning opportunities by removing barriers in structures, teaching, and attitudes (UNESCO, 2021). AI can:

- Customise instruction
- Modify sensory load
- Offer multimodal supports
- Provide structured routines
- Reduce cognitive overload. These features are especially useful for neurodivergent students who need learning environments that are predictable, responsive, and flexible. For example, AI can convert written text into speech for students with dyslexia, provide visual aids for students with autism, or adjust the pace for students with ADHD.

AI should support, not replace, human teaching. Teachers bring emotional understanding, ethical judgment, and context that AI cannot provide. AI enhances educators' capacity by offering data-driven insights, targeted feedback, and adaptive scaffolding. Rather than automating teaching, AI

assists educators by managing time-consuming tasks such as progress monitoring and data analysis (Luckin et al., 2016). This frees teachers to concentrate on socio-emotional and relational aspects of learning.

AI systems tailor tasks to learners' cognitive profiles, such as adjusting reading difficulty or offering structured routines for learners with ASD (Holmes, Bialik, & Fadel, 2019). Teachers and AI collaborate as co-educators. AI proposes instructional adaptations, while teachers validate and implement them (Selwyn, 2019). AI lessens administrative workload, allowing teachers to focus more on engaging with learners (Luckin et al., 2016).

APPLICATIONS OF AI FOR NEURODIVERGENT LEARNERS

AI has many applications that directly support neurodivergent students by addressing their thinking, sensory, behaviour, and communication needs. These tools provide various learning pathways, reduce barriers, and create environments where neurodivergent students can engage with the curriculum in meaningful ways.

Adaptive Learning Platforms

Adaptive learning platforms personalise content delivery by analysing learner performance, engagement levels, and error patterns. Tools such as DreamBox and Knewton adjust difficulty, pacing, and modes of representation based on real-time data. For learners with ADHD, these platforms can break tasks into smaller chunks, offer short interactive modules, and incorporate gamified rewards that sustain attention. Dyslexic learners benefit from embedded decoding support, scaffolded vocabulary development, and multimodal reading materials that reduce cognitive load (Luckin et al., 2016). Such systems enable educators to tailor instruction at scale while maintaining individual responsiveness.

Intelligent Tutoring Systems

Intelligent Tutoring Systems (ITS) simulate one-to-one human tutoring by offering immediate feedback, targeted hints, and dynamic questioning patterns. They adapt to the learner's pace and continuously modify instructional pathways based on performance. For autistic learners, ITS can include social narratives, visual cues, and interactive simulations designed to teach social norms, emotional understanding, and problem-solving skills (D'Mello & Graesser, 2015). These systems support learners in practising skills within structured, low-stress environments where repetition and personalised guidance are easily accessible.

Emotion Recognition Technologies

Emotion recognition technologies utilise artificial intelligence to analyse facial expressions, voice patterns, posture, and physiological indicators to interpret emotional states. These tools are especially beneficial for neurodivergent learners who find it difficult to express emotions or recognise social cues. By detecting signs of distress, disengagement, or cognitive overload, AI systems can alert teachers and adapt instructional strategies accordingly (Mollahosseini et al., 2019). This supports emotional regulation, diminishes behavioural escalation, and helps create safer, more empathetic learning environments.

Assistive Communication Tools

AI-enhanced assistive communication tools—such as speech-to-text applications, predictive text systems, and natural language processing platforms—offer essential support for learners with language or speech impairments. These tools help students express their thoughts, take part in discussions, and finish written tasks with greater independence. For dyslexic learners and those with expressive language difficulties, these systems enhance accuracy, lessen frustration, and enable them to participate more confidently in academic activities (Holmes et al., 2019).

Learning Analytics and Early Intervention

Learning analytics utilises AI to monitor patterns in academic performance, attendance, engagement, and behaviour. By identifying potential learning difficulties early, AI enables teachers and specialists to intervene before challenges escalate. Predictive models can detect early signs of attention issues, reading difficulties, or emotional distress (UNESCO, 2021). This proactive approach encourages timely, targeted, and evidence-based supportive interventions.

Gamified Learning and Virtual Reality

AI-powered gamified learning platforms incorporate motivational features such as points, levels, and interactive challenges to boost engagement. These are especially effective for learners with ADHD, who often respond well to immediate rewards and dynamic tasks. Virtual reality (VR) systems, however, create immersive environments where autistic learners can practise social interactions, daily routines, and communication strategies in controlled, low-pressure settings (Parsons & Cobb, 2011). These tools support experiential learning, build self-confidence, and facilitate the transfer of skills to real-world contexts.

CHALLENGES AND ETHICAL CONSIDERATIONS IN AI FOR NEURODIVERGENT EDUCATION

Although AI offers significant benefits for supporting neurodivergent learners, there are also ethical, technical, and social challenges that must be addressed to ensure it is used safely and fairly. These include concerns around data such as performance, behavioural patterns, and emotional states—much of which is sensitive and deeply personal. Without robust privacy safeguards, this data may be vulnerable to misuse or unauthorised access. Protecting the dignity and rights of neurodivergent learners requires strict adherence to privacy regulations, informed consent procedures, and transparent data governance structures (UNESCO, 2021).

Algorithmic Bias

AI models trained mainly on neurotypical populations may fail to recognise or correctly interpret the behaviours and communication styles of neurodivergent learners. Such biases can cause inaccurate predictions, mislabelling of behaviours, or unsuitable interventions (Holmes et al., 2019). Tackling algorithmic bias requires inclusive datasets, continuous auditing, and active participation of neurodivergent communities in design processes.

Impact on Emotional Well-being

While AI can support personalised learning, overreliance on technology may weaken meaningful human relationships. Neurodivergent learners often rely on emotional support, empathy, and social interaction—elements that AI cannot imitate. Excessive screen time or automated feedback

can limit opportunities for interpersonal contact, thus impacting social-emotional development (Selwyn, 2019). Educators need to balance the use of AI with direct human interaction.

Threats to Teacher Autonomy

AI-generated recommendations may unintentionally sway decisions and diminish teachers' independence. Teachers should remain responsible for interpreting AI information, using it as a tool rather than as explicit instructions. Their professional judgment is necessary to contextualise AI results and ensure they are utilised ethically and in the best interests of students (Luckin et al., 2016). Access to AI also varies across socio-economic and geographic regions. Schools in rural or low-income areas may lack the infrastructure, trained staff, or technology required to effectively employ AI. This digital divide can exacerbate existing educational inequalities, limiting the benefits of AI for neurodivergent learners (UNESCO, 2021). Investment in equitable infrastructure is crucial.

Alignment with NEP 2020

NEP 2020 envisions an inclusive, learner-centred education system where technology promotes flexibility, equity, and overall development. The integration of AI aligns closely with this vision.

Inclusive and Equitable Education

NEP focuses on the removal of barriers to participation and the support of diverse learning needs. AI tools that personalise instruction for learners with ASD, ADHD, and dyslexia directly support the inclusivity aims of NEP 2020 by ensuring all learners can access meaningful learning opportunities.

Competency-Based Learning

The policy shifts the emphasis from rote memorisation to skills like critical thinking, creativity, and problem-solving. AI supports this change by providing instant, personalised feedback, adaptive assessments, and real-time progress monitoring (Holmes et al., 2019). These tools promote mastery-based progression in line with NEP's learner-centred approach.

Teacher Professional Development

NEP 2020 emphasises the importance of upskilling teachers in digital technologies, AI tools, and data interpretation. With proper training, teachers can utilise AI to improve instructional quality, lessen administrative workload, and develop personalised learning plans (Luckin et al., 2016).

Ethical Use of Technology

Ethical considerations are central to NEP 2020, which mandates the responsible, transparent, and child-centred use of technology. AI applications must therefore preserve learner autonomy, dignity, and well-being while ensuring data protection (Government of India, 2020).

Future-Ready Learning

AI equips students for a growing digital world by fostering adaptability, technological literacy, and resilience. These skills match NEP's focus on preparing learners for globalised and technology-driven futures.

FUTURE DIRECTIONS AND RECOMMENDATIONS

To ensure that AI enhances learning opportunities for neurodivergent students, several strategic directions must be prioritised.

Inclusive AI Design

AI systems should be developed using diverse and representative datasets that reflect the full spectrum of neurodivergent experiences. Collaboration among educators, neuroscientists, technologists, and disability advocates is vital to ensure accuracy, fairness, and cultural sensitivity (UNESCO, 2021).

Strengthen Teacher Training

Teachers must undergo systematic training in AI literacy, ethical technology use, and data interpretation. Professional development programmes should prepare educators to integrate AI into classroom practice critically and confidently (Luckin et al., 2016).

Promote Human–AI Collaboration

A balanced co-teaching approach ensures that AI supports, rather than replaces, human interactions. Teachers should use AI insights to enhance instructional practices while maintaining close relationships with learners (Selwyn, 2019).

Ensure Ethical Governance

Policies are necessary to regulate AI deployment, addressing areas such as data privacy, algorithmic transparency, accountability, and equitable access. Strong governance guarantees the protection of neurodivergent learners' rights and well-being (Government of India, 2020).

Expand Infrastructure

Governments and institutions must invest in digital infrastructure, particularly in rural and underserved areas. Access to dependable devices, internet connectivity, and assistive technologies is crucial for maximising AI's benefits.

Support Research

Comprehensive, long-term research is essential to understand AI's effects on academic results, social-emotional growth, and future well-being. Findings can inform evidence-based policies and teaching practices.

Engage Families

Parental involvement strengthens AI-supported learning by providing consistent reinforcement at home. Families can offer valuable insights about learners' strengths, challenges, and routines, thereby improving the personalisation of AI-driven interventions (D'Mello & Graesser, 2015).

CONCLUSION

AI has significant potential to support personalised, inclusive learning for neurodivergent children, enabling meaningful and accessible engagement with educational content. When implemented ethically and collaboratively, AI enhances rather than replaces teacher expertise. It supports differentiated instruction, assists with emotional regulation, and promotes learner autonomy (Holmes, Bialik, & Fadel, 2019; Luckin et al., 2016). However, its use requires careful

attention to privacy, fairness, human oversight, and access (Selwyn, 2019). In line with NEP 2020, a human-centred and ethically grounded approach ensures that AI acts as a pedagogical partner, enabling neurodivergent learners to thrive academically and emotionally in inclusive educational settings.

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Chapter Five

ARTIFICIAL INTELLIGENCE IN PERSONALISED LEARNING: OPPORTUNITIES, CHALLENGES, AND ETHICAL DILEMMAS

Bindu Dua and Reeta Dwivedi

ABSTRACT

The integration of artificial intelligence (AI) in personalised learning marks a transformative shift in educational technology, offering unprecedented opportunities while also presenting complex challenges and ethical issues. This conceptual paper explores AI-driven personalised learning systems, examining their potential to revolutionise education through adaptive content delivery, intelligent tutoring systems, and real-time learning analytics. AI enables increased student engagement with tailored content, better outcomes via adaptive assessments, and scalable personalised instruction that accommodates diverse learning styles. However, there are significant implementation challenges, including technological infrastructure needs, teacher training requirements, and the complexity of modelling human learning processes. The digital divide risks worsening educational inequalities, while algorithmic bias could reinforce systemic discrimination. Key ethical dilemmas involve student privacy protection, data ownership rights, algorithmic transparency, and the potential dehumanisation of educational relationships. This paper suggests a balanced framework for implementing AI in personalised learning that maximises educational benefits while addressing ethical concerns through transparent algorithms, strong privacy safeguards, and a focus on human-centred pedagogical approaches.

Keywords: *Artificial Intelligence, Personalised Learning, Educational Technology, Adaptive Learning, Learning Analytics.*

INTRODUCTION

Artificial Intelligence (AI) can be defined as the capacity of machines and computer systems to imitate human cognitive functions such as learning, reasoning, problem-solving, and decision-

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making (Nguyen, 2022; UNESCO, 2021). Unlike traditional computer programs that follow fixed sets of instructions, AI technologies are capable of analysing data, recognising patterns, and adapting their outputs based on experience (Bhutoria, 2022). Over the past two decades, AI has expanded beyond industrial and commercial sectors to find applications in healthcare, governance, business, and most recently, education (Tu, 2025; Workday, 2025). In the educational context, AI is increasingly employed to design adaptive learning systems, automate assessments, provide real-time feedback, and create personalised learning experiences that cater to the unique needs of each learner (Tapalova & Bhutoria, 2022; Vorobyeva et al., 2025).

Personalised learning describes an instructional approach that moves away from the traditional "one-size-fits-all" teaching model. Instead, it highlights flexibility, learner agency, and customised pathways that adapt to students' pace, abilities, and interests (Bhutoria, 2022; Vorobyeva et al., 2025). The aim of personalised learning is to ensure that every learner can engage with content in a way that is most meaningful and effective for them. AI plays a vital role in facilitating this by analysing large amounts of learner data—such as performance records, behavioural patterns, and engagement levels—to recommend suitable resources, modify task difficulty, and provide focused feedback (Tu, 2025; Luo, 2025). Tools like intelligent tutoring systems, adaptive testing, recommendation engines, and chatbots are now integral to the personalised learning ecosystem (Tapalova, 2022; Hasan & Tu, 2025).

The idea of personalised education has historical origins in early adaptive learning systems of the late twentieth century, which utilised simple rule-based mechanisms to tailor instruction. However, these systems lacked adaptability and contextual understanding (Bhutoria, 2022). With advances in AI—particularly machine learning and natural language processing—personalised learning has become significantly more sophisticated and responsive. Contemporary AI-powered platforms can monitor a learner's progress in real time, anticipate areas of difficulty, and adapt the learning pathway accordingly (Tu, 2025; UNESCO, 2022). This development marks a paradigm shift in pedagogy: from standardised curricula to dynamic, data-driven ecosystems that value learner diversity (Vorobyeva et al., 2025; Mochizuki, 2025).

The importance of AI-enabled personalised learning has increased in the post-COVID-19 era. The abrupt and widespread shift to online and blended learning revealed significant challenges in access, adaptability, and quality across global education systems (OECD, 2021; UNESCO, 2023). In this context, AI has emerged as a potential solution to sustain engagement, support differentiated learning, and enhance the resilience of education (Axios, 2025; Workday, 2025). Simultaneously, the growing digitalisation of society and the escalating demands of the knowledge economy emphasise the need to prepare learners for a rapidly evolving world (OECD, 2023; Li, 2025). Within global education policy, AI is also linked to Sustainable Development Goal 4, which seeks to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" (UNESCO, 2023; OECD, 2021).

This paper aims to conceptually analyse the role of AI in personalised learning by exploring three key dimensions: opportunities, challenges, and ethical dilemmas. While AI promises to enhance engagement, accessibility, and efficiency in learning, it also raises concerns regarding bias, data privacy, equity, and pedagogical integrity (Nguyen, 2022; Mochizuki, 2025). A research gap exists because much of the current literature emphasises technical efficiency or policy adoption while paying insufficient attention to the sociological, pedagogical, and ethical dimensions of AI

in education (Li, 2025; Tapalova & Bhutoria, 2022). By addressing this gap, the paper seeks to provide a more balanced and critical perspective.

The main argument of this paper is that AI-driven personalised learning has great potential to transform education, but its realisation must be guided by careful reflection and ethical issues (UNESCO, 2021; Tapalova, 2022). Without tackling problems of fairness, transparency, and inclusivity, AI risks perpetuating existing inequalities and diminishing the human element of teaching and learning (Mochizuki, 2025; Vorobyeva et al., 2025). A detailed, multidisciplinary approach is therefore essential to ensure that AI serves as a tool for empowerment rather than domination in education (Mochizuki, 2025; OECD, 2024).

REVIEW OF LITERATURE

The integration of Artificial Intelligence (AI) into personalised learning has attracted considerable interest in recent years, resulting in an expanding body of research covering technical, pedagogical, ethical, and sociological aspects. Early research focused mainly on adaptive learning systems that used rule-based algorithms to modify instructional content based on student performance (Luo, 2025; Tu, 2025). Although these systems marked an initial step towards personalisation, they were constrained by limited flexibility, contextual understanding, and scalability (Mochizuki, 2025).

With the rise of modern AI technologies, such as machine learning, natural language processing, recommender systems, and intelligent tutoring systems, personalisation has become more sophisticated and dynamic (Nguyen, 2022; UNESCO, 2022). Research shows that AI can facilitate adaptive content delivery, offer predictive analytics to identify at-risk learners, and boost engagement through gamification and interactive platforms (Bhutoria, 2022; Tapalova & Bhutoria, 2022). Case studies of platforms like IBM Watson Tutor, Squirrel AI, and personalised MOOCs demonstrate the real-world application of these technologies, highlighting improved learning outcomes and customised pathways for diverse learners (Vorobyeva et al., 2025; Tu, 2025).

The theoretical bases of AI in personalised learning stem from constructivist learning theories and models of human-machine collaboration. Constructivist approaches, based on the work of Dewey and Vygotsky, highlight that learners build knowledge through interaction, reflection, and experience (Vorobyeva et al., 2025; Mochizuki, 2025). AI-driven personalisation, on the other hand, often focuses on efficiency, measurable outcomes, and algorithmic suggestions. Although these systems can improve performance, there is a danger of reducing learning to data points and overlooking wider cognitive and socio-emotional development (Nguyen, 2022; Tapalova & Bhutoria, 2022).

Human-in-the-loop frameworks advocate that AI should augment rather than replace teachers, maintaining relational, ethical, and contextual aspects of learning (Tapalova & Bhutoria, 2022; UNESCO, 2022). Teachers interpret AI outputs, contextualise recommendations, and provide moral and socio-emotional support, preserving the human element of education (Vorobyeva et al., 2025; Tu, 2025). Critical pedagogy perspectives, inspired by Freire, warn against uncritical techno-optimism that reduces learners to data points and reinforces systemic inequalities (Mochizuki, 2025). AI can deepen social inequities if it encodes bias or favours learners with better digital access.

However, scholars also emphasise the challenges and limitations of AI integration. Algorithmic bias, unequal access to technology, over-reliance on AI, and pedagogical constraints are common concerns (Nguyen, 2022; Mochizuki, 2025; UNESCO, 2021). Ethical issues, such as privacy, autonomy, and fairness, are increasingly highlighted in the literature, with frameworks like utilitarianism and deontological ethics applied to AI governance in education (Li, 2025; Tapalova & Bhutoria, 2022).

Policy and governance have become key themes in the literature. International guidelines from UNESCO and OECD emphasise human-centred AI, inclusivity, and data protection (UNESCO, 2021; OECD, 2023). National policies, such as India's NEP 2020, promote AI-enabled learning, teacher training, and digital infrastructure while recognising risks like algorithmic bias and privacy issues (Government of India, 2020; Bhutoria, 2022).

Despite these contributions, the literature reveals a research gap. Most studies are either technical or policy-focused, with limited investigation of holistic sociological, pedagogical, and ethical viewpoints (Mochizuki, 2025; Nguyen, 2022). This emphasises the necessity for conceptual analyses that encompass the opportunities, challenges, and ethical dilemmas of AI in personalised learning within wider educational and sociological contexts.

RESEARCH QUESTIONS

This study aims to conceptually examine the role of AI in personalised learning by exploring three key dimensions: opportunities, challenges, and ethical dilemmas. The specific research questions guiding this investigation are:

1. What are the opportunities of AI in personalised learning, and how do they enhance educational outcomes and accessibility?
2. What are the main challenges and risks associated with AI-enabled personalised learning in terms of implementation, equity, and pedagogical integrity?
3. What ethical dilemmas arise in balancing personalisation with privacy, autonomy with algorithmic control, and equity with market-driven motives?
4. How can policy frameworks, governance mechanisms, and teacher preparedness effectively mitigate these challenges while maximising the benefits of AI in education?

These research questions aim to provide a thorough understanding of the complex nature of AI integration in personalised learning, extending beyond technical aspects to include broader sociological, pedagogical, and ethical dimensions that are often overlooked in current literature.

METHODOLOGY

This paper adopts a conceptual and qualitative research method to examine the role of Artificial Intelligence (AI) in personalised learning. Instead of collecting primary data through empirical means, the study reviews secondary sources to explore opportunities, challenges, ethical dilemmas, and policy implications. This method is especially suitable for investigating emerging technologies such as AI, where sociological, pedagogical, and ethical considerations often demand critical reflection and theoretical grounding (Nguyen, 2022; Mochizuki, 2025).

DATA SOURCES

The primary evidence base comprises peer-reviewed journal articles, including studies published in *Computers & Education*, *British Journal of Educational Technology*, and *AI & Society*, offering insights into AI applications, learning analytics, and personalised learning platforms (Bhutoria, 2022; Tapalova & Bhutoria, 2022; Vorobyeva et al., 2025). Additionally, international policy documents such as UNESCO's Recommendation on the Ethics of Artificial Intelligence and OECD AI guidelines provide normative frameworks for ethical and equitable AI implementation in education (UNESCO, 2021; OECD, 2023). National policies, notably India's NEP 2020, were reviewed to understand the domestic governance perspective on AI integration (Government of India, 2020). Case studies of AI-enabled platforms, such as IBM Watson Tutor, Squirrel AI, and AI-powered MOOCs, offer practical examples of opportunities and limitations in real-world learning contexts (Tu, 2025; Vorobyeva et al., 2025).

SCOPE AND FOCUS

This study is conceptual rather than empirical, focusing on the sociological, pedagogical, and ethical aspects of AI in education. It does not concentrate on quantitative outcomes such as test scores or completion rates but instead critically explores the implications of AI for learners, teachers, and institutions. Main areas include learner autonomy, equity, algorithmic bias, privacy, teacher roles, and governance structures.

ANALYTICAL FRAMEWORK

The analysis is guided by a theoretical and interdisciplinary perspective, integrating views from sociology, pedagogy, and ethics. Foundational educational theories, including constructivism and critical pedagogy, form the basis for evaluating how AI-mediated learning interacts with human-centred teaching practices. Ethical frameworks, such as utilitarian and deontological approaches, are utilised to examine dilemmas like privacy versus personalisation and equity versus market-driven motives (Nguyen, 2022; Tapalova & Bhutoria, 2022).

By integrating literature synthesis, theoretical grounding, and insights from case studies, this methodology facilitates a comprehensive understanding of AI in personalised learning. It enables a critical evaluation of both technological opportunities and sociological-ethical issues, positioning AI within wider debates about education, equity, and digital transformation.

RESULTS AND DISCUSSION

Research Question 1: Opportunities of AI in Personalised Learning

Artificial Intelligence (AI) presents transformative opportunities for personalised learning, enabling customised educational experiences that cater to the distinct needs, abilities, and interests of each learner (Bhutoria, 2022; Tu, 2025). By utilising data-driven insights, AI supports adaptive teaching, predictive analytics, engagement, inclusivity, scalability, and lifelong learning.

Adaptive Content Delivery: One of the most significant benefits of AI is its ability to provide adaptive content, tailoring lessons, exercises, and assessments to a learner's profile (Tapalova, 2022; Bhutoria, 2022). For example, intelligent tutoring systems (ITS) can adjust question difficulty based on a student's performance in real time (Tu, 2025; Hasan & Tu, 2025). This ensures learners are neither under-challenged nor overwhelmed, promoting optimal engagement

and mastery of concepts (Luo, 2025). Adaptive content also enables differentiation for learners with different cognitive abilities and learning styles, fostering equity within the classroom (UNESCO, 2022). Modern platforms can analyse learning patterns and automatically modify presentation formats, pacing, and complexity levels to suit individual learner preferences and capabilities.

Learning Analytics and Prediction: AI-powered learning analytics give educators actionable insights into student progress. Algorithms identify patterns in performance and engagement, helping teachers spot at-risk students early (OECD, 2024; Luo, 2025). Predictive models can foresee potential learning gaps, enabling timely interventions and resource planning (Tu, 2025; UNESCO, 2022). Such predictive tools improve instructional planning and support personalised pathways that meet individual learner needs (Bhutoria, 2022). These analytics can also determine optimal learning times, preferred content formats, and effective instructional strategies for each student, creating a detailed profile that guides pedagogical decisions.

Inclusivity and Accessibility: AI promotes inclusive learning environments, especially for learners with disabilities. Assistive technologies driven by AI—such as speech-to-text, automated translations, and personalised interfaces—allow access to content for students with sensory, linguistic, or cognitive difficulties (Vorobyeva et al., 2025; UNESCO, 2022). These tools democratise education by removing barriers and offering equitable opportunities for learners who might otherwise struggle in traditional classroom settings (Mochizuki, 2025). AI-enabled accessibility features can automatically produce captions, translate content into multiple languages, and modify visual presentations to meet the diverse needs of students.

Engagement and Motivation: AI boosts learner engagement and motivation through gamification, interactive platforms, and personalised feedback (Tapalova, 2022; Hasan & Tu, 2025). Adaptive learning environments can dynamically modify challenges, rewards, and content formats to maintain interest and intrinsic motivation (Nguyen, 2022). Personalised feedback plays a key role, helping learners understand errors, reinforce correct reasoning, and guide future learning strategies (Tu, 2025). By balancing challenge and support, AI encourages self-efficacy and a growth mindset in learners (Bhutoria, 2022; Vorobyeva et al., 2025).

Scalability of Personalised Education: AI also tackles the challenge of expanding personalised learning to large populations (OECD, 2023; UNESCO, 2023). In settings where teacher-student ratios are high, AI systems can provide individualised instruction to thousands of learners at once (Tapalova & Bhutoria, 2022). By automating routine tasks such as grading, assessments, and progress monitoring, educators can concentrate on higher-order pedagogical activities and mentorship (Luo, 2025). Scalability ensures that personalised education is not restricted to elite or well-resourced institutions but becomes accessible to diverse learners, including those in remote or underserved areas.

Research Question 2: Challenges in AI-Enabled Personalised Learning

Although AI offers vast opportunities in personalised learning, its adoption comes with notable conceptual, technical, and social challenges. Addressing these is essential to ensure AI acts as a tool for empowerment rather than sustaining inequalities or undermining pedagogical integrity (Nguyen, 2022; Mochizuki, 2025).

Algorithmic Bias and Fairness: AI systems depend on historical and behavioural data to generate predictions and recommendations. If these datasets mirror existing social inequalities, the AI might unintentionally reproduce or intensify biases related to gender, caste, race, or socio-economic background (Nguyen, 2022; Mochizuki, 2025). For instance, recommendation engines could favour students with prior access to high-quality resources, leaving disadvantaged learners behind. Ensuring fairness involves meticulous dataset curation, ongoing auditing, and the implementation of bias-mitigation strategies (Tapalova & Bhutoria, 2022; UNESCO, 2022). The challenge is heightened by the fact that bias can be subtle and hard to identify, necessitating continuous monitoring and adjustment of AI systems.

Data Privacy and Security: AI-driven personalisation relies on collecting and analysing extensive student data, including performance metrics, behavioural patterns, and engagement histories (UNESCO, 2021; World Bank, 2024). While this data enables customised learning, it also raises serious privacy and security concerns. Risks include unauthorised access, data breaches, and surveillance capitalism, where student information is monetised by third-party EdTech providers (Nguyen, 2022; Mochizuki, 2025). Obtaining informed consent, encrypting sensitive data, and following legal frameworks like GDPR are essential for reducing these risks (OECD, 2023; UNESCO, 2023). The challenge is especially significant given the sensitive nature of educational data and the long-term effects of data collection on students' lives and opportunities.

Equity and the Digital Divide: The deployment of AI heavily relies on digital infrastructure, which varies across regions and socio-economic contexts (OECD, 2024; UNESCO, 2023). Urban students in well-equipped schools benefit disproportionately, while learners in rural or under-resourced areas may lack access to devices, high-speed internet, or digital literacy. This digital divide risks exacerbating educational inequalities rather than reducing them (Bhutoria, 2022; Mochizuki, 2025). Policymakers and institutions must ensure that AI adoption is supported by initiatives to improve equitable access and affordability (Li, 2025; OECD, 2023).

Over-Reliance on Technology: Excessive dependence on AI may lessen teacher-student interactions and decrease opportunities for socio-emotional growth (Tapalova, 2022; Vorobyeva et al., 2025). Key pedagogical elements such as empathy, moral guidance, and contextual judgment cannot be fully reproduced by machines (Mochizuki, 2025; Tu, 2025). Over-reliance on automated feedback and algorithmic suggestions risks treating students as data points rather than holistic learners (Nguyen, 2022). The human aspects of education—mentorship, inspiration, and emotional support—remain irreplaceable and vital for comprehensive development.

Pedagogical Challenges: AI lacks the emotional intelligence and contextual understanding needed for nuanced teaching (Vorobyeva et al., 2025; Tapalova & Bhutoria, 2022). Complex decisions—such as interpreting misunderstandings, addressing socio-emotional needs, or facilitating critical thinking—cannot be fully automated. Teachers must remain central to interpreting AI insights and adapting instruction to learners' socio-cultural and emotional contexts (UNESCO, 2022; Mochizuki, 2025). The challenge lies in integrating AI tools effectively while maintaining the essential human elements of effective teaching.

Research Question 3: Ethical Dilemmas in AI and Personalised Learning

The integration of Artificial Intelligence (AI) into personalised learning raises complex ethical dilemmas, stemming from the tension between technological capabilities and essential human values. While AI offers efficiency, accessibility, and engagement, it also prompts concerns about privacy, autonomy, equity, and accountability (Nguyen, 2022; Mochizuki, 2025).

Privacy versus Personalisation: AI-driven personalised learning depends heavily on data collection—tracking students' performance, behaviour, and engagement patterns (UNESCO, 2021; Tapalova & Bhutoria, 2022). While such data allows customised content and adaptive pathways, it also poses risks of privacy intrusion and surveillance. The ethical dilemma involves balancing the advantages of personalised learning with protecting student autonomy and consent (Nguyen, 2022; World Bank, 2024). Poor management of sensitive information can undermine trust, lead to profiling, and potentially result in misuse by third-party EdTech providers (OECD, 2023; Mochizuki, 2025). The core challenge is deciding how much privacy students must forfeit for the benefits of personalisation.

Efficiency versus Human Values: AI can optimise learning processes, monitor progress in real time, and improve outcomes (Tu, 2025; Bhutoria, 2022). However, this focus on efficiency may conflict with broader human values such as creativity, moral reasoning, empathy, and socio-emotional development (Vorobyeva et al., 2025; Mochizuki, 2025). The ethical question is whether education should be approached as a mechanistic process of optimisation or as a holistic practice that fosters human growth and critical thinking (Mochizuki, 2025; Tapalova, 2022). The challenge is balancing the humanistic aspects of education while utilising technological advantages.

Autonomy versus Control: AI recommendations, algorithms, and nudges can influence learner choices and behaviours, potentially restricting autonomy (Nguyen, 2022; Li, 2025). For instance, adaptive learning platforms might prioritise certain pathways or content based on predicted performance, subtly steering students towards algorithmically chosen outcomes. This raises concerns about agency, especially when learners may not fully understand or agree with how AI impacts their educational decisions (UNESCO, 2022; Tapalova & Bhutoria, 2022). The ethical challenge is to preserve student agency while offering beneficial guidance and support.

Equity versus Marketisation: The commercialisation of AI in EdTech creates a tension between fairness and profit motives. Many AI-powered platforms are developed by private companies aiming for revenue, potentially prioritising market efficiency over learner inclusivity (Axios, 2025; World Bank, 2024). This can increase disparities between well-resourced learners and those from marginalised communities, undermining the ethical principle of fair and inclusive education (OECD, 2023; Mochizuki, 2025). The challenge is ensuring that AI promotes educational equity rather than commercial interests.

Research Question 4: Policy and Governance Dimensions

The successful integration of Artificial Intelligence (AI) in personalised learning relies not only on technological progress but also on strong policy frameworks and governance structures. Governments, international bodies, and educational institutions play a vital role in ensuring that AI is implemented ethically, fairly, and effectively in education (OECD, 2023; UNESCO, 2021).

At the international level, organisations such as UNESCO and the OECD have established guidelines to encourage ethical AI usage in education. UNESCO's Recommendation on the Ethics of Artificial Intelligence stresses transparency, inclusivity, accountability, and the protection of human rights (UNESCO, 2021, 2023). Likewise, the OECD's AI Principles promote human-centric AI that supports education while safeguarding privacy, equity, and learner autonomy (OECD, 2023, 2024). These frameworks underline the necessity for AI in education to balance technological progress with ethical safeguards, ensuring that the advantages of personalised learning do not undermine social justice or learner well-being (Nguyen, 2022; Mochizuki, 2025).

National policies also play a crucial role. In India, the National Education Policy (NEP) 2020 explicitly emphasises the integration of technology in education, including AI, to improve teaching, learning, and administrative efficiency (Government of India, 2020). NEP 2020 supports expanding digital infrastructure, AI-enabled adaptive learning platforms, and programmes to develop teachers' skills to create an inclusive and technologically prepared education system. However, the policy also acknowledges the risks related to data privacy, algorithmic bias, and digital inequalities, highlighting the importance of responsible deployment (Bhutoria, 2022; UNESCO, 2022).

A fundamental aspect of governance is data protection. Personalisation depends heavily on student data, making robust privacy laws essential. Globally, the European Union's General Data Protection Regulation (GDPR) sets a high standard for consent, transparency, and data security, serving as a benchmark for other countries (OECD, 2023). India's Digital Personal Data Protection Act (2023) offers guidelines on the collection, storage, and processing of personal data, although its application in educational settings is still developing (World Bank, 2024). These laws are vital for safeguarding students' rights and building trust in AI-driven learning systems (Tapalova & Bhutoria, 2022).

Equally important are teacher training and curriculum reform. AI adoption requires educators to understand the technology, interpret algorithmic outputs, and responsibly integrate AI tools into pedagogy (Vorobyeva et al., 2025). Professional development programmes should focus on digital literacy, ethical AI use, and the principles of personalised learning (Li, 2025). Curriculum reforms must also include foundational AI education for students, equipping them with the skills to navigate AI-mediated learning environments critically and responsibly (Mochizuki, 2025; Tu, 2025).

The integration of Artificial Intelligence (AI) in personalised learning presents a complex landscape of opportunities, challenges, and ethical dilemmas (Nguyen, 2022; Mochizuki, 2025). On one hand, AI enables adaptive content delivery, predictive analytics, inclusivity, engagement, scalability, and lifelong learning (Bhutoria, 2022; Tapalova, 2022). These possibilities have the potential to make education more learner-centred, efficient, and accessible across diverse contexts (UNESCO, 2022; OECD, 2023). Platforms such as IBM Watson Tutor, Squirrel AI, and personalised MOOCs illustrate how AI can transform educational experiences, providing tailored pathways that respect individual differences and learning needs (Tu, 2025; Vorobyeva et al., 2025).

Conversely, the deployment of AI faces numerous challenges. Algorithmic bias, unequal access, data privacy issues, excessive dependence on technology, pedagogical limitations, and institutional restrictions highlight the dangers of uncritical adoption (Nguyen, 2022; Mochizuki, 2025; UNESCO, 2021). Ethical dilemmas—such as balancing privacy with personalisation, autonomy with algorithmic control, and equity with market-driven motives—further complicate its realisation (Tapalova & Bhutoria, 2022; Li, 2025). Without meticulous oversight, AI risks entrenching existing social inequalities, reducing education to measurable metrics, and undermining the relational and moral aspects of teaching (Freire, as cited in Mochizuki, 2025; Vorobyeva et al., 2025).

Given this dual nature, AI should be understood neither as a panacea nor as an inherent threat. Its effectiveness and ethical acceptability depend on context, design, and governance (OECD, 2023; UNESCO, 2022). Human-in-the-loop models emerge as a crucial strategy, ensuring that teachers remain central to the learning process while AI provides data-driven support (Tapalova, 2022; Tu, 2025). Such collaboration preserves human values, empathy, and contextual judgment that technology alone cannot provide (Mochizuki, 2025; Vorobyeva et al., 2025).

Furthermore, the complexity of AI in education requires interdisciplinary dialogue. Educators, technologists, policymakers, and ethicists must work together to design, implement, and oversee AI systems responsibly (Nguyen, 2022; UNESCO, 2023). International guidelines, national policies like India's NEP 2020, and robust data protection frameworks provide the structural foundation, but practical, on-the-ground cooperation among stakeholders is vital to ensure equity, transparency, and learner autonomy (OECD, 2024; World Bank, 2024).

Essentially, AI in personalised learning exemplifies a subtle balance of promise and risk. Its potential can only be achieved through contextualised, ethically guided, and human-focused approaches that combine technological innovation with pedagogical insight, sociological understanding, and moral responsibility (Tapalova & Bhutoria, 2022; Mochizuki, 2025; UNESCO, 2022).

EDUCATIONAL IMPLICATIONS

The integration of Artificial Intelligence (AI) in personalised learning has notable educational implications for curriculum design, teaching methods, learner engagement, and institutional planning.

Curriculum Design and Instructional Practices

AI facilitates the creation of adaptable curricula that tailor to learners' strengths, weaknesses, and interests (Bhutoria, 2022; Tapalova & Bhutoria, 2022). Educators can craft learning experiences that are more student-centred, enabling students to progress at their own rhythm while achieving mastery of essential concepts. Intelligent tutoring systems, AI-driven simulations, and gamified platforms allow for the dynamic personalisation of content, promoting deeper understanding and engagement (Tu, 2025; Vorobyeva et al., 2025).

Teacher Roles and Professional Development

While AI supports instructional decision-making, it does not replace the teacher's role. Educators remain central in providing socio-emotional guidance, ethical oversight, and contextual judgment that AI lacks (Mochizuki, 2025). Consequently, teacher professional development must focus on

digital literacy, the ethical use of AI, and the pedagogical integration of technology (UNESCO, 2022; OECD, 2023). Teachers equipped with these skills can effectively leverage AI tools to enhance learning outcomes while maintaining human-centric instruction.

Learner Engagement and Autonomy

AI-driven personalised learning can boost motivation and engagement by offering immediate feedback, interactive exercises, and content tailored to individual interests (Nguyen, 2022; Tapalova, 2022). However, it is crucial to ensure that students retain control over their learning, with AI acting as a supportive tool rather than a controlling force (Freire, as cited in Mochizuki, 2025). Preserving this balance encourages learner autonomy, critical thinking, and self-regulated learning.

Equity and Accessibility

AI provides opportunities to promote inclusivity, such as speech-to-text tools, translations, and assistive technologies for learners with disabilities (Vorobyeva et al., 2025; Bhutoria, 2022). However, disparities in digital access between urban and rural areas or across socioeconomic groups need to be addressed through targeted policies and infrastructure investment to prevent worsening the digital divide (OECD, 2024; UNESCO, 2023).

Institutional Planning and Resource Allocation

Educational institutions must strategically plan for AI integration, including investments in infrastructure, software, teacher training, and ongoing evaluation of AI's impact on learning outcomes (Luo, 2025; Government of India, 2020). Incorporating AI into institutional policies ensures that technology enhances education sustainably while aligning with broader pedagogical and ethical objectives.

CONCLUSION

Artificial Intelligence (AI) in personalised learning provides unprecedented opportunities to make education more adaptable, engaging, and inclusive. By tailoring lessons, assessments, and feedback to individual learners, AI has the potential to improve learning outcomes, support lifelong skill development, and democratise access to educational resources. Real-world implementations such as IBM Watson Tutor, Squirrel AI, and personalised MOOCs demonstrate the transformative potential of AI-driven customisation, highlighting its ability to cater to diverse learner needs and learning contexts.

However, this promise is accompanied by significant challenges and ethical dilemmas. Algorithmic bias, inequitable access, over-reliance on technology, data privacy concerns, and pedagogical limitations highlight the need for critical reflection. Ethical tensions, including privacy versus personalisation, autonomy versus algorithmic control, and equity versus marketisation, further complicate the adoption of AI in education. Without careful attention to these issues, AI risks reinforcing existing inequalities, undermining learner autonomy, and reducing the human aspects of teaching to mechanical processes.

Balancing innovation with ethics is therefore crucial. Human-in-the-loop models, where AI supports rather than replaces educators, maintain the relational, moral, and contextual aspects of teaching. Strong governance frameworks, international guidelines, and national policies such as India's NEP 2020 offer structural support for ethical AI application. Furthermore, teacher training, curriculum reform, and institutional readiness are vital to ensure that AI tools are used effectively and responsibly.

Future research should emphasise empirical studies that evaluate the long-term effects of AI on learning outcomes, learner autonomy, and social equity. Cross-cultural analyses can shed light on how AI impacts learners in various socio-economic and linguistic contexts, while longitudinal studies can explore possible unintended consequences of prolonged AI-mediated learning. Interdisciplinary collaboration among educators, technologists, ethicists, and policymakers will be essential in designing AI systems that are pedagogically effective, socially just, and culturally sensitive.

In conclusion, AI in personalised learning has the potential to significantly transform education. However, its true promise can only be fulfilled when technological advancements are guided by principles of fairness, transparency, and respect for human dignity. By embedding AI within ethical, pedagogical, and sociological frameworks, we can guarantee that personalised learning functions not just as a means for efficiency, but as a pathway to inclusive, meaningful, and empowering education for all learners.

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Chapter Six

POSITIVE LEARNING ENVIRONMENTS: CREATING INCLUSIVE AND SUPPORTIVE SPACES

Chhottu Ram

ABSTRACT

A positive learning environment is crucial for students' overall development. It helps learners feel safe, respected, and motivated to engage in learning activities. This research examines how inclusive and supportive spaces can be created in schools and classrooms. A positive environment not only promotes academic success but also supports the social and emotional well-being of every learner. Teachers play a vital role by fostering respectful relationships, encouraging collaboration, and providing equal opportunities for all. Simple practices like active listening, using encouraging words, and offering fair feedback help students feel confident and valued. Inclusive approaches such as universal design for learning (UDL), group activities, and cultural sensitivity ensure that students from diverse backgrounds and with different abilities can learn together without obstacles. The study also explores how classroom design, teaching methods, and school policies can enhance student engagement and independence. When students feel included, they are more likely to develop essential life skills such as teamwork, problem-solving, and empathy. Creating such spaces requires collaboration among teachers, parents, and school leaders. A positive and inclusive environment not only enhances academic achievement but also prepares students to face challenges outside school and become responsible members of society.

Keywords: *Positive Learning Environment, Inclusive Spaces, Supportive Classrooms, Student Well-Being, Universal Design For Learning (UDL), Equity, Motivation, Teamwork.*

INTRODUCTION

Education in the 21st century is no longer limited to transmitting academic knowledge alone; instead, it has developed into a comprehensive process that fosters learners' intellectual, emotional, social, and moral growth. Schools today are expected to prepare students not only for exams but also for life—equipping them with values, empathy, teamwork skills, and resilience. Within this framework, the idea of a positive learning environment has become a key element of effective education. A positive learning environment describes a classroom atmosphere where students feel safe, respected, and supported, and where they are motivated to engage actively in

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learning. Such environments provide the foundation for inclusive and equitable education systems that respond to the diverse needs and abilities of learners.

The global shift towards inclusive education, supported by UNESCO's *Education for All* initiative and reaffirmed by *Sustainable Development Goal 4 (SDG-4)*, highlights the right of every child—regardless of ability, gender, socioeconomic background, or heritage—to access quality and equitable education. In inclusive classrooms, students with and without disabilities learn together, gaining from shared experiences, collaboration, and respect for differences. However, for inclusion to truly succeed, the school environment must foster positivity, acceptance, and a sense of belonging. A negative or unsupportive classroom atmosphere can result in disengagement, low self-esteem, and even school dropout among students with special educational needs (SEN). Therefore, creating a positive learning environment becomes not only a pedagogical requirement but also a moral and social obligation.

IMPORTANCE OF A POSITIVE LEARNING ENVIRONMENT

A positive learning environment affects every part of education— from curriculum delivery to student motivation and teacher effectiveness. When students feel emotionally secure, they are more inclined to take academic risks, engage in discussions, and express themselves openly. This sense of safety encourages creativity, curiosity, and resilience, which are vital qualities for lifelong learning. As Pianta, Hamre, and Allen (2012) point out, teacher–student relationships marked by warmth, respect, and support play a crucial role in students' engagement and academic achievement. Additionally, an inclusive and supportive atmosphere reduces behavioural problems, improves social skills, and fosters empathy among peers.

Conversely, classrooms that lack emotional support or inclusive practices often marginalise learners who differ from the norm—whether in ability, culture, or language. Such exclusionary experiences can damage students' self-esteem and impede their participation. Therefore, fostering a positive learning environment requires intentionally designing classroom practices, school policies, and pedagogical approaches that value diversity and promote cooperation instead of competition.

CONCEPT OF INCLUSION AND POSITIVE CLIMATE

Inclusion is not just about physically placing students with disabilities into general classrooms; it reflects a philosophical shift towards recognising diversity as an educational resource rather than a barrier. A positive learning environment, therefore, forms the basis for inclusive education to flourish. It involves fostering a sense of belonging, acceptance, and mutual respect among all learners. Teachers must adapt instruction, assessments, and classroom management strategies to cater to diverse learning needs through differentiated instruction and Universal Design for Learning (UDL).

The Universal Design for Learning (UDL) framework provides a flexible approach to teaching that addresses learner differences by offering multiple means of representation, engagement, and expression (Meyer, Rose, & Gordon, 2014). When teachers apply UDL principles to lesson planning, they make content accessible to all students—those with disabilities, learning difficulties, or language barriers. In doing so, they help create an inclusive and positive classroom environment where every student can participate meaningfully.

TEACHER'S ROLE IN CREATING POSITIVE AND INCLUSIVE SPACES

Teachers are the key figures in shaping classroom culture. Their attitudes, expectations, and interactions with students significantly influence how learners view themselves and others. A teacher who listens attentively, offers constructive feedback, and shows empathy builds trust and mutual respect. Promoting cooperative learning activities, where students collaborate in diverse groups to reach shared goals, encourages teamwork and decreases social stigma among learners with disabilities. Positive reinforcement, praising effort rather than just achievement, and employing restorative discipline techniques further improve classroom harmony.

In inclusive classrooms, special educators and general educators must collaborate to ensure that teaching is accessible and fair. Co-teaching models—where teachers share responsibility for planning, delivering, and assessing learning—have been shown to enhance both academic and social outcomes for students with special needs. Additionally, classroom management strategies should be proactive rather than punitive, focusing on understanding student behaviour as a form of communication and addressing underlying needs rather than merely enforcing compliance.

ENVIRONMENTAL AND STRUCTURAL FACTORS

A positive learning environment is shaped not only by teacher behaviour and pedagogy but also by the physical and social structure of the school. Accessibility features such as ramps, tactile signage, and age-appropriate toilets enable students with physical disabilities to navigate the school independently and confidently. The physical arrangement of classrooms—adequate lighting, flexible seating, and the availability of assistive technologies—also plays a vital role in supporting inclusion. Beyond the classroom, inclusive schools implement policies that promote equity, cultural sensitivity, and student voice in decision-making.

School leadership must actively support teachers by providing training, mentoring, and resources for inclusive practices. When school administrators prioritise emotional well-being, celebrate diversity, and encourage teacher collaboration, they help create an organisational culture that sustains positive learning environments. Parent and community involvement further strengthens this ecosystem, ensuring that inclusion extends beyond the classroom to the broader social context.

SOCIO-EMOTIONAL LEARNING AND STUDENT WELL-BEING

The integration of Social and Emotional Learning (SEL) into classroom practice enhances the development of a positive environment. SEL concentrates on nurturing self-awareness, emotional regulation, social skills, and responsible decision-making among students (Zins et al., 2004). When teachers deliberately model and teach these skills, students learn to manage stress, resolve conflicts constructively, and empathise with others. SEL, therefore, bridges the gap between academic achievement and holistic well-being, strengthening the emotional foundation of inclusive education.

In inclusive settings, SEL becomes even more crucial. Students with disabilities or from marginalised backgrounds often face exclusion or bullying, which can impact their confidence and involvement. A positive learning environment addresses these issues by fostering acceptance, empathy, and peer support. Classrooms that celebrate diversity through inclusive art, literature, and collaborative activities help students absorb the values of equality and social justice.

NEED FOR THE PRESENT STUDY

While the theoretical significance of positive learning environments is widely acknowledged, there remains a gap in understanding how these environments are practically implemented and experienced in inclusive schools, especially within the Indian context. The National Education Policy (NEP, 2020) advocates for transforming schools into inclusive spaces that foster creativity, critical thinking, and emotional safety for all learners. However, realising this vision necessitates concrete strategies and ongoing assessment of school practices.

In Jammu city, several inclusive schools are working to implement inclusive education principles, but challenges remain—ranging from inadequate teacher training to limited infrastructure and resources. This study aims to explore the current practices and perceptions of teachers and students in these schools, identifying effective strategies and areas for improvement. By examining the lived experiences of both educators and learners, the research intends to offer practical recommendations for fostering positive, inclusive learning environments that promote student participation and success.

In conclusion, fostering a positive learning environment is fundamental to successful inclusive education. It requires deliberate effort from all stakeholders—teachers, administrators, parents, and policymakers—to make sure every learner feels valued and supported. The classroom should be a space where diversity is celebrated, not merely tolerated, and where collaboration replaces competition. A nurturing environment not only encourages academic development but also enhances the emotional and social skills essential for lifelong achievement.

As education systems evolve to meet the demands of an increasingly diverse society, the need to understand and implement strategies for building positive, inclusive learning environments becomes even more urgent. This study thus attempts to contribute to that ongoing effort by exploring how inclusive schools in Jammu city are shaping environments that inspire learning, respect, and belonging among all students.

REVIEW OF LITERATURE

Makweya and Sepadi (2025), in their chapter “*The Crucial Role of Empathy in Fostering Inclusive Learning Environments*” from **Global Practices in Inclusive Education Curriculum and Policy**, emphasised empathy as a vital element in developing inclusive and supportive classrooms. They clarified that empathy strengthens teacher-student relationships, improves collaboration, and promotes appreciation for diversity.

The authors highlighted that empathetic educators can better understand students’ individual needs and tailor their teaching approaches to ensure every learner feels valued and respected. They also observed that empathy enhances educators’ professional development by fostering cooperation and emotional well-being among teachers. The study concluded that empathy plays a transformative role in creating compassionate, equitable, and inclusive learning communities that benefit both students and educators.

Grainger Clemson and Coyle (2025), in their study “*Space Matters: Creating Inclusive Learning Spaces for Pupils with Additional Support Needs (ASN) in Scotland*,” explored how the physical design of learning environments affects inclusion and engagement in schools. Conducted across four inner-city schools—ranging from early years to secondary and special settings—the study

involved interviews with 14 educators who worked with interior designers to develop adaptive and flexible learning spaces. The findings highlighted that well-designed physical spaces, both indoor and outdoor, significantly support pupils' emotional regulation, comfort, and participation in learning activities. The authors emphasised that spatial design and adaptability are not only vital for students with additional support needs but also improve the learning experience for all learners. They concluded that “spatial literacy”—the awareness of how physical environments influence learning—should be recognised as an essential pedagogical tool in inclusive education.

Irshad, Amir, and Rafaqat (2024), in their study *“Towards Inclusive Classrooms: Identification of the Role of Teachers in Creating an Inclusive Learning Environment,”* examined the vital role of teachers in promoting inclusion at the primary school level in Punjab, Pakistan. Conducted in Tehsil Gojra using structured questionnaires and SPSS analysis, the study found that teachers' attitudes and inclusive practices significantly influence students' engagement and sense of belonging. Key strategies identified included supporting all learners collectively (mean = 2.33), focusing on students' strengths (mean = 2.27), and fostering empathy (mean = 2.25). The authors concluded that inclusive classrooms thrive when teachers employ flexible teaching methods, empathetic communication, and differentiated instruction, supported by ongoing teacher training to effectively address diverse learning needs and promote equity for all students.

Pramono et al. (2024), in their study *“The Role of Positive Discipline in the Digital Era: Fostering Inclusive Learning Environments,”* highlighted positive discipline as a key strategy for creating inclusive and emotionally supportive classrooms in Indonesia. Conducted through a professional development seminar for principals and teachers, the study emphasised that positive discipline goes beyond behaviour management by fostering respect, empathy, and collaboration between educators and students. Participants learned practical approaches such as restorative practices, encouragement-based feedback, and student reflection to strengthen teacher-student relationships and reduce behavioural issues. The authors concluded that positive discipline, when integrated with digital-era competencies, helps build inclusive, respectful, and engaging learning spaces, emphasising the need for ongoing professional training to sustain such practices effectively.

Pattiasina, Lamaloang, and Santoso (2024), in their study *“The Role of Communication in Creating Inclusive and Collaborative Learning Environments,”* highlighted communication as a vital element in fostering diversity, cooperation, and mutual understanding in education. Using a literature-based research method, the authors found that effective communication—both verbal and non-verbal—enhances collaboration and inclusivity by addressing individual needs and promoting positive student interactions. The study emphasised the integration of modern communication technologies such as interactive learning platforms, multimedia tools, and collaborative apps to increase engagement and participation. However, it also underscored that empathy and direct interpersonal interaction remain essential for creating truly inclusive and responsive learning experiences.

Debasu and Yitayew (2023) emphasised that designing and managing an inclusive learning environment requires a systematic and collaborative approach that addresses both physical and pedagogical dimensions of inclusion. Their review highlights that accessibility is a fundamental element—schools must provide age-appropriate, accessible facilities, such as toilets, ramps, signage, canteens, stairs, and pathways, to ensure barrier-free movement for all learners. Equally

important are a flexible curriculum and pedagogy that adapt to students' diverse needs, abilities, and learning styles. The study underscores that creating such environments requires active collaboration among teachers, students, administrators, and community stakeholders to ensure that every aspect of the school setting promotes equity and participation. Ultimately, an inclusive learning environment nurtures a sense of belonging, engagement, and success for all learners, reflecting the true essence of inclusive education.

Debasu (2023) further emphasises that inclusive learning environments are not solely created through structural adjustments; they also rely on the attitudes, training, and commitment of educators who foster positive interactions and equitable opportunities. Involving students, teachers, and stakeholders in decision-making processes helps ensure that the learning environment remains responsive to everyone's needs. The article concludes that designing and managing inclusive spaces requires ongoing reflection, planning, and community engagement to establish schools where all learners—regardless of ability, background, or circumstance—can participate, belong, and succeed.

Horverak (2023), in her study “*Strategies to Succeed with Inclusion in a Diverse Learning Environment*”, published in the *IAFOR Journal of Education*, examined the challenges and strategies teachers use to foster inclusion in Norwegian primary schools. Using the SAMM project framework—focused on mastery, participation, and motivation—the study involved interviews with ten teachers who implemented a five-step method encouraging students to identify goals, success factors, and obstacles. The analysis revealed three key challenge areas: relational (teacher-student and peer interactions), structural (curriculum and classroom organisation), and individual (student needs and abilities). Teachers addressed these through systematic, long-term strategies promoting self-regulation, choice-making, and active participation. The study concluded that sustained, reflective, and student-centred approaches are essential for creating inclusive learning environments that accommodate diversity and support holistic development.

Goldwasser and Hubbard (2019), in their article “*Creating and Maintaining Inclusive Classrooms*,” examined how higher education faculty can foster inclusivity and a sense of belonging among diverse student populations. Through qualitative interviews with undergraduates, the study found that students' feeling of inclusion is strongly influenced by professors' teaching methods and attitudes. Inclusive classrooms were characterised by diverse examples, real-world connections, and interactive group discussions that encouraged participation. The authors emphasised that inclusivity involves actively validating diverse perspectives, using respectful and inclusive language, and building empathetic teacher-student relationships. They concluded that creating inclusive classrooms requires ongoing reflection and deliberate efforts by educators to design equitable, student-centred learning environments that value diversity and promote belonging.

NEED AND SIGNIFICANCE OF THE STUDY

The need for this research stems from the increasing focus on inclusive education, which requires learning spaces that appreciate diversity and ensure equal participation for all students. A positive learning environment is crucial for helping pupils, especially those with special educational needs, feel confident, respected, and motivated. Such an environment boosts self-esteem,

encourages cooperative learning, and supports social and emotional well-being. By fostering acceptance and empathy, it guarantees equal opportunities for students of all abilities and backgrounds. Additionally, nurturing a supportive classroom atmosphere prepares learners to become responsible, compassionate citizens, making the development of positive and inclusive environments a vital element of educational achievement.

OBJECTIVES OF THE STUDY

1. To examine the role of a positive learning environment in inclusive classrooms.
2. To identify strategies teachers can use to create supportive and inclusive classroom climates.
3. To analyse how inclusive practices influence students' academic and social-emotional development.
4. To explore the collaboration between teachers, parents, and administrators in fostering positive learning environments.

RESEARCH METHODOLOGY

Research Design

The study employs a descriptive research design to examine current practices and perceptions regarding positive learning environments in inclusive classrooms.

Population and Sample

The population consisted of teachers and students from inclusive schools in Jammu city. A purposive sample of 50 teachers and 100 students was chosen, representing both primary and secondary levels.

Instrument Used

Two research instruments were used:

- A Teacher Questionnaire on Positive Learning Environment consisting of 20 items on a 5-point Likert scale.
- A Student Perception Scale to assess students' sense of belonging, motivation, and classroom participation.

Data Collection Procedure

Data were collected through in-person visits to inclusive schools, ensuring ethical considerations such as informed consent, confidentiality, and voluntary participation.

Data Analysis and Interpretation

The data collected from teachers and students were analysed using descriptive statistical techniques, including mean, percentage, and standard deviation, to identify trends and patterns related to the development of positive learning environments in inclusive classrooms. The responses provided meaningful insights into the perceptions and experiences of both teachers and students regarding inclusive practices and their impact on learning outcomes.

The analysis showed that 86% of teachers strongly agreed that inclusive teaching practices and respectful communication are crucial for improving classroom participation. This indicates that when teachers show empathy, listen carefully, and treat all students with respect, learners feel more at ease expressing themselves and taking part in classroom activities. Such inclusive behaviour not only aids students with special needs but also benefits the entire class by fostering a climate of mutual respect and acceptance.

Similarly, 78% of students reported feeling more motivated and confident when teachers used positive reinforcement strategies and created inclusive group activities. Students highlighted that encouragement, recognition of effort, and opportunities for collaborative work made them feel valued and capable, regardless of their abilities or backgrounds. These findings suggest that positive reinforcement not only increases academic engagement but also enhances students' emotional connection to learning.

Moreover, 82% of teachers agreed that collaborative learning and peer support play a vital role in reducing stigma and encouraging social inclusion. Teachers noted that when students are encouraged to work together, exchange ideas, and assist one another, the barriers between learners with and without disabilities lessen. This emphasises the significance of peer interaction in nurturing understanding, empathy, and a sense of belonging among students.

Overall, the data confirm that emotional safety, teacher empathy, and equitable opportunities are essential pillars of a positive learning environment. Classrooms where teachers demonstrate inclusive values and provide fair participation opportunities allow students to flourish academically, socially, and emotionally. These findings highlight that inclusive education is most effective when rooted in supportive relationships, collaborative practices, and a steadfast commitment to respect and equality for all learners.

Findings

The study revealed several important findings emphasising the vital role of positive learning environments in fostering inclusive education.

Firstly, the findings show that positive learning environments greatly improve both students' academic success and emotional well-being. When students feel respected, supported, and safe in their classrooms, they are more likely to participate actively in learning activities, have better concentration, and achieve higher academically. Emotional safety helps students to take risks in learning without fear of failure, which boosts their confidence and motivation.

Secondly, it was found that teachers' inclusive practices—such as active listening, fair feedback, and promoting cooperative learning—significantly influence students' motivation and participation. When teachers adopt empathetic communication and value each student's input, learners develop a stronger sense of belonging and are more willing to contribute. Cooperative learning activities encourage peer interaction and mutual support, fostering a more inclusive classroom culture.

Thirdly, the study emphasised that classroom design, flexible pedagogy, and supportive school leadership policies are essential for creating inclusive and engaging environments. Accessible classrooms with appropriate seating arrangements, visual aids, and assistive technologies address the needs of diverse learners. Similarly, flexible teaching strategies—such as differentiated

instruction and universal design for learning (UDL)—enable students to learn at their own pace and through their preferred modalities. School leadership that prioritizes inclusivity fosters a positive atmosphere for the entire institution, ensuring that inclusion is implemented at every level.

Fourthly, the research found that students in inclusive classrooms develop essential social and emotional skills, including empathy, teamwork, and respect for diversity. Learning in diverse groups exposes students to multiple perspectives, helping them appreciate differences and work collaboratively. These skills extend beyond the classroom, preparing students to become compassionate, responsible citizens in a multicultural society.

Finally, the findings highlighted that collaboration among teachers, parents, and school administrators is crucial for maintaining positive learning environments. Inclusion is a collective duty that demands ongoing communication and coordination among all parties involved. Teachers require support from parents and administrators to effectively apply inclusive strategies, while schools must develop policies that promote teamwork, continuous professional development, and family engagement.

In summary, the findings confirm that a positive and inclusive learning environment is multifaceted, encompassing emotional, social, structural, and institutional elements. It is through the collaborative efforts of educators, students, families, and policymakers that schools can create environments where every learner feels valued, supported, and empowered to succeed.

CONCLUSION

Creating a positive and inclusive learning environment is an ongoing effort that requires commitment from all stakeholders. When learners feel valued, supported, and respected, they become more confident, motivated, and capable of reaching their full potential. Teachers should adopt inclusive pedagogies such as UDL and SEL, while schools must ensure their policies, physical settings, and assessment methods support diversity.

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Chapter Seven

DIGITAL LITERACY: BUILDING ESSENTIAL DIGITAL SKILLS FOR STUDENTS AND EDUCATORS

Deepa Sikand Kauts and Rajbir Kaur

ABSTRACT

In the rapidly changing digital world of today, digital literacy has become a vital skill for both teachers and students. It encompasses a wide range of abilities, from basic computer skills to critical thinking, digital communication, online safety, and content creation. The capacity to access, evaluate, and utilise digital resources is crucial as education increasingly integrates these tools for teaching, learning, assessment, and collaboration. However, digital literacy development is uneven, with disparities in access, training, and experience still evident. This paper examines the concept of digital literacy within educational contexts, outlines the core digital skills needed by students and educators, discusses challenges such as the digital divide and misinformation, and offers evidence-based strategies to improve digital competence. The findings highlight that fostering digital literacy is not a one-off training exercise, but a continuous, inclusive process vital for academic success, lifelong learning, and career readiness in the 21st century.

Keywords: Digital Literacy, Education Technology, Digital Skills, Students, Educators, Digital Divide, Online Learning, Media Literacy, Digital Citizenship, 21st-Century Skills

INTRODUCTION

The integration of technology in education has significantly changed how knowledge is delivered, acquired, and assessed. Digital literacy—the ability to use digital technologies efficiently and responsibly—has become a core skill in modern education (Ng, 2012). In a post-pandemic world

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where online learning, digital collaboration, and virtual assessments are common, developing strong digital skills is more important than ever. Although students are often seen as digital natives, research shows differences in their digital abilities, especially in academic and professional settings (Eshet, 2012). Likewise, teachers face the challenge of adapting their teaching methods to incorporate new technologies while ensuring fair learning opportunities for all students.

This paper explores the changing idea of digital literacy, highlights the key digital skills required by students and educators, discusses the digital divide, and recommends best practices for developing a digitally literate academic community. By investing in digital literacy, institutions can promote inclusive, effective, and future-ready education.

DEFINING DIGITAL LITERACY IN EDUCATION

Digital literacy includes more than basic computer skills. It covers information literacy, media literacy, digital communication, digital citizenship, and the ability to use technology for collaboration and problem-solving (Hobbs, 2010). The American Library Association (2013) defines digital literacy as “the ability to utilise information and communication technologies to locate, assess, generate, and convey information, necessitating both cognitive and technical competencies.”

In the educational setting, digital literacy enables students to research effectively, use digital tools for assignments, and critically evaluate online sources. For educators, it involves using digital platforms to create instructional content, communicate with students, assess performance, and participate in professional development.

ESSENTIAL DIGITAL SKILLS FOR STUDENTS

Contemporary students must develop a wide range of digital skills to navigate academic environments and future careers effectively. Key competencies include:

a. Information and Data Literacy

Students should be able to search for, evaluate, and ethically use information found online. This includes understanding how to identify credible sources, avoid plagiarism, and cite appropriately (Livingstone et al., 2017).

b. Communication and Collaboration

Online communication platforms such as Google Classroom, Microsoft Teams, and Zoom are now integral to education. Students should be proficient in digital etiquette, participating in virtual discussions and working collaboratively on digital documents (Redecker, 2017).

c. Digital Content Creation

Creating presentations, videos, blogs, and infographics boosts creativity and engagement. These skills help students express ideas clearly and prepare them for digital storytelling and content marketing roles in the workforce.

d. Digital Safety and Citizenship

Awareness of privacy, cyberbullying, online safety, and responsible behaviour online is essential. Students must understand digital footprints, data protection, and respectful online conduct (Ribble, 2011).

e. Technical Proficiency

Students require essential technical skills to operate learning management systems, install software, troubleshoot minor technical problems, and make use of educational applications.

ESSENTIAL DIGITAL SKILLS FOR EDUCATORS

Educators must demonstrate digital literacy and consistently adapt to changing educational technologies. Key skills include:

a. Instructional Design Using Technology

Teachers should be capable of designing digital learning experiences that are interactive, accessible, and aligned with curriculum objectives. This involves using multimedia, learning management systems, and educational software (Koehler & Mishra, 2009).

b. Assessment and Feedback Tools

Digital tools like Kahoot, Quizlet, and Google Forms support formative assessments and prompt feedback. Educators need to be proficient in using analytics to monitor student progress and spot learning gaps.

c. Professional Development and Lifelong Learning

Staying current with new teaching tools, engaging in webinars, and collaborating with peers in online communities promotes ongoing growth (Trust, 2018).

d. Digital Classroom Management

Maintaining discipline and ensuring participation in virtual classrooms requires familiarity with moderation tools, breakout rooms, and digital attendance tracking.

e. Equity and Inclusion

Educators must address digital inequalities by providing alternative formats and ensuring that digital resources are accessible to students with impairments or limited technological access (Warschauer, 2004).

CHALLENGES IN BUILDING DIGITAL LITERACY

a. Digital Divide

A major obstacle to digital literacy is the digital divide—disparities in access to technology and internet connectivity. Students from economically disadvantaged backgrounds or rural regions often lack the essential resources for full participation in digital learning (Van Dijk, 2020).

b. Lack of Professional Training

Many educators lack formal training in digital tools and feel unprepared to teach using technology. Time pressures, limited institutional support, and resistance to change further exacerbate this problem.

c. Information Overload and Misinformation

The abundance of online content can overwhelm students, who may find it difficult to differentiate between trustworthy and false information. Digital literacy should encompass critical thinking and fact-checking skills.

d. Cybersecurity and Privacy Concerns

With the rising use of digital tools, concerns about student data protection, hacking, and digital surveillance have increased. Institutions must establish strong digital policies and procedures.

STRATEGIES TO ENHANCE DIGITAL LITERACY

a. Curriculum Integration

Digital literacy should be incorporated across various disciplines instead of being seen as a standalone subject. This ensures contextual learning and continuous skill development (Beetham & Sharpe, 2013).

b. Teacher Training and Support

Regular professional development workshops, mentorship programmes, and resource sharing can empower educators to integrate technology effectively.

c. Access to Technology

Governments and institutions should invest in infrastructure, supply subsidised devices, and enhance internet access to close the digital divide.

d. Digital Literacy Frameworks

Implementing international frameworks such as the European Commission's DigCompEdu and UNESCO's Media and Information Literacy framework can guide policy and practice.

e. Parental and Community Involvement

Educating parents about digital tools helps strengthen learning at home and builds a supportive digital environment for students.

CONCLUSION

The transformation of education in the digital age requires a collective effort to promote digital literacy among both students and teachers. In a world where technological ability determines access to knowledge, employment, and civic engagement, ensuring digital competence is no longer optional but crucial. Students with digital skills can critically evaluate information, produce meaningful content, and engage responsibly in digital environments. Similarly, teachers who adopt digital tools improve their teaching, encourage innovation, and serve as role models for lifelong learning.

To unlock the full potential of education in the digital age, stakeholders must work together to remove barriers such as the digital divide, outdated training, and limited infrastructure. Policies, curricula, and community initiatives should focus on digital literacy as a lifelong learning journey. By integrating digital literacy into the core of education, institutions equip learners not only for academic achievement but also for engaged, informed participation in the global digital community.

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Chapter Eight

VOCATIONAL EDUCATION AND TRAINING (VET): FOSTERING INDUSTRY COLLABORATION FOR TRANSFORMING EDUCATION FOR THE FUTURE

D. Raja Jebasingh and Sridhar L S

ABSTRACT

Over the past years, India has undertaken transformative reforms under the National Education Policy (NEP) 2020 to strengthen both school and higher education. Higher education in India is experiencing a significant transformation, fuelled by integration of the National Education Policy 2020, sweeping reforms to make education flexible, multidisciplinary and aligned with global standards and 21st-century needs. These remarkable shifts provide opportunity for a dynamic academic ecosystem that enhances learning accessibility, equity, improving quality, and nurturing talent. Given the changes in the industry workforce the higher educational institutions (HEIs) should have collaboration with industry. Such kind of collaboration underlines the significance of industry desirable curriculum design, assessment, skill development, faculty upskilling and addressing emerging global challenges. The National Education Policy (NEP) 2020 has given special emphasis on vocational education and skill development. Integration of vocational education with general education and mainstreaming of vocational education have been identified as the key reforms in the education system of the country. This article examines the significance of Industry collaboration and Vocational education and training (VET) and the goals outlined in NEP-2020. This study adopted a qualitative research design. The study employed purposive sampling, selecting documents that were relevant to the objective of the study. The required data have been collected from the secondary data sources only, such as scholarly articles, official policy documents / reports of UGC, AICTE, Ministry of Education- Govt of India and other resources from ASSOCHAM, CII, FICCI, NASSCOM etc. In conclusion, we are living an era of great interest for Institution, Society and students as new age technology continues to transform education sector. The potential benefits are enormous but HEIs must navigate these collaborative practice approaches thoughtfully and resourcefully. Hence, this kind of VET–industry collaboration is significantly paving the way for a highly skilled workforce to power India's future development and also builds a sustainable global workforce.

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Keywords: *Vocational education and training (VET), Industry collaboration, Transforming education, Ministry of Education, Global workforce.*

INTRODUCTION

Over the past few years, India has undertaken transformative reforms under the National Education Policy (NEP) 2020 to strengthen both school and higher education. Higher education in India is undergoing a significant transformation, driven by the integration of the National Education Policy 2020 and sweeping reforms aimed at making education flexible, multidisciplinary, and aligned with global standards and 21st-century requirements. These notable shifts provide opportunities for a dynamic academic ecosystem that enhances access to learning, promotes equity, improves quality, and nurtures talent. Given the changes in the industry workforce, higher educational institutions (HEIs) should collaborate with industry. Such collaboration highlights the importance of industry-relevant curriculum design, assessment, skill development, faculty upskilling, and addressing emerging global challenges.

The National Education Policy (NEP) 2020 has emphasised vocational education and skill development. Integrating vocational education with general education and mainstreaming it are recognised as key reforms in the country's education system. India, as a developing nation with a rich demographic dividend, needs skill development through vocational education and training (VET) to effectively harness this dividend for economic growth (Ministry of Skill Development and Entrepreneurship 2015,2). Moreover, organisations like the Organisation for Economic Co-operation and Development (OECD) highlight VET as a vital part of future-ready education and skills systems, serving a diverse group of young and adult learners. Due to its close links with the world of work, VET can provide learners with a practical and employability skills mix that supports their transition to employment and helps them adapt to change.

THE CONCEPT OF VOCATIONAL EDUCATION AND TRAINING (VET)

VET plays a vital role in education and training systems worldwide. Across OECD nations, 44% of learners in upper-secondary education are enrolled in vocational programmes. (<https://www.oecd.org>). The Indian education system is among the largest globally, reflecting the country's social, cultural, and economic realities. A distinctive feature of the Indian education system is its strong focus on academic education, even in fields that are typically delivered in a more vocational or practice-oriented manner in other countries (Wessels & Pilz 2018; Pilz & Regel 2021; Schneider & Pilz 2024).

Vocational education, or Vocational Education and Training (VET), also known as Career and Technical Education (CTE), prepares learners for jobs that involve manual or practical activities, typically non-academic and directly related to a specific trade, occupation, or vocation, hence the term in which the learner engages. It is sometimes called technical education, as the learner acquires expertise in a particular set of techniques or technology. (<https://www.aicte.gov.in/education/vocational-education>). The recently concluded G20 India's Education Working Group also emphasised the importance of skilling, upskilling, and reskilling for learners, which foster lifelong learning in the context of the future of work.

India is a developing country with a significant demographic dividend. This demographic advantage provides India with a unique chance for economic growth, with its young population driving sustained development and prosperity. The Ministry of Skill Development and

Entrepreneurship (MSDE)'s Annual Report for 2023-24 (<https://www.msde.gov.in>) highlights the urgent need for reforms in the country's skill and entrepreneurship sectors. It also details policies and initiatives aimed at improving skill development and closing the employment gap among India's expanding youth population. According to the National Sample Survey Office 2011-12 (68th round) report on the Status of Education and Vocational Training in India, about 2.2% of people aged 15-59 reported having received formal vocational training, while 8.6% participated in non-formal vocational training.

OBJECTIVE OF THE STUDY

This paper aims to provide a conceptual framework to understand the significance of Industry collaboration and Vocational Education and Training (VET).

RESEARCH METHODOLOGY

This study used a qualitative research design. It employed purposive sampling by selecting documents relevant to the study's objective.

DATA COLLECTION

The required data have been collected solely from secondary data sources, such as scholarly articles, official policy documents or reports of UGC, AICTE, Ministry of Education, Ministry of Skill Development and Entrepreneurship, Govt of India, and other resources from PIB, Invest India, and NCVET.

DISCUSSION

National Education Policy 2020 and VET

The National Education Policy 2020 aims to overhaul all aspects of education, including the structure, regulations, and governance, to establish a new system aligned with the aspirational goals of 21st-century students. According to the policy, by 2025, at least 50% of learners in school and higher education will have exposure to vocational education. The National Education Policy 2020 has emphasised the importance of vocational education and its role in shaping India's educational landscape.

The National Skill Development Corporation (NSDC)

The National Skill Development Corporation (NSDC) remains a fundamental part of India's skill development landscape, focusing on intensive training initiatives that boost employability across various sectors through vocational training programmes. As documented by the National Skills Network, NSDC's extensive programmes have successfully trained over 40 million individuals (<https://nationalskillsnetwork.in/nsdc-expands-skilling-footprint-with-50-future-skill-centres-and-10-international-academies>) to date, with particularly strong participation from women and traditionally marginalised communities. These remarkable figures highlight the programme's dual effect on personal empowerment and industry-specific workforce development, demonstrating the importance of vocational training for the Indian economy.

Ministry of Skill Development and Entrepreneurship (MSDE)

The Ministry is responsible for coordinating all Skill Development initiatives across the country, eliminating the disconnect between demand and supply of skilled manpower, developing the

vocational and technical training framework, upskilling, acquiring new skills, and fostering innovative thinking—not only for existing jobs but also for jobs that are to be created. The Ministry aims to skill on a large scale with speed and high standards to realise its vision of a ‘Skilled India’. (<https://www.msde.gov.in/>). Since 2014, the Ministry of Skill Development and Entrepreneurship has empowered more than 6 crore Indians through various schemes, helping them build a brighter future for themselves and the nation. The Ministry of Skill Development and Entrepreneurship (MSDE)'s Annual Report for 2023-24 (<https://www.msde.gov.in/>) highlights the urgent need for reforms in the country’s skilling and entrepreneurship landscape. It also outlines policies and initiatives to bolster skill development and bridge the employment gap among India's growing youth population.

Key government initiatives towards India’s vocational and Skill Development

India celebrated a landmark occasion, 10 years of the Skill India Mission, and over the decade, several significant milestones have been achieved. These achievements and initiatives not only showcase the Skill India Mission but also set the stage for the next era of inclusive, AI-driven, and industry-aligned skilling. These initiatives will be equally transformative for India’s workforce.

The following are the significant milestones:

Skill India Mission: The Skill India Mission (SIM) offers skill, reskilling, and upskilling training through a wide network of skill development centres and institutes under various schemes. In February 2025, the restructured ‘Skill India Programme’ was approved for 2022-23 to 2025-26, merging Pradhan Mantri Kaushal Vikas Yojana 4.0 (PMKVY 4.0), the Pradhan Mantri National Apprenticeship Promotion Scheme (PM-NAPS), and the Jan Shikshan Sansthan (JSS) Scheme into a single Central Sector Scheme.

Pradhan Mantri Kaushal Vikas Yojana (PMKVY) offers short-term skill training along with upskilling and re-skilling through Recognition of Prior Learning (RPL) for youth across the country, including rural regions.

Jan Shikshan Sansthan (JSS) provides vocational skills training to non-literates, neo-literates, and school dropouts (up to 12th standard), aged 15–45. It focuses on women, SC, ST, OBC, and minorities in rural and low-income urban areas. Over 26 lakh people have been trained from FY 2018-19 to FY 2023-24 under the scheme.

The National Apprenticeship Promotion Scheme (NAPS) encourages apprenticeship by providing financial support for apprentice stipends. Training encompasses both basic and hands-on practical training in industries. Under PM-NAPS, more than 43.47 lakh apprentices have been engaged across 36 states and Union Territories as of 19 May 2025, with participation from over 51,000 establishments.

- The Skill India Digital Hub (SIDH)
- SOAR (Skilling for AI Readiness)
- NCVET’s Kaushal Verse Digital Enterprise Portal
- Assessment Agencies and Awarding Body Guidelines

- Skill Impact Bond (SIB)
- The National Skills Qualifications Framework (NSQF)
- 36 Sector Skill Councils (SSCs), led by industry leaders in their respective sectors, have been established to identify the skill development needs of these sectors and to determine skill competency standards.
- Indian Institute of Skills (IIS), established in Ahmedabad and Mumbai in a Public-Private Partnership (PPP) Model, provides training to develop an industry-ready workforce equipped with cutting-edge technology and hands-on training.
- Rozgar Melas to boost employment initiatives in the country through the National Skill Development Corporation (NSDC), under the Ministry of Skill Development & Entrepreneurship (MSDE). These events aim to connect unemployed youth with suitable job opportunities in the private sector.
- The Youth Internship Programme, announced in the Union Budget 2024-25, aims to provide invaluable practical experience to 1 crore young individuals over five years, thereby significantly enhancing their job readiness and market competitiveness.

Industry Collaboration and Major Transformation of skill development and VET

- Industry-led models
- Academic credit frameworks
- Benchmarks for Awarding Bodies and Assessment Agencies,
- Aligning qualifications with the National Skills Qualifications Framework (NSQF)
- Promoting blended learning
- Training of trainers (ToT)
- Training of assessors (ToA)
- Enhancing the relevance of the vocational education curriculum
- Strengthening partnerships between vocational institutes and industries.
- Improving Quality of Training
- Expanding Access to Vocational Education
- The right set of skills to meet industry needs
- Global partnerships (France, IITs, Microsoft, Apollo MedSkills & more)
- Just-in-time upskilling and reskilling programmes
- Industry-rec Rozgar Melas and Pradhan Mantri National Apprenticeship Melas (PMNAMs) to facilitate the placements and apprenticeship opportunities to the certified candidates with recognised skill assessments

EDUCATION AND TRAINING SYSTEM IN INDIA

Table 1. Education and Training System in India.

Age Group	Grade	Academic Pathway	Technical Pathway	Vocational Pathway	Outcome
Age: 6-14	Class: 1 - 8	Elementary Education Certificate			Workers without specific skills
Age: 15-16	Class: 9 - 10	General Secondary Board Exam Certificate	Vocational Secondary		
Age: 17-18	Class: 11 -12	Senior Secondary Board Exam Certificate	Polytechnics (3-year diploma)	ITIs (1-2 years craftsman DGET certificate) Apprenticeship (2-4 years certificate)	Craftsman
Age: 19-21		University (undergraduate, 3-4 years degree)	Engineering colleges	Advanced training institutes Central/Foreign training institutes	Technicians
Age: 22 and above		Masters program Doctorate programs			Engineers, Technologists, Scientists
World Bank (2007) Skill development in India : the vocational education and trainingsystem https://documents1.worldbank.org/curated/en/314211468035471251/pdf/42113optmzd0In1ning0Report01PUBLIC1.pdf					

This table (Table 1) outlines the structure of the Indian education and vocational system by age, from elementary levels to undergraduate and postgraduate stages. It encompasses academic, technical, and vocational pathways with corresponding certifications and diplomas, illustrating how students can transition into skilled trades or pursue higher technical education and professional roles. The table highlights diverse learning opportunities across ages 6–22+, supporting comprehensive workforce development.

Table 2. Education and Training Systems around the World.

System/ Country	Pathway from Basic Education	Secondary/Technical/ Vocational Option	Tertiary Education	Labour Market Entry Points
German System	Apprenticeship & Technological Workshop	Secondary Education	Yes	After either apprenticeship, secondary, or tertiary
French System	Secondary & Vocational Technical Schools	Secondary Education	Yes	After technical/vocational, secondary, or tertiary
North American System	Secondary Education incl. Vocational	Community Colleges	Yes	After community college or tertiary education
Japanese System	Secondary Education	Vocational Training by Corporations	Yes	After vocational or tertiary education
Latin American System	Vocational Training	Secondary Education	Yes	After vocational internship, secondary, or tertiary

This table (Table 2) compares vocational education pathways across global systems (Germany, France, North America, Japan, Latin America, and Australia). It illustrates entry points into the labour market, the integration of apprenticeship and vocational options with secondary and tertiary education, and the accessibility of technical training. The comparison highlights India's evolving yet still fragmented system compared to robust models in Germany and Australia. These images compare system flowcharts for vocational education entry and exit points in developed countries versus India, visually demonstrating the streamlined progression and articulation from academia to vocational training and then to the labour market in Germany and Australia, contrasting with India's more complex and sometimes overlapping tracks. They emphasise the importance of seamless transitions and clearer system structures.

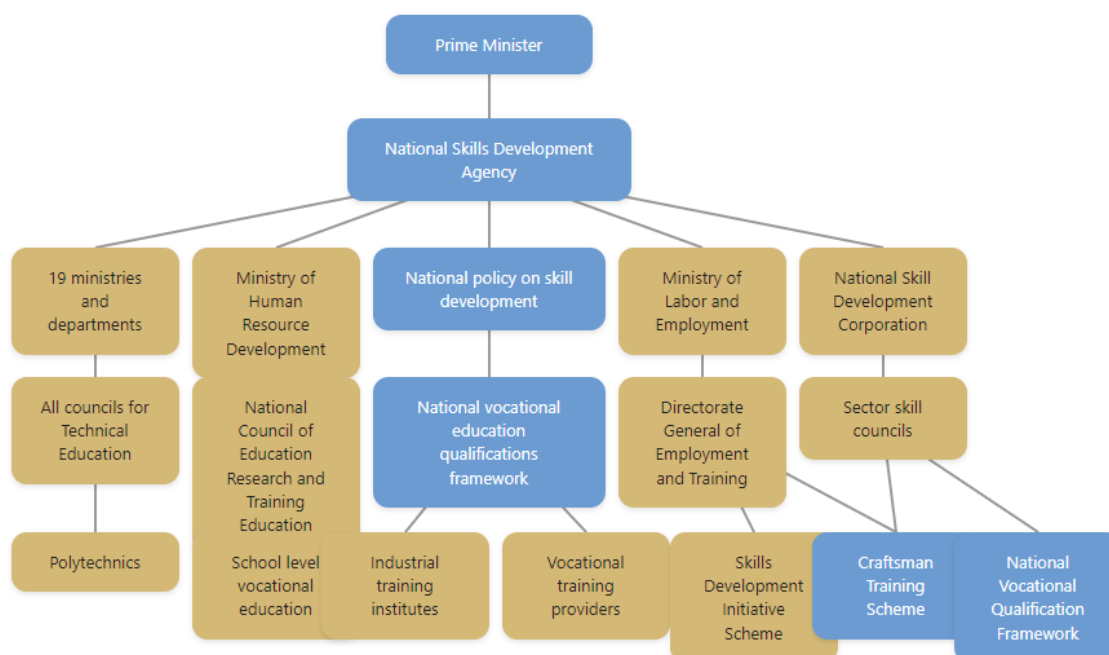


Figure 1. Technical and Vocational Education System in India.

Source: Institute of Applied Manpower Research 0-21

Note: MHRD regulates polytechnics and school-level vocational education, while MOLE regulates Industrial Training Institutes and Vocational Training Providers

This diagram (Figure 1) visually organises policy initiatives (blue), ministries/institutions (yellow), and training tracks, outlining how the National Skills Development Agency, Ministry of Labour, and ITIs interact within the broader skills development framework. The schematic emphasises the multi-layered, inter-ministerial approach and demonstrates integration challenges and opportunities for increased cooperation.

Table 3. State/UT-wise Number of Students who have Opted for Vocational Education and Training in the Country from 2019-20 to 2021-22

Sl. No.	States	2020-21	2021-22	2022-23	CAGR
1	Andaman and Nicobar Islands	6012	9911	8799	14%
2	Andhra Pradesh	51080	51819	51819	0%
3	Arunachal Pradesh	14363	22114	31601	30%
4	Assam	37441	54116	71723	24%

5	Chandigarh	3191	7180	8554	39%
6	Chhattisgarh	128140	124084	119523	-2%
7	Daman and Diu and Dadar and Nagar Haveli	643	1829	20569	217%
8	Delhi	5212	18180	2540	-21%
9	Goa	6976	8982	9463	11%
10	Gujarat	8444	22788	22855	39%
11	Haryana	126651	186903	129669	1%
12	Himachal Pradesh	80767	91251	89058	3%
13	Jammu and Kashmir	46814	80615	89885	24%
14	Jharkhand	22550	93500	93500	61%
15	Karnataka	15386	17063	19535	8%
16	Kerala	10284	15720	32238	46%
17	Ladakh	1265	2657	2676	28%
18	Lakshadweep	703	360	605	-5%
19	Madhya Pradesh	143032	247086	244452	20%
20	Maharashtra	53507	73368	73368	11%
21	Manipur	13243	13033	13113	0%
22	Meghalaya	2040	7490	7490	54%
23	Mizoram	3332	6536	6536	25%
24	Nagaland	3672	8360	8299	31%

25	Odisha	55552	112742	58180	2%
26	Puducherry	520	1401	1401	39%
27	Punjab	133680	158055	176506	10%
28	Rajasthan	125255	197313	197313	16%
29	Sikkim	21453	19378	19378	-3%
30	Tamil Nadu	10254	29373	38043	55%
31	Telangana	69469	65405	65405	-2%
32	Tripura	1334	9286	16558	132%
33	Uttar Pradesh	0	0	0	0%
34	Uttarakhand	0	8733	17826	0%
35	West Bengal	147910	116672	110795	-9%
Source: Data.gov.in https://www.data.gov.in/resource/stateut-wise-number-students-who-have-opted-vocational-education-and-training-country-2019					
Note: Compound Annual Growth Rate (CAGR) has been calculated by authors					

This extensive data in Table 3 displays state-wise information on students choosing vocational education over three academic years, including compound annual growth rates (CAGR). Growth rates vary significantly: Jharkhand (61%), Kerala (46%), Tamil Nadu (55%), Chandigarh (39%), and Daman & Diu (217%) show notable increases, while some states experience negative or minimal growth. It highlights stark regional disparities and the need for targeted policy interventions to support lagging areas.

Table 4. State/UT-wise Vocational Educational Training Centres.

Sl. No.	State / UT	Government ITIs	Private ITIs	Total ITIs	NSTIs and IToTs	JSS Centres	PMKVY 4.0 CSCM Centres	Apprenticeship Training Scheme Centres	Total
1	Andaman and Nicobar Islands	3	1	4	0	1	0	6	15
2	Andhra Pradesh	85	435	520	1	6	150	598	1795
3	Arunachal Pradesh	7	0	7	0	0	9	9	32
4	Assam	31	14	45	0	5	107	385	587
5	Bihar	150	1226	1376	1	21	29	529	3332
6	Chandigarh	2	0	2	0	1	2	78	85
7	Chhattisgarh	120	112	232	2	14	26	197	703
8	Delhi	17	36	53	0	3	20	387	516
9	Goa	11	2	13	1	1	2	345	375
10	Gujarat	274	229	503	1	9	40	4966	6022
11	Haryana	160	228	388	6	4	40	3493	4319
12	Himachal Pradesh	128	142	270	9	11	10	455	1025
13	Jammu and Kashmir	49	1	50	5	1	59	162	327
14	Jharkhand	77	270	347	5	12	12	236	959

15	Karnataka	275	1229	1504	6	12	27	1167	4220
16	Kerala	149	315	464	2	9	27	942	1908
17	Ladakh	3	0	3	0	2	1	9	18
18	Lakshadweep	1	0	1	0	1	0	0	3
19	Madhya Pradesh	195	882	1077	3	27	56	630	2870
20	Maharashtra	422	619	1041	10	21	51	4050	6214
21	Manipur	10	0	10	0	4	3	11	38
22	Meghalaya	7	1	8	1	1	3	18	39
23	Mizoram	3	0	3	0	1	4	4	15
24	Nagaland	9	0	9	0	2	13	7	40
25	Odisha	75	450	525	18	28	24	414	1534
26	Puducherry	8	7	15	0	0	3	124	157
27	Punjab	115	235	350	16	2	34	500	1252
28	Rajasthan	165	1455	1620	36	8	55	519	3858
29	Sikkim	4	0	4	0	0	3	31	42
30	Tamil Nadu	87	411	498	2	8	46	1581	2633
31	Telangana	66	236	302	9	6	25	669	1313
32	Dadra and Nagar Haveli and Daman and Diu	4	0	4	0	2	0	71	81

33	Tripura	20	2	22	5	2	3	31	85
34	Uttar Pradesh	289	2968	3257	11	47	127	3467	10166
35	Uttarakhand	105	82	187	2	8	13	431	828
36	West Bengal	163	139	302	2	8	37	545	1196
	Total	3289	11727	15016	154	288	1061	27067	58602

Source: Data.gov.in

Table 4 lists government and private Industrial Training Institutes (ITIs), National Skill Training Institutes (NSTIs), Jawahar Skill Centres (JSS), PMKVY Centres, and apprenticeship training centres across Indian states. Uttar Pradesh leads with 3,257 ITIs and more than 10,000 centres in total, indicating significant infrastructure investment. However, smaller states and Union Territories have limited resources. The data highlights both strengths and gaps in India's skill development ecosystem.

The table shows a rising trend, indicating increased private sector involvement in skilling initiatives, which is vital for resource mobilisation and closing public-private gaps in vocational education delivery.

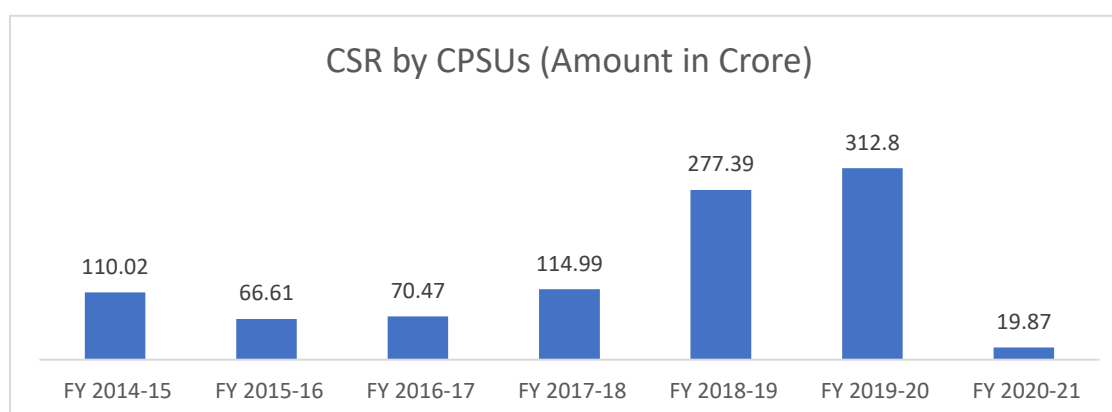


Figure 2. Year-wise CSR Expenditure by Central PSUs in Vocational Skills Development Sector from 2014-15 to 2020-21.

Source: Data.Gov.in <https://www.data.gov.in/resource/year-wise-csr-expenditure-central-psus-vocational-skills-development-sector-2014-15-2020>.

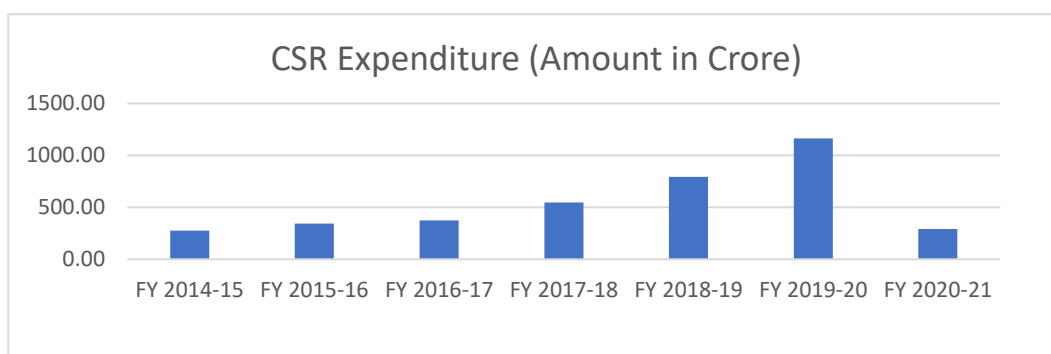


Figure 3. Year-wise CSR Expenditure in the Development Sector Vocational Skill by the Corporate Sector from 2014-15 to 2020-21.

Source: Data.Gov.in <https://www.data.gov.in/resource/year-wise-csr-expenditure-development-sector-vocational-skill-corporate-sector-2014-15>

Between 2014-15 and 2020-21, year-by-year CSR expenditure by the corporate sector in India on vocational skill development steadily increased, reflecting growing recognition of its social and economic value. This trend indicates heightened corporate involvement in upskilling, which supports national workforce development initiatives and bridges government–industry gaps in skill delivery. The continual rise in allocations also suggests policy alignment and a strong private sector commitment to sustainable human capital investments.

CONCLUSION

We are living in an era of great interest for institutions, society, and students as new age technology continues to transform the education sector. The potential benefits are enormous, but higher education institutions (HEIs) must navigate these collaborative practice approaches thoughtfully and resourcefully. Hence, this kind of VET–industry collaboration is significantly paving the way for a highly skilled workforce to power India’s future development and also build a sustainable global workforce. The Ministry of Education and the Ministry of Skill Development and Entrepreneurship have brought together stakeholders from industry, skill centres, and academia to enhance awareness of NCVET’s new initiatives for strengthening the Vocational Education and Training (VET) ecosystem. It is imperative that the collective responsibility and efforts of government departments, regulators, policymakers, industry partners, and academia are harnessed to build a demand-driven, responsive vocational education ecosystem. Additionally, these efforts will surely pave the way for fostering a successful and inclusive future in the global labour market.

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Chapter Nine

SMART, GREEN, AND SUSTAINABLE ACADEMIC LIBRARIES IN THE NEP 2020 ERA: CATALYSTS FOR SUSTAINABILITY EDUCATION AND UN SDGS

Eesha Sharma

ABSTRACT

The National Education Policy (NEP) 2020 envisions a technology-enabled, sustainable, and inclusive education system that prepares learners to become responsible global citizens. Academic libraries are uniquely positioned to support this vision by integrating smart technologies with green, eco-conscious practices, thereby becoming dynamic hubs for innovation and sustainability in higher education. This paper investigates how smart, green, and sustainable academic libraries function as catalysts for sustainability education, digital literacy, and the achievement of the United Nations Sustainable Development Goals (UN SDGs), particularly SDG 4 (Quality Education) and SDG 13 (Climate Action). Smart libraries utilise digital tools, artificial intelligence (AI), the Internet of Things (IoT), and data analytics to improve accessibility, user experience, and resource management, whilst green libraries focus on energy-efficient infrastructure, digital resource adoption, and environmentally responsible operations. Drawing on theoretical frameworks, policy documents, and global case studies, the study explores the evolution, importance, and prospects of technologically advanced and ecologically responsible library systems. Although obstacles such as limited budgets, inadequate digital infrastructure, and insufficient policy mechanisms persist, the paper proposes scalable strategies to address these barriers. It concludes that smart, green, and sustainable academic libraries form essential, future-ready infrastructure for delivering the transformative goals of NEP 2020. By balancing technological progress with ecological responsibility, these libraries serve as models for sustainable innovation in higher education.

Keywords: Smart Libraries, Green Libraries, NEP 2020, Sustainability Education, UN SDGs, Academic Libraries

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INTRODUCTION

Academic libraries worldwide are undergoing a significant transformation in their identity, purpose, and roles as they adapt to technological developments and global sustainability goals. Traditionally seen as guardians of books and records of printed knowledge, libraries mainly functioned as quiet reading areas and archival centres focused on organising, preserving, and sharing information. Their importance was often judged by the size of their collections, the completeness of their catalogues, and their ability to provide reference and lending services. However, the advent of digital technologies, growing user expectations, and rapid shifts in higher education have changed the nature of library work. Today's academic libraries are evolving from static, collection-focused institutions into vibrant, technology-driven learning environments that effortlessly blend physical and digital spaces (Schopfel, 2018).

This transformation is mainly driven by two interconnected global forces. The first is the swift progress of digital technologies, which has fundamentally changed how information is produced, accessed, and used. Innovations such as artificial intelligence, cloud computing, big data analytics, Internet of Things (IoT) applications, and RFID-based automation have transformed library operations and user services. Smart technologies allow libraries to offer personalised user experiences, remote access to resources, integrated discovery systems, automated circulation processes, and smooth access to digital repositories (Igwe & Sulyman, 2022). IoT-enabled environmental sensors further improve user comfort by monitoring lighting, air quality, and occupancy, enabling efficient and data-driven management of library spaces (Zhou, 2024). These advancements reflect a wider shift towards smart library ecosystems, where automation and analytics support real-time decision-making and enhanced service delivery (Singh & Mahajan, 2014).

The second significant force influencing the development of academic libraries is the global urgency to tackle environmental sustainability and climate change. As higher education institutions worldwide adopt environmentally responsible policies, libraries have started incorporating green infrastructure, renewable energy systems, and sustainability-focused practices into their operations. The green library movement encourages energy-efficient building designs, the use of eco-friendly materials, improved indoor environmental quality, sustainable procurement, recycling initiatives, and water conservation measures (Hauke & Werner, 2013). Green libraries not only minimise institutional carbon footprints but also serve as educational centres that promote environmental literacy and sustainability awareness among students and staff. By functioning as visible examples of eco-conscious design and resource management, they embody the principles of environmental stewardship increasingly emphasised in global higher education (Lozano et al., 2015; Dogan & Gurbinar, 2023).

The convergence of digital transformation and environmental sustainability has created a new paradigm: smart, green, and sustainable academic libraries. These libraries combine intelligent technologies with environmentally responsible infrastructure to establish learning environments that are technologically advanced, energy-efficient, and aligned with the pedagogical needs of 21st-century learners. They act as living laboratories where students can experience sustainability practices firsthand while benefiting from cutting-edge digital services (Hauke, 2021). By supporting digital literacy, open access, collaborative learning, and sustainability education,

smart and green libraries directly contribute to institutional objectives and global development agendas, including the United Nations Sustainable Development Goals (SDGs).

In India, this transformation closely aligns with the National Education Policy (NEP) 2020, which stresses the development of digitally enriched and environmentally conscious learning environments to encourage multidisciplinary, experiential, and sustainable education. NEP 2020 advocates for innovative pedagogical methods, incorporation of technology in teaching and learning, and the creation of green campuses that foster environmental responsibility. Academic libraries play a key role in fulfilling these objectives, acting as centres that support digital empowerment, sustainability education, and community engagement. They serve not only as resource hubs but also as catalysts for promoting sustainability education, green practices, and enabling students to engage meaningfully with the United Nations Sustainable Development Goals (UN SDGs).

THE EMERGENCE OF SMART LIBRARIES

The concept of the smart library has gained prominence over the past decade as advances in digital technologies reshape the landscape of information access, scholarly communication, and library services. Smart libraries integrate technologies such as the Internet of Things (IoT), Radio Frequency Identification (RFID), artificial intelligence (AI), cloud-based architectures, and big data analytics to enhance user engagement and operational efficiency. According to Schopfel (2018), smart libraries represent a conceptual shift towards intelligent, automated, and interconnected systems that support learning and research environments through real-time data and adaptive technologies. These libraries are increasingly adopting IoT-based sensors to monitor occupancy patterns, air quality, lighting, and temperature, thereby ensuring a responsive and user-centred environment (Zhou, 2024).

Automation is another vital element of intelligent library infrastructures. RFID technology enables automated circulation, instant inventory control, self-checkout systems, and loss prevention measures, drastically reducing manual effort and enhancing service speed (Singh & Mahajan, 2014). AI-powered tools further improve user experiences by facilitating personalised search suggestions, smart reference services, and automated cataloguing workflows (Prasanna & Yogendra, 2023). Together, these technologies optimise routine library operations and enable staff to concentrate on higher-level tasks such as research support, information literacy training, and user engagement.

Furthermore, smart libraries represent the merging of digital access with pedagogical innovation. As students increasingly depend on electronic resources, integrated discovery systems and federated search interfaces provide seamless access to books, journals, and institutional repositories (Igwe & Sulyman, 2022). Cloud-based storage and remote authentication mechanisms facilitate access to academic materials anytime and anywhere, supporting hybrid and online learning models that dominate higher education. This digital expansion of library services promotes collaborative learning, virtual research communities, and data-driven decision-making within academic institutions. As a result, smart libraries embody a shift towards information environments that are not only technologically advanced but also pedagogically tailored to the needs of digital-native learners.

GREEN LIBRARIES AND SUSTAINABLE INFRASTRUCTURE

Parallel to technological progress, environmental sustainability has become a key focus for academic libraries. The concept of a green library, as defined by the International Federation of Library Associations and Institutions (IFLA), refers to library spaces designed, constructed, and operated to minimise environmental impact. Green libraries promote eco-friendly infrastructure, responsible resource management, and environmentally conscious services that encourage communities to adopt sustainable lifestyles. Green libraries aim to reduce ecological impact through energy efficiency, integration of renewable energy, water conservation, and waste reduction (Hauke et. al. 2011). Werner (2013) highlights that green library design principles include optimising natural lighting, improving indoor air quality, and selecting low-emission construction materials. Solar panels, rooftop gardens, and green roofing systems help lower carbon footprints while providing thermal insulation. Sustainable construction materials such as recycled wood, low-emission paints, and eco-certified furniture ensure that library spaces are both environmentally friendly and safe for users. These elements contribute to healthier learning environments while significantly lowering operational costs.

Sustainability in libraries goes beyond infrastructure to include environmentally mindful practices such as recycling programmes, digital notices, and paperless workflows. Dogan & Gulpinar, (2023) notes that users increasingly value environmentally responsible library services and see green practices as vital parts of modern library operations. Water management initiatives—such as harvesting rainwater, recycling greywater, and adopting low-flow fixtures—further support sustainable operations and reduce resource use.

Beyond physical infrastructure, green libraries also act as educational spaces that promote environmental literacy through awareness programmes, exhibitions, workshops, and community outreach activities to foster environmental consciousness. (Enang & Kolawole, 2024)

CONVERGENCE OF SMART AND GREEN LIBRARY PARADIGMS

The integration of smart and green principles in academic libraries signifies an emerging paradigm where digital transformation and sustainability support each other. Modern libraries are increasingly creating hybrid spaces where physical environments and digital systems coexist, fostering flexible, collaborative, and environmentally conscious learning. Smart technologies can promote sustainability objectives through data-driven environmental monitoring systems that optimise energy use, automate lighting, and control heating, ventilation, and air conditioning (HVAC) based on occupancy patterns (Enang & Kolawole, 2024). These systems minimise carbon footprints while enhancing user comfort.

The merging of smart and green paradigms also promotes long-term institutional sustainability. Data analytics tools used in smart libraries enable administrators to monitor environmental metrics, forecast energy demands, and evaluate the impact of sustainability initiatives. Such insights support informed decision-making and effective resource allocation. As Lozano et al. (2015) argue, sustainability in higher education requires holistic approaches that combine infrastructure, pedagogy, and organisational culture. Smart-green library ecosystems help this integrated view by combining technological innovation with environmental stewardship.

LIBRARIES, NEP 2020 AND SUSTAINABILITY EDUCATION

The National Education Policy (NEP) 2020 positions Indian higher education at a transformative point by emphasising digital empowerment, multidisciplinary learning, and environmental sustainability. NEP 2020 advocates for the development of digitally enriched curricula, online learning platforms, and green campuses that align with global sustainability priorities. Academic libraries play a crucial role in this transformation by supporting digital literacy, providing access to open educational resources, and encouraging sustainability-focused learning opportunities.

NEP 2020 stresses the integration of 21st-century skills, experiential learning, and environmental awareness across all subjects. Libraries support these aims by curating sustainability-related materials, providing digital literacy workshops, and facilitating experiential learning through maker spaces, virtual labs, and interactive digital tools (Ministry of Education, 2020). As repositories of knowledge and facilitators of scholarly communication, academic libraries also contribute to research on sustainability by hosting institutional repositories, supporting open-access publishing, and offering data management services.

The policy advocates for developing digital-ready campuses equipped with ICT-enabled learning spaces, open-access digital libraries, and online resource-sharing platforms. Simultaneously, it encourages environmentally sustainable practices such as waste reduction, renewable energy adoption, biodiversity conservation, and sustainable infrastructure development.

Academic libraries are essential to the implementation of NEP 2020. They facilitate digital learning through remote access systems, e-resources, and digital repositories. Additionally, they support interdisciplinary research by providing access to a variety of academic materials, data sets, and open educational resources. Furthermore, libraries assist NEP's emphasis on community engagement by organising awareness programmes, sustainability exhibitions, and public outreach initiatives that extend learning beyond the classroom. These activities promote a culture of environmental responsibility and help students understand the real-world implications of sustainability. By aligning their services with NEP 2020, libraries become crucial to the national goal of cultivating informed, eco-conscious, and digitally empowered citizens.

LIBRARIES AND THE UN SUSTAINABLE DEVELOPMENT GOALS

Academic libraries greatly support various United Nations Sustainable Development Goals (SDGs) through their services, programmes, infrastructure, and community engagement efforts. Their contributions can be broadly understood through the following SDGs:

SDG 4: Quality Education – Libraries support SDG 4 by offering inclusive access to information, digital learning resources, and lifelong learning opportunities (Dei & Asante, 2022). Through their role as information providers and skill-builders, libraries enable learners to engage critically with sustainability issues and global development challenges.

SDG 9: Industry, Innovation, and Infrastructure – Smart libraries integrate digital technologies and innovative infrastructural designs that improve institutional efficiency and support technology-driven learning environments. Technologies such as IoT, AI, and RFID modernise library operations and establish digital ecosystems conducive to research and knowledge creation (Schopf, 2018).

SDG 11: Sustainable Cities and Communities – Green libraries act as eco-friendly community spaces that foster urban sustainability, eco-literacy, and community wellbeing. Their environmentally conscious design principles lower ecological footprints while improving community welfare (Hauke & Werner, 2013).

SDG 13: Climate Action – Integrating sustainability programming and climate literacy initiatives aligns libraries with SDG 13. By reducing carbon emissions, promoting responsible energy use, and empowering communities through workshops, curated collections, outreach campaigns, and climate literacy programmes, libraries enable communities to understand and address climate challenges (Enang & Kolawole, 2024).

By integrating smart technologies with environmentally friendly operations, libraries improve their contributions to SDG achievement and strengthen their role as vital partners in institutional sustainability strategies. These features show how smart and green libraries can simultaneously promote sustainability, accessibility, and technological innovation.

CHALLENGES IN IMPLEMENTING SMART AND GREEN LIBRARIES

Despite the promising benefits, multiple challenges hinder the widespread adoption of smart and green library models in developing countries.

1. High Initial Costs for Smart and Green Technologies

One of the biggest challenges in establishing smart and green libraries is the high initial cost for advanced technological and sustainable infrastructure. Smart technologies such as IoT, RFID systems, and automated infrastructure present a significant obstacle for institutions with limited budgets. Likewise, green infrastructure—such as solar panels, energy-efficient HVAC systems, LED retrofitting, and green roofing—requires substantial financial investment, which may not be feasible for older campuses with structural limitations.

2. Infrastructure Gaps in Older and Legacy Institutions

Older educational institutions often face challenges with outdated physical infrastructure that hampers the adoption of smart or green technologies. Buildings built decades ago may lack modern electrical wiring, networking capabilities, or sufficient structural strength to support installations such as solar panels or heavy digital equipment. Retrofitting these spaces requires extensive renovations, including rewiring, installing data ports, reinforcing structural components, improving ventilation, and redesigning physical layouts. Many institutions also lack reliable internet connectivity, stable power supply, or enough physical space needed for implementing smart or green features.

3. Insufficient Funding and Absence of Policy-Level Mandates

Another major obstacle is the inconsistent funding and the lack of clear policy mandates that focus on smart and green transformations in academic libraries. While national frameworks like NEP 2020 highlight digital transformation and sustainability, they do not always offer dedicated funding streams or detailed operational guidelines for library modernisation.

4. Resistance to Change Among Staff and Limited Digital Literacy

Resistance to change also presents a significant challenge. Library staff may be reluctant to embrace new technologies, fearing automation or lacking digital literacy. Without adequate

training and capacity-building programmes, shifting to smart and green library models becomes challenging.

Recommendations for Strengthening Smart and Green Library Initiatives

1. To address current challenges, higher education institutions must implement a phased and strategic approach. Retrofitting existing library spaces with energy-efficient LED lighting, installing motion-sensor systems, and initiating solar panel installations can serve as effective starting points.
2. Behavioural change campaigns, such as “Switch-off Drives,” and waste-reduction initiatives can encourage user participation in sustainability efforts.
3. Libraries should modernise workflows by adopting RFID technology for circulation management, thereby reducing manual labour and enhancing service efficiency. Incorporating digital repositories, open educational resources, and e-learning platforms will strengthen academic support systems.
4. Academic libraries should also proactively promote sustainability education through organising exhibitions, seminars, workshops, and student engagement programmes. These initiatives can help foster environmental awareness among students and staff.
5. Furthermore, institutional policies must explicitly include library sustainability goals within broader NEP 2020 implementation plans. Collaborations with government agencies, NGOs, and technology providers can assist in securing funding and expertise.

CONCLUSION

Smart, environmentally friendly, and sustainable academic libraries exemplify a transformative model for 21st-century higher education. These libraries play a vital role in supporting NEP 2020’s vision of digitally empowered, multidisciplinary, and sustainability-focused higher education. By incorporating smart technologies, green architecture, and sustainability-driven programmes, libraries actively contribute to the United Nations Sustainable Development Goals and motivate future generations to embrace eco-conscious lifestyles. Institutions that invest in smart and green library development will not only update their infrastructure but also reinforce their commitment to sustainability, innovation, and inclusive learning. Ultimately, smart thinking, green living, and sustainable learning must form the foundation of future-ready academic ecosystems. The integration of smart technologies and green design principles improves operational efficiency, enhances user experiences, and decreases environmental impacts. Through their services, programmes, and infrastructure, academic libraries meaningfully support global development priorities and institutional sustainability agendas. As higher education evolves, smart and green library ecosystems will be essential for cultivating informed, responsible, and environmentally conscious learners. Consequently, smart libraries mark a shift from static, print-centric repositories to dynamic, interactive, and data-driven environments. Their development is not just technological but pedagogical, as they underpin online learning, hybrid classrooms, digital literacy, and research skills central to NEP 2020.

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Chapter Ten

DEVELOPMENT OF AN EFFICIENT METHOD FOR TEACHING IN THE MIDDLE-STAGED CLASSROOMS

Jagriti Gupta

ABSTRACT

The National Education Policy 2020 is a landmark event in the Indian education system. The thoughtful framework behind the policy addresses present needs and acts as a bridge between policymakers and the actual beneficiaries of the system. The articulation of the policy is designed to accommodate the ever-growing demand for education by fundamentally revolutionising the school system. The policy strongly emphasises integrating technology into education, familiarising teachers with its use, which significantly impacts the teaching-learning process in classrooms, making it more convenient and interactive. The main focus is on employing technology responsibly and optimally to support the country's growth. In this paper, we propose a method to reduce the digital divide and enhance pedagogical skills, which can improve the overall teaching and learning process. The primary objectives of the method include comprehensive training for teachers to use technology ethically, effectively address classroom challenges, and realise the full potential of students. This approach aims to increase the overall productivity of teaching, especially for children aged eleven to fourteen, in the most effective way possible.

Keywords: Classroom, Pedagogy, Technology, Digital Divide, Middle Staged Classrooms.

INTRODUCTION AND LITERATURE REVIEW

The National Education Policy represents a step forward in the progressive development of our country's education system. The policy aims to act as a catalyst for change within the education system. With advancements in educational technology, efforts have been made to make the education system more inclusive and accountable. The National Education Policy will help make the country's education system more flexible and capable of meeting the needs of the 21st century. The socio-political transformation and the shift towards indigenous knowledge systems have increased the relevance of the new policy. It has attempted to address the challenges that have arisen.

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Hindrance in the growth of the Indian education system. The policy closely aligns with global trends towards the universalisation of education (Ashokkumar et al., 2025). The entire policy shifts from rigid compartmentalisation to more flexible choices among different streams and their respective disciplines.

A comprehensive outlook considers a multidisciplinary curriculum that integrates sports, fitness, arts, crafts, science, and mathematics. The persistent gap between the skills required for employment and the mere accumulation of data will be narrowed through NEP 2020. It is essential to focus on the necessary skill set, as the number of graduates increases each year, yet employment trends remain negative. Youth in the country often experience anxiety and despair due to the pressure of being unable to secure employment even after higher education. This situation can lead to a vicious cycle of self-doubt, depression, and anger among the country's capable human resources. Therefore, NEP 2020 represents a significant step forward in this regard (Rajpriya, 2025). The comprehensive approach helps students become resilient to physical, social, cultural, mental, and spiritual constraints, ultimately fostering responsible and healthy citizens of the country (Pol et al., 2024).

The formation of the National Education Technological Forum itself enhances the integration of technology with education. It offers a platform for unifying different techniques and methods to ensure equitable access to education for all. This promotes the exchange of ideas and best practices among various stakeholders, educational leaders, and government bodies. Additionally, it encourages the introduction of new pedagogical approaches, teacher training programmes, and a shift towards a more learner-centred, constructivist model. Modern technology has completely transformed how we access information and acquire knowledge. Education is now more accessible and valuable than ever thanks to these advancements. Teachers still frequently rely on traditional methods, such as highlighting key concepts with PowerPoint presentations or YouTube videos. However, it is clear that students need to move beyond these habits and adopt new learning techniques that actively engage their interest, utilise their smart devices, and foster a sense of community among peers (Mdhlalose & Mlambo, 2023). Consequently, the emphasis on practical knowledge shifts the responsibility to make the education system responsive to current market demands. This review provides a comprehensive perspective on this matter. The policy's focus on integrating digital learning tools will help foster a transformative, state-of-the-art educational environment within the conventional learning landscape.

The use of artificial intelligence and its ethical application will aid in personalising content according to student requirements (Aayog, n.d.). An effective school system should integrate digital methods into physical classrooms, which will enhance overall student performance, especially in areas with a shortage of teachers (NITI Aayog, 2021). The school system has seen significant progress in blending education with technology. According to the Economic Survey 2024-25, school education in India serves 24.8 crore students across 14.72 lakh schools with over 98 lakh teachers, with increasing staff supply. This positions India as an educational hub. It is noteworthy that India has seen a marked rise in facilities to incorporate technology into the education system. Blended learning, as outlined in NEP2020, offers a more engaging experience by combining traditional classroom instruction with online resources. The utilisation of tools such as AI, robotics, and simulations, particularly in STEM

subjects, will be highly beneficial. Teacher empowerment will be fundamental, with comprehensive training and incentives to help educators become digitally literate and proficient. The implications of NEP 2020 for students, teachers, and stakeholders will be substantial, facilitating systematic progress (Guru, 2020). According to the Ministry of Skill Development and Entrepreneurship, the policy emphasises vocational education to bridge the gap between academic knowledge and industry demands. Analyses of similar programmes suggest that aligning industry requirements with vocational training can boost career readiness and employability. Consequently, this will have a significant impact on vocational education. It is important to note that the overall development envisaged in NEP 2020 will advance the education system through various new approaches.

The following data will illustrate the growth resulting from the integration of technology with education.

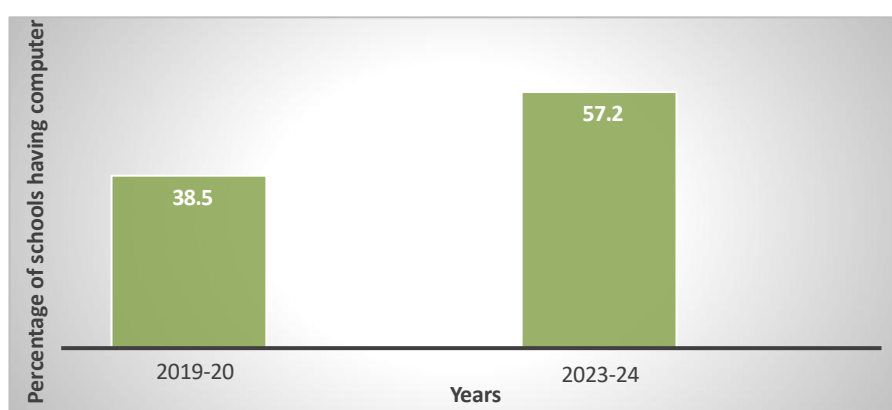


Figure 1: Represents the increase in the percentage of schools having computers. (Ministry of Finance, 2024-25).

As illustrated in Figure 1, the proportion of schools equipped with computers increased from 38.5% in 2019-2020 to 57.2% in 2023-24, marking a significant change. As shown in Chart 2, there has also been a rise in the percentage of schools with internet access from 2019-20 to 2024-25. Therefore, it is important to note that this increase will enhance school education and improve teachers' ability to integrate technology into their teaching methods.

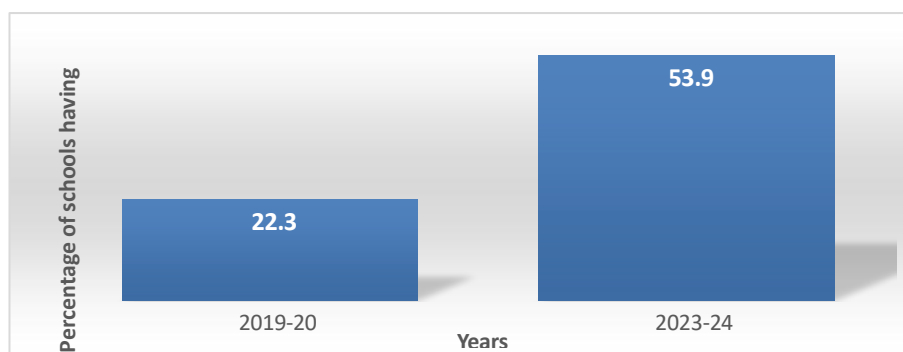


Figure 2: Shows the rising percentage of schools with internet facilities. (Ministry of Finance, 2024-25)

OBJECTIVES

The following are the objectives that help in giving structure to the whole review:

1. The benefits of integrating technology in the teaching and learning process in middle-staged classrooms.
2. The second major objective concerns the development of a method to equip teachers to use technology in their professional practice.
3. A comparative analysis of the National Education Policy with the best educational trends followed globally in light of the usage of technology.

METHODOLOGY

The integration of technology into the teaching process has always been questioned due to a lack of resources and teachers' technical know-how. Therefore, it is essential to provide proper training channels for teachers to enhance their ability to conduct effective research. Many teachers are accustomed to traditional teaching methods, which presents a problem as they lack the necessary knowledge to educate students in modern ways required for their holistic development in an ever-changing world. It is crucial to qualitatively assess the need to familiarise teachers with the use of technological tools. The paper addresses this issue and offers a general consensus on how teacher education can support practical application. The following presents a literature survey in this field.

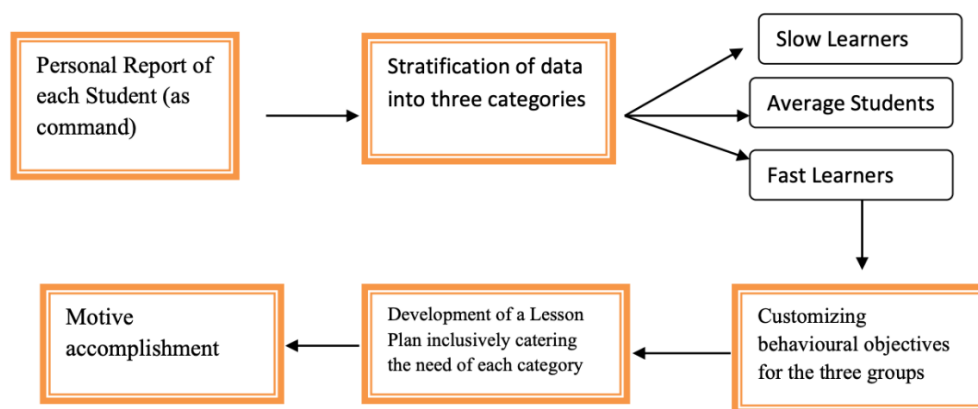


Figure 3. Framework of the Proposed Model.

The proposed framework (as shown in Figure 3) results from recent technological advancements by training a model to enhance the teaching and learning process. The idea behind it is to leverage the numerous opportunities within this particular discipline. When integrated with technology, the entire teaching and learning process can create a lasting impact. Special emphasis will be placed on inclusive classrooms, ensuring that individual differences among students are not overlooked. This approach helps students who learn more slowly to realise their own potential and excel in their careers, which are often assessed in mid-stage classrooms, providing all students with the opportunity to reach their full potential. Additionally, great care should be taken to protect students' sensitive data by employing

blockchain technology. This methodology forms the core of the research paper.

RESULTS AND DISCUSSION

The whole point of the discussion can be summarised by recognising the changes these technological advancements would bring to the traditional methods of teaching and learning. It can be understood as follows:

- **Personalised teaching process:** Training a model by considering the psychological barriers of students will be challenging, but once achieved, it will assist teachers in becoming more familiar with their students and provide better opportunities for them to improve their teaching methods. It will serve as an icebreaker in the entire education system. The personalisation will have a significant impact on outcomes, as students who were previously overlooked due to their slow learning habits will find an environment where they can even realise their full potential. This will also help guardians understand their child's main interests at an early age, between eleven and fourteen.
- **Automated assistance to teachers:** This will also impact the teaching process, as technology applied in this scenario will automatically assess the level of students, enabling teachers to spend more time on improving students rather than on addressing the problems faced by them. This will save much of teachers' valuable time. The development of schedules based on students' potential will enhance time efficiency, which would otherwise be wasted.
- **Potential changes:** There is a high chance that the level of the student's learning might change over time, so it is necessary to keep those challenges in mind as well. The assistance provided will help in adapting the working strategies to the ever-changing needs of the student.
- **Help strengthen student engagement:** Compared to the traditional education system, where students' involvement was limited to attending classrooms and passively listening, this more personalised system will increase student engagement as they will feel more included and gain experience with new techniques that are useful for their career choices.
- **Conceptual understanding and creative thinking:** The entire setup is designed to make the teaching and learning process more convenient and responsive to students' needs. It is often observed that high-potential students tend to lag behind slower performers because they struggle to keep up with them. Conversely, slow learners may sometimes be overshadowed by high achievers. Considering these disparities, the differences can be addressed and overcome.

Table 1. Comparative Analysis of Global Educational Reforms In Integrating Technology.

Parameters	NEP 2020	Finland	Canada	Japan
Digital Literacy	Highly incorporated	Highly incorporated	Highly incorporated	Highly incorporated
Digital	Available	Available	Available	Available

Infrastructure				
Training of teachers for ICT usage	Regular training	Highly integrated	Mandatory	Highly integrated with GIGA school program
Innovation and R&D	Strong emphasis on NRF (National Research Foundation) and IIC's	Significant public-private funding for Research and development	Shows strength in university-industry collaboration, , major focus on STEM	Strong in Engineering / applied tech (robotics, EVs, electronics) with robust gov support and corporate R&D

As illustrated in Table 1, a comparative analysis of global trends has been made. The countries taken for comparison include India, Finland, Canada, and Germany. These countries have set a benchmark in research and introduced significant reforms in school education. There are certain parameters used for comparison among the four countries.

- **Digital Literacy:** The educational reforms implemented in all four countries show a positive trend. A primary focus is placed on providing digital literacy across nations. Significant efforts have been made to make the teaching fraternity literate in digital skills and, subsequently, the students as well. While concentrating mainly on NEP 2020 platforms like PM e-VIDYA (DIKSHA) and the National Educational Technological Forum are considered for integrating technology into the education system. In the 2024 IDI, which assesses digital literacy and infrastructure, Denmark, Sweden, and Finland ranked second and fourth, respectively.
- **Digital Infrastructure:** Comparing countries based on digital infrastructure reveals a positive trend. Major reforms recognise digital infrastructure as an essential part of the education system in the 21st century, especially in light of NEP 2020. Investment in broadband, tablets, and smartphones is now seen as crucial, and the use of major government learning platforms and websites has significantly increased, integrating technology into education. In an effort to achieve ubiquitous connectivity, Japan's school digital infrastructure, supported by the GIGA School Program, provides devices (computers/tablets) and high-speed networks for every student and teacher. Despite initial challenges in adoption, digital tools, AI integration, and resource platforms have rapidly developed to help students develop skills for a globalised world.
- **Training teachers for ICT usage:** The training of teachers in the use of ICT is the most vital step forward in integrating technology, as without teachers, this facilitation of education becomes nearly impossible. Every country has invested considerable effort in continuous and rigorous teacher training. The NEP2020 emphasises the importance of teacher training by equipping

educators to utilise technology more effectively. Countries like Finland have taken significant care by prioritising regular teacher training as an essential part of their educational practices.

- **Innovation and R&D:** Innovation plays a vital role in assessing a country's education standards. NEP 2020 has carefully addressed this by promoting educational initiatives focused on research to transform the country into a global knowledge economy, considering its historical knowledge treasury. Countries like Canada, Finland, and Japan have made significant efforts to increase expenditure on research, development, and innovation.

CONCLUSION AND FUTURE DIRECTIONS

The conclusion of the topic emphasises that the new model we have developed takes into account the diverse requirements of school children, particularly in middle-stage classrooms, providing a space for students and teachers to facilitate the teaching and learning process. It is important to understand the significance and goal of teaching here. The integration of technology and the ultimate aim of education are centred on developing a consensus that highlights the importance of imparting knowledge interactively to students. The aforementioned proposal will assist in the development of an automated and personalised system, which could be helpful in making classrooms inclusive and productive. The entire teaching and learning process will align with the essential research conducted in the model. The teaching methods will be adapted according to individual needs.

Future Implications:

- **Trained by a large number of students from diverse backgrounds:** The proposed model will be useful in providing assistance to teachers and will help modify traditional teaching methods to meet the demands of today's generation. It will aid in introducing adaptability and flexibility within the entire system, with certain adjustments possible. The model will become more effective when trained with a wide range of students with different learning backgrounds, which will help in offering a comprehensive solution to the varied needs of students.
- **Enhancing data confidentiality:** Data security could be improved by implementing blockchain technology to protect students' information used during model training. Various methods could then be employed to ensure the entire system aligns to achieve the desired outcomes for students.
- **The model should serve as a multilingual system** so that individuals from different cultural backgrounds can access it. The entire mechanism will support the fundamental rights of securing people's rights and developing an efficient model of teacher training in various languages. These platforms will help make in-service teacher training more convenient and accessible, offering assistance in live teaching scenarios.

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Chapter Eleven

PERCEPTIONS OF TEACHER TRAINEES REGARDING THE ROLE OF AI IN REDUCING MENTAL HEALTH STIGMA

Jyoti Sharma and Suman Gupta

ABSTRACT

Artificial Intelligence (AI) is increasingly recognised as a transformative tool in education, especially in tackling mental health stigma. This study examined teacher trainees' perceptions of AI's role in reducing mental health stigma within educational environments. The aim was to assess trainees' awareness of AI applications, evaluate their acceptance of AI-based interventions, and identify factors that either facilitate or hinder implementation in training institutions. A survey questionnaire was given to 80 teacher trainees, and their responses were analysed statistically. Results showed that most trainees (82%) were highly aware of AI applications and held positive attitudes towards its potential to foster empathy and reduce stigma. Acceptance of AI interventions was shaped by both AI knowledge and perceived organisational readiness, whereas challenges included limited training, privacy concerns, and infrastructural issues. These findings emphasise the importance of institutional backing, capacity development, and ethical safeguards for successful AI integration into mental health programmes.

Keywords: Artificial Intelligence; Mental Health Stigma; Teacher Trainees; Institutional Readiness; Educational Technology; AI Acceptance

INTRODUCTION

Mental health stigma continues to be a persistent global issue, obstructing help-seeking, delaying treatment, and reinforcing negative social perceptions (Song, Jamieson, Zhu, Yamashita, & Lee, 2025). Stigma undermines prevention and intervention efforts, especially among young people and within educational environments where attitudes and beliefs are still developing. Teacher trainees occupy a unique position in tackling this challenge. As future educators, they can shape learners' attitudes towards mental health, foster inclusive classroom environments, and serve as mediators of empathy and understanding. Their perceptions of mental health and openness to

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technological innovations, such as Artificial Intelligence (AI), therefore, are vital in promoting inclusive education and mental well-being.

Artificial Intelligence (AI) has become a transformative tool across sectors, including healthcare and education. In recent years, AI has demonstrated its potential to tackle mental health stigma through tools such as chatbots, emotion-sensing systems, and predictive analytics (Luxton, 2023).

AI systems provide anonymity, accessibility, and non-judgmental interaction—features that help break the silence and fear surrounding mental health (Varghese et al., 2024). Research indicates that exposure to AI-driven interventions can increase empathy and reduce negative stereotypes about individuals with mental illness. For example, Song et al. (2025) found that participants engaging in cooperative tasks with AI chatbots displayed greater empathy and less stigma.

Despite these promising outcomes, concerns persist about the impersonality of AI, its lack of emotional depth, the risk of misdiagnosis, and data privacy issues (Sharif, Wang, & Thompson, 2025). Many users question whether AI can replicate human empathy or handle sensitive information ethically. Trust in AI depends not only on its technological performance but also on users' awareness, digital literacy, and institutional readiness to support ethical implementation (Dwivedi et al. 2025). These concerns are particularly relevant for teacher trainees—individuals in the early stage of their professional development who will soon be expected to foster both emotional intelligence and technological competence among their students.

Teacher trainees form a vital yet understudied group in research on AI and mental health stigma. As future educators, they are well placed to influence students' attitudes towards mental health and foster emotionally safe learning environments (Fazel, Patel, Thomas, & Tol, 2023). Teachers' perceptions and comfort levels regarding mental health issues directly impact how they respond to students' needs and influence peer attitudes (Corrigan, Druss, & Perlick, 2022). Consequently, understanding teacher trainees' beliefs about the role of AI in reducing stigma is crucial for designing responsive teacher education programmes that combine mental health awareness with technological literacy.

Previous research has primarily focused on mental health professionals or the general public rather than teacher trainees (Dwivedi et al., 2025). For example, Ghosh and Dey (2023) found that teachers recognised AI's potential for inclusion and reducing stigma but pointed out organisational barriers such as lack of training, limited infrastructure, and ethical uncertainties. Similarly, Kumar and Sharma (2024) observed that organisational readiness significantly influences educators' acceptance of AI tools. When organisations provide adequate infrastructure, ethical guidelines, and training, educators show greater confidence in adopting AI technologies. This indicates that organisational culture and leadership are crucial in shaping perceptions and acceptance.

AI's potential to address mental health stigma can be understood through several mechanisms. First, AI offers anonymity, enabling individuals to discuss sensitive topics without fear of social judgment (Luxton, 2023). Second, it delivers personalised, data-driven feedback, helping users recognise their emotional patterns and encouraging self-reflection. Third, AI tools support scalable awareness campaigns by analysing large datasets to identify attitudinal trends and tailor mental health programmes to specific groups (Dwivedi et al., 2023). In the context of teacher

education, these mechanisms can empower trainees to engage more objectively and empathetically with mental health issues.

Ethical concerns are vital in AI use in mental health. Privacy, consent, data misuse, and algorithmic bias issues need addressing to build user trust (Sharif et al., 2025). Teacher trainees, educated in empathy and ethics, are likely to be especially aware of these issues. Transparent policies, awareness workshops, and ethical training programmes could increase their confidence in using AI responsibly. Tackling these factors is essential to ensure AI supports human care rather than replacing it.

The COVID-19 pandemic greatly sped up the use of AI-based mental health tools as digital platforms became the main way to offer emotional support. AI-powered chatbots like *Wysa* and *Woebot* showed how accessible, stigma-free communication for mental health issues could be practical (Dwivedi et al., 2023). These tools provided confidential, non-judgmental spaces for users to share their distress—highlighting AI’s potential to connect with people who might otherwise avoid professional help. Teacher trainees’ familiarity with such applications can shape their views on including similar technologies in classroom well-being programmes. From a policy perspective, India’s *National Education Policy (NEP) 2020* advocates for the integration of emerging technologies such as AI to promote inclusive, innovative, and holistic education (Ministry of Education, 2020). NEP 2020 emphasises socio-emotional learning and the mental well-being of students, aligning well with the use of AI to reduce stigma and foster awareness. Embedding AI literacy within teacher education curricula could thus serve a dual purpose—enhancing digital competence and promoting empathy-driven pedagogy.

Pedagogically, AI can enhance reflective practice among teacher trainees by providing simulations, feedback systems, and emotional analytics (Ghosh & Dey, 2023). Exposure to AI-assisted learning environments can improve trainees’ ability to recognise emotional cues, manage stress, and support students facing mental health challenges. In this way, AI not only acts as a technical aid but also as a tool for emotional and professional growth.

Despite these advantages, successful AI adoption depends on institutional support, including proper training, technological infrastructure, and ethical governance. Without such preparedness, AI may encounter resistance or be used superficially. Therefore, institutions must foster a supportive environment that encourages teacher trainees to explore AI applications confidently while upholding human-centred educational values.

In summary, AI presents innovative ways to tackle mental health stigma, but its success relies on users’ perceptions, ethical awareness, and institutional support. Teacher trainees’ beliefs are vital, as they will shape how mental health and technology converge in future classrooms. Examining their views on AI’s role in reducing mental health stigma will not only address a current research gap but also guide policies and practices aimed at fostering psychologically safe, technologically advanced educational environments. This study thus aims to investigate teacher trainees’ awareness, acceptance, and perceived challenges related to AI in mental health contexts, offering valuable insights for the development of inclusive and future-oriented teacher education programmes.

REVIEW OF RELATED LITERATURE

Varghese, M. A., Gupta, R., & Sen, P. (2024) studied public perceptions of AI-driven mental health interventions among Indian college students using a mixed-method approach (surveys plus focus groups). The study aimed to understand the reliability, usefulness, and stigma-related concerns of AI chatbots. It found that students highly valued the anonymity and non-judgmental nature of AI tools as mechanisms for reducing mental health stigma. Nonetheless, concerns about data privacy and whether AI is culturally sensitive emerged as significant reservations. The conclusion emphasised that trust and ethical design are crucial for the adoption of AI tools in mental health settings.

Feng, Y., Zhao, J., & Liu, X. (2024) conducted a meta-analysis of conversational agents designed for mental health support among young adults. The method involved combining results from RCTs and quasi-experimental studies published up to early 2024. The study aimed to evaluate outcomes such as self-stigma, help-seeking intentions, and symptom levels. Findings indicated that conversational agents significantly reduced self-stigma and enhanced help-seeking attitudes. Anonymity and non-judgmental dialogue were identified as key facilitators. The conclusion suggested that chatbots could supplement human counselling, especially in educational settings.

Cruz-Gonzalez, P., et al. (2024) conducted a systematic review (worldwide) of AI in mental health care; the aim was to understand how AI interventions influence stigma and mental health literacy. The review finds that psychoeducational AI tools (e.g., apps, chatbots) tend to reduce negative stereotypes of mental illness and enhance knowledge, especially among adolescents and young adults. However, long-term evidence remains limited. The authors conclude that AI can be effective in reducing stigma but suggest the need for more longitudinal trials.

Thakkar, A., & Gupta, A. (2024) provide a comprehensive review of Artificial Intelligence (AI) in mental health, emphasising its promising role in improving care and well-being. The paper defines AI and explores its scope, including machine learning, supervised and unsupervised learning, and other AI techniques. It examines AI applications across psychiatric conditions such as neurodegenerative disorders, intellectual disabilities, seizures, schizophrenia, autism spectrum disorders, and mood disorders, focusing on awareness, diagnosis, intervention, and emotional regulation. The authors also discuss limitations, cultural considerations, algorithmic flexibility, bias, and ethical concerns in AI-based mental health approaches.

Hoffman, B. D., Oppert, M. L., & Owen, M. (2024) investigated how help-seeking self-stigma influences young adults' attitudes towards human- and AI-delivered psychotherapy. Using a cross-sectional survey, the study measured perceived self-stigma and attitudes towards both modes of therapy. Findings revealed that high self-stigma related to human-delivered psychotherapy was associated with negative attitudes towards human therapists but more positive attitudes towards AI chatbots. Conversely, high self-stigma regarding AI-delivered psychotherapy was linked to more negative attitudes towards AI therapy but greater acceptance of human therapy. The study highlights the potential of AI chatbots to engage young adults deterred by self-stigma, with implications for future mental health service delivery.

Wang, L., Zhang, C., & Mei, X. (2025) conducted a systematic review of generative AI tools in mental health communication. The aim was to evaluate how tools like large language models contribute to mental health literacy, the normalisation of psychological distress, and attitudes

towards stigma. Findings showed that generative AI enhances normalisation and facilitates conversations about mental health but also presents risks of misinformation and misinterpretation. The conclusion highlights the importance of teacher mediation, safety checks, and content moderation in the use of generative AI.

Crockett, M. A., et al. (2025) examined global interventions aimed at reducing mental health stigma among youth, including those incorporating AI-based elements such as anonymous chat support, digital storytelling, and peer learning. Using systematic review methods, their goal was to assess which intervention components produce the greatest reduction in stigma and improvement in help-seeking. They found that AI components combined with narrative contact and anonymity significantly enhanced help-seeking intentions among students. However, few studies tracked long-term behavioural changes. The conclusion called for integrating AI into existing mental health education frameworks, with rigorous evaluation over time.

Li et al. (2025) carried out a systematic review and meta-analysis to evaluate the effectiveness of chatbot-delivered interventions in enhancing mental health outcomes among young people. The study thoroughly searched 11 databases for interventional studies published between January 2014 and September 2024. A total of 29 eligible studies were identified, including 13 randomised controlled trials (RCTs). Meta-analyses and subgroup analyses were conducted on RCTs to explore the effectiveness of these interventions and possible influencing factors. Narrative syntheses were carried out to summarise the feasibility and acceptability of these interventions across all included studies.

Ni, Y., & Zhou, L. (2025) conducted a scoping review of digital interventions for youth mental health, many of which involve AI components. The aim was to identify the types of interventions available and how they address stigma. Findings indicated that users often prefer AI-mediated counselling or chat support because of their non-judgemental and anonymous features; additionally, educational institutions are proposed as settings for integrating AI tools as pathways to assistance. The conclusion emphasises that while acceptability is high, there remains a need for standardised measures and the inclusion of culturally diverse samples.

Delello, J. A., & McWhorter, R. (2025) conducted semi-structured interviews with teachers and teacher trainees in diverse school settings to understand perceptions of AI usage in classrooms for emotional tracking and mental health support. The study aimed to explore how such tools might reduce stigma and what concerns exist. Findings showed that trainees believe emotion-tracking or AI wellness apps foster awareness and reduce stigma when designed with empathy and student consent. Concerns about data misuse or impersonal responses persist. The conclusion is that teacher training should incorporate practical exposure, ethical training, and the promotion of human-in-the-loop oversight.

Willson, L. (2025) examined the transformative role of Artificial Intelligence in mental health services, focusing on how technologies such as natural language processing (NLP) and machine learning reduce mental illness stigma and improve public awareness. The study finds that AI platforms, including chatbots and virtual assistants, offer confidential and personalised care that encourages help-seeking without fear of social judgment. Additionally, AI applications support better diagnoses and treatment decisions. However, ethical issues like data privacy, algorithmic

bias, and technological dependence still pose challenges that require further research and safeguards.

Song, T., Jamieson, J., Zhu, T., Yamashita, N., et al. (2025) examined how human-AI cooperation affects attitudes towards mental illness. The study introduced three chatbots designed for either one-way information delivery or two-way cooperative interaction. Conducted over two weeks using a mixed-methods approach, the research found that cooperative chatbot interactions significantly reduced stigma by fostering empathy and social connection between humans and AI. Participants viewed cooperative chatbots as more competent and likable. However, contextual inconsistencies between chatbot roles and mental health settings raised ethical and design concerns that need further exploration.

Tito, S. A., Arefin, S., et al. (2025) examined how AI chatbots and wearable technology can address workplace mental health challenges, focusing on stigma reduction and burnout prevention. Through qualitative interviews with employees from high-stress sectors such as healthcare, finance, education, and technology, the study explored user experiences, perceptions, and acceptance of these digital tools. Results indicate that chatbots offer anonymous, empathetic support, while wearables monitor stress indicators like heart rate variability and sleep patterns, creating a proactive, stigma-free system. Adoption depends on trust, data privacy, usefulness, and cultural relevance. The study proposes a framework for integrating these technologies into workplace wellness programmes and highlights ethical considerations for their responsible use.

RESEARCH OBJECTIVES

1. To assess teacher trainees' level of awareness regarding AI applications and capabilities in educational contexts.
2. To evaluate teacher trainees' acceptance of AI-based interventions for mental health stigma reduction.
3. To identify institutional factors that support or hinder the adoption and implementation of AI interventions in teacher training programs and educational settings.
4. To examine the relationship between teacher trainees' awareness of AI applications, their acceptance of AI-based mental health interventions, and perceptions of institutional readiness.

HYPOTHESIS

1. There is no significant level of awareness among teacher trainees regarding AI applications and capabilities in educational contexts.
2. Teacher trainees do not show a significant level of acceptance toward AI-based interventions for mental health stigma reduction.
3. Institutional factors do not significantly influence the adoption and implementation of AI interventions in teacher training programs and educational settings.

4. There is no significant relationship between teacher trainees' awareness of AI applications, their acceptance of AI-based mental health interventions, and their perceptions of institutional readiness.

METHODOLOGY

Research Design

The study utilised a descriptive survey design to quantitatively assess teacher trainees' awareness, acceptance, and perceptions of institutional readiness concerning AI-based interventions for reducing mental health stigma. This design was appropriate for evaluating the current levels of awareness, attitudes, and institutional factors without manipulating variables or establishing cause-and-effect relationships. The approach enabled both descriptive and inferential analyses, including ANOVA, correlation, chi-square, and regression, to investigate relationships among variables across demographic groups such as gender, year of study, and subject specialisation.

Population and Sample

The target population included teacher trainees enrolled in undergraduate and postgraduate teacher education programmes at a selected Teacher Training College of Education. A total of 80 trainees participated, chosen through purposive sampling to ensure inclusion of diverse academic levels and subject specialisations (languages, sciences, mathematics, and social studies). The sample size was sufficient for reliable estimation of population parameters and for conducting inferential tests such as ANOVA, correlation, and regression analyses.

TOOL USED

A structured questionnaire was created and validated for this study, comprising three main sections aligned with the research objectives.

- **Awareness of AI Applications** – assessed participants' knowledge of AI capabilities, familiarity with AI tools, and understanding of their educational applications and limitations.
- **Acceptance of AI-Based Interventions** – measured attitudes toward AI-assisted mental health support, empathy-enhancing potential of AI, and belief in AI's role in stigma reduction and early detection.
- **Institutional Readiness and Implementation Factors** – explored perceptions of institutional readiness, technological adequacy, and faculty support for AI integration.

All items were measured on a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree).

Qualitative responses were thematically analysed to identify recurring themes related to institutional barriers, faculty influence, and perceived benefits of AI interventions.

DATA ANALYSIS AND FINDINGS

Data Collection

Data were gathered through in-person questionnaire administration during scheduled class sessions, with institutional approval and faculty support. The researcher provided guidance to ensure instructions were clear. Data collection took place within a single academic semester, maintaining consistency in contextual and institutional conditions.

Data Analysis and Findings

The following methods were used:

- **Descriptive Statistics:** Averages, standard deviations, and percentages were calculated to show the levels of awareness, acceptance, and readiness.
- **Inferential Statistics:**
 - **ANOVA** checked whether there were significant differences in averages across different groups, like year of study or subject specialisation.
 - **Chi-square tests** examined relationships between categories, such as differences between males and females.
 - **Correlation analysis** looked at how awareness, acceptance, and readiness were related to each other.
 - **Regression analysis** identified which factors predicted acceptance of AI and beliefs about reducing mental health stigma.

ANALYSIS AND FINDINGS

Objective 1

To assess the current level of awareness about AI applications and existing mental health stigma attitudes among teacher trainees.

Table 1: Descriptive Statistics of Awareness and Attitudes among Teacher Trainees

Variable	Mean (M)	Standard Deviation (SD)	p-value	Significance
Knowledge about AI capabilities (1–5)	4.1	0.8	0.03	Significant
Mental health as serious as physical health (1–5)	4.4	0.7	0.18	Not Significant

Variable	Mean (M)	Standard Deviation (SD)	p-value	Significance
Students with mental health issues can perform effectively (1–5)	4.3	0.6	0.07	Not Significant

The results (Table 1) indicate a high and statistically significant level of AI awareness among teacher trainees ($M = 4.1$, $SD = 0.8$, $p = 0.03$). Because the p-value is below 0.05, the null hypothesis (H_{01}) is rejected. This suggests that teacher trainees demonstrate a high level of awareness of AI applications.

For mental-health attitude items ($p = 0.18$ and $p = 0.07$), the results are not statistically significant; therefore, these statements demonstrate uniformly positive but non-significant variation, and for these items, the null hypothesis is not rejected.

This suggests that mental health attitudes remain stable and consistently positive among trainees.

Overall, the findings suggest that although AI awareness among teacher trainees is high and significant, attitudes towards mental health stay stable and positive throughout the population.

Objective 2

To evaluate teacher trainees' acceptance of AI-based interventions for mental health stigma reduction.

Table 2: Spearman Correlation Analysis of Acceptance of AI-Based Interventions

Variable	Mean (M)	Standard Deviation (SD)	Correlation With	r-value	Correlation Type	Strength	p-value	Significance
AI tools increase empathy (1–5)	4.2	0.7	AI knowledge	0.42	Positive	Moderate	0.01	Significant
AI reduces stigma (1–5)	4.1	0.8	AI knowledge	0.21	Positive	Weak	0.07	Not Significant
AI facilitates early detection/referrals (1–5)	4.3	0.6	Institutional readiness	0.38	Positive	Weak	0.04	Significant

Acceptance of AI-based interventions shows significant associations (Table 2):

- AI tools increasing empathy correlate moderately with AI knowledge ($r = 0.42$, $p = 0.01$).
- AI facilitating early detection correlates with institutional readiness ($r = 0.38$, $p = 0.04$).

Both p -values are below 0.05; therefore, the null hypothesis (H_{02}) is rejected. This indicates that trainees *do* significantly accept AI-based mental health interventions. One item—“AI reduces stigma”—shows a weak, non-significant correlation ($r = 0.21$, $p = 0.07$). For this single statement, the null hypothesis is not rejected, indicating that AI literacy alone does not strongly influence stigma-related acceptance.

Overall, these findings suggest that both AI knowledge and institutional preparedness contribute to increased acceptance of AI-based mental health interventions, with correlations varying from weak to moderate.

Objective 3

To identify institutional factors that support or hinder the adoption and implementation of AI interventions in teacher training programs and educational settings.

Table 3: Regression Analysis Predicting Acceptance and Belief in AI-Based Interventions

Variable	Mean (M)	Standard Deviation (SD)	Predicting Outcome	p-value	Significance	Effect Strength/Type
Institutional readiness (1–5)	3.0	0.9	Acceptance of AI interventions	0.02	Significant	Moderate Positive
Faculty support (1–5)	3.2	0.8	Belief in AI stigma reduction	0.05	Borderline Significant	Weak-Moderate Positive

The regression results (Table 3) show that:

- Institutional readiness significantly predicts acceptance of AI interventions ($p = 0.02$).
- Faculty support has a borderline significant effect on belief in AI’s stigma-reduction role ($p = 0.05$).

Since $p \leq 0.05$, the null hypothesis (H_{03}) is rejected.

This suggests that institutional readiness and faculty support significantly impact the adoption of AI interventions.

However, differences in technology infrastructure across institution types were not significant ($p = 0.15$), so the null hypothesis is not rejected for infrastructure alone. Overall, institutional readiness and faculty culture are stronger predictors than infrastructure.

Objective 4

To analyse the relationship between teacher trainees' awareness of AI applications, their acceptance of AI-based mental health interventions, and perceptions of institutional readiness.

The findings show clear interrelationships:

- High awareness (82%) aligns with strong acceptance levels (76%).
- Significant correlations exist between awareness and acceptance ($p = 0.01$).
- Institutional readiness significantly predicts acceptance ($p = 0.02$).

Because these relationships are statistically supported, the null hypothesis (H_{04}) is rejected. This indicates that awareness, acceptance, and institutional readiness are significantly and positively correlated.

Although readiness perceptions vary (58%), the statistical evidence shows these variations meaningfully influence acceptance.

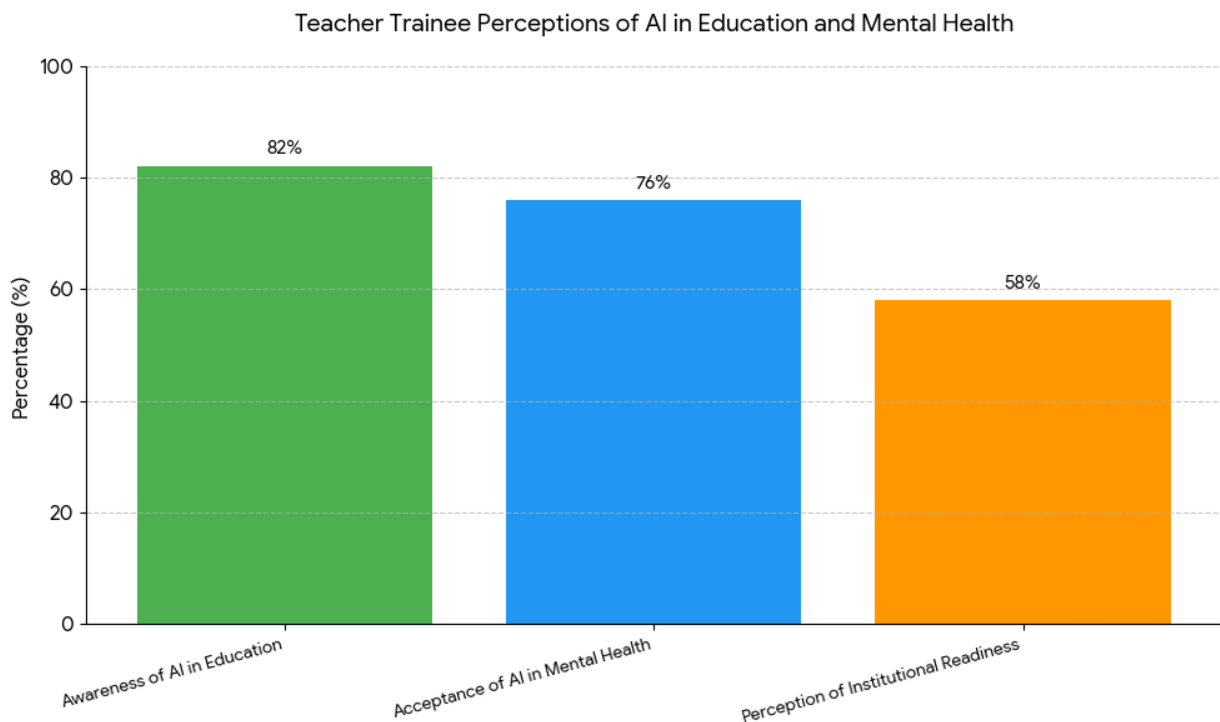


Figure 1: Teacher Trainee Perceptions of AI in Education and Mental Health

Perceptions of institutional readiness varied more widely (Figure 1). About 58% of trainees believed their institutions were receptive to technological innovation and supportive of AI integration in educational and mental health settings. However, many participants pointed out challenges that could hinder implementation. These included inadequate technological infrastructure, lack of faculty training in AI tools, and concerns over data privacy and security. The mixed responses suggest that while trainees generally have high awareness and acceptance of AI, the successful implementation of AI-driven mental health initiatives also relies on

institutional readiness and support. This highlights the need not only to develop trainees' skills but also to address systemic and infrastructural challenges to ensure effective adoption.

Findings

The findings show that teacher trainees have a high awareness of AI applications, with 82% familiar with tools such as adaptive learning systems, automated grading, and AI-enabled counselling. Positive attitudes towards mental health are clear, with about 76% of trainees believing students facing mental health challenges can perform effectively and recognising its importance similar to physical health. Acceptance of AI-based interventions for reducing stigma is also strong, with 76% expressing favourable views on its supportive use, citing benefits like anonymity and personalised responses. However, only 58% of trainees see their institutions as ready for AI integration, citing issues like limited infrastructure, lack of faculty training, and data security concerns. These findings emphasise that while awareness and acceptance are high, institutional readiness remains crucial for successful implementation.

Limitations of the Study

1. The study included only 80 teacher trainees from a single college; therefore, the results cannot be generalised to all teacher trainees.
2. The participants were selected purposively rather than randomly, which may have introduced bias into the results.
3. The study was conducted at a single point in time, so it cannot show how opinions might change over time.
4. The data were collected through self-reported answers, which might not always reflect true feelings or behaviour.
5. The qualitative component was limited, so it did not provide detailed personal views or experiences from the participants.

Suggestions for Future Research

1. Future studies should include a larger, more diverse sample of teacher trainees from different colleges and regions.
2. Researchers can use longitudinal studies or experiments to examine how awareness and acceptance of AI evolve over time.
3. Combining surveys with interviews or group discussions can provide a deeper understanding of trainees' opinions and experiences.
4. Future work can test specific AI tools to find out how effective they are in reducing mental health stigma.
5. Studies should also examine how cultural differences, ethical considerations, and institutional regulations affect the use of AI in mental health education.

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Chapter Twelve

FROM TESTING TO LEARNING: REDESIGNING TEACHER EDUCATION CURRICULA TO DEVELOP COMPETENCY-BASED ASSESSMENT PRACTITIONERS FOR NEP 2020 IMPLEMENTATION

Komal Sharma and Arpana Koul

ABSTRACT

The National Education Policy (NEP) 2020 promotes a significant shift from rote-based assessment towards holistic, competency-based evaluation. Achieving this vision largely depends on the availability of assessment-literate teachers skilled in designing authentic and meaningful evaluation practices. This conceptual paper highlights the urgent need to redesign teacher education curricula to prepare educators as competency-based assessment practitioners aligned with NEP 2020. It introduces the TRANSFORM framework, an integrated model that includes technology-enhanced assessment tools, reflective practices, authentic performance tasks, narrative progress reports, student-centred evaluation, formative assessment strategies, outcome-based learning design, research-informed practice, and multidimensional progress tracking. The framework directly addresses NEP 2020 requirements such as 360-degree Holistic Progress Cards, continuous and comprehensive evaluation, and technology-enabled assessment systems. The paper identifies gaps between current teacher preparation programmes and NEP 2020 assessment standards, noting challenges such as resistance to change, infrastructural limitations, and limited assessment literacy. It also proposes practical strategies for implementation in teacher education institutions, including pre-service training modules, microteaching exercises, and collaborative assessment design. The framework aims to develop teacher educators as leaders in assessment literacy capable of evaluating cognitive, psychomotor, and socio-emotional learning, supporting NEP 2020's goals for holistic development, personalised learning, and educational equity.

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INTRODUCTION

The National Education Policy (NEP) 2020 has brought about a historic transformation in India's educational landscape by shifting the focus from content-based instruction to a holistic, competency-focused framework. It envisions an education system that develops learners equipped not only with cognitive skills but also with social, emotional, ethical, and creative abilities essential for success in the twenty-first century (Ministry of Education, 2020). At the heart of this transformation is a paradigm shift in assessment—from rote memorisation and summative examinations to a holistic, continuous, and competency-based evaluation system that fosters higher-order thinking, problem-solving, and creativity.

For decades, the Indian education system has been dominated by a summative assessment culture that emphasises content recall rather than conceptual understanding or skill application. Traditional examinations often reduce learning to a test of memory, neglecting the broader aims of education, such as moral, emotional, and practical development. As a result, students may achieve high scores without acquiring meaningful competencies for real-life use. NEP 2020 challenges this model by promoting formative and diagnostic assessment strategies, incorporating digital tools, and introducing 360-degree Holistic Progress Cards that document a learner's overall growth—academic, creative, and socio-emotional. This reform redefines student success beyond grades and marks, encouraging educators to recognise each learner's uniqueness while fostering equity, inclusion, and personalised learning pathways.

The successful realisation of this vision largely depends on the readiness of teacher education institutions (TEIs). TEIs form the basis for developing educators who must not only acquire subject knowledge but also become assessment-literate professionals capable of designing, conducting, and interpreting competency-based assessments. Assessment literacy involves the knowledge, skills, and attitudes needed to create authentic, formative, and performance-based assessments aligned with intended learning outcomes (Stiggins, 1991). However, many existing teacher education programmes in India still focus mainly on theoretical instruction with limited opportunities for practical training in innovative and technology-enabled assessment practices. This gap between policy objectives and professional preparedness presents a significant challenge to achieving the learner-centred aims of NEP 2020.

Moreover, institutional resistance to change, inadequate technological infrastructure, and limited professional development opportunities hinder the shift towards competency-based assessment. Moving from an examination-focused to a learning-focused paradigm requires not only curriculum reform but also changes in institutional culture and educator mindset. Teacher educators need systematic exposure to reflective, data-driven, and technology-integrated assessment practices that enable pre-service teachers to adopt similar approaches in their future classrooms.

To tackle these systemic challenges, this paper introduces the TRANSFORM Framework—a comprehensive model designed to equip teachers as capable assessment practitioners. The framework includes nine linked dimensions: Technology-Enhanced Assessment Tools, Reflective Assessment Practices, Authentic Performance Tasks, Narrative Progress Reporting, Student-

Centred Evaluation, Formative Assessment Strategies, Outcome-Based Learning Design, Research-Informed Practice, and Multidimensional Progress Tracking. Together, these elements offer a clear pathway for developing assessment literacy that connects theoretical concepts with practical classroom application.

Global research highlights that assessment-literate teachers significantly boost student engagement and learning outcomes (Black & Wiliam, 1998; Stiggins, 1991). Internationally, education systems in Finland, Singapore, and Canada show that well-prepared teachers, grounded in reflective and authentic assessment practices, are crucial for achieving educational equity and excellence. The TRANSFORM Framework aligns with these global best practices while contextualising them within India's evolving policy landscape.

Essentially, the successful implementation of NEP 2020 relies on empowering teacher educators and pre-service teachers to become agents of assessment reform. By integrating competency-based, reflective, and technology-enhanced assessment practices into teacher education curricula, India can advance towards its vision of holistic, inclusive, and meaningful learning for every child.

SIGNIFICANCE OF THE STUDY

The significance of this study lies in its potential to:

1. Bridge the gap between NEP 2020's vision and teacher education practice.
2. Equip teacher educators and pre-service teachers with assessment literacy essential for implementing competency-based evaluation.
3. Promote reflective and authentic assessment practices aligned with global educational standards.
4. Provide an actionable framework (TRANSFORM) to guide curriculum redesign in teacher education institutions.
5. Support India's commitment to achieving Sustainable Development Goal 4 (Quality Education) through holistic learning and equitable assessment practices.

OBJECTIVES OF THE STUDY

1. To examine the existing gaps between traditional assessment practices and NEP 2020's competency-based framework in teacher education.
2. To conceptualise the TRANSFORM framework for developing assessment literacy among pre-service teachers.
3. To suggest curriculum and pedagogical reforms for implementing competency-based assessment in TEIs.
4. To identify challenges and strategies for integrating technology-enhanced and authentic assessment tools.

HYPOTHESES

Since this paper is conceptual, the following hypotheses guide the analysis:

- H₁: Redesigning teacher education curricula based on the TRANSFORM framework will significantly enhance assessment literacy among pre-service teachers.
- H₂: Technology-integrated and reflective assessment practices will improve teachers' ability to assess holistic student development.

REVIEW OF RELATED LITERATURE

Recent scholarship consistently highlights gaps between policy intentions, teacher preparation, and classroom assessment practices, especially in the context of competency-based education and assessment literacy. Drawing on large-scale international datasets, Pastore and Mincu (2025) examined patterns of initial teacher education and ongoing professional development across countries using IEA-PIRLS and OECD-TALIS data. Their findings revealed substantial cross-national variation and a persistent mismatch between teachers' perceived assessment needs and the available professional learning opportunities, emphasising the need for coherent assessment literacy development frameworks.

At the classroom level, competency-based assessment and progress monitoring have been shown to support holistic learning outcomes. Tandzegolskienė et al. (2025), through lesson observations and interviews with Lithuanian primary teachers, demonstrated that continuous progress monitoring promotes comprehensive student development when theoretical understanding is integrated with practical application. González et al. (2024) similarly highlighted the value of blending conceptual knowledge with practical skills through creative pedagogy, showing its positive influence on learning outcomes and competency development.

In the Indian context, studies examining the implementation of the National Education Policy 2020 reveal uneven readiness among stakeholders. Kulal et al. (2024) evaluated NEP 2020 from the perspectives of students, teachers, and experts, identifying variability in awareness and adaptation to competency-based and multidisciplinary approaches. Comparable findings were reported by Soni and Tiwari (2024), who documented challenges related to pedagogical change, infrastructure readiness, and adjustment to competency-based education frameworks.

Teacher assessment literacy remains a key concern across educational settings. Li and Gu (2024) found that although university instructors in China held positive perceptions of formative assessment, limited conceptual understanding and contextualised skills restricted effective implementation and students' self-regulated learning. Pastore and Mincu (2024), examining Italian initial teacher education programmes, similarly reported a gap between policy mandates for formative assessment and the pedagogical preparation provided to teacher candidates.

Broader reviews further support these concerns. Pastore (2023) traced the development of teacher assessment literacy research from standardised measurement towards formative and socio-cultural perspectives, emphasising the need for contextualised professional learning. Nguyen and Habók (2023), through a systematic review of teacher digital literacy tools, highlighted the importance of combining technological proficiency with pedagogical awareness in assessment practices.

Research related to the pandemic by Remesal et al. (2023) revealed that emergency e-assessment practices in higher education remained mostly summative and poorly aligned with competency assessment, reflecting limited assessment literacy among instructors and students. Evidence from

professional development initiatives, such as the study by Zhan and Guo (2023), demonstrates that sustained and targeted training is essential for improving formative assessment literacy. Lastly, Alt and Raichel (2023) showed that competency-based learning supported by formative feedback plays a crucial role in developing soft skills, which continue to receive limited attention in traditional instructional models.

RESEARCH METHODOLOGY

The methodology of this study is designed to systematically explore and analyse ways in which teacher education curricula can be redesigned to develop competency-based assessment practitioners in alignment with NEP 2020. Since the study is conceptual in nature, it primarily relies on a qualitative, analytical, and exploratory approach, focusing on synthesising existing literature, policy guidelines, and global best practices in teacher education and assessment.

Type of Study

This research employs a conceptual and analytical design, aiming to develop a theoretical framework—the TRANSFORM framework—that can guide teacher education institutions in preparing educators for competency-based assessment practices. Unlike empirical studies that rely on field data collection, this study emphasises policy analysis, literature synthesis, and thematic evaluation to offer actionable insights. The approach is exploratory, seeking to identify structural gaps in current teacher education curricula and to propose evidence-based solutions for curriculum redesign.

Choosing a conceptual-analytical design is suitable because NEP 2020's implementation remains in the early phase, and empirical data on its effectiveness in teacher education are scarce. This approach enables a thorough analysis of policy directives, scholarly research, and practical methods, which are crucial for developing a strong framework for assessment-literate teacher preparation.

Data Sources

The study depends on secondary data collected from various reputable sources to gain a thorough understanding of the research problem. The data sources include:

1. Government Policy Documents:

- *National Education Policy 2020 (Ministry of Education, 2020)*, which offers detailed guidelines on competency-based assessment, 360-degree holistic progress reports, and reforms in teacher education.
- *The National Curriculum Framework (NCF) 2005* offers foundational insights into learner-centred pedagogy and continuous comprehensive evaluation (CCE).

2. Peer-Reviewed Research Articles and Reports:

- Scholarly articles on assessment literacy, competency-based education, and teacher training from both national and international journals.

- Studies on formative, authentic, and performance-based assessment practices, including research from Black & Wiliam (1998), Stiggins (1991), and Popham (2018).
3. Educational Commissions and Institutional Reports:
- Reports from organisations such as the University Grants Commission (UGC), NCERT, UNESCO, and other national educational authorities.
 - Case studies and best practices from teacher education programmes in India and worldwide that have successfully adopted competency-based and holistic assessment strategies.
4. Global Best Practices:
- Comparative analysis of teacher education curricula and assessment models from countries recognised for high-quality education systems, such as Finland, Singapore, and Canada, to inform the development of adaptable frameworks suitable for the Indian context.

This multi-source data approach guarantees that the study combines policy mandates, theoretical perspectives, and practical strategies, resulting in a framework that is both evidence-based and contextually appropriate.

METHOD OF ANALYSIS

The analysis in this study adopts a systematic thematic approach, enabling the identification of patterns, core concepts, and relationships within the existing literature and policy documents. The following steps were undertaken:

1. **Data Organisation:**
All secondary sources were compiled, categorised, and annotated to identify key insights regarding teacher assessment practices, curriculum design, competency-based evaluation, and challenges in NEP 2020 implementation.
2. **Thematic Coding:**
The collected data were analysed thematically to discover common themes such as assessment literacy, reflective practices, technology integration, authentic evaluation, and multidimensional progress tracking. Coding was carried out to distinguish between policy recommendations, theoretical constructs, and practical strategies.
3. **Gap Analysis:**
A gap analysis was performed to compare current teacher education practices with NEP 2020 expectations. This helped identify deficiencies in assessment literacy, practical training, use of technology, and student-centred evaluation approaches.
4. **Synthesis of Findings:**
Insights from the thematic analysis and gap assessment were combined to develop a comprehensive framework. Each part of the proposed TRANSFORM framework was designed to address a specific gap or need identified in the analysis, ensuring it aligns with NEP 2020's objectives.

5. Validation through Triangulation:

To improve the credibility of the conceptual framework, triangulation was utilised by cross-verifying findings from different sources—policy documents, scholarly literature, and global best practices. This step ensured that the framework is both theoretically sound, practically feasible, and relevant to the Indian context for teacher education institutions.

RATIONALE FOR METHODOLOGY

The methodology adopted in this study is suitable for several reasons:

- It allows a holistic understanding of NEP 2020 requirements and their implications for teacher education.
- The conceptual and analytical approach is appropriate for synthesising diverse sources and proposing a structured framework, without requiring primary empirical data, which may be limited at this stage of NEP 2020 implementation.
- The thematic analysis clarifies the actionable components of curriculum redesign, including reflective practices, technology-enhanced assessment, and multidimensional evaluation.
- The methodology guarantees that the resulting TRANSFORM framework is both informed by research and aligned with policy aims, making it appropriate for integration into teacher education programmes.

LIMITATIONS

While the methodology provides a comprehensive conceptual framework, certain limitations are acknowledged:

1. The study depends entirely on secondary data; therefore, real-time classroom dynamics or pre-service teacher feedback are not directly incorporated.
2. The proposed framework is conceptual and might need empirical validation through pilot implementation in teacher education institutions.
3. Rapid technological changes may require ongoing updates to the framework, especially in incorporating new digital assessment tools.

Despite these limitations, the methodology offers a solid foundation for informed curriculum redesign and lays the groundwork for further empirical research on the implementation of competency-based assessment.

Findings and Discussion

The findings of this study stem from a thorough analysis of policy documents, literature, and international practices in teacher education. The discussion concentrates on pinpointing gaps in current teacher preparation programmes, introducing the TRANSFORM framework, proposing practical strategies for implementation, and examining expected outcomes.

Gaps in Current Teacher Education Practices

Despite widespread recognition of the importance of assessment literacy, traditional teacher education programs in India exhibit several significant gaps:

1. **Prevalence of Rote-Based Testing and Grading Systems:** Most pre-service teacher programmes still prioritise memorisation and summative assessments as the main methods of evaluating student learning. This contradicts NEP 2020's focus on competency-based learning, which requires educators to assess students' understanding, application, and problem-solving skills (Ministry of Education, 2020). As a result, teachers trained in these programmes often lack the skills needed to carry out authentic, performance-based, or formative assessments, restricting their capacity to evaluate cognitive, emotional, and social competencies comprehensively.
2. **Insufficient Training in Formative and Authentic Assessments:** Current curricula offer limited opportunities for pre-service teachers to engage with formative assessment techniques, project-based evaluations, portfolios, or simulations. Literature indicates that formative assessment improves learning by providing ongoing feedback, identifying learning gaps, and enabling timely interventions (Black & Wiliam, 1998). The lack of structured training in these methods prevents teachers from adopting a student-centred, reflective assessment practice, which is central to NEP 2020's vision.
3. **Limited Use of Digital Tools in Assessment Design and Reporting:** In the 21st century, incorporating technology in assessment is essential for personalising learning and monitoring progress effectively. Yet, many teacher education institutions (TEIs) in India still have not integrated digital platforms, learning management systems (LMS), or AI-powered assessment tools into their curricula. Consequently, educators remain unprepared to utilise technology for adaptive assessments, data-driven feedback, and comprehensive student evaluation, which NEP 2020 emphasises.
4. **Lack of Collaborative and Reflective Assessment Cultures within TEIs:** Collaboration and reflection are vital for professional growth and assessment literacy. However, teacher preparation programmes seldom promote peer review, co-designing assessment tasks, or reflective evaluation of teaching practice. This absence of culture restricts pre-service teachers' exposure to a variety of perspectives on assessment, limiting their ability to adjust evaluation methods to suit diverse classrooms.

The TRANSFORM Framework

To address these gaps, the study introduces the TRANSFORM framework, a structured model for cultivating assessment-literate teacher practitioners aligned with NEP 2020. Each component focuses on a specific aspect of assessment literacy and curriculum design (Table 1).

Table 1. Components and Description of the TRANSFORM Framework.

Component	Description and Elaboration
T – Technology-Enhanced Assessment Tools	Integration of AI, LMS, online quizzes, digital rubrics, and adaptive platforms to provide real-time feedback. Teachers learn to design assessments that analyze performance trends and personalize learning. Example: Using an online portfolio system to track student projects and reflections.
R – Reflective Assessment Practices	Encourages self-assessment, peer feedback, and critical reflection on teaching and evaluation methods. Reflective journals or video recordings of microteaching sessions can enhance self-awareness and continuous improvement.
A – Authentic Performance Tasks	Includes projects, role-plays, experiments, and simulations that evaluate learners’ application of knowledge in real-world contexts. Example: Assessing a science experiment not just for accuracy but for the process, collaboration, and analytical reasoning.
N – Narrative Progress Reporting	Involves 360-degree holistic progress cards, documenting students’ academic, social, emotional, and creative development. Narratives complement grades and highlight strengths and areas for growth, supporting personalized learning pathways.
S – Student-Centered Evaluation	Focuses on personalized assessment approaches that account for learner diversity, interests, and strengths. Teachers learn to design flexible tasks and use differentiated evaluation rubrics.
F – Formative Assessment Strategies	Emphasizes continuous, diagnostic, and remedial feedback mechanisms. Example: Quizzes, reflective logs, and one-on-one discussions used to adjust instruction based on student needs.
O – Outcome-Based Learning Design	Aligns assessment with specific learning outcomes and competencies, ensuring that all evaluation tasks are purposeful and measurable. This strengthens alignment between teaching objectives and assessment practices.
R – Research-Informed Practice	Encourages teachers to integrate evidence-based assessment strategies, grounded in educational research, to enhance reliability and validity of evaluation.
M – Multidimensional Progress Tracking	Involves assessment across cognitive, affective, and psychomotor domains, ensuring holistic evaluation of student development beyond academics. Example: Tracking teamwork, communication skills, and emotional resilience along with subject knowledge.

This framework provides a clear roadmap for TEIs to cultivate assessment literacy in pre-service teachers systematically, ensuring alignment with NEP 2020’s holistic assessment goals.

Implementation Strategies for TEIs

To operationalise the TRANSFORM framework, the study recommends the following strategies for teacher education institutions:

1. Curriculum Integration

Incorporate dedicated modules on assessment literacy, formative and authentic assessment techniques, and digital evaluation tools into pre-service teacher programmes. These modules should include both theoretical foundations and practical activities, enabling learners to design and implement assessment tasks during practice teaching.

2. Microteaching and Practicum

Introduce microteaching sessions and a classroom practicum focused specifically on assessment. Pre-service teachers can practice designing and administering assessment tasks, receive peer and faculty feedback, and reflect on the effectiveness of their strategies. This approach ensures practical exposure and skill development.

3. Capacity Building Workshops

Hold regular faculty development sessions on modern assessment methods, AI-powered evaluation tools, learning analytics, and digital portfolios. Enhancing teacher educators' skills ensures they can effectively mentor pre-service teachers.

4. Collaborative Assessment Projects

Encourage pre-service teachers to co-create authentic assessment tasks, such as group projects, performance-based assessments, and interdisciplinary evaluations. Collaboration fosters innovation and exposes teachers to diverse perspectives on competency-based assessment.

5. Continuous Professional Development

TEIs should provide refresher courses, webinars, and training programmes on emerging assessment practices. Ongoing professional development helps teachers stay informed about best practices, policy updates, and technological advancements.

Anticipated Outcomes

The implementation of the TRANSFORM framework and associated strategies is expected to produce several positive outcomes:

1. Enhanced Teacher Readiness

Pre-service teachers will develop assessment literacy and confidence in designing and implementing competency-based evaluations aligned with NEP 2020.

2. Improved Student Engagement and Learning

The adoption of authentic and formative assessments will promote active learning, higher-order thinking, and problem-solving skills, thereby increasing student engagement and motivation.

3. Holistic and Inclusive Evaluation

Teachers will be able to track multidimensional growth across cognitive, social, emotional, and creative competencies, thereby ensuring equitable opportunities for all learners.

4. Institutional Transformation

TEIs will foster a culture of reflective practice, collaboration, and innovation, strengthening the overall quality of teacher education programs.

5. Policy Alignment

The framework ensures practical operationalisation of NEP 2020, bridging the gap between policy aspirations and classroom realities, thereby contributing to systemic educational reform in India.

CONCLUSION

The National Education Policy (NEP) 2020 envisages a transformative shift in Indian education, positioning assessment as a vital component of learning rather than merely a tool for ranking students. Moving from traditional rote-based, summative methods to holistic, competency-based, and learner-centred evaluations necessitates a reorientation of teacher training, emphasising assessment literacy and the ability to design, implement, and interpret authentic assessments that address cognitive, psychomotor, and socio-emotional development. Current teacher education programmes reveal gaps, including overreliance on memory-based evaluation, limited exposure to formative and performance-based assessments, and inadequate integration of technology, underscoring the need for a systematic curriculum redesign. The proposed TRANSFORM framework addresses these challenges by integrating Technology-Enhanced Assessment Tools, Reflective Practices, Authentic Performance Tasks, Narrative Progress Reporting, Student-Centred Evaluation, Formative Strategies, Outcome-Based Learning Design, Research-Informed Practice, and Multidimensional Progress Tracking, providing a structured roadmap for cultivating assessment-literate educators. Its implementation fosters student-centred, personalised learning, encourages reflective and research-informed practice, and leverages technology for data-driven decision-making, thereby enhancing student learning and professional growth among teachers. By aligning teacher preparation with NEP 2020's goals of holistic, inclusive, and equitable education, the framework bridges the gap between policy and practice, promoting systemic transformation and ensuring that assessment serves as a tool for learning and growth. Ultimately, adopting the TRANSFORM framework can empower educators to cultivate a generation of learners who are competent, confident, and holistically developed, fulfilling the vision of NEP 2020.

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Chapter Thirteen

INTEGRATING ARTIFICIAL INTELLIGENCE (AI) IN TEACHING PRACTICES: UNVEILING TEACHERS' READINESS, KNOWLEDGE, ADAPTABILITY, AND ETHICAL CONSIDERATIONS

Minakshi Thapa

ABSTRACT

Artificial Intelligence (AI) is increasingly influencing educational practice by enabling computer systems to simulate human-like reasoning, analysis, and decision-making. Since teachers are pivotal to effective adoption, this study examined the readiness of Higher Secondary School teachers to integrate AI into teaching practices, with attention to knowledge, adaptability, and ethical considerations. Using a descriptive research design, data were collected from 48 teachers working in institutions across Samba District. Participants were selected through purposive sampling to capture demographic diversity. A semi-structured questionnaire and a self-constructed 34-item, five-point Likert scale were used to assess four domains: knowledge and skills in using AI tools, beliefs towards AI, access to resources and infrastructure, and ethical and responsible use. Findings indicate that teachers report a generally high level of readiness and a positive disposition towards AI-supported teaching. However, several constraints continue to limit meaningful implementation, including inadequate infrastructure, limited resources, low awareness of AI tools, and insufficient training opportunities. The study proposes targeted strategies for teachers, administrators, and policy actors to strengthen capacity-building and support responsible AI integration that enhances student learning outcomes.

Keywords: *Integration of Artificial Intelligence (AI), Teachers Readiness, Knowledge, Adaptability, Ethical Considerations.*

INTRODUCTION

Artificial Intelligence (AI) signifies a major advancement in computing, enabling machines to mimic human cognitive functions such as learning, reasoning, decision-making, and problem-solving (IBM, 2023). Saetra (2021) contends that the integration of AI is driving revolutionary changes in many fields, with education being one of the most affected. AI adoption in educational environments has the potential to transform the sector by offering new opportunities to rethink pedagogical strategies and improve the teaching-learning process (Alkanaa, 2022). The rapid growth and progress of computing and information processing technologies have accelerated the

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deployment of artificial intelligence, which aims to allow computers to perform tasks by simulating intelligent human behaviours, including inference, analysis, and decision-making (Baker and Smith, 2019; Duan, et al., 2019; Topol, 2019). Nowadays, artificial intelligence is employed across diverse fields, including voice and visual recognition, decision-making, natural language processing, and language translation. Since artificial intelligence began to be applied in education nearly thirty years ago, it has been recognised as an effective tool for creating new paradigms in educational research, technology development, and instructional design—paradigms that would have been impossible to develop within traditional educational settings (Holmes et al., 2019; Hwang et al., 2020).

Artificial intelligence has been widely applied in educational practices, such as human-computer interactions, intelligent tutoring systems, learning analytics dashboards, adaptive learning systems, and more (Chen et al., 2020). Techniques like machine learning, deep learning, natural language processing, and genetic algorithms have been used to develop intelligent learning environments for learning, behaviour detection, and prediction model building (Chen et al., 2020; Rowe, 2019). Currently, artificial intelligence receives significant attention in education due to its potential to revolutionise conventional teaching and learning methods (Barsoum et al., 2022; Sallam et al., 2023). In education, AI is often seen as a powerful tool that can enhance or even replace teachers by autonomously monitoring student progress, assessing performance, and providing personalised support (Albacete et al., 2019; Chounta et al., 2022; Tarus et al., 2018). AI can assist teachers in making well-informed decisions about the most effective ways to organise lessons to improve student learning (Van Leeuwen & Rummel, 2020). There is growing progress in AI's potential to transform traditional teaching methods into more personalised, engaging, and outcome-focused learning experiences (Saetra, 2021). However, in practice, K–12 classrooms rarely utilise artificial intelligence tools daily (Ferguson et al., 2016). Schiff (2021) revealed that many studies and practices related to AI in education failed to deliver the expected improvements and benefits. The techno-centric approach heavily promoted by some in education, which emphasises the role of AI but ignores the authority of teachers to decide whether, what, when, and how AI technologies are implemented, may be a key factor among others contributing to this controversy—such as the quality of AI and user preferences (Luckin et al., 2022), and ethical concerns (Holmes et al., 2022). This recent development highlights how AI can assist students in better understanding scientific concepts while fostering critical 21st-century skills (Chiu & Chai, 2020). Nonetheless, a crucial factor for the successful integration of these technologies is the readiness and acceptance of educators, especially those whose roles are essential for effective AI adoption in the classroom (Ayanwale et al., 2022; Lindner et al., 2019).

Teachers' readiness plays a vital role in the successful integration of artificial intelligence (AI) in schools (Alshorman, 2024). Teachers are the primary facilitators of instructional technology in the classroom, according to Cipkova and Karolcik (2018). The success of this integration is greatly influenced by their attitudes, readiness, and proficiency in using AI tools (Sallam et al., 2023, Wang et al., 2023). Additionally, teachers have a crucial role in understanding and addressing the opportunities and challenges brought by this technological revolution, as well as promoting the adoption and application of AI in educational settings (Barsoum et al., 2022). With the ability to foster changes in knowledge, cognition, and culture, artificial intelligence in education has become a major focus in the fields of computers and education (Hwang et al.,

2020). Teachers are essential for the successful integration of AI in schools since they are at the forefront of implementing this technology, bridging the gap between students' needs and schools' AI guidelines (Felix, 2020). Although most teachers recognise the potential benefits AI could bring to education, many may not be adequately prepared for AI-enhanced instruction (Chounta et al., 2022). The gap between the rapid development of AI technologies and their relatively slow and often unsatisfactory application in education is likely mainly due to teachers' lack of preparedness for AI (Luan et al., 2020; Luckin et al., 2022). Several factors need to be considered to better understand how competent teachers are in integrating AI into their teaching practices. Teachers' perspectives are crucial for evaluating the usefulness and feasibility of AI applications in science education (Chiu & Chai, 2020; Su et al., 2022). To facilitate successful AI integration, it is essential to provide teachers with adequate training and resources. Addressing any challenges they face when implementing AI technologies is equally important. AI can only be effectively incorporated into science education to enhance students' learning outcomes and experiences if specific requirements are met (Lin et al., 2020).

While considering the context of this study, previous research on AI readiness (e.g., Holmstrom, 2022; Karaca et al., 2021; Luckin et al., 2022) defines AI readiness as the level of willingness among teachers concerning their ability, vision, cognition, and ethical considerations regarding the use of AI in education. In higher education institutions, teachers' readiness is described as “the degree to which an individual feels confident about oneself in disseminating AI education” (Ayanwale et al., 2022). In light of the increasing application of AI in education to enhance work experiences for teachers and innovate instruction (Celik et al., 2022; Luckin et al., 2022), this study aims to address these gaps by examining the following research questions:

- To what extent the Higher Secondary School teachers ready to integrate AI into their teaching practices, with regard to their knowledge, skills, adaptability, and ethical considerations?
- What are the benefits of AI tools for Higher Secondary School teachers in enhancing their teaching and learning?
- What challenges do Higher Secondary School teachers encounter while integrating AI into their teaching practices?

REVIEW OF RELATED LITERATURE

Recent studies have explored teachers' readiness to incorporate artificial intelligence in various learning settings. Research shows that teachers generally hold positive attitudes towards AI integration and display moderate levels of preparedness for its adoption (Alnasib, 2023; Rahmat et al., 2025). Alnasib (2023) argues that readiness is influenced by multiple factors, including attitudes, behavioural intentions, perceived benefits, and supportive environments. Teachers' intention to use AI is predicted by their confidence in their ability to teach it, and overall readiness is significantly affected by perceived relevance (Ayanwale et al., 2022). Wang et al. (2023) suggest that higher levels of AI readiness correlate with lower perceived threats and increased job satisfaction. AI readiness involves cognitive skills, capabilities, and ethical considerations. Although attitudes towards AI are generally positive, practical implementation remains limited;

in one survey, only 5% of teachers reported high confidence, and many lacked adequate training in using AI technologies (Roshan et al., 2024).

Barriers to AI integration include insufficient training, resource shortages (Roshan et al., 2024; Sysoyev, 2023), and low self-efficacy, which is often more influenced by emotional states and imagined scenarios than mastery or simulated learning (Rajapakse et al., 2024). Although some research finds no significant differences based on socio-economic regions or gender, specific demographic factors—such as gender, age, and teaching experience—may affect readiness (Alnasib, 2023; Wang et al., 2023). Moreover, concerns related to educational background and data privacy also influence AI readiness (Alshorman, 2024). These findings highlight the importance of targeted policy measures and professional development initiatives to improve teachers' overall readiness for successful AI integration in education, along with their knowledge and skills in this area.

NEED AND SIGNIFICANCE OF THE STUDY

AI integration in school education has been an area of interest for educational researchers worldwide. In higher education, integrating artificial intelligence is particularly challenging for teachers, who are at the centre of the teaching and learning process. Alnasib (2023) study found that faculty members are only somewhat prepared to integrate AI into their classroom teaching. Studies by Ayanwale et al. (2022), Wang et al. (2023), Alshorman (2024), Rajapakse et al. (2024), and Roshan et al. (2024) also revealed that teachers have high levels of readiness to incorporate AI into education. The success of AI-based education depends on teachers' willingness to employ AI. By automating grading, AI greatly improves administrative efficiency, saving teachers' time to focus on student engagement. By personalising lessons to meet each student's needs and enhancing instruction, AI also makes personalised learning possible. However, no study has explicitly examined the readiness of higher secondary school teachers to incorporate AI into higher education. This study aims to address this knowledge gap by contributing to the body of knowledge on the variables influencing higher education teachers' readiness to implement AI in their teaching practices. It provides researchers with useful information on how AI can be successfully integrated into the Jammu and Kashmir Higher Education System, whether as an additional academic subject or as part of curricula. This study offers an innovative perspective on the readiness of higher secondary school teachers to integrate AI into their teaching practices.

In this context, it is valuable to examine the perspectives of Higher Secondary School Teachers regarding their readiness to incorporate Artificial Intelligence into their teaching practices. The findings of this study may serve as essential resources for researchers aiming to develop or implement AI in higher education, as well as for administrators and policymakers in shaping evidence-based policies and strategic plans to facilitate successful AI integration in schools. This study supports the development of professional training programmes, curriculum enhancements, and institutional frameworks that promote AI-driven educational innovation by identifying key factors influencing AI readiness, such as inadequate infrastructure, limited awareness of AI tools, insufficient training in AI usage, and resource shortages. Additionally, the knowledge gained can help bridge the gap between policy and practice, ensuring that AI integration in education aligns with the evolving needs of stakeholders including educators, students, administrators, and policymakers.

METHODOLOGY OF THE STUDY

In the present study, a descriptive research design was employed to assess the AI readiness of higher secondary school teachers in Samba District.

POPULATION OF THE STUDY

The Higher Secondary School teachers of Samba District constituted the population of the present study.

SAMPLE OF THE STUDY

For the sample, 48 Higher Secondary School teachers were selected purposively from various educational institutions in the Samba District.

TOOLS AND TECHNIQUES EMPLOYED FOR DATA COLLECTION

A semi-structured questionnaire with 34 items and a constructed five-point Likert scale, which included response options such as Strongly Agree, Agree, Neutral/Undecided, Disagree, and Strongly Disagree, was used to gather data. The five-point Likert scale covered four dimensions: Knowledge and Skills in Using AI Tools, Teachers' Beliefs towards AI, Access to Resources and Infrastructure, and Ethical and Responsible Use of AI. The questionnaire was pilot tested with a small group of teachers and reviewed by experts to ensure clarity, face validity, and content validity.

The data was collected online through Google Forms, and the responses were analysed using descriptive statistics such as frequency and percentage counts.

ANALYSIS AND INTERPRETATION OF THE DATA

Profile of the Research Participants

Table 1: Profile of the Research Participants

S. No.	Category	Sub-categories	Percentage
01.	Gender	Male	35.42% (17)
		Female	64.58% (31)
02.	Locality	Rural	68.75% (15)
		Urban	31.25% (33)
03.	Stream	Arts	50% (24)
		Science	43.75% (21)
		Commerce	6.25% (3)

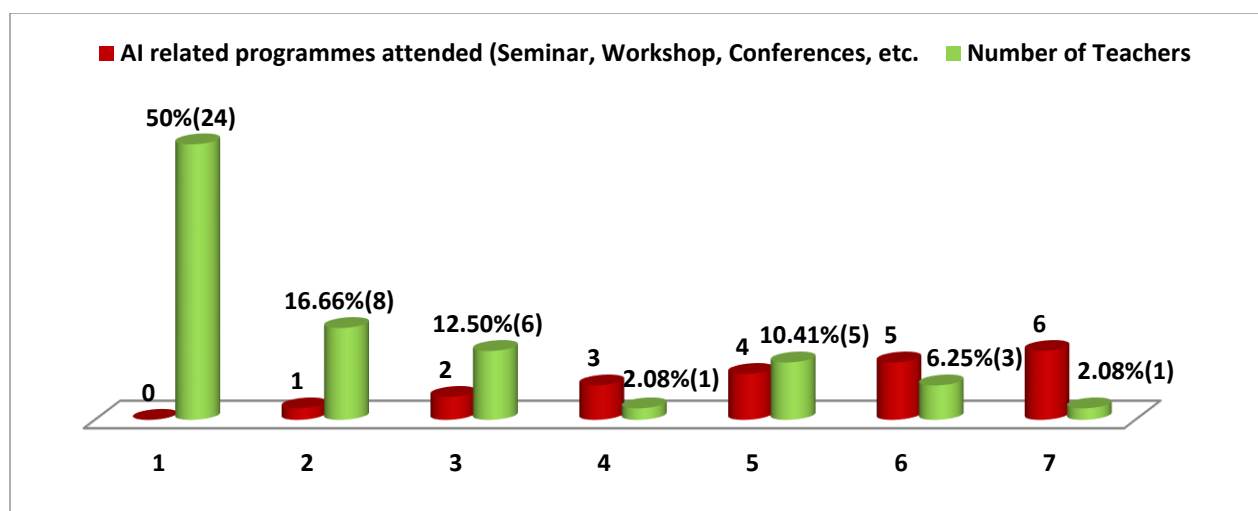


Figure 1: Number of AI-related programmes attended (Seminar, Workshop, Conferences, etc.)

Figure 1 offers a clear comparison of the number of teachers and their participation in seminars, workshops, and conferences related to artificial intelligence. The data shows that **50% of the teachers (24 out of 48) have not attended any AI-related programmes**. As the number of programmes attended increases, participation gradually declines. Specifically, 5 teachers (10.41%) attended four programmes, 6 teachers (12.5%) attended two, and 8 teachers (16.66%) attended one. Only 3 teachers (6.25%) attended six programmes, and just 1 teacher (2.08%) attended both four and six programmes. This indicates that very few teachers participate in more than four AI-related programmes. It suggests that only a small number of teachers are actively involved in ongoing development programmes in this field, while most have minimal or no exposure to AI training.

Figure 2 illustrates the interest of teachers in employing AI in the teaching-learning process. Only **15% of the teachers disagreed** whereas **85% of the teachers agree** with integrating AI into teaching-learning process. This indicates a **strong and positive attitude** among teachers towards the use of AI in teaching and learning process while suggesting a readiness to adopt AI tools in the classroom settings.

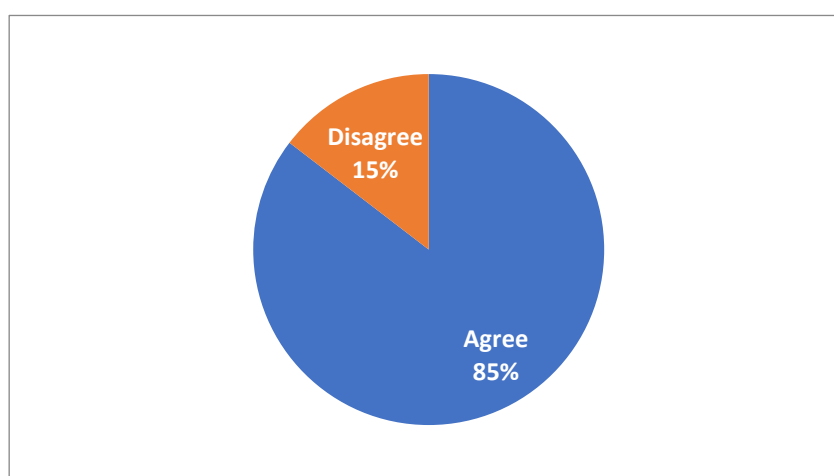


Figure 2. Interest of Teachers in Employing AI in the Teaching-Learning Process

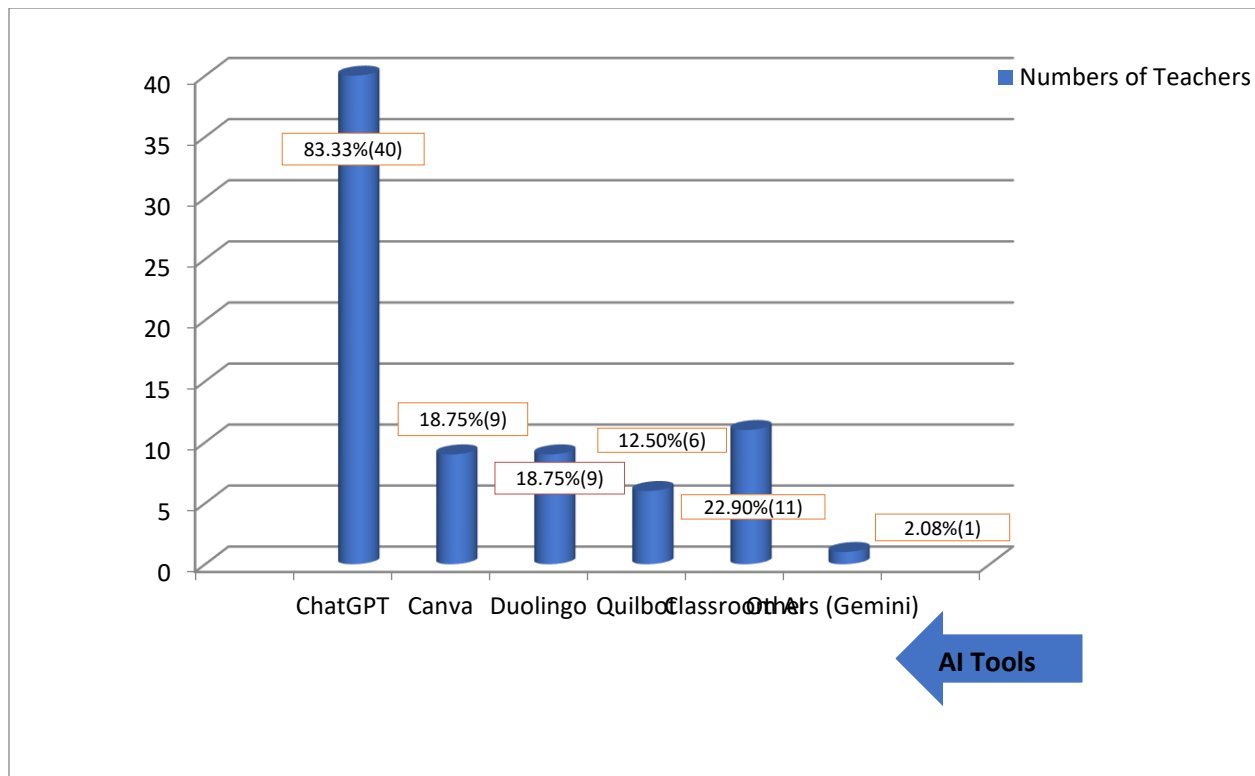


Figure 3: AI tools are utilised in Teaching And Learning Practices

Figure 3 illustrates the distribution of AI tools utilised by teachers in their teaching and learning practices. The data shows that 83.33% (40 teachers) reported using ChatGPT, making it the most popular tool. This indicates that teachers have a strong preference for ChatGPT, possibly due to its flexibility in generating content and offering instructional support. Classroom AI ranks as the second most used tool, adopted by 22.90% (11 teachers), reflecting growing interest in AI-supported classroom applications.

With 22.90% (11 teachers) using it, Classroom AI is the second most popular tool, indicating a growing interest in AI-integrated classroom applications. Both Canva and Duolingo are equally used by 18.75% (9 teachers) of the total population, showing their popularity in language learning and creative design respectively. 12.50% (6 teachers) utilise QuillBot mainly for writing enhancement and paraphrasing. Only 2.08% (1 teacher) reported using additional AI tools such as Gemini.

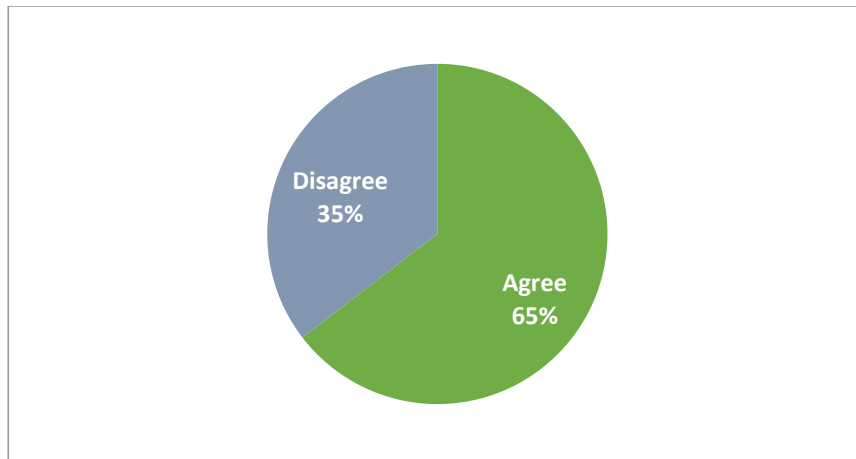


Figure 4: Accessibility in using AI tools in Institutions/College

Figure 4 demonstrates the availability of AI tools in institutions or colleges. It indicates that 65% of teachers agree with using AI tools in educational settings, while 35% disagree. This distribution emphasises that the majority of teachers are in favour of AI adoption in educational contexts.

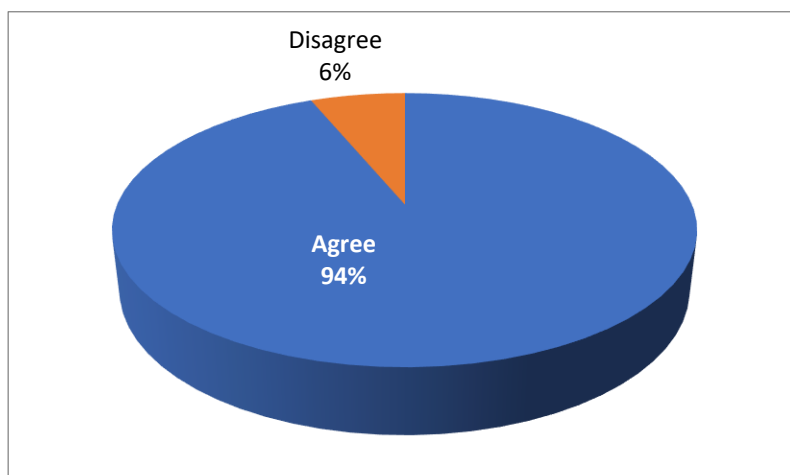


Figure 5: Integration of AI in the Indian Education System has a positive impact

Figure 5 illustrates the integration of AI into the Indian education system and its effects. The data indicates that **94% of teachers believe** that AI has a **positive influence**. Conversely, only **6% of teachers disagree**, showing a small level of concern. This implies that AI can play a significant role in transforming and improving the Indian education system.

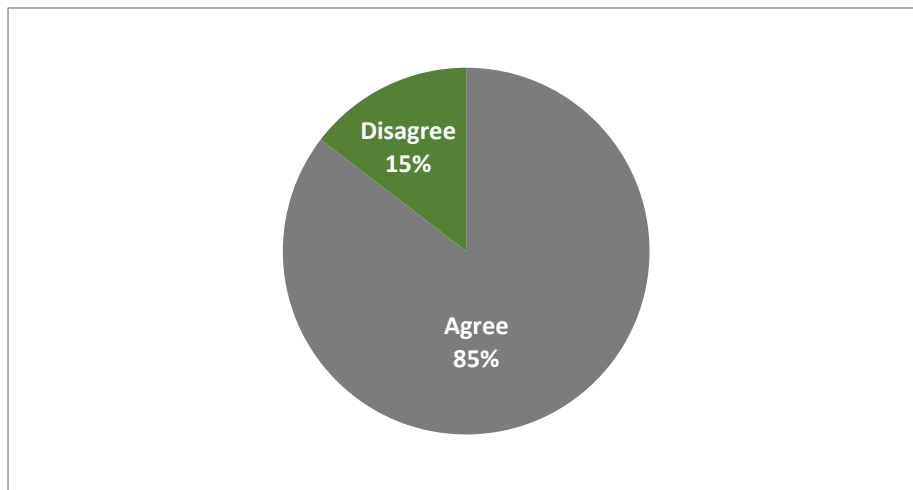


Figure 6: Requires more Training on the use of AI in Classroom Settings

Figure 6 illustrates the training teachers need to effectively use AI in classroom settings. A majority of 85% of teachers agree that more training is necessary, highlighting the importance of adequately preparing teachers with the skills and knowledge to utilise AI tools in lessons. Conversely, just 15% disagree, indicating that only a small fraction of teachers believe current training is enough.

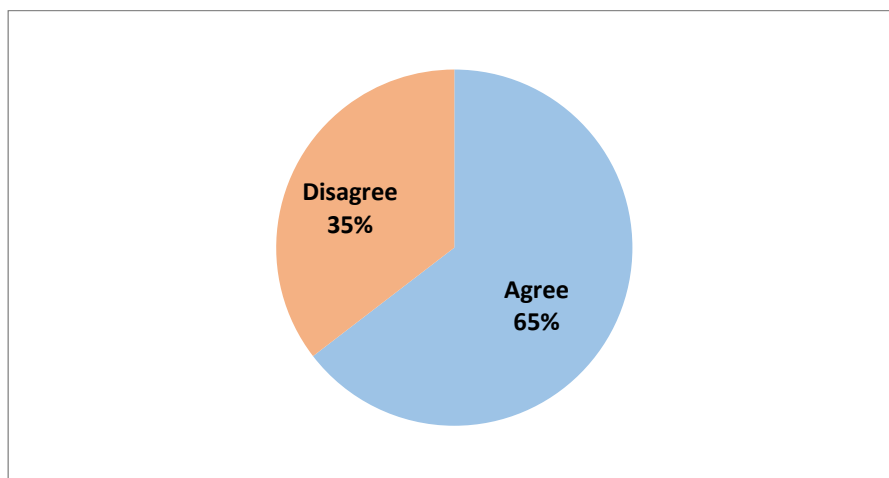


Figure 7: Difficulties In Using AI Tools To Modify Lessons For Students With Different Learning Needs.

Figure 7 illustrates the challenges teachers face when using AI tools to adapt lessons for students with different learning needs. The data shows that only 35% of teachers disagree, while 65% agree that they experience difficulties in using AI tools for this purpose. This indicates that the majority of teachers struggle to effectively incorporate AI-based modifications into their teaching methods.

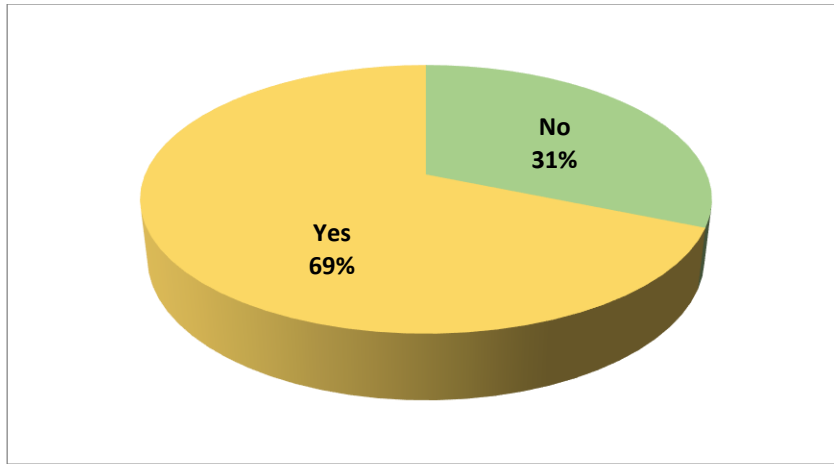


Figure 8: Challenges Encountered in the Integration Of AI In Teaching Subjects

Figure 8 illustrates the challenges faced by teachers in integrating AI into teaching subjects. It shows that 69% of teachers face challenges such as inadequate infrastructure and resources, limited accessibility and availability of AI tools in classrooms, insufficient technical skills to use AI tools, a lack of awareness about their use, and limited knowledge of the various AI tools and their applications in the classroom. However, 31% of teachers stated that they do not encounter challenges when integrating AI into teaching subjects.

Table 2: Item-Wise percentage distribution of teachers' responses on the AI Readiness Likert scale

S. No.	Items	SA	A	N	D	SD
1.	I have adequate knowledge about AI tools available for teaching and learning.	10.42%	43.75%	31.25%	14.58%	0%
2.	I lack the technical skills to use AI tools with other digital learning tools in my teaching.	8.33%	43.75%	27.10%	14.58%	6.25%
3.	I have knowledge of AI to enhancing collaboration and communication among students.	6.25%	56.25%	20.83%	16.67%	0%
4.	I think that it is difficult for me to creating educational content in my subject by integrating AI.	2.10%	31.25%	37.50%	29.16%	0%
5.	I am capable in using AI platforms to create quizzes and assignment for students.	14.58%	45.83%	25%	12.50%	2.10%
6.	I don't have knowledge in using AI applications to develop interactive learning activities.	8.33%	33.33%	25%	27.10%	6.25%
7.	I am aware of how to use AI software like chatboats, canva etc., for student engagement.	14.56%	37.5%	31.25%	16.67%	0%
8.	I don't have adequate knowledge of integration of AI in teaching of my subjects.	2.10%	29.17%	39.58%	22.92%	6.25%
9.	I have the knowledge of AI tools which analyze student behavior patterns to improve classroom management.	2.10%	39.58%	37.50%	20.83%	0%
10.	I am not much interested to integrate AI in my teaching subjects.	4.17%	14.58%	22.92%	50%	8.33%
11.	I believe that AI tools can reduce student engagement in classroom environment.	29.17%	4.17%	35.42%	29.17%	2.10%

12.	AI assists in developing creative lesson plans based on student need and interest.	10.42%	66.67%	18.75%	4.17%	0%
13.	I believe that AI does not teach essential skills like empathy and teamwork.	18.75%	22.92%	35.42%	22.92%	0%
14.	I believe that AI could not address student's emotional and social learning needs.	8.33%	41.67%	35.42%	14.58%	0%
15.	I think that AI can create more dynamic and flexible learning environment in the classroom.	10.42%	56.25%	29.16%	4.17%.	0%
16.	I am not comfortable to adapt AI-generated content to align with specific lesson goals and objectives.	4.17%	37.50%	25%	33.33%	0%
17.	I am able to integrate an AI-driven learning environment to equip students for their future professions.	4.17%	58.33%	29.17%	8.33%	0%
18.	I think that teachers should guide their students on the ethical use of AI tools in their self-learning.	12.50%	79.17%	8.33%	0%	0%
19.	I am ready to improve my knowledge in integrating AI in my teaching and learning.	14.58%	62.50%	20.83%	2.10%	0%
20.	I ensure that AI-based educational content is up-to-date prior to use it for educational purposes.	8.33%	54.17%	29.17%	8.33%	0%
21.	I provide clear instruction to students on how to use AI responsibly for academic purpose.	2.10%	60.42%	29.17%	6.25%	2.10%
22.	I neglect the ethical risks of AI while integrating it into my teaching practices.	0%	33.33%	31.25%	31.25%	4.17%
23.	I think that AI-driven assessments can be used without considering their fairness and reliability.	2.10%	35.42%	31.25%	25%	6.25%

24.	I think that using AI tools reduces the interaction between students and teachers.	14.58%	39.58%	22.92%	22.92%	0%
25.	I preferred to follow the ethical guidelines of AI tools when integrating them into my teaching subjects.	10.42%	66.67%	18.75%	4.17%	0%
26.	I believe that the lack of proper training limits my ability to integrate AI in teaching.	31.25%	50%	16.67%	2.10%	0%

The findings of the study showed that teachers have moderate to high levels of knowledge and awareness about AI tools for teaching and learning. About 62% of teachers knew how AI could improve student collaboration and communication, and 54% said they had enough understanding of AI tools (Item 1). A significant number of respondents mentioned having difficulties, even though 60% believed they could use AI platforms to create quizzes and assignments (Item 5) and 52% were aware of AI tools like chatbots and Canva for student engagement (Item 7). 42% lacked the technical skills needed to use AI alongside other digital tools (Item 2), 37% found it difficult to design educational content that incorporated AI (Item 4), and 33% felt uncomfortable modifying AI-generated content to meet specific lesson objectives (Item 16).

While 58% of teachers disagreed with the statement that they were not interested in integrating AI (Item 10), the majority of teachers held positive attitudes towards AI, with 77% agreeing that AI helps create creative lesson plans (Item 12) and 66% believing it fosters a dynamic and flexible learning environment (Item 15). A strong ethical stance was evident, with 77% of teachers preferring to follow ethical guidelines when integrating AI (Item 25) and 92% emphasising the importance of instructing students on responsible AI use (Item 18). However, a small percentage of teachers acknowledged neglecting ethical risks (35%, Item 22) or using AI assessments without considering fairness (38%, Item 23).

Moreover, 81% of teachers reported that their ability to effectively incorporate AI is impeded by insufficient training (Item 26), highlighting the need for specialised professional development in technical skills, practical understanding, and the ethical use of AI in classrooms.

MAJOR FINDING OF THE STUDY

The findings show that teachers have strong positive attitudes towards AI integration, despite limited formal experience. Half of the teachers (50%) reported not attending any AI-related programmes, yet 85% agreed with incorporating AI into the teaching and learning process. ChatGPT was the most commonly used tool (83%), and 65% supported the use of AI tools in educational settings. An overwhelming majority (94%) perceived AI integration as having a positive effect; however, 85% expressed the need for more training. This need for training corresponds with reported barriers to implementation, as 65% found it difficult to modify lessons with AI tools for learners with diverse needs, and 69% faced challenges in integrating AI into subject teaching.

In terms of readiness-related competencies and dispositions, 54% reported adequate knowledge of AI tools, 62% acknowledged understanding how AI can enhance collaboration and communication, and 60% felt capable of using AI platforms to create quizzes and assignments. Over half (52%) were aware of AI software such as chatbots and Canva for student engagement. Pedagogically, 77% agreed that AI helps in developing creative lesson plans, and 66% believed it can create a dynamic and flexible classroom environment. Motivationally, 58% disagreed with the statement that they were not interested in integrating AI, indicating a moderate readiness to adopt AI tools. Ethically, 92% emphasised guiding students on ethical AI use, and 77% preferred following ethical guidelines, although 81% still reported that lack of proper training limits effective integration.

DISCUSSION OF THE RESULTS

The findings of the study indicate that teachers at the Higher Secondary School of Samba District show a high level of readiness for AI integration in their teaching practices. This result aligns with the findings of Ayanwale et al. (2022), Wang et al. (2023), Alshorman (2024), Rajapakse et al. (2024), and Roshan et al. (2024), which state that teachers are highly prepared to incorporate AI into education. Furthermore, the study by Alnasib (2023) shows that faculty members have an average level of readiness to integrate AI into their classroom teaching.

CONCLUSION AND EDUCATIONAL IMPLICATIONS OF THE STUDY

The study's conclusion showed that Higher Secondary School teachers display a high level of readiness for AI integration into teaching practices. This indicates that most teachers possess the relevant knowledge, skills, and positive attitudes necessary for successful AI incorporation into the teaching and learning process. Their willingness to adopt innovative instructional methods, use technology in the classroom, and pursue ongoing professional development reflects their high level of preparedness. Furthermore, the study revealed that teachers in higher secondary schools are motivated and well-equipped to perform their roles effectively, which enhances student learning outcomes and the overall quality of education. However, this high level of readiness should be sustained and further enhanced through ongoing training, institutional support, and policy initiatives.

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Chapter Fourteen

LIFELONG LEARNING COMPETENCIES: EQUIPPING TEACHER EDUCATORS FOR A DYNAMIC WORLD

Nalini Verma and Tirmal Singh

ABSTRACT

Teacher educators play a crucial role in strengthening teacher education in India, yet rapidly evolving pedagogies, technologies, and learner diversity require sustained lifelong learning skills. This paper highlights the importance of emphasising these skills in teacher-educator training and professional development, specifically referencing the National Council for Teacher Education (NCTE) guidelines and the National Professional Standards for Teachers (NPST). This qualitative documentary analysis reviews secondary sources such as policy documents, scholarly literature, and expert analyses to explore how lifelong learning skills align with emerging expectations in teacher education. The analysis identifies adaptability, digital literacy, critical thinking, reflective practice, and collaboration as essential abilities that foster ongoing pedagogical innovation and responsiveness to diverse learner needs. Findings indicate that although NCTE and NPST recognise the importance of continuous learning, clear integration and practical guidance for these skills in teacher-educator preparation and development are limited. The paper recommends embedding lifelong learning skills within curricula, targeted professional development initiatives, and institutional supports that promote inquiry and innovation. Enhancing these skills can improve the quality of teacher education and contribute to better educational outcomes in a dynamic, future-ready system.

Keywords: *Lifelong Learning Competencies, NCTE, NPST, Teacher Educators, 21st Century*

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INTRODUCTION

A dilemma for teacher education is how it can prepare such teachers if there are no certainties about what the future holds. The whole issue of lifelong learning is that the pedagogical response in a complex and dynamic world cannot and should not be driven by learning outcomes in a national curriculum because overemphasis on such drives the need to be ready for the unknown of the future and can lead to the neglect of individuals. The concept of lifelong learning competencies has gained prominence as a crucial element in equipping these educators for the dynamic challenges they face (Kumar & Mishra, 2020). As India strives to implement transformative educational policies like the National Education Policy 2020, the need for teacher educators to embody and impart lifelong learning skills becomes increasingly apparent (Srivastava, 2021). The National Education Policy 2020 emphasises the need for continuous professional development of teachers and teacher educators, highlighting the significance of lifelong learning (Ministry of Education, 2020). Additionally, the National Council for Teacher Education (NCTE) and the National Professional Standards for Teachers (NPST) provide frameworks that implicitly support the development of these competencies (NCTE, 2019; MHRD, 2020).

Recent research has emphasised the importance of digital literacy, adaptability, and reflective practice as vital competencies for teacher educators (Guerriero & Révai, 2017). Studies demonstrate that educators who participate in continuous professional development and self-directed learning are better prepared to handle the complexities of modern education systems (Darling-Hammond et al., 2017). Furthermore, the capacity to foster critical thinking and creativity in learners has been recognised as a crucial skill for teacher educators (Redecker, 2017). Research by Kools and Stoll (2016) highlights the importance of developing a growth mindset and embracing collaborative learning environments. Additionally, cultural competence and global awareness have become essential qualities for teacher educators working in increasingly diverse educational settings (Zeichner et al., 2015). However, there is an increasing acknowledgement that an explicit focus on lifelong learning skills is necessary to equip teacher educators for the complexities of contemporary education. As Bhat and Joshi (2020) argue, teacher educators in India need to be equipped with skills such as digital literacy, critical thinking, and adaptive expertise to effectively prepare future teachers. Lifelong learning involves the ongoing pursuit of knowledge and skills throughout an individual's life, fostering adaptability and resilience (Candy, 1991). For teacher educators, developing lifelong learning competencies is vital to prepare future teachers to navigate the intricacies of the modern educational landscape. Teacher educators are not merely conduits of knowledge; they are mentors shaping the philosophies and practices of aspiring educators. The paper examined the following research questions:

1. What are the fundamental prerequisites for lifelong learning competencies for teachers and educators in Indian education?
2. How do these competencies align with and support the evolving needs of teacher education?
3. What is the role of NCTE and NPST in promoting Lifelong Learning Competencies?
4. What are the key components of lifelong learning competencies?

SIGNIFICANCE OF LIFELONG LEARNING COMPETENCIES

The world is experiencing unprecedented change, driven by technological advancements, globalisation, and the continuous influx of new knowledge. In such a dynamic environment, traditional models of education, focused on acquiring knowledge within a fixed timeframe, are proving to be inadequate. In the rapidly shifting landscape of education, the concept of lifelong learning has become paramount, especially in the context of teacher education in India. As the country works to reform its education system to address 21st-century challenges, equipping teacher educators with lifelong learning skills has become essential. In the context of globalisation early in the twenty-first century, a key trait of future teachers in teacher education is the ability to self-evolve. With rapidly changing contexts, the future cannot be precisely predicted, which eliminates the possibility of training for a fixed set of attributes and attitudes to meet already known parameters.

LITERATURE REVIEW

The literature on lifelong learning competencies for teacher educators has gained considerable attention recently, especially in light of evolving educational standards such as those established by the National Council for Teacher Education (NCTE) and the National Professional Standards for Teachers (NPST). Research by Darling-Hammond et al. (2017) stresses the importance of ongoing professional development for educators, aligning with NCTE's focus on improving teacher quality through continuous learning. The NPST framework, as discussed by AITSL (2011), accentuates the need for teachers to participate in professional learning throughout their careers, a notion supported by studies on teacher-educator competencies. Redecker's (2017) work on digital competence frameworks for educators resonates with both NCTE and NPST standards, highlighting the integration of technology into teaching practices. In the Indian context, Bhat and Beri (2016) examined the implementation of NCTE regulations, revealing challenges in fostering lifelong learning skills among teacher educators. The concept of adaptive expertise, as explored by Timperley (2011), aligns with NPST's professional engagement domain and is vital for teacher educators operating in dynamic educational settings. Recent research by Tack et al. (2018) on the professional development needs of teacher educators highlights the importance of research competencies, reflecting NCTE's emphasis on research-based teacher education. Additionally, Loughran (2014) discusses the complexities of teacher-educator roles, stressing the need for specialised competencies beyond those required for classroom teaching. This aligns with NPST's emphasis on lead teacher roles. The literature consistently underscores the necessity of a comprehensive approach to developing lifelong learning competencies in teacher educators, integrating technological, pedagogical, and content knowledge (TPACK) as outlined by Mishra and Koehler (2006), a concept reflected in both the NCTE and NPST frameworks.

Additionally, Darling-Hammond et al. (2017) emphasised the importance of continuous professional development, highlighting how educator effectiveness improves with sustained, job-embedded learning opportunities. This aligns with Guerriero and Révai's (2017) work on knowledge-based teaching, which underscores the need for teacher educators to constantly update their pedagogical content knowledge. In the digital realm, Redecker's (2017) DigCompEdu framework provides a structure for understanding and developing digital competencies among educators, a crucial aspect in today's technology-driven educational landscape. Kools and Stoll (2016) explored the concept of schools as learning organisations, emphasising the role of teacher

educators in fostering collaborative learning environments and a growth mindset. The importance of cultural competence and global awareness in teacher education was highlighted by Zeichner et al. (2015), who argued for a more democratic approach to teacher education that acknowledges diverse perspectives. More recently, Darling-Hammond et al. (2020) discussed the impact of COVID-19 on education, emphasising the need for adaptability and resilience among teacher educators. Tondeur et al. (2019) focused on the integration of technology in teacher education programmes, emphasising the importance of modelling effective tech integration for future teachers. Cochran-Smith et al. (2018) provided a critical analysis of teacher preparation research, calling for more robust methodologies in studying teacher educator competencies. Lastly, Livingston (2018) explored the professional learning of teacher educators, emphasising the need for tailored professional development opportunities that address the unique challenges of educating future teachers in a rapidly changing world.

METHODOLOGY

The proposed qualitative study on lifelong learning competencies for teacher educators will use a secondary data analysis method. It will include a systematic review and thematic analysis of existing literature, policy documents, and research reports. Data collection will target peer-reviewed journal articles, conference proceedings, government publications, and institutional reports from the past decade. This approach enables a thorough exploration of existing knowledge, supporting the synthesis of diverse perspectives on lifelong learning competencies for teacher educators in evolving educational settings.

DISCUSSION

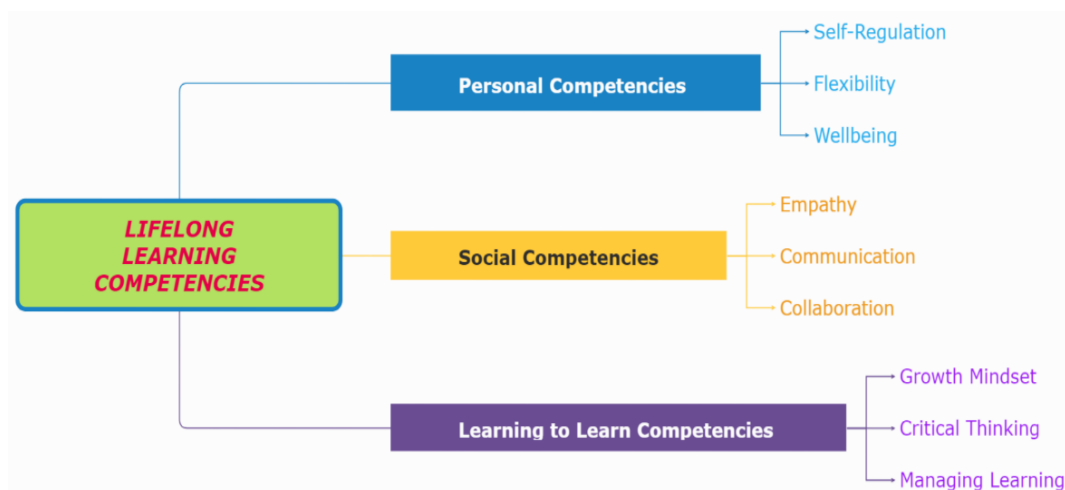
The Lifelong Learning Competencies, as outlined by the National Council for Teacher Education (NCTE) and the National Professional Standards for Teachers (NPST), form the foundation of effective and evolving pedagogical practices. In India's diverse and rapidly changing educational landscape, these prerequisites encompass a range of skills, attitudes, and knowledge that enable educators to adapt, innovate, and excel continuously. From digital literacy and cultural competence to reflective practice and research skills, these competencies are vital for navigating the complexities of modern education. By focusing on these key prerequisites, we aim to equip teachers and educators with the tools needed to foster a culture of ongoing learning, thereby improving the quality of education and preparing students for the challenges of a global, knowledge-driven society. Research on lifelong learning competencies for teachers and educators in India, in relation to NCTE and NPST standards, highlights several essential prerequisites. Studies by Bhat and Beri (2016) underline the importance of continuous professional development aligned with NCTE regulations. Digital literacy is identified as a critical competency, as noted by Reddy and Padmavathi (2013) in connection with NPST standards. Reflective practice and adaptive expertise are recognised as key skills by Mathew et al. (2017). Cultural competence and understanding diverse learning needs are stressed within NCTE frameworks and are supported by research from Rao and Meo (2016). Moreover, research skills and the capacity to integrate technology into pedagogy are considered fundamental, aligning with both NCTE and NPST expectations (Tondeur et al., 2019).

The National Council of Teachers of English (NCTE) plays a vital role in fostering lifelong learning skills in English language arts education. NCTE encourages educators to create learning

environments that promote curiosity, critical thinking, and independent research skills (NCTE, 2012) [NCTE, College Literacy Standards], which leads to the development of inquiry-based learning. Developing awareness of one's own learning processes is crucial for lifelong learning. NCTE promotes strategies that encourage students to reflect on their learning and identify areas for improvement (NCTE, 2017) [NCTE, Position Statement on the Importance of Teaching Students About Their Own Learning]. Integrating technology into the curriculum equips students with the skills to access and evaluate information online (NCTE, 2018) [NCTE, Standards 2018], which fosters digital literacy. The NCTE and NPST emphasise the essential role of educational institutions in fostering lifelong learning competencies among learners. This can be achieved through a multifaceted approach involving curriculum design, instructional strategies, assessment methods, and the creation of a supportive learning environment.

Qualitative research findings reveal a strong connection between lifelong learning competencies and the changing needs of teacher education. Studies by Darling-Hammond et al. (2017) and Tack et al. (2018) show that adaptive expertise and ongoing professional development are essential for meeting the evolving demands of education. Findings from Redecker (2017) emphasise the importance of digital skills in supporting innovative pedagogical approaches. Research by Loughran (2014) highlights the need for specialised competencies in teacher educators, aligning with the complexity of their roles. Furthermore, studies by Timperley (2011) and Guerriero and Révai (2017) underline the significance of reflective practice and research skills in improving the quality of teacher education, supporting the sector's changing requirements for evidence-based practices and continuous improvement.

Research findings on the key components of lifelong learning competencies highlight several essential elements. Self-directed learning ability is consistently recognised as a core component, with Knowles et al. (2015) stressing its importance in ongoing professional development. The key components synthesised from the literature are summarised in Figure 1.



Source: Author's own

Figure 1. Key Components of Lifelong Learning Competencies

Critical thinking and problem-solving skills are emphasised by Facione (2015) as vital for adapting to new challenges. Digital literacy emerges as an essential competence, with Redecker

(2017) underlining its importance in contemporary educational contexts. Emotional intelligence, as discussed by Goleman (2020), is recognised as crucial for effective communication and relationship-building in learning environments. Metacognitive skills, including self-reflection and self-assessment, are identified by Schraw et al. (2006) as fundamental to lifelong learning. Adaptability and flexibility are highlighted by Dweck (2016) through the concept of a growth mindset. Collaborative skills are noted by Dillenbourg (2016) as key in increasingly interconnected learning settings. Lastly, cultural competence is emphasised by Deardorff (2015) as essential for navigating diverse educational environments. These components collectively form a comprehensive framework for lifelong learning skills.

CONCLUSION

Lifelong learning, the ongoing process of acquiring new skills and knowledge throughout life, has become an essential competency for individuals to navigate this complexity. In the rapidly transforming landscape of the 21st century, developing lifelong learning skills has become crucial for individuals to succeed and adapt. By integrating cognitive, metacognitive, social, and emotional dimensions, the conceptual framework presented in this paper offers a comprehensive approach to fostering lifelong learning abilities. In line with the guidelines set forth by the NCTE and NPST, educational institutions play a vital role in embedding lifelong learning skills within their curricula, teaching practices, assessment methods, and learning environments. By embracing this shift in perspective, we can equip teacher educators and learners with the key skills and mindsets needed to manage the complexities of an ever-changing world and become lifelong learners, capable of continuous growth and adaptation. Today, lifelong learning skills are essential for individuals to succeed in a dynamic world. By promoting these skills through effective educational practices, educators can empower learners to become self-directed, adaptable, and future-ready. Although extensive research exists on lifelong learning skills for teachers, there remains a significant gap in understanding how to effectively develop and evaluate these skills specifically for teacher educators, especially in the context of rapidly evolving educational technologies and diverse global learning environments. This paper offers a conceptual framework for lifelong learning skills. Future research could investigate effective pedagogical strategies to cultivate these skills in classrooms, the impact of lifelong learning programmes on individual and societal wellbeing, and the role of technology in supporting and enhancing lifelong learning experiences.

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Chapter Fifteen

BEYOND SCREENS: RESTORING HUMAN INTERACTION THROUGH THOUGHTFUL TECHNOLOGY USE

Nishta Rana

ABSTRACT

In today's digital world, technology influences how people communicate, learn, and build relationships. While digital platforms provide unmatched access to information and new opportunities for collaboration, they can also reduce the depth of human connection by promoting surface-level interaction, dependence on devices, and feelings of social isolation. This paradox—being constantly connected yet emotionally distant—emphasises the need to use technology in ways that strengthen rather than weaken human bonds. This paper, “Beyond Screens: Restoring Human Interaction Through Thoughtful Technology Use,” explores the dual role of technology as both a support and a challenge within educational settings. Guided by the vision of the National Education Policy (NEP) 2020, it argues that technology should complement holistic, learner-centred education without compromising social-emotional development. It examines how digital tools can improve inclusivity, tailor learning experiences, and enable global collaboration, while also addressing concerns such as reduced empathy, digital fatigue, and weakened teacher–student relationships. Examples from schools, higher education, and community projects illustrate how NEP 2020's call for balanced and mindful technology integration can be implemented. The paper concludes that technology, when employed thoughtfully, can enhance communication and deepen learning. By deliberately shaping digital habits, educators and learners can ensure that technology genuinely supports human interaction and meaningful engagement in modern classrooms.

Keywords: Digital Education, Human Interaction, NEP 2020, Holistic Learning, Technology Integration.

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INTRODUCTION

Digital technologies have quickly transformed how people interact, communicate, and learn, becoming essential to modern education systems. Virtual platforms, learning management systems, and AI-enabled tools now facilitate a significant part of teacher–student and peer communication. While these technologies offer better access, flexibility, and personalisation, they also create new challenges in maintaining meaningful human relationships (Selwyn, 2016). Scholars argue that although digital tools broaden learning opportunities, they can also fragment attention, diminish emotional presence, and weaken interpersonal bonds (Rosen et al., 2014). This increasing tension between technological progress and social connectedness remains a key concern for modern education.

Research indicates that constant connectivity may paradoxically lead to social isolation and decreased empathy among learners (Turkle, 2015). Classrooms that once focused on dialogue, shared experiences, and collaborative inquiry now contend with multitasking, digital overload, and superficial online interactions. Studies suggest that excessive dependence on screens can impact the quality of teacher–student relationships, which are fundamental to effective pedagogy and socio-emotional development (Hattie, 2009; Jennings & Greenberg, 2009). Despite having unprecedented access to learning resources, many learners report feeling lonely, experiencing digital fatigue, and possessing reduced motivation, underscoring the need for a more balanced approach to technology use (OECD, 2021).

The National Education Policy (NEP) 2020 addresses these challenges by advocating for thoughtful, ethical, and purposeful incorporation of technology in education. The policy highlights that digital tools should enhance—rather than replace—the core human aspects of teaching such as care, communication, and emotional engagement (Ministry of Education, 2020). NEP 2020 also emphasises the significance of socio-emotional learning, holistic development, and human-centred pedagogies, aligning with global frameworks that promote responsible and equity-focused technology use (UNESCO, 2023). This vision highlights the necessity of utilising technology in ways that foster inclusion, collaboration, and learner well-being.

Building on this perspective, the paper *“Beyond Screens: Restoring Human Interaction Through Thoughtful Technology Use”* explores how technology can act as a bridge to strengthen human connection rather than obstruct it. Through an analysis of current literature, policy directions, and case studies from various educational settings, the paper advocates for intentional and reflective digital practices. By refocusing human relationships within technologically mediated environments, educators can foster deeper engagement, empathy, and a sense of belonging—elements vital for holistic learning in the 21st-century classroom.

REVIEW OF LITERATURE

The discussion on technology and human interaction in education has grown significantly in recent years, reflecting the increasing impact of digital ecosystems on learning environments. Scholars widely agree that technology has changed access to information, communication methods, and teaching practices, providing learners with new chances for personalisation, collaboration, and engagement (Means et al., 2013). Digital tools such as learning management systems, collaborative platforms, and AI-based learning assistants have been demonstrated to

support differentiated learning and expand participation, especially for students who need flexible, multimodal forms of instruction (Bond et al., 2021).

Simultaneously, a growing body of research highlights challenges linked to technology-driven education. Studies show that increased screen exposure can harm attention, lessen emotional engagement, and weaken the depth of interpersonal interactions (Mueller & Oppenheimer, 2014; Twenge et al., 2019). Turkle's (2015) work points to the paradox of being digitally connected yet socially isolated, suggesting that frequent digital mediation can reduce the capacity for empathy and meaningful conversation. Likewise, educational psychologists underline that face-to-face interactions remain essential for developing social-emotional skills, a sense of belonging, and motivation (Wentzel, 2016).

The role of teachers in technology-mediated environments has also become a key area of research. Hattie (2009) argues that teacher–student relationships have one of the strongest influences on student learning outcomes, a point supported by Jennings and Greenberg (2009), who emphasise the importance of teachers' socio-emotional skills in creating supportive learning environments. While technology can improve instructional delivery, it cannot replace the relational, emotional aspects that underlie effective teaching. Scholars warn that over-reliance on digital platforms may reduce opportunities for meaningful dialogue, mentorship, and community-building—elements essential for holistic learning (OECD, 2021).

From a policy perspective, frameworks such as the National Education Policy (NEP) 2020 advocate for balanced and purposeful technology integration. The policy emphasises leveraging digital tools to enhance inclusion and quality while safeguarding the centrality of human relationships in educational processes (Ministry of Education, 2020). International organisations, including UNESCO (2023), echo this sentiment by calling for ethical and human-centred approaches to educational technology, highlighting issues of equity, digital well-being, and responsible use.

Recent empirical studies further demonstrate how mindful technology use can promote collaborative learning and community engagement when applied with pedagogical purpose. For instance, synchronous digital environments such as virtual classrooms can enhance social presence when educators employ strategies that foster interaction, reflection, and peer collaboration (Garrison & Cleveland-Innes, 2005). Blended learning approaches have also been linked to increased learner autonomy and engagement when designed to integrate online and offline experiences (Graham, 2013).

Overall, the literature presents a dual narrative: technology provides significant opportunities to enhance education, but its unconsidered use may weaken the social-emotional aspects vital to human interaction. This paper draws on these insights to examine how thoughtful technology integration can help restore and bolster human connection within educational settings.

THEORETICAL FRAMEWORK

The relationship between technology use and human interaction in educational settings can be understood through several complementary theoretical perspectives. These frameworks offer insights into how digital tools influence communication, social presence, and the overall learning

experience. Together, they emphasise the need for careful technology integration that aligns with human-centred values.

1. Social Presence Theory

Social Presence Theory offers a fundamental perspective for understanding how interpersonal communication is influenced in mediated environments. Short, Williams, and Christie (1976) introduced the idea to describe how different media vary in their capacity to convey warmth, immediacy, and a sense of “being with others.” In educational settings, social presence is crucial for building trust, motivation, and collaborative learning (Garrison, Anderson, & Archer, 1999). Digital environments that lack cues such as facial expressions, gestures, and tone may reduce the emotional depth of interactions. The theory indicates that technology should be used in ways that enhance—rather than diminish—learners' sense of connection.

2. Community of Inquiry (CoI) Framework

The Community of Inquiry model further explores the interaction between technology and human relationships in learning contexts. Garrison, Anderson, and Archer (1999) identify three core elements—social presence, cognitive presence, and teaching presence—that together foster a meaningful online learning experience. The framework underscores that technology can support deep learning only when social and teaching presence are properly maintained. Excessive reliance on automated or screen-based tasks risks weakening these aspects, reducing opportunities for dialogue and shared understanding. The CoI framework thus stresses the essential role of teachers in guiding relational and cognitive engagement in digital environments.

3. Constructivist Learning Theory

Constructivist approaches, influenced by the work of Vygotsky (1978) and Bruner (1996), emphasise learning as a socially mediated process. Knowledge construction occurs through interaction, dialogue, and shared experiences—processes that require authentic human engagement. Vygotsky’s notion of the Zone of Proximal Development (ZPD) highlights the importance of guided support from peers and teachers. While technology can scaffold learning, constructivist theory asserts that human mentors remain essential for modelling thinking processes, offering emotional support, and co-constructing knowledge. Thus, technology must enhance collaborative learning rather than replace interpersonal interaction.

4. Socio-emotional Learning (SEL) Frameworks

The importance of relationships in learning is also highlighted by socio-emotional learning frameworks, such as those developed by the Collaborative for Academic, Social, and Emotional Learning (CASEL, 2020). SEL frameworks identify competencies—including empathy, relationship-building, and responsible decision-making—as essential for holistic development. Research shows that face-to-face interactions promote these competencies more effectively than screen-based communication (Jones & Doolittle, 2017). Therefore, thoughtful use of technology should complement and reinforce the relational practices that underpin SEL.

5. Human-Centred Design and Ethics of Technology

Human-centred design frameworks, particularly those applied to educational technologies, argue that tools should be created and used in ways that prioritise human needs, values, and well-being

(Norman, 2013). UNESCO's (2023) guidelines on AI ethics in education support this perspective, calling for digital tools that foster inclusion, equity, transparency, and human dignity. These frameworks warn that poorly designed technologies—especially those promoting excessive screen time or algorithmic bias—can damage relationships and learner well-being.

Synthesis

Together, these theoretical perspectives converge on a central argument: technology should act as a bridge to human connection rather than a substitute for it. Social presence, collaborative meaning-making, and socio-emotional support remain central to learning, even in digitally mediated environments. By drawing on these frameworks, this paper highlights the importance of balanced, mindful technology integration that maintains the relational, holistic aims of NEP 2020 and contemporary pedagogical thought.

RATIONALE OF THE STUDY

The rapid integration of digital technologies into education has created both extraordinary opportunities and complex challenges. While technology improves access to information, encourages personalised learning paths, and broadens collaborative possibilities, growing worries about diminished human interaction, weakened teacher–student bonds, and declining socio-emotional well-being have led scholars and policymakers to advocate for more deliberate and balanced approaches to digital engagement (Selwyn, 2016; OECD, 2021). The COVID-19 pandemic further highlighted this contrast: despite greater connectivity through digital platforms, many learners and educators experienced increased feelings of isolation, digital exhaustion, and a reduced sense of belonging (UNESCO, 2023). These issues emphasise the importance of exploring how technology can be utilised not just as a teaching tool but as a means to strengthen human relationships within learning environments.

India's National Education Policy (NEP) 2020 recognises technology as a transformative force while advising caution regarding its effects on human connection. The policy stresses developing holistic, value-based, and learner-centred educational practices, asserting that technology should support — not replace — the relational foundations of teaching and learning (Ministry of Education, 2020). This dual focus aligns with global viewpoints advocating for human-centred and ethical technology integration that emphasises socio-emotional development, inclusivity, and learner well-being (UNESCO, 2023). Nevertheless, empirical and conceptual gaps remain in understanding how educators and institutions can practically attain this balance within diverse and swiftly changing educational environments.

Existing research highlights risks associated with excessive screen use, fragmented attention, and diminished interpersonal communication (Turkle, 2015; Twenge et al., 2019), yet fewer studies explore strategies that leverage technology to *enhance* meaningful interaction rather than erode it. There is a pressing need to shift the discourse from technological efficiency to relational quality, examining how thoughtfully designed digital practices can support deeper engagement, empathy, and collaborative learning. Furthermore, the rise of AI-driven tools, virtual classrooms, and automated feedback mechanisms presents new questions regarding the future of human roles in education—particularly how teachers can maintain emotional presence and relational continuity in digitally mediated environments.

This study addresses these gaps by investigating how technology can serve as a bridge to restore and enhance human interaction in educational environments. Drawing on theoretical insights, policy frameworks, and real-world examples, the paper aims to deepen the understanding of technology's role in fostering human connection. In doing so, it aligns with NEP 2020's vision of an education system that combines technological innovation with the social, emotional, and ethical aspects vital for holistic learning in the 21st century.

Objectives of the Study

The primary aim of this study is to investigate how technology can be thoughtfully utilised to restore, enhance, and maintain human interaction within educational settings. The study aims to:

1. Examine the dual role of technology as both an enabler and a challenge in fostering meaningful human connections in educational settings.
2. Analyse the implications of technology use on teacher–student relationships, peer interactions, and socio-emotional dynamics in learning environments.
3. Identify theoretical and practical strategies for integrating technology to promote social presence, empathy, and relational engagement.
4. Evaluate how NEP 2020's vision of balanced, human-centred technology integration can be operationalised in schools and higher education institutions.
5. Propose a framework of thoughtful technology use that supports holistic learning and enhances human interaction in the digital era.

RESEARCH QUESTIONS

Based on the objectives, the study is guided by the following research questions:

1. How does technology simultaneously support and hinder human interaction in educational contexts?
2. What effects do digitally mediated learning environments have on the quality of teacher–student and peer relationships?
3. Which theoretical perspectives best explain the relationship between technology use and human interaction in learning?
4. How can educational institutions implement NEP 2020's call for mindful, balanced technology integration?
5. What strategies or models effectively leverage technology to enhance social presence, empathy, and collaborative engagement among learners?

METHODOLOGY

This paper uses a conceptual research approach to explore how technology can be thoughtfully employed to restore and improve human interaction in educational settings. Conceptual studies are especially suitable for investigating emerging issues, synthesising existing knowledge, and developing new theoretical insights (Jabareen, 2009). Given the changing nature of digital learning environments and the complexity of socio-emotional dynamics in education, a

conceptual approach offers the flexibility needed to analyse diverse perspectives, theories, and policy frameworks.

Research Approach

The study employs an interpretive and analytical approach, drawing on key theories of learning, communication, and human–technology interaction, including Social Presence Theory, the Community of Inquiry framework, Constructivist Learning Theory, and socio-emotional learning models. These theories informed the selection, interpretation, and organisation of the reviewed literature.

Data Sources

The analysis is based on a thorough review of peer-reviewed journal articles, books, policy documents, and international guidelines published between 2000 and 2024. Key databases consulted include:

- ERIC (Education Resources Information Center)
- Scopus
- Web of Science
- Google Scholar

Sources were chosen based on their relevance to themes such as digital learning, socio-emotional development, teacher–student relationships, educational technology, ethical technology use, and NEP 2020 implementation.

Inclusion Criteria

Literature was included if it met the following criteria:

1. Addressed technology use in educational settings (school or higher education).
2. Examined aspects of human interaction, social presence, empathy, or relational dynamics.
3. Provided theoretical, empirical, or policy-based insights.
4. Offered credible, verifiable scholarship from recognised publishers or academic institutions.

Analytical Strategy

The selected literature was synthesised using thematic analysis, a method suitable for recognising recurring concepts, patterns, and contradictions across diverse sources (Braun & Clarke, 2006). Themes related to opportunities, challenges, theoretical perspectives, and strategies for the thoughtful use of technology were identified and organised to support the paper's conceptual framework.

The analysis also included a policy perspective, using NEP 2020 and UNESCO's 2023 AI guidelines to assess the alignment between technological practices and national/global expectations for human-centred education.

Limitations of the Methodology

As a conceptual study, the paper does not include primary data collection. While this allows for extensive theoretical analysis, it limits the ability to empirically generalise the findings. Future research could benefit from qualitative or mixed-methods studies that gather perspectives from teachers, students, and administrators to validate and expand the conceptual assertions.

DISCUSSION AND ANALYSIS

The evolving role of technology in education presents a complex duality: it provides avenues for enriching learning experiences while simultaneously questioning the depth and quality of human interaction. Analysing theoretical perspectives and existing scholarship shows that technology's impact is not inherently positive or negative; instead, its effects depend on the intentions, design, and pedagogical choices that shape how it is used.

1. Technology as a Catalyst for Inclusion and Personalisation

Digital tools have broadened opportunities for personalised and inclusive learning. Adaptive learning systems, assistive technologies, and multimodal platforms allow learners with diverse needs to access content in meaningful ways (Bond et al., 2021). Online collaboration tools further enable students to participate in global dialogue and co-create knowledge beyond physical boundaries (Means et al., 2013). These possibilities align with NEP 2020's focus on using technology to promote flexibility and learner autonomy (Ministry of Education, 2020). When integrated thoughtfully, technology can democratise access and raise learner voices.

2. The Paradox of Hyperconnectivity and Human Disconnection

Despite increased digital contact, research indicates a decline in the quality of interpersonal engagement. Turkle (2015) warns that constant device use fragments attention, diminishes empathy, and discourages meaningful conversation. Similarly, Twenge et al. (2019) link high screen exposure to lower socio-emotional well-being among adolescents. In educational settings, multitasking behaviours and shallow online interactions can weaken the relational fabric of classrooms, undermining the trust and shared presence essential for learning (Rosen et al., 2014). The paradox of being "connected yet disconnected" remains one of the most urgent concerns of digital-era education.

3. Teacher–Student Relationships in Digitally Mediated Spaces

Teacher–student relationships are among the most important factors influencing learning outcomes (Hattie, 2009). However, technology can mediate, obscure, or even disrupt these relationships. Automated feedback tools and AI-driven tutoring systems, although efficient, lack the emotional nuance, empathy, and adaptive judgement that human teachers offer. Jennings and Greenberg (2009) highlight that socio-emotional competence in teachers enhances the classroom climate and student engagement. Excessive dependence on screen-based instruction might reduce opportunities for such relational practices, making it essential to intentionally design digital experiences that maintain teacher presence.

4. The Role of Social Presence and Collaborative Meaning-Making

Theoretical insights from Social Presence Theory and the Community of Inquiry (CoI) framework emphasise that digital environments must intentionally foster warmth, trust, and

dialogue to support human interaction (Garrison et al., 1999; Short et al., 1976). Synchronous video communication, structured online discussions, and collaborative problem-solving tasks can enhance social presence when guided by strong teaching presence. However, without deliberate design, digital platforms risk encouraging passive, transactional learning.

5. Human-Centred Technology Use as an Ethical Imperative

UNESCO's (2023) guidelines on AI ethics emphasise the importance of safeguarding human dignity, relationality, and well-being in technology-enabled learning. Human-centred design advocates for digital practices that prioritise communication, empathy, and inclusivity (Norman, 2013). This view aligns closely with NEP 2020's vision of holistic education, which positions technology as a supportive tool rather than a substitute for human engagement. Thoughtful use of technology, therefore, becomes not only a pedagogical choice but also an ethical responsibility.

6. Restoring Human Interaction Through Thoughtful Digital Practices

The evidence points to the importance of intentional, reflective, and relationally focused technological design. Strategies like blended learning approaches, interactive dialogues, collaborative digital initiatives, and teacher-led online discussions can improve social presence and lessen feelings of isolation (Garrison & Cleveland-Innes, 2005). Educators have a vital role in modelling digital citizenship, cultivating empathy, and creating genuine opportunities for connection. When viewed through a relational perspective, technology can serve as a bridge—fostering deeper interaction, shared meaning-making, and comprehensive learning.

RECOMMENDATIONS

Based on the conceptual analysis, theoretical foundations, and policy perspectives discussed, the following recommendations are proposed to ensure that technology enhances—rather than replaces—human interaction in educational environments. These recommendations assist educators, institutions, and policymakers in creating human-centred digital ecosystems aligned with the vision of NEP 2020.

1. Prioritise Relational Pedagogies in Technology-Integrated Classrooms

Teachers should deliberately design learning activities that foster communication, collaboration, and emotional presence even when employing digital tools. Strategies such as structured discussions, reflective dialogues, and peer feedback can strengthen social presence and increase engagement (Garrison et al., 1999). Technology should be utilised to enhance — not lessen — the teacher's relational role.

2. Adopt Blended Learning Models that Balance Online and Offline Interaction

Blended learning environments enable educators to combine the advantages of both digital and face-to-face methods. Offline activities such as group projects, debates, and community-based tasks offer opportunities for genuine social interaction, reducing the risks of digital fatigue and isolation (Graham, 2013).

3. Strengthen Teacher Capacity for Human-Centred Digital Pedagogies

Professional development programmes should concentrate not only on technical skills but also on relational abilities—such as empathy, communication, and emotional intelligence. Training

ought to enable teachers to foster warm, inclusive, and engaging environments across digital platforms (Jennings & Greenberg, 2009).

4. Integrate Socio-Emotional Learning (SEL) into Digital Practices

Institutions should integrate SEL competencies into technology-rich curricula. Digital tools can facilitate group reflections, collaborative problem-solving, and empathy-building activities, supporting holistic development in line with NEP 2020 (CASEL, 2020).

5. Encourage Thoughtful and Ethical Use of AI and Automation

AI-driven systems should complement—rather than replace—human judgement and interpersonal support. Institutions must adhere to ethical guidelines such as UNESCO’s (2023) principles on transparency, inclusivity, and human dignity. AI should be utilised in ways that maintain teachers’ emotional and relational roles.

6. Promote Digital Well-Being and Conscious Technology Use Among Learners

Schools and higher education institutions should implement policies that limit unnecessary screen time, promote digital mindfulness, and foster balanced routines. Research indicates that excessive screen exposure can impair attention and socio-emotional well-being (Twenge et al., 2019). Digital well-being frameworks can assist learners in developing healthy habits.

7. Strengthen Community-Building in Online and Hybrid Learning Environments

Educators should establish virtual environments—such as discussion boards, collaborative projects, and small-group breakout sessions—that promote shared meaning-making and a sense of belonging. A strong sense of community is vital for motivation, retention, and emotional support (Garrison & Cleveland-Innes, 2005).

8. Align Institutional Technology Policies with Human-Centred Principles

Institutions should ensure that technology procurement, digital infrastructure, and platform design emphasise accessibility, inclusivity, and relational engagement. Policies must mirror NEP 2020’s focus on holistic education and UNESCO’s ethical guidelines for AI in education.

9. Conduct Ongoing Research on Human Interaction in Technology-Rich Contexts

There is a need for ongoing research to understand how digital tools influence social presence, teacher–student relationships, and learner well-being. Institutions should promote interdisciplinary studies that inform evidence-based policies and innovations.

Implications for Policy and Practice

1. Embedding Human-Centred Digital Principles in National and Institutional Policies

Educational policies must explicitly emphasise relational aspects of learning when promoting technology integration. NEP 2020’s principles should guide institutional strategies to ensure that digital tools support holistic development, socio-emotional skills, and learner well-being.

2. Professional Development for Teachers in Relational Digital Pedagogies

Ongoing training should provide teachers with not only technological skills but also pedagogical strategies that foster social presence, empathy, and emotional support in both digital and blended settings.

3. Designing Digital Platforms that Foster Interaction and Community

Technology developers and educational institutions must work together to create tools that promote collaboration, dialogue, and peer connections rather than passive content consumption. Features that facilitate discussion, co-creation, and feedback loops are essential.

4. Strengthening Digital Well-Being Frameworks

Institutions should implement guidelines that encourage healthy digital habits, manage screen time, and provide mental health support related to digital fatigue. This is essential due to the established connections between excessive technology use and diminished socio-emotional well-being (Twenge et al., 2019).

5. Prioritising Equity and Inclusion in Technology Deployment

Policies must tackle the digital divide by ensuring access to devices, reliable connectivity, and accessible platforms. Technology that fosters linguistic, cultural, and disability inclusion supports NEP 2020's equity objectives and UNESCO's ethical principles for AI.

6. Encouraging Research and Innovation on Human–Technology Interaction

Further interdisciplinary research is necessary to assess how various digital designs and pedagogical models influence interaction, engagement, and learning outcomes. Insights from such research can inform more nuanced, evidence-based policy decisions.

7. Reimagining Learning Spaces to Integrate Digital and Human Elements

Future classrooms should be designed as hybrid spaces that foster both digital collaboration and face-to-face interaction. Physical layouts, schedules, and pedagogical structures must support community-building and relational practices alongside digital innovation.

CONCLUSION

The rapid digitalisation of education has transformed how learners communicate, collaborate, and build knowledge. While technology has increased access, promoted inclusion, and provided innovative routes for personalised learning, it has also raised important concerns about diminished interpersonal engagement, reduced empathy, and weakened teacher–student relationships. The conceptual analysis in this paper emphasises that technology is neither inherently beneficial nor harmful; rather, its effect depends on how intentionally and thoughtfully it is incorporated into educational systems.

The theoretical frameworks—Social Presence Theory, the Community of Inquiry model, Constructivist Learning Theory, and socio-emotional learning principles—highlight that meaningful human interaction remains vital to effective and holistic education. NEP 2020 further supports this view by advocating a balanced approach to digital integration that maintains human dignity, relational warmth, and learner well-being. Technology must therefore serve as a bridge to deeper engagement rather than a barrier that isolates individuals from genuine connection.

If educators, institutions, and policymakers adopt deliberate, relationally oriented practices, technology can become a powerful tool for restoring social presence, enhancing collaboration, and supporting holistic learning in the 21st century. The future of education requires neither a

rejection of digital tools nor an uncritical embrace of them, but a mindful synthesis that places human interaction at the core of every technological decision.

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Chapter Sixteen

ARTIFICIAL INTELLIGENCE IN INDIAN EDUCATION: CONCEPTUAL FOUNDATIONS, POLICY TRAJECTORIES, AND ETHICAL IMPERATIVES

Nishta Rana and Rashim Wadhwa

ABSTRACT

The increasing integration of Artificial Intelligence (AI) in education marks a significant driver of systemic change in India's educational landscape. This paper critically reviews the conceptual foundations, policy development, and ethical issues of AI adoption, presenting AI not just as a technological tool but as a catalyst for pedagogical and governance reform. Rooted in constructivist and socio-cultural learning theories, the analysis examines how AI-enabled systems support learner-centred, data-informed, and competency-based approaches, while also raising concerns related to human agency and professional independence. The study traces the evolution of Indian education policy from the National Policy on Education (1986) to the National Education Policy (2020), highlighting a clear shift towards viewing AI as a strategic tool for enhancing access, quality, and institutional efficiency. Major national initiatives, including #AIforAll, the National Digital Education Architecture, PM eVIDYA, and the proposed National Educational Technology Forum, are analysed to understand how AI-driven reforms are being implemented through digital governance frameworks. The paper also emphasises critical challenges such as data privacy, algorithmic bias, digital inequalities, and limited teacher training, warning against uncritical adoption. It concludes by advocating a human-centred, ethically grounded, and context-sensitive approach to ensure AI contributes to inclusive and sustainable educational transformation in India.

Keywords: Artificial Intelligence, Indian Education, Education Policy, NEP 2020, Digital Governance, Ethics and Inclusion, Teacher Preparedness.

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INTRODUCTION

Artificial Intelligence (AI) has become a transformative force reshaping education systems worldwide, affecting pedagogical methods, institutional management, and policy development. AI technologies—including machine learning, natural language processing, learning analytics, and intelligent automation—are increasingly incorporated into educational settings to personalise learning, improve assessment methods, and support data-driven decisions (OECD, 2021). As education systems adapt to the needs of the knowledge economy and rapid technological advancements, AI is seen not just as a technical tool but as a driver for comprehensive educational reform.

In the Indian context, the importance of AI in education is highlighted by the scale, diversity, and complexity of the national education system. Ongoing challenges related to access, equity, quality, and efficiency continue to influence educational outcomes, especially for learners from rural, economically disadvantaged, and marginalised communities. AI-driven educational solutions have the potential to tackle these issues by enabling personalised learning routes, supporting differentiated instruction, boosting teacher effectiveness, and strengthening institutional management through predictive analytics (NITI Aayog, 2018). As a result, AI has become increasingly prominent in national policy discussions as a way to improve both educational quality and inclusivity.

The integration of AI in education, however, signifies a deeper epistemological and pedagogical shift rather than just a technological upgrade. Modern educational thinking has gradually shifted away from content-focused and teacher-led models towards constructivist and learner-centred paradigms that highlight active participation, self-regulation, and contextual learning (Piaget, 1972; Vygotsky, 1978). AI-enabled systems support these viewpoints by enabling adaptive instruction, ongoing formative assessment, and personalised feedback. At the same time, scholars warn that increasing reliance on data and algorithms raises important concerns related to teacher autonomy, human agency, and the very purpose of education (Selwyn, 2019).

India's engagement with educational technology has gradually developed over the past few decades. The National Policy on Education (1986) recognised the role of technology in expanding access and enhancing instructional quality, particularly through distance and open learning. This progression continued through initiatives such as the Programme of Action (1992), ICT@Schools, and Digital India, which established the digital infrastructure needed for advanced technological interventions. The National Education Policy (2020) signifies a clear shift by explicitly highlighting emerging technologies, including AI, machine learning, and data analytics, as essential drivers of educational transformation across school and higher education sectors (Government of India, 2020).

NEP 2020 takes a balanced approach by promoting technological innovation while reaffirming the humanistic values of education. It highlights ethical use of technology, learner well-being, inclusion, and social justice, reflecting global calls for human-centred AI in education (UNESCO, 2021). The policy sees AI as a tool to assist teachers, boost learner engagement, and improve governance, rather than as a replacement for human interaction and professional judgement. This stance aligns with international views that regard AI as augmentative rather than substitutive in educational settings (OECD, 2021).

Despite strong policy intentions, the implementation of AI-driven educational reforms in India faces notable challenges. Uneven digital infrastructure, limited AI literacy among teachers, concerns about data privacy and algorithmic bias, and the ongoing digital divide all hinder equitable adoption (UNESCO, 2021). Without careful engagement and policy that considers context, AI risks reinforcing existing inequalities or reducing education to narrowly measurable outcomes. These issues highlight the need to critically examine both the conceptual basis and the development of AI policies in Indian education.

Against this backdrop, the present paper critically examines the conceptual foundations of AI integration in education and traces the evolution of AI-focused educational policies in India. By analysing key national policy documents and initiatives, the paper aims to evaluate how AI is being positioned as a tool for educational reform and to what extent ethical, inclusive, and human-centred considerations are incorporated within these policy frameworks. In doing so, the study contributes to current academic and policy debates on ensuring that AI acts as an enabler of inclusive, equitable, and sustainable educational transformation.

CONCEPTUAL FOUNDATIONS OF ARTIFICIAL INTELLIGENCE IN EDUCATION

The integration of Artificial Intelligence in education is grounded in well-established educational philosophies and modern learning theories that highlight learner agency, flexibility, and evidence-based practice. Instead of functioning as an independent pedagogical force, AI operates within conceptual frameworks that guide how teaching, learning, and assessment are structured and implemented. Understanding these foundational ideas is crucial for critically evaluating AI's role in educational reform.

From a theoretical perspective, constructivist learning theory offers a strong epistemological foundation for AI-enabled learning environments. Constructivism claims that learners actively develop knowledge through interaction with content, context, and prior experiences (Piaget, 1972). AI-powered adaptive learning systems apply this principle by continuously adjusting instructional content, difficulty levels, and feedback based on individual responses. This personalisation allows learners to progress at their own pace, supporting deeper understanding and mastery.

Socio-cultural theory further reinforces the conceptual basis of AI in education by highlighting the importance of social interaction, mediation, and cultural tools in learning (Vygotsky, 1978). In digital learning environments, AI acts as a mediational tool that supports learning through intelligent prompts, guided feedback, and collaborative platforms. When carefully designed, AI-supported systems can improve peer interaction, facilitate collaborative problem-solving, and extend learning beyond the classroom, aligning with the socio-cultural focus on learning as a socially embedded process.

Pedagogically, AI closely aligns with learner-centred and competency-based education models that prioritise learning outcomes, critical thinking, and real-world application. Learning analytics and predictive modelling enable educators to monitor learner progress, identify learning gaps, and provide timely interventions, thereby strengthening formative assessment practices (OECD, 2021). AI-driven assessment tools also support continuous feedback and reflective learning, moving beyond traditional summative evaluation methods.

At the institutional level, AI helps educational leaders make decisions based on data by enabling them to analyse large datasets about enrolment patterns, learner performance, and resource distribution. Such applications align with systems theory, which sees educational institutions as dynamic systems capable of ongoing improvement through feedback mechanisms (Fullan, 2016). However, reliance on data and algorithms requires careful scrutiny to ensure transparency, accountability, and consistency with educational values.

Despite its alignment with progressive educational theories, AI integration raises significant concerns about human agency and professional autonomy. Scholars warn against techno-deterministic views that see AI as a neutral or objective solution to complex educational issues (Selwyn, 2019). Teaching remains an inherently relational and ethical practice involving judgement, empathy, and contextual understanding—dimensions that cannot be fully emulated by algorithmic systems. Therefore, AI should be viewed as an augmentative tool that supports, rather than replaces, the professional roles of teachers.

In the Indian context, these conceptual considerations are especially important due to the diversity of learners, languages, and socio-cultural environments. AI-driven educational reforms must therefore be based on pedagogical sensitivity and contextual relevance to promote inclusivity and equity. Engaging critically with the foundational concepts of AI in education offers the essential perspective for understanding how policy frameworks transform technological possibilities into meaningful educational practices.

POLICY EVOLUTION OF ARTIFICIAL INTELLIGENCE IN INDIAN EDUCATION

India's engagement with educational technology and, more recently, Artificial Intelligence in education has developed through a gradual and layered policy progression. Rather than appearing in isolation, AI-driven educational reforms are integrated within broader national efforts to expand access, improve quality, and increase efficiency across the education system. An analysis of key policy milestones shows a consistent shift from viewing technology as a supplementary resource to recognising it as a strategic instrument of systemic reform.

The National Policy on Education (1986) was the first comprehensive policy to acknowledge the role of technology in education. It emphasised utilising educational technology to expand access, especially through distance education and mass media, and to enhance instructional quality. Although AI as a concept was not explicitly outlined at that time, the policy established a foundational vision for using technology to address structural inequalities in education (Government of India, 1986). The subsequent Programme of Action (1992) implemented this vision by encouraging technology-based teacher training, curriculum development, and institutional capacity enhancement.

The early 2000s saw a renewed policy emphasis on information and communication technologies (ICT) in education, as reflected in initiatives such as ICT@Schools and the expansion of open and distance learning systems. These efforts aimed to develop digital infrastructure, improve teacher skills, and incorporate technology into classroom practices. Although mainly focused on basic digital literacy and connectivity, these initiatives laid the technological groundwork necessary for more advanced AI-based interventions.

A major policy change took place with the launch of the Digital India programme in 2015, which aimed to turn India into a digitally empowered society and knowledge economy. Digital India

improved broadband connectivity, digital service provision, and institutional digitisation, thereby establishing essential groundwork for data-driven and AI-enabled educational reforms (Government of India, 2015). Education became a key sector within this digital transformation agenda.

The National Education Policy (2020) marks a significant shift in India's approach to incorporating technology into education. NEP 2020 explicitly acknowledges the potential of emerging technologies, including Artificial Intelligence, machine learning, and data analytics, to revolutionise teaching, learning, assessment, and governance (Government of India, 2020). The policy promotes the creation of dedicated institutional frameworks, such as the National Educational Technology Forum (NETF), to support evidence-based decision-making, knowledge sharing, and the ethical application of technology.

This policy envisions AI as a tool to support personalised learning, formative assessment, teacher professional development, and efficient governance, while maintaining a strong focus on equity, inclusion, and human-centred design. By emphasising ethical considerations and social responsibility, NEP 2020 aligns national priorities with global frameworks that promote responsible and inclusive AI in education (UNESCO, 2021).

Complementing NEP 2020, several national initiatives have operationalised the AI vision in education. The National Strategy for Artificial Intelligence, developed by NITI Aayog, identifies education as a priority sector and highlights AI's role in personalised learning and teacher support systems (NITI Aayog, 2018). Similarly, the National Digital Education Architecture (NDEAR) aims to create a federated, interoperable digital ecosystem that enables innovation while ensuring scalability and inclusivity (Ministry of Education, 2021). Programmes such as PM eVIDYA further aim to bridge access gaps by integrating multiple digital learning platforms, particularly for learners from disadvantaged backgrounds (Ministry of Education, 2020).

Despite these progressive policy developments, gaps persist between policy intent and classroom-level implementation. Variations in infrastructure, institutional readiness, and teacher capacity continue to influence the uneven adoption of AI-driven reforms across regions and educational settings. These challenges highlight the need for ongoing policy coherence, capacity development, and continuous assessment to ensure that AI integration results in meaningful and equitable educational outcomes.

NATIONAL INITIATIVES AND DIGITAL GOVERNANCE FRAMEWORKS FOR AI IN EDUCATION

The vision outlined in the National Education Policy (2020) is implemented through various national initiatives and digital governance frameworks that collectively facilitate the integration of Artificial Intelligence in education. These initiatives adopt a systemic approach, where AI is incorporated into broader digital ecosystems designed to improve access, quality, transparency, and innovation within the education sector.

A key initiative in this area is the National Strategy for Artificial Intelligence: #AIforAll, developed by NITI Aayog. The strategy recognises education as a priority sector and emphasises the use of AI to enable personalised learning, improve teacher effectiveness, and enhance administrative efficiency (NITI Aayog, 2018). It highlights the importance of inclusive AI by

promoting solutions that address diverse linguistic, cultural, and socio-economic contexts, thereby aligning technological innovation with social equity.

The National Digital Education Architecture (NDEAR) serves as a fundamental governance framework designed to support AI-enabled educational solutions. NDEAR adopts a federated and interoperable architecture that allows various stakeholders—including government agencies, educational institutions, and private innovators—to develop and deploy digital tools within a shared ecosystem (Ministry of Education, 2021). By enabling secure data exchange and modular system design, NDEAR promotes the integration of AI-driven applications such as learning analytics, adaptive platforms, and decision-support systems, while also addressing concerns related to scalability and data governance.

Another important initiative is PM eVIDYA, which unifies various digital learning platforms to promote equal access to education. The programme combines online, television, radio, and mobile-based learning resources, recognising the digital diversity of Indian learners (Ministry of Education, 2020). While not solely focused on AI, PM eVIDYA provides the infrastructure and data environment needed for the future deployment of AI-driven personalised and adaptive learning tools, especially for learners in underserved regions.

Institutional governance mechanisms have also been enhanced to guide ethical and evidence-based adoption of educational technologies. The creation of the National Educational Technology Forum (NETF), as outlined in NEP 2020, aims to promote research, dialogue, and policy advice on emerging technologies, including AI. NETF is designed as a platform for sharing best practices, assessing technological interventions, and ensuring policy decisions are grounded in empirical evidence rather than technological determinism (Government of India, 2020).

Collectively, these initiatives demonstrate a shift from fragmented digital interventions to a unified governance-driven approach to AI integration in education. By emphasising interoperability, inclusivity, and ethical oversight, India's digital education frameworks aim to balance innovation with accountability. However, the success of these initiatives ultimately relies on coordinated implementation, institutional capacity-building, and ongoing investment in human resources.

The increasing focus on digital governance underscores the importance of embedding AI-driven reforms within a broader framework of educational values and social responsibility. As AI-enabled systems more frequently influence learning pathways and institutional decisions, strong governance mechanisms are vital to ensure transparency, trust, and alignment with the democratic and humanistic aims of education.

ETHICAL, EQUITY, AND INCLUSION DIMENSIONS OF AI IN EDUCATION

The growing integration of Artificial Intelligence in education has heightened ethical debates about data governance, fairness, transparency, and human agency. While AI-driven systems provide substantial potential to improve efficiency and personalise learning, they also raise concerns about how data and algorithms influence educational experiences and outcomes. Addressing these ethical, equity, and inclusion issues is therefore vital to ensuring that AI-driven educational reforms align with the core values of education.

One of the main ethical concerns involves data privacy and protection. AI-supported educational systems depend heavily on large amounts of learner data to create personalised recommendations and predictive insights. Without strong data governance frameworks, such data practices could put learners at risk of surveillance, misuse, or unauthorised access (UNESCO, 2021). In the Indian context, where regulations for educational data governance are still developing, protecting learner autonomy and informed consent is especially important.

Algorithmic bias poses another key ethical issue. AI systems are shaped by the data they are trained on, and if these datasets mirror existing social, cultural, or economic inequalities, the algorithms may reproduce or even worsen these biases (OECD, 2021). In education, biased algorithms can affect assessment results, learning suggestions, and access to opportunities, thus threatening fairness and social justice. This issue is especially important in a diverse society like India, characterised by wide differences in language, region, gender, and socio-economic background.

Equity and inclusion are fundamental to AI-driven educational reform. Although AI has the potential to assist learners with diverse needs through adaptive interfaces and assistive technologies, its advantages remain unevenly distributed due to ongoing digital divides. Limited access to devices, connectivity, and digital literacy continues to exclude learners from rural and marginalised communities, raising concerns about the fair reach of AI-powered interventions (Government of India, 2020). Without intentional policy and design measures, AI risks perpetuating existing educational inequalities instead of narrowing them.

Human agency and teachers' professional autonomy are also vital ethical considerations. Excessive reliance on automated systems for assessment, monitoring, or decision-making may marginalise the role of teachers and reduce complex pedagogical judgements to algorithmic outputs. Scholars argue that education is fundamentally a relational and moral practice that requires empathy, contextual understanding, and ethical reasoning—dimensions that cannot be fully replicated by AI systems (Selwyn, 2019). Therefore, maintaining meaningful human oversight is essential for safeguarding the integrity of educational practice.

Recognising these challenges, NEP 2020 advocates for a human-centric and ethically grounded approach to the use of educational technologies. The policy emphasises inclusion, accessibility, and responsible data utilisation, aligning national priorities with international frameworks that uphold rights-based and value-driven AI governance (Government of India, 2020; UNESCO, 2021). Incorporating ethical reasoning, transparency, and accountability within AI systems is therefore essential for sustainable educational reform.

In summary, ethical, equity, and inclusion issues must be incorporated into the design, implementation, and evaluation of AI-driven educational reforms. A critical and reflective approach is essential to ensure that AI acts as an enabler of social justice and holistic development, rather than as a tool that exacerbates existing inequalities. These considerations offer an important perspective for addressing the practical challenges of applying AI across diverse educational settings.

IMPLEMENTATION CHALLENGES AND TEACHER PREPAREDNESS

Despite a supportive policy environment and expanding digital infrastructure, the effective implementation of Artificial Intelligence-driven reforms in Indian education remains uneven and

intricate. Turning policy goals into practice at the classroom level demands not only technological readiness but also institutional capacity, professional skills, and cultural acceptance. Several interconnected challenges continue to influence the pace and quality of AI adoption in education.

One of the most significant challenges is the variation in digital infrastructure across regions and institutions. While urban and well-resourced institutions are increasingly able to implement AI-enabled platforms, many rural and marginalised areas continue to face challenges related to connectivity, device access, and technical support. These infrastructural inequalities directly influence the scalability and inclusivity of AI-driven interventions, heightening concerns about unequal educational opportunities (Government of India, 2020; UNESCO, 2021).

Teacher preparedness is a crucial factor in successful AI adoption. Teachers play a key role in mediating the pedagogical use of AI tools, yet many lack sufficient exposure to AI literacy, data-informed pedagogy, and ethical use of technology. Existing professional development programmes often emphasise basic digital skills rather than enhancing teachers' ability to critically assess, adapt, and integrate AI tools into meaningful teaching practices (OECD, 2021). Without ongoing, context-specific capacity building, AI may be perceived as an externally imposed solution rather than a valuable pedagogical resource.

Institutional readiness also presents a challenge. Integrating AI demands organisational structures that foster innovation, experimentation, and ongoing assessment. Many educational institutions lack dedicated support systems for digital transformation, including technical expertise, data governance frameworks, and ethical oversight. Without clear institutional strategies, AI initiatives may remain fragmented or underutilised.

Another challenge concerns the risk of over-automation in educational decision-making. AI-driven assessment and monitoring systems, while efficient, may prioritise quantifiable outcomes over holistic learning processes. Scholars warn that excessive reliance on algorithmic outputs can narrow pedagogical focus and reduce teachers' professional judgement (Selwyn, 2019). It is therefore essential to ensure that AI serves as a decision-support tool rather than a decision-maker.

Furthermore, resistance to change and concerns about job displacement can influence teachers' attitudes towards AI adoption. Addressing these concerns requires transparent communication, participatory policy implementation, and reassurance that AI is intended to enhance, not replace, human roles in education. NEP 2020 implicitly recognises this need by emphasising teacher empowerment and ongoing professional development as central to educational reform (Government of India, 2020).

Overall, implementing AI-driven educational reforms requires a comprehensive approach that combines infrastructure development, teacher capacity building, institutional leadership, and ethical governance. Enhancing teacher preparedness and institutional readiness is vital to ensure that AI makes a meaningful contribution to pedagogical improvement and educational equity, rather than remaining a mere symbolic policy goal.

RECOMMENDATIONS AND WAY FORWARD

The effective integration of Artificial Intelligence in education requires a strategic, ethical, and context-aware approach that aligns technological innovation with the fundamental values of

equity, inclusion, and human development. Based on the conceptual analysis and policy review presented in this paper, several key recommendations arise to guide the sustainable implementation of AI-driven educational reforms in India.

A fundamental goal is the systematic incorporation of AI literacy and ethics into teacher training and professional development programmes. Both pre-service and in-service teacher education must advance beyond basic digital skills to include an understanding of AI principles, data-driven pedagogy, algorithmic bias, and ethical decision-making. Empowering teachers to critically engage with AI tools will enhance their professional autonomy and ensure that technology supports pedagogical aims rather than controlling them (OECD, 2021; Selwyn, 2019).

Enhancing data governance and regulatory frameworks is equally vital. Clear guidelines on data privacy, informed consent, transparency, and accountability must be embedded within educational systems. Aligning national data governance practices with international human-centred AI frameworks can foster trust among stakeholders and safeguard learners' rights (UNESCO, 2021). Strong governance mechanisms are especially important in a data-intensive educational environment where AI-driven decisions increasingly shape learning paths and institutional outcomes.

Inclusive and context-responsive design should be the foundation of AI-enabled educational solutions. AI tools need to be created to support linguistic diversity, cultural contexts, and the needs of learners with disabilities. Filling infrastructural gaps through targeted investment in connectivity and digital resources is vital to ensure AI-driven reforms do not worsen existing inequalities. Such measures conform closely to the equity-focused vision outlined in NEP 2020 (Government of India, 2020).

At the institutional level, adopting blended governance models that combine technological efficiency with human oversight can help maintain the relational and ethical aspects of education. AI systems should serve as decision-support tools that inform, rather than replace, professional judgement. Promoting participatory implementation involving teachers, administrators, and learners can further improve acceptance and effectiveness of AI initiatives.

Finally, ongoing research and evaluation are essential to understand the long-term pedagogical, social, and ethical effects of AI in education. Interdisciplinary research initiatives and pilot studies can provide evidence on best practices, contextual challenges, and unintended consequences. Institutions such as the National Educational Technology Forum can play a key role in fostering dialogue, knowledge exchange, and policy refinement based on empirical insights (Government of India, 2020).

Moving forward, India's AI-driven educational reforms must stay grounded in humanistic and democratic values. A balanced approach that combines innovation with ethical responsibility, teacher empowerment, and social inclusion will be vital to ensure that Artificial Intelligence contributes meaningfully to inclusive and sustainable educational transformation.

CONCLUSION

Artificial Intelligence-driven educational reforms offer a significant opportunity to reimagine teaching, learning, and governance within the Indian education system. As this paper has shown, the integration of AI in education is rooted in progressive pedagogical theories and backed by an

evolving policy framework that increasingly recognises technology as a catalyst for systemic change. From early policy initiatives with educational technology to the comprehensive vision outlined in the National Education Policy 2020, India's policy journey reflects a growing commitment to using AI to improve access, quality, and efficiency in education.

However, the transformative potential of AI cannot be realised through technological adoption alone. The analysis emphasises that ethical considerations, equity, and human agency must remain central to AI-driven reforms. Challenges related to data privacy, algorithmic bias, digital divides, and teacher preparedness highlight the need for cautious and reflective implementation. Without deliberate safeguards and inclusive design, AI risks reinforcing existing inequalities and reducing the broader educational purpose to measurable outcomes.

The study highlights the vital role of teachers and institutions in shaping the impact of AI on educational practices. Teacher preparedness, professional autonomy, and institutional readiness are key factors determining whether AI acts as an empowering pedagogical tool or as a technocratic intervention. Policies such as NEP 2020, along with national initiatives like NDEAR and PM eVIDYA, establish a solid foundation, but their success relies on coherent implementation, ongoing capacity building, and continuous evaluation.

In conclusion, AI should be seen as an empowering force that enhances human abilities rather than replacing them. A balanced, ethically grounded, and contextually sensitive approach is vital to ensure that AI-driven educational reforms support inclusive, equitable, and sustainable educational progress in India. By aligning technological innovation with humanistic values and social responsibility, India can utilise the potential of Artificial Intelligence to strengthen its education system and advance its wider developmental objectives.

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Chapter Seventeen

EMBEDDING MENTAL HEALTH SUPPORT IN EDUCATION: ADVANCING STUDENT WELL-BEING IN THE LIGHT OF NEP 2020

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ABSTRACT

The National Education Policy (NEP) 2020 envisions an inclusive, learner-centred, and holistic framework for education in India, where students' well-being is central to their overall development. In this context, mental health support becomes a vital pillar for achieving the policy's transformative goals. Rising levels of stress, anxiety, and depression among students highlight the urgent need for systemic interventions that extend beyond academics to foster emotional resilience and psychological well-being. This paper examines how mental health support can be integrated into the educational ecosystem envisioned by NEP 2020. It explores proactive strategies—such as institutional counselling frameworks, teacher training, digital mental health tools, and peer-support systems—that can create supportive and inclusive learning environments. The study also emphasises the importance of interdisciplinary approaches, ethical practices, and skill-based learning in developing resilient learners prepared for future challenges. Drawing on case studies, institutional practices, and emerging research, the paper presents innovative initiatives across India that align with the vision of holistic education outlined in NEP 2020. It advocates for evidence-based policies, collaborative partnerships, and the adoption of global best practices to bridge the gap between policy and practice. Ultimately, the paper asserts that embedding mental health support within educational frameworks is crucial not only for academic success but also for nurturing emotionally balanced, socially responsible, and future-ready citizens.

Keywords: *Student well-being, Mental health in education, NEP 2020, Inclusive learning, Holistic development.*

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INTRODUCTION

Mental health problems among students, such as stress, anxiety, depression, and burnout, have become more prevalent in recent years. The rapid pace of academic competition, digital changes in learning, and societal pressures have heightened these concerns. Research consistently demonstrates that untreated mental health issues harm not only academic achievement but also personal growth, social engagement, and future employment prospects. Therefore, incorporating mental health support into educational institutions is both a moral obligation and a strategic necessity.

NEP 2020 provides a timely and future-oriented framework to address this requirement. By emphasising holistic education, the policy envisions schools and higher education institutions as environments that promote resilience, empathy, creativity, and emotional well-being alongside cognitive skills. It also underlines the importance of multidisciplinary approaches, skill-based learning, and value-driven education—each of which ties into the broader discussion on student mental health.

This paper situates mental health support within the implementation framework of NEP 2020. It explores how proactive institutional policies, teacher training, digital interventions, and community participation can collectively create safe, inclusive, and empowering learning environments. Furthermore, it showcases innovative practices and case studies from India and beyond, demonstrating how integrating mental health strategies into education can help realise NEP 2020's vision of a learner-centred and future-ready system.

OBJECTIVES OF THE STUDY

To review existing research and policy documents related to student mental health and well-being in the Indian educational context.

1. To analyse the alignment of mental health support initiatives with the vision and recommendations of the National Education Policy (NEP) 2020.
2. To identify innovative practices and models—both institutional and community-based—that have demonstrated effectiveness in supporting student well-being.
3. To highlight barriers and challenges (e.g., stigma, lack of awareness, infrastructure gaps, teacher preparedness) that hinder the integration of mental health initiatives in schools and higher education institutions.
4. To propose evidence-based recommendations for embedding mental health support into educational frameworks, thereby fostering inclusive, holistic, and learner-centred environments in line with NEP 2020.

REVIEW OF LITERATURE

Mental Health Challenges and Prevalence

Student mental health issues such as anxiety, depression, stress, and suicidal ideation are increasingly recognised as crucial concerns in Indian education. A systematic review of 31 studies

involving children and adolescents reported a high prevalence of psychological distress, behavioural problems, and internet addiction, emphasising the need for urgent school-based screening and interventions (Singh et al., 2022). Similarly, Deb and Deb (2025) found that school students encounter multiple adversities, including academic pressure, family neglect, and social discrimination, and highlighted that supportive family relationships can significantly buffer against mental health risks.

These findings indicate that untreated mental health issues negatively impact not only academic outcomes but also overall development, a concern directly addressed by the holistic vision of the National Education Policy (NEP) 2020.

Policy Framework and Alignment with NEP 2020

NEP 2020 emphasises learner well-being, stress-free education, and holistic development, encouraging psychosocial support, teacher preparedness, and the inclusion of counselling services (Government of India, 2020). In response, initiatives such as NCERT's Manodarpan survey provided the first national-level insights into student well-being, highlighting self-image, academic perception, and coping strategies as key areas of concern (Ministry of Education, 2022).

At the state level, Andhra Pradesh excelled in deploying trained career and mental health counsellors in government schools under the Samagra Shiksha Abhiyan, offering support to students, teachers, and parents (India Today, 2025). Additionally, mapping studies such as the *SIMHA Government School Mental Health Initiatives Landscape Report* documented multi-tiered and interdepartmental models, emphasising the importance of policy integration and referral mechanisms (Sattva, 2024).

Innovative Practices and Emerging Models

Recent studies highlight various interventions aligned with NEP 2020's vision of inclusivity and holistic support. A scoping review by Sharma et al. (2022) found that adolescent-focused mental health interventions in India range from school-based psychosocial programmes to digital platforms and peer-support networks, many of which show positive outcomes, although often only at a pilot stage.

Technology-driven tools are emerging as important supports. Sehgal et al. (2025) highlighted adolescent preferences for culturally sensitive, private, and text-based chatbot interventions, suggesting digital mental health tools can reduce stigma while improving accessibility. Teacher-centred interventions are also gaining popularity. The "Saharaline" initiative, a WhatsApp-based peer-support network for low-income school teachers, showed potential to strengthen teacher resilience and indirectly support student well-being (Sivakumar et al., 2024).

Barriers and Challenges

Despite policy progress, implementation problems persist. The shortage of qualified counsellors, especially in rural and under-funded schools, remains a major obstacle (Raman & Thomas, 2023). Stigma around mental health continues to deter students and families from seeking support (Deb & Deb, 2025). Additionally, interventions often overlook India's cultural and linguistic diversity, which limits their reach and effectiveness (Raman & Thomas, 2023). Gaps in coordination

between education, health, and community sectors also hinder referral and follow-up services (Sattva, 2024).

Recommendations from Literature

Across the reviewed studies, several recommendations consistently emerge:

- Establishing school-based family counselling to strengthen protective home–school linkages (Deb & Deb, 2025).
- Embedding mental health literacy in teacher training to improve early identification and referral (Singh et al., 2022).
- Designing digital tools that are contextually relevant and integrated into the school ecosystem (Sehgal et al., 2025).
- Developing multi-tiered approaches combining promotion, prevention, and referral mechanisms (Sharma et al., 2022).
- Institutionalising policies that mandate dedicated counsellors, monitoring systems, and collaborative stakeholder engagement (Raman & Thomas, 2023).

Together, these insights underscore the need for a systemic, holistic, and inclusive approach that is fully aligned with NEP 2020’s transformative vision for education.

RESEARCH DESIGN AND METHODOLOGY

This study employs a systematic literature-based approach to examine strategies for enhancing student mental health and well-being within the framework of NEP 2020. By synthesising evidence from previous empirical studies, policy documents, and institutional case reports, the paper aims to identify best practices, gaps, and practical recommendations for educational institutions.

SOURCE SELECTION

Relevant literature was gathered from peer-reviewed journals, government reports, policy documents, and reputable online resources published over the last decade, with an emphasis on studies conducted in India or similar educational contexts. Key sources include:

- National Education Policy (NEP) 2020 documents and associated implementation guidelines.
- Reports from the Ministry of Education, CBSE, NCERT, and other national bodies.
- Empirical studies on student mental health, counselling, digital interventions, and teacher well-being.

- Case studies and pilot projects demonstrating institutional practices for student mental health support.

ANALYTICAL APPROACH

The collected literature was thematically analysed to identify recurring patterns, challenges, and interventions relevant to student mental health and well-being. The analysis focused on:

1. **Institutional Strategies** – Approaches adopted by schools, colleges, and teacher education institutions to support mental health.
2. **Policy Integration** – Alignment of practices with NEP 2020's principles of holistic, inclusive, and learner-centred education.
3. **Innovative Interventions** – Emerging tools, digital platforms, and peer-support initiatives.
4. **Barriers and Opportunities** – Gaps in implementation, resource constraints, and contextual challenges.

This approach allows the paper to produce evidence-based insights and practical recommendations without primary data collection, offering a comprehensive overview of the current state of student mental health support in India.

FINDINGS AND DISCUSSION

The reviewed literature emphasises key patterns in student mental health support in India, as well as opportunities and challenges in aligning these efforts with the NEP 2020. The findings are summarised below into four thematic areas.

1. Rising Mental Health Concerns among Students

Evidence consistently shows that mental health challenges among children and adolescents are increasing, manifesting as anxiety, depression, stress, and behavioural difficulties (Singh et al., 2022; Deb & Deb, 2025). Academic pressure, societal expectations, and inadequate coping mechanisms exacerbate these issues. These findings align with NEP 2020's recognition of the need for a stress-free and supportive educational environment (Government of India, 2020). Without systemic interventions, untreated mental health problems threaten not only students' academic progress but also their overall well-being and long-term social and emotional development.

2. Policy Momentum and Institutional Initiatives

The policy environment in India is becoming increasingly supportive of student well-being. NEP 2020 places holistic development and well-being at the centre of its vision, emphasising counselling and mentorship as essential to education (Government of India, 2020). Initiatives like *Manodarpan* by NCERT have already begun assessing mental health needs across the country (Ministry of Education, 2022). At the state level, Andhra Pradesh's approach to integrating trained counsellors into schools demonstrates scalable best practices (India Today, 2025).

However, as Raman and Thomas (2023) note, effective implementation requires not only policy vision but also sustainable infrastructure, financial backing, and trained human resources. The

current disparity between policy ambitions and real-world conditions emphasises the urgency of closing this gap.

3. Emerging Models: Digital Tools and Peer Networks

Innovations in digital technology and community-driven support have considerable potential to achieve the objectives of NEP 2020. Research highlights that digital platforms such as chatbots, mobile apps, and online counselling can enhance access, reduce stigma, and provide context-sensitive support for adolescents (Sehgal et al., 2025). Teacher-centred peer-support initiatives, like *Saharaline*, show that improving teachers' well-being directly benefits student outcomes (Sivakumar et al., 2024).

These methods are particularly vital in India’s diverse and resource-constrained environments, where traditional face-to-face counselling may not be feasible in all schools. By integrating digital innovations into the NEP framework, India can leverage technology to broaden mental health support in an inclusive and equitable manner.

4. Barriers and Challenges in Implementation

Despite encouraging trends, challenges remain. Stigma surrounding mental health continues to discourage families and students from openly seeking support (Deb & Deb, 2025). Infrastructure and human resource constraints, particularly in rural and government schools, create barriers to access (Raman & Thomas, 2023). Furthermore, interventions often lack cultural sensitivity, failing to recognise the socio-linguistic diversity of India (Sharma et al., 2022).

These barriers emphasise the importance of **multi-layered strategies** that combine universal wellbeing promotion, targeted prevention for vulnerable groups, and referral systems for specialised care (Sattva, 2024).

IMPLICATIONS FOR NEP 2020 IMPLEMENTATION

Taken together, the findings show that although India has made notable progress in recognising and addressing student mental health, systemic integration within education is still developing. NEP 2020 offers a forward-looking policy directive that aligns with global best practices of inclusive and holistic education. To achieve this vision, India must:

Objective	Findings from Literature	Gaps Identified
1. Review existing research and policy related to student mental health	Several systematic reviews and surveys document prevalence, types of challenges, and policy initiatives like Manodarpan and state programs (Singh et al., 2022; Ministry of Education, 2022)	Lack of longitudinal studies tracking mental health trends; uneven representation across rural/urban and socio-economic contexts
2. Analyse alignment of mental health initiatives with NEP 2020	Policy initiatives reflect NEP’s focus on holistic development, counselling, and teacher capacity	Many programs remain pilot-level, limited evaluation of actual implementation and outcomes; inadequate

	building (Government of India, 2020; India Today, 2025)	integration into institutional policy
3. Identify innovative practices and models supporting student well-being	Digital tools, school-based counselling, peer-support networks, and teacher-centered interventions show promise (Sehgal et al., 2025; Sharma et al., 2022; Sivakumar et al., 2024)	Limited large-scale or rigorously evaluated interventions; challenges with scalability, sustainability, and contextual adaptation
4. Highlight barriers to implementing mental health initiatives	Common barriers include stigma, lack of trained personnel, inadequate infrastructure, and cultural/linguistic mismatches (Raman & Thomas, 2023; Deb & Deb, 2025)	Limited research on context-specific adaptations for tribal, remote, or minority populations; weak coordination between education, health, and community stakeholders
5. Propose evidence-based recommendations for embedding mental health support	Literature suggests multi-tiered interventions, teacher training, family counselling, digital integration, and policy mechanisms (Sattva, 2024; Deb & Deb, 2025)	Few studies provide detailed roadmaps for policy-to-practice translation or evaluation of long-term impact; insufficient monitoring and scaling strategies

- Institutionalise mandatory counselling and well-being frameworks in all schools.
- Embed mental health literacy in teacher training curricula.
- Encourage collaboration between health, education, and community sectors.
- Scale digital and community-led initiatives to reach underserved populations.

By addressing these aspects, mental health support can become a central part of India's education system, ensuring that the NEP 2020 vision of holistic, equitable, and learner-centred education is realised. The summary of gaps related to study objectives is presented in Table 1.

Table 1: Summary of Gaps with Respect to Study Objectives

CONCLUSION

This review highlights the vital need to incorporate mental health support into India's education system to promote student well-being and comprehensive development. The literature clearly shows that mental health issues among children and adolescents are increasing, driven by academic pressure, societal expectations, and limited access to support (Singh et al., 2022; Deb & Deb, 2025). While programmes such as *Manodarpan* and state-level models demonstrate notable policy momentum, shortages in trained personnel, infrastructure, and cultural sensitivity still hinder progress (Raman & Thomas, 2023).

The National Education Policy (NEP) 2020 offers a transformative framework for tackling these challenges by placing well-being, inclusivity, and learner-centred education at the core of educational reform (Government of India, 2020). Integrating mental health initiatives with this policy vision provides a pathway not only to improve academic results but also to enable students to thrive emotionally, socially, and ethically in an increasingly complex world.

RECOMMENDATIONS

Drawing from the reviewed literature, the following recommendations can assist policymakers, educators, and practitioners in effectively integrating mental health support into India's education system.

1. Institutionalise School-Based Counselling

- Every school, as envisioned by NEP 2020, should have access to trained counsellors and psychologists.
- School-based family counselling models can strengthen protective home–school linkages (Deb & Deb, 2025).

2. Strengthen Teacher Preparedness

- Teacher education curricula must embed mental health literacy and early identification skills.
- Peer-support interventions, such as *Saharaline*, can build resilience among teachers and indirectly benefit students (Sivakumar et al., 2024).

3. Leverage Digital and Technology-Enabled Interventions

- Context-sensitive digital tools, including chatbots and online counselling, should be integrated into school systems to extend access and reduce stigma (Sehgal et al., 2025).
- Hybrid models that combine in-person and digital support can promote inclusivity across diverse educational contexts.

4. Adopt Multi-Tiered and Collaborative Models

- Schools must integrate preventive, promotive, and referral-based interventions to address varying levels of student need (Sattva, 2024).
- Collaboration among education, health, and community stakeholders is essential to develop sustainable, comprehensive support systems.

5. Policy and Monitoring Mechanisms

- Clear guidelines, funding allocations, and accountability mechanisms should ensure that mental health support is not treated as peripheral but as **core to educational reform**.
- Regular monitoring and evaluation can help scale successful practices and identify gaps.

By incorporating these strategies, India can advance towards the NEP 2020 vision of a comprehensive, inclusive, and learner-focused education system, where student well-being is prioritised alongside academic achievement. Mental health support, when systematically embedded into policy and practice, will not only safeguard students' emotional and social growth but also help in developing a resilient, empathetic, and future-ready generation.

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Chapter Eighteen

FOSTERING DIGITAL ETHICS THROUGH ORWELL'S 1984: A QUALITATIVE STUDY IN ETHICAL LITERARY CRITICISM AND DIGITAL CITIZENSHIP

Palvi Mangotra and Himanshi Vashishat

ABSTRACT

The integration of ethical and critical thinking skills in educational curricula is central to the National Education Policy (NEP) 2020, which aims to develop learners who are digitally skilled yet ethically aware. To this end, the present qualitative research examines the educational potential of George Orwell's 1984 to foster digital ethics and civic digital responsibility among students. Drawing on Nie Zhenzhao's Ethical Literary Criticism framework, along with insights from Martha Nussbaum's theory of moral imagination and Foucault's ideas on surveillance and power, the paper explores how Orwell's dystopian novel highlights the ethical issues surrounding data manipulation, surveillance, and the loss of autonomy—topics especially relevant in the current era of AI. Through textual analysis and interpretive research, the study demonstrates how reading 1984 can help students critically engage with questions of truth, privacy, and liberty in a digital context. Furthermore, it proposes pedagogical strategies for integrating literary analysis into discussions on technology ethics and civic responsibility. By arguing that literature, when used as an ethical-critical tool, serves as a transformative agent in preparing digitally responsible, empathetic, and ethically conscious citizens—objectives aligned with NEP's holistic and value-driven vision—NEP 2020 finds much of its purpose.

Keywords: *Ethical Literary Criticism, Digital Citizenship, NEP 2020, Orwell's 1984, Digital Ethics, Moral Imagination.*

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INTRODUCTION

The National Education Policy (NEP) 2020 outlines an ambitious vision for education in India, aiming to create a learner-centred, holistic, and ethics-focused learning environment. Its core principles highlight the importance of nurturing humanity, empathy, and constitutional values across all subjects, encouraging a shift from rote memorisation to conceptual understanding and critical thinking. NEP 2020 emphasises the vital role of digital technology in education, promoting equitable access, digital literacy, and the responsible, ethical use of AI-based tools in classrooms. In an era dominated by AI, social media, and surveillance capitalism, societies face rising datafication and algorithmic control, raising new ethical concerns around privacy, misinformation, and ongoing power imbalances. There is an urgent need to develop digital ethics and strong digital citizenship—precisely the skills and sensitivities NEP 2020 aims to foster—underscoring the importance of value-driven educational models in the digital age. Literature is regarded as a crucial resource for ethical reflection, as theorised by scholars like Martha Nussbaum and Nie Zhenzhao. Nussbaum describes literature as ‘moral imagination,’ providing vicarious experiences that help readers develop empathy, ethical reasoning, and social awareness. At the same time, Nie Zhenzhao’s concept of Ethical Literary Criticism is based on the belief that every literary work is ultimately a narrative of ethical experience. Ethical Literary Criticism explores the narrative of literature, human nature’s challenges, decision-making, and ethical consciousness.

Among literary works, George Orwell’s novel *1984* stands unmatched for its foresight in analysing surveillance, propaganda, misinformation, and the profound loss of moral autonomy. The dystopian novel, depicting totalitarian surveillance and control, reflects the issues one will encounter in a digital society. Ultimately, *1984* provides a compelling model for ethical inquiry and discussion.

REVIEW OF RELATED LITERATURE

Research on *1984* consistently presents the novel as a profound moral and political critique—examining themes of oppression, government control, and the manipulation of truth. Scholarship emphasises Orwell’s skill in dramatising the impacts of totalitarian regimes, media manipulation, and alienation, with particular importance for studies on deliberative democracy and personal liberty.

Ethical Literary Criticism, as outlined by Nie Zhenzhao (2010; 2014), views literature as a record of moral experience—an arena where readers confront ethical dilemmas, question choices, and develop ethical awareness. Its application in educational contexts enables students to go beyond mere understanding of texts to engaging more deeply with ethical issues and discernment.

Digital citizenship, as defined by the NEP framework, involves responsible, informed, and critically aware engagement in online communities and digital environments. Initiatives by UNESCO and theorists like Mike Ribble have highlighted the importance of digital literacy, cyber safety, and ethical online conduct. Modern research indicates that digital citizenship should be not only technical but also ethical—encompassing informed decision-making, empathy and respect for privacy and identity.

Despite the recognised potential of literature and Ethical Literary Criticism, a notable research gap persists. Few studies explicitly utilise literary texts such as *1984* as pedagogical tools for

digital ethics education within formal curricula. The intersection of humanities-oriented moral inquiry and technology education remains under-theorised and seldom implemented in classrooms—underscoring the urgent need for interdisciplinary pedagogies.

THEORETICAL ANCHORS

Three complementary frameworks ground the present study:

- Ethical Literary Criticism (Nie Zhenzhao): Concentrates on human nature, ethical awareness, and the dilemmas involved in decision-making, using literature as a means for ethical reflection and growth.
- Martha Nussbaum's Moral Imagination advocates for literature's ability to foster empathy, ethical awareness, and imagination essential for moral development and social comprehension.
- Foucault's Surveillance and Power: Presents powerful ideas of panopticons, normalisation, and disciplinary power—usual control methods that foreshadow today's widespread data surveillance, algorithmic monitoring, and loss of autonomy.

OBJECTIVES AND RESEARCH QUESTIONS

Objectives:

- To analyse Orwell's *1984*, utilising Ethical Literary Criticism to delineate its ethical motifs pertinent to digital citizenship.
- To explore how the representation of surveillance and truth manipulation in *1984* illuminates dilemmas of AI, media, and autonomy in the digital age.
- To propose a pedagogy integrating literary interpretation with digital ethics education, advancing holistic development in learners.

Research Questions:

1. How do Orwell's *1984* ethically engage readers with the consequences of technological control, manipulation, and surveillance?
2. In what ways can Ethical Literary Criticism facilitate students' understanding of digital ethics and civic responsibility?
3. How can literature-based pedagogy promote NEP 2020's goal of cultivating ethically aware, critically reflective, and responsible digital citizens?

RESEARCH METHODOLOGY

Research Design

This study adopts a qualitative interpretive approach, focusing on textual analysis of literary and theoretical sources. The methodology emphasises conceptual clarity, ethical reflection, and analytical depth rather than empirical quantification, in line with the nature of ethical literary criticism and humanities inquiry.

Data Source

- Primary Text: George Orwell, *1984*

- Secondary Sources: Peer-reviewed articles on digital ethics, NEP 2020 policy documentation, theoretical essays by Nie Zhenzhao, Martha Nussbaum, Michel Foucault, scholarship on digital citizenship, and pedagogy sources.

Analytical Framework

The analysis employs Ethical Literary Criticism to explore ethical conflicts and moral reasoning within *1984*. Major motifs—Big Brother, Newspeak, Thought Police, Memory Hole—are seen as allegories for digital-age issues of control, surveillance, and information distortion.

Through the lens of moral imagination and power discourse, the study connects the novel's themes with contemporary practices of digital citizenship, privacy, and ethical responsibility in technological settings.

Relevance to NEP 2020

Interpretive findings are linked to pedagogical implications, showing how literature can develop ethical awareness, critical thinking, and empathy—key outcomes in NEP 2020's humanistic vision for 21st-century education.

RESULTS / DISCUSSIONS

4.1 Ethical Themes in *1984*

1984 dramatises three central themes—truth and falsehood, surveillance and privacy, freedom and autonomy—each directly relevant to ethical challenges in the digital era:

- Truth and Falsehood: The regime's manipulation of historical records and language (e.g., Newspeak, Memory Hole) reflects real-world dangers of misinformation, digital propaganda, and algorithmic distortion. In an age of social media and AI content generation, the boundaries between fact and fiction become increasingly blurred, raising unsettling ethical questions for public discourse.
- Surveillance and Privacy: "Big Brother," the ever-present eye of the state, foreshadows modern algorithmic oversight—facial recognition, location tracking, personalised ads—that threaten individual privacy and autonomy. The moral cost of constant monitoring is a central concern in digital citizenship and ethics debates.
- Freedom and Autonomy: The novel examines the balance between safety and convenience versus the loss of moral agency. Winston and Julia's fight for integrity amid psychological control and systemic surveillance reflects modern ethical debates about consent, autonomy, and algorithmic influence.

4.2 Ethical Literary Criticism in Action

- Winston Smith's Moral Conflict: Winston's resistance to the distortion of truth, efforts to maintain authentic memory, and desire for freedom from key ethical dilemmas. His gradual transformation demonstrates the mental and emotional effects of living under constant surveillance, emphasising the importance of choice, personal integrity, and ethical awareness.

- Julia's defiance and betrayal: Julia's pragmatic rebellion and eventual surrender highlight the tension between survival and moral integrity, relevant for students reflecting on ethical compromise in digital environments.
- O'Brien and Power: The manipulation exercised by O'Brien and the state highlights the ethics of leadership, authority, and the risks of centralised control over data and information—mirroring dilemmas of power in the online world.

4.3 Parallels to the Digital Age

- Telescreens and Smart Devices: The omnipresent telescreens in *1984* eerily resemble today's smart devices and IoT networks, with their abilities for surveillance and data collection.
- Newspeak and Online Discourse: The impoverishment of language caused by Newspeak mirrors the decline of moral discussion on algorithm-driven social media, where brevity and outrage often replace thoughtful debate and empathy.
- Algorithmic Culture and Moral Blindness: The “ethical numbness” caused by algorithmic filtering and behavioural prediction encourages disengagement from critical reflection and civic responsibility—a pattern examined through both literary analysis and digital ethics research.

4.4 Literature as Pedagogical Tool

Teaching *1984* enables a multifaceted approach to digital ethics:

- Develop critical digital literacy by questioning sources, information flows, and the construction of technological realities.
- Fostering empathy and moral reasoning through sustained character analysis and exploration of ethical dilemmas.
- Encourage ethical reflection on online behaviour, privacy, and data sharing by connecting literary themes to students' digital experiences.
- Incorporated discussion-based and reflective writing pedagogies—seminars, debates, journaling—that support dialogic, student-centred learning aligned with NEP 2020's goals.

CONCLUSION

Summary of Findings

1984 functions as an ethical allegory—highlighting the fragile boundaries of truth, autonomy, and freedom within environments shaped by surveillance, manipulation, and power. Ethical Literary Criticism offers a strong framework to interpret these themes, positioning literature as a catalyst for ethical judgment and reflective awareness among students.

Pedagogical Implications

English and humanities classrooms, when reimagined as ‘ethical laboratories’, become spaces for examining digital dilemmas and fostering responsible digital citizens. Combining literature,

technology, and ethics promotes holistic growth, equipping students with the reflective skills NEP 2020 envisions for India's future generations.

Suggestions for Future Research

Future research should:

- Apply ethical literary criticism to other digital-age literary texts, including Indian writing in English and postcolonial analyses.
- Conduct comparative research on how literature influences moral reasoning and digital citizenship in different cultures and educational settings.
- Explore interdisciplinary approaches that combine technology, the humanities, and ethics for holistic citizenship education.

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Chapter Nineteen

AI FOR INCLUSION: THEORETICAL PERSPECTIVES ON TECHNOLOGY-ENABLED SUPPORTIVE CLASSROOMS

Raj Pawan and Anuradha Thakur

ABSTRACT

This theoretical paper develops a comprehensive framework explaining how Artificial Intelligence (AI) can contribute to inclusive and positive learning environments. Integrating perspectives from Universal Design for Learning (UDL), social constructivism, adaptive learning theory, critical disability studies, and ethical AI governance, the framework identifies five mechanisms through which AI supports inclusion: multimodal accessibility, adaptive learning pathways, cognitive scaffolding, socio-emotional affordances, and data-driven inclusivity. The synthesis is based on a structured review of theoretical and empirical literature from 2010–2025, cross-checked against policy and case reports. AI is conceptualised not as a replacement for human educators but as a pedagogical amplifier that can expand opportunities for personalised and equitable learning when guided by clear ethical principles. The paper proposes measurable indicators for inclusive AI design, emphasises teacher agency and data rights, and presents vignettes illustrating practical implications. Potential risks—algorithmic bias, privacy erosion, and digital inequity—are critically examined. The concluding section outlines an agenda for future research emphasising participatory design, intersectional evaluation, and the co-creation of AI tools with educators and learners. The proposed framework aims to bridge theory, ethics, and practice, guiding policymakers, researchers, and developers towards equitable and context-sensitive implementation of AI in education.

Keywords: *Inclusive Education, Artificial Intelligence, UDL, Adaptive Learning, Algorithmic Bias, Ethical AI, Equity and Accessibility.*

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INTRODUCTION

The integration of Artificial Intelligence (AI) into education represents one of the most transformative shifts in modern pedagogy. AI's capacity to personalise learning, automate assessment, and broaden access for diverse learners has generated global interest in its role within inclusive education (Holmes et al., 2019; Miao et al., 2021). However, its uncritical application may also reinforce inequities through algorithmic bias, data exploitation, and depersonalised learning (Baker & Hawn, 2021; Noble, 2018). Therefore, a theoretical framework is vital to align AI innovation with the principles of inclusion, equity, and human development. This paper introduces a conceptual model positioning AI as a *pedagogical amplifier*—a tool that enhances human potential to create equitable and compassionate learning environments.

RATIONALE AND CONTEXT

UNESCO's Sustainable Development Goal 4 (SDG 4) advocates inclusive education that guarantees equitable access, participation, and achievement for all, including learners with disabilities, linguistic barriers, or socio-economic challenges. Meanwhile, educational systems worldwide are increasingly adopting AI tools—such as adaptive platforms, predictive analytics, and speech and language technologies—to improve teaching and learning (Luckin et al., 2016; Zawacki-Richter et al., 2019). However, without appropriate frameworks, these systems risk perpetuating systemic inequalities by favouring datasets and pedagogical assumptions rooted in dominant cultures (Williamson & Eynon, 2020). Therefore, AI should not be seen merely as technology but as a socio-technical system influenced by ethics, governance, and human context. A solid theoretical foundation—drawing on Universal Design for Learning (UDL), social constructivism, and humanistic education—is essential for aligning AI's application with inclusive pedagogical principles (CAST, 2018; Rose & Meyer, 2002).

THE PROMISE AND THE PARADOX

AI's potential resides in improving *multimodal accessibility*—offering automatic captions for those with hearing impairments, text-to-speech tools for visually challenged learners, and adaptable pathways for various cognitive needs (Schiff, 2021). It can provide real-time feedback, detect learning barriers early, and reduce teachers' administrative burdens, enabling more focus on relational and emotional engagement (Holstein et al., 2018). However, this potential presents paradoxes. The same systems that tailor learning may also monitor and categorise students, risking bias if datasets lack diversity (Mehrabi et al., 2021). Excessive reliance on automation could diminish teacher autonomy and student agency. The real challenge is not just AI's technical capacity but ensuring its ethical and pedagogical alignment—so that it empowers rather than controls learners.

THEORETICAL GAP

Although research on AI in education is expanding, theoretical links between AI and inclusive learning remain disjointed. Existing studies often focus either on technical innovation or on inclusive pedagogy but seldom combine both (Gouseti, 2025; Ifenthaler et al., 2024). This paper addresses that gap by proposing a unified model that integrates pedagogical theory, AI ethics, and socio-technical design. It demonstrates how five AI mechanisms—multimodal accessibility, adaptive learning, cognitive scaffolding, socio-emotional affordances, and data-driven inclusivity—can collectively foster inclusive learning environments.

PURPOSE AND OBJECTIVES

The study aims to develop a theoretical framework demonstrating how AI promotes inclusive and supportive education. Its objectives are:

1. To synthesise interdisciplinary insights from education, cognitive science, disability studies, and AI ethics.
2. To conceptualise five mechanisms supporting inclusion through AI.
3. To suggest ethical guidelines and metrics for responsible AI use.
4. To outline future research directions focusing on participatory and intersectional approaches.

SIGNIFICANCE OF THE STUDY

This framework contributes theoretically by linking constructivist learning, UDL, and disability studies to define AI's role in inclusive pedagogy. Methodologically, it uses an integrative synthesis approach, combining theory and practice. Practically, it provides educators and policymakers with tools to evaluate inclusivity in AI systems, aligned with UNESCO (2024) and U.S. Department of Education (2023) guidelines. Importantly, it highlights human dignity, teacher agency, and data ethics—promoting AI as a collaborator, not a replacement, for educators. True inclusion, it contends, emerges from the emotional, relational, and cultural aspects of teaching that AI must support, not undermine.

THEORETICAL FOUNDATIONS

Building inclusive and equitable learning environments through Artificial Intelligence (AI) requires a solid theoretical foundation that combines pedagogy, technology, and ethics. This section presents five key theoretical perspectives—Universal Design for Learning (UDL), Social Constructivism, Adaptive Learning Theory, Critical Disability Studies, and Ethics with Socio-Technical Systems Theory. Collectively, these frameworks demonstrate how AI can support inclusive practices without compromising human agency.

Universal Design for Learning (UDL) Accessibility and Flexibility

Developed by CAST, Universal Design for Learning (UDL) provides a fundamental approach to creating inclusive teaching. It encourages multiple ways of engagement, representation, and expression to ensure that every learner, regardless of background or ability, can access and showcase learning (CAST, 2018; Rose & Meyer, 2002).

AI supports UDL principles through multimodal accessibility tools such as text-to-speech, captioning, translation, and image recognition for visually impaired learners. Adaptive interfaces enable personalised pacing and interaction. However, UDL emphasises that technology should complement—not replace—human sensitivity to cultural and emotional contexts. AI must act as an assistive scaffold that extends teachers' abilities to differentiate instruction while respecting learner variability. Therefore, UDL functions as a pedagogical lens guiding AI design for flexibility, accessibility, and inclusion.

Social Constructivism: Learning as Interaction and Mediation

Social Constructivism, based on Vygotsky's Zone of Proximal Development (ZPD), sees learning as a social process facilitated through cultural tools and collaboration (Vygotsky, 1978). In inclusive classrooms, peer dialogue, cooperative learning, and scaffolding are key to engagement.

AI technologies can improve this interaction through intelligent tutoring systems, chatbots, and collaborative platforms that respond to learner interactions (Koedinger & Corbett, 2006). For example, AI-driven transcription allows students with hearing impairments to participate in discussions, while sentiment analysis tools assist teachers in monitoring emotional well-being. However, the constructivist perspective insists that AI should enhance rather than replace human relationships. Teachers remain facilitators who guide understanding and collaboration, with AI acting as a co-mediatory of dialogue and involvement.

Adaptive Learning Theory: Personalisation and Scaffolding

Adaptive Learning Theory centres on tailoring instructions to each learner's profile and development. AI utilises this theory through data-driven personalisation, examining learner behaviour and feedback to adapt content, pace, and assessment (Pane et al., 2017).

AI-driven tutors, for instance, can identify conceptual gaps and offer scaffolded tasks, while language processing systems suggest reading materials appropriate to comprehension levels. Based on Vygotsky's concept of scaffolding, this adaptivity supports learners just beyond their current abilities. However, excessive automation might diminish learner control and awareness. Therefore, teachers must interpret AI feedback to preserve pedagogical balance and learner autonomy. Adaptive learning thus forms the cognitive core of AI-driven inclusion, ensuring fair progress for all.

Critical Disability Studies (CDS): Dignity, Justice, and Power

Critical Disability Studies shift the focus from impairment to social and structural barriers that cause exclusion (Ferri & Connor, 2006). Inclusion, therefore, involves dismantling these barriers and ensuring justice and empowerment.

In the context of AI, CDS emphasises issues of representation and agency. Algorithms trained on biased or incomplete datasets may misrecognise marginalised groups, perpetuating inequality (Noble, 2018). Moreover, CDS advocates participatory design—"nothing about us without us"—ensuring that people with disabilities actively influence AI tools. This framework redefines inclusion as transformative justice, ensuring AI enhances autonomy, dignity, and participation rather than fostering dependence.

Ethics and Socio-Technical Systems Theory: Governance and Oversight

Socio-technical systems theory states that technologies and social environments are interconnected. Therefore, AI in education must be assessed not only for its performance but also for its impact on privacy, trust, and relationships (Selwyn, 2019). Ethical standards—such as

UNESCO's *Recommendation on AI Ethics (2021)* and the U.S. *AI and Equity Principles (2023)*—emphasise transparency, accountability, and fairness.

This theory discourages technological determinism, promoting participatory governance involving educators, students, and communities. Ethical AI in schools should be co-designed, regularly audited for bias, and guided by transparent accountability mechanisms.

Synthesis: An Integrated Theoretical Base

The integration of these five perspectives forms a comprehensive foundation:

- UDL ensures accessibility and flexibility.
- Social Constructivism highlights mediated collaboration.
- Adaptive Learning Theory provides cognitive justification for personalisation.
- CDS embeds justice and agency.
- Socio-Technical Ethics ensures governance and accountability.

Together, they establish a human-centred, ethically grounded, and pedagogically robust foundation for designing AI that encourages genuine inclusion—amplifying human values rather than replacing them.

METHODOLOGY

Design and Approach

This study adopts a pluralistic framework synthesis, combining systematic review methods with theory-building to explain how AI can promote inclusive and positive learning environments. Instead of quantifying effects, the goal is to integrate theoretical insights through PRISMA-inspired search and screening procedures. Using thematic coding and theory-driven integration, the study constructs a five-mechanism model linking AI functions with inclusive pedagogy.

Databases, Sources, and Time Frame

Searches covered multidisciplinary databases—ERIC, Scopus, Web of Science, IEEE Xplore, and Google Scholar—to gather educational, technological, and policy perspectives. Additional searches were performed on UNESCO, OECD, and U.S. Department of Education websites to ensure policy relevance. The review included literature from January 2010 to September 2025, reflecting the modern AI-in-education era. Only materials in English were considered, and snowballing and citation chasing were used to identify further relevant works.

Search Strategy

A systematic and transparent search strategy was employed to gather relevant literature. Boolean strings combined terms such as “Artificial Intelligence,” “Machine Learning,” “education,” “inclusion,” and “Universal Design for Learning (UDL)” to identify studies linking AI to inclusive education. Additional searches concentrated on algorithmic bias, fairness, and assistive technologies such as speech recognition and text-to-speech. Filters limited results to key subject areas—Education, Computer Science, and Social Sciences—and to peer-reviewed journals,

conference papers, and policy reports. This method ensured the inclusion of only credible and relevant sources for analysis.

Eligibility Criteria

Inclusion:

1. Peer-reviewed or theoretical studies on AI in education.
2. Works addressing inclusion, equity, or accessibility.
3. Policy documents from recognised organisations.
4. Studies explaining core constructions (UDL, adaptive learning, socio-technical ethics).

Exclusion: Purely technical AI papers, non-English or non-scholarly items, duplicates, and inaccessible full texts.

Screening and Selection

After removing duplicates, titles and abstracts were screened against the inclusion criteria. Two reviewers independently examined 25% of the sample for calibration and calculated Cohen's κ to assess reliability. Differences were resolved by consensus, and the rules were refined before final screening. When both preprint and published versions were available, the published version was retained.

Data Extraction and Coding

A structured template documented bibliographic details, study type, education level, disability focus, AI tool type, and ethical notes. Coding consisted of two stages:

- Open coding identified recurring mechanisms (accessibility, adaptivity, scaffolding, socio-emotional support, analytics).
- Axial coding linked mechanisms to contextual factors like teacher agency, culture, and ethical safeguards.

Disagreements were resolved through discussion and documented for auditability.

Quality Appraisal

Empirical studies were assessed based on research design, sampling, and validity. Theoretical works were evaluated for coherence and conceptual clarity, while policy sources were scrutinised for credibility and scope. Low-quality or unverifiable materials were excluded.

Synthesis and Model Construction

Themes were synthesised into five mechanisms: multimodal accessibility, adaptive pathways, cognitive scaffolding, socio-emotional affordances, and data-driven inclusivity. Each mechanism was characterised by its theoretical rationale, AI functions, enabling factors, and ethical risks. Relationships among mechanisms were mapped to develop the final conceptual framework.

Validation and Ethics

Model plausibility was assessed using empirical vignettes from reputable AI education cases (e.g., adaptive tutoring, bias audits). Triangulation across studies and policies ensured

consistency. Limitations include an English-only scope and the evolving nature of AI after 2023. To ensure transparency, search strings and eligibility rules are provided in appendices. No human subjects were involved.

Theoretical Framework: Five Mechanisms Of AI-Enabled Inclusion

Building on the earlier theoretical foundations, this section introduces a five-mechanism framework that explains how Artificial Intelligence (AI) supports inclusive and positive learning environments. Each mechanism illustrates a pathway through which AI improves access, participation, and engagement for diverse learners. These mechanisms operate interdependently within educational, social, and ethical contexts influenced by teacher agency and governance.

Multimodal Accessibility: Expanding Access to Learning

The first mechanism, multimodal accessibility, concentrates on delivering learning materials in multiple formats tailored to diverse sensory, linguistic, and cognitive needs. AI facilitates this through tools such as speech recognition, text-to-speech, image captioning, translation, and real-time transcription. For example, automatic captions support students with hearing impairments, while text-to-speech helps those with dyslexia or low vision.

Aligned with Universal Design for Learning (UDL), these tools provide multiple means of representation, ensuring fair access to content. However, accessibility must also consider cultural and infrastructural contexts—such as low-bandwidth environments or local languages. Therefore, AI tools must be adaptable and teacher-guided to foster meaningful inclusion.

Example: A government school in Haryana uses an AI reading app that reads aloud in Hindi and English and adjusts pace and phonetics—benefiting both visually impaired and remedial learners.

Adaptive Learning Pathways: Personalised and Equitable Progress

The second mechanism, adaptive learning pathways, uses AI to personalise instruction according to each learner's abilities and pace. Through continuous data analysis, AI adjusts content difficulty, feedback, and sequencing—helping both advanced and struggling learners.

Rooted in Vygotsky's Zone of Proximal Development (ZPD), AI supports learners by offering timely scaffolding that keeps challenges appropriate. However, too much personalisation can restrict learners to algorithmic paths; therefore, teacher oversight remains vital. Adaptive learning encourages inclusion by providing all learners with equal opportunities through varied pathways.

Example: A maths platform analyses student errors and recommends scaffolded exercises. Teachers review dashboards to adjust AI suggestions, enabling students with mild intellectual disabilities to learn alongside peers.

Cognitive Scaffolding: Supporting Thinking and Understanding

Cognitive scaffolding refers to AI's ability to enhance learners' cognitive and metacognitive skills. AI systems offer prompts, summaries, or reflective questions that help guide understanding. Tools like Large Language Models (LLMs) simulate Socratic dialogue, while AI mind-mapping supports learners with organisational challenges.

By enhancing attention and memory, cognitive scaffolding decreases cognitive load—particularly for students with ADHD or learning disabilities. However, supports must taper off gradually to prevent over-reliance.

Example: A science app detects misconceptions and provides guided hints (“What law applies here?”) instead of direct answers, encouraging independent reasoning.

Socio-Emotional Affordances: Promoting Belonging and Motivation

Inclusion also relies on emotional well-being. Socio-emotional opportunities involve AI tools that foster empathy, motivation, and a sense of belonging. Affective computing and empathetic chatbots can provide encouragement or mindfulness reminders, while sentiment analysis assists teachers in identifying disengaged students.

Rooted in humanistic education and positive psychology, this mechanism emphasises emotional safety as essential to inclusion. However, emotional data must be treated ethically—safeguarding privacy, consent, and authenticity.

Example: A virtual writing assistant detects user frustration and offers supportive messages, increasing persistence among shy or anxious students.

Data-Driven Inclusivity: Detecting and Addressing Inequities

The fifth mechanism, data-driven inclusivity, uses analytics to spot inequities and guide institutional improvements. AI systems can identify participation or achievement gaps, audit grading biases, and support inclusive interventions.

Aligned with socio-technical systems theory, this mechanism highlights ethical data use, transparency, and teacher interpretation. Data should inform—not substitute—human decision-making.

For example: District analytics show that girls and students with disabilities are underrepresented in STEM subjects, leading to curriculum reforms and mentoring programmes.

Integration of Mechanisms: A Dynamic Model

The five mechanisms form a continuous cycle: accessibility opens entry → adaptivity personalises learning → scaffolding deepens understanding → socio-emotional support sustains engagement → data analytics guides systemic improvement. Together, they create an evolving model of inclusive education enhanced by human-centred AI.

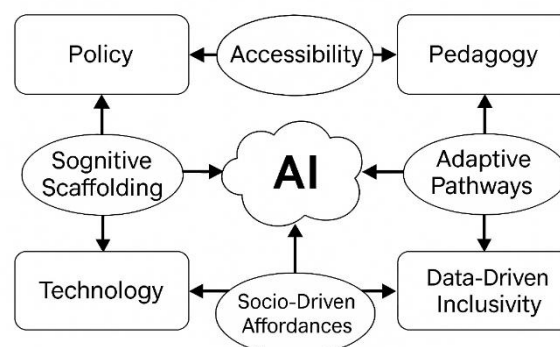


Figure 1. Conceptual Framework of AI in Education Ecosystems

Implications

This framework links theory and practice, helping educators assess whether AI tools truly foster inclusion. It highlights human-centred AI—technologies that enhance teacher capacity, uphold learner dignity, and promote equity. The next section translates these mechanisms into ethical principles and practical metrics for responsible deployment.

Ethical Principles And Operationalization

Artificial Intelligence (AI) operates within profoundly human contexts—such as classrooms, relationships, and communities. Therefore, its application in inclusive education must be grounded in ethical responsibility and institutional accountability. Ethical governance serves as the fundamental cornerstone that ensures technology enhances, rather than supplants, the humanistic mission of education.

This section presents five guiding ethical principles—human dignity and agency, data rights, bias auditing, relational pedagogy, and intersectional evaluation—and offers an operational framework for their real-world application. These principles are based on global policy frameworks (UNESCO, 2021; U.S. Department of Education, 2023; European Commission, 2022) and inclusive theories such as UDL and Critical Disability Studies.

Human Dignity and Agency

AI in education should prioritise human dignity by enhancing rather than replacing human judgment. Teachers and learners must remain key decision-makers with authority over AI-generated suggestions. Education ought to embody empathy, autonomy, and cultural respect—fundamental principles in humanistic and disability-inclusive pedagogy.

Operationalization:

1. Percentage of AI suggestions that teachers can override or adapt.
2. Evidence of participatory design involving educators and learners with disabilities.
3. Institutional policy affirming teacher accountability for instructional decisions.

Example: An AI tutor suggests activities, but teachers modify them based on emotional readiness or cultural appropriateness—maintaining teacher autonomy and student dignity.

Data Rights and Privacy-by-Design

Ethical inclusion relies on trustworthy data. All learners’ data—whether biometric, behavioural, or academic—must be safeguarded through consent, purpose limitation, and data minimisation. Privacy-by-design should be a built-in feature, not an option, ensuring learners clearly understand how their data is used in straightforward, accessible formats.

Operationalization:

1. Availability of an accessible “AI Data Transparency Notice.”
2. Regular consent renewals and clear deletion rights.
3. Successful processing of stakeholder requests for correction or removal.

Example: A learning app stores minimal data locally and permits students or parents to delete histories at any time, with clear video explainers on data use in regional languages.

Bias Auditing and Algorithmic Accountability

Algorithms mirror human biases unless they are constantly monitored. Regular bias audits are crucial to spot demographic differences in performance or recommendation rates. Multidisciplinary audit teams—comprising educators, technologists, and advocates—should evaluate and publicly disclose their findings.

Operationalization:

1. Frequency of bias audits (at least once per term).
2. Documented performance disparities across groups.
3. Public summaries of audit results and corrective measures.

Example: A dropout prediction tool exhibits bias against rural learners. Retraining it with diverse linguistic datasets diminishes unfair predictions and enhances fairness.

Relational Pedagogy and Emotional Integrity

Education depends on human relationships. AI should support, not undermine, the connection between teacher and learner. Socio-emotional AI tools ought to complement human care systems without replacing empathy. Emotional data must be interpreted ethically to prevent depersonalisation.

Operationalization:

1. Ratio of AI-mediated to human feedback sessions.
2. Student satisfaction with teacher presence and connection.
3. Training hours for teachers on relational and emotional ethics.

Example: A chatbot offering stress management advice directs students experiencing distress to human counsellors, ensuring emotional support stays human-led.

Intersectional Evaluation and Equity Metrics

True inclusion acknowledges intersectional disadvantages—how gender, disability, language, caste, and class interact to influence learning opportunities. AI evaluation must break down data across these dimensions and include marginalised voices in both design and review.

Operationalization:

1. Disaggregated AI performance by at least three identity factors.
2. Inclusion of underrepresented groups on evaluation committees.
3. Evidence of policy updates based on intersectional findings.

Example: Analytics reveal low participation among female students with disabilities. The institution responds with captioned lectures, flexible schedules, and mentorship programmes.

Institutional Operational Rubric

Ethical Principle	Key Metric	Frequency	Responsible Entity
Human Dignity & Agency	% of teacher overrides	Per semester	Pedagogical Leadership
Data Rights & Privacy	Consent renewals, transparency notices	Annual	Data Protection Officer
Bias Auditing	Reports & corrections completed	Termly	AI Ethics Committee
Relational Pedagogy	Teacher presence index	Biannual	Academic Welfare Unit
Intersectional Evaluation	Disaggregated data reviews	Annual	Inclusion & Diversity Board

This rubric provides institutions with measurable indicators to ensure AI practices remain ethical, transparent, and accountable.

Embedding Ethics in Practice

Ethical governance must be institutionalised through:

1. AI Ethics and Inclusion Committees with diverse representation.
2. Ethical impact assessments should be conducted before adopting any AI system.
3. Teacher training in inclusive AI design and data ethics.
4. Feedback mechanisms allowing learners to report bias or exclusion.

Such steps reinforce that inclusion stems from human stewardship, not algorithms alone.

Ethical AI in education is an evolving practice rooted in fairness, empathy, and transparency. As technologies develop, so too must ethical standards. The framework guarantees AI enhances—not replaces—human connection, fostering classrooms where every learner feels valued, respected, and empowered.

DISCUSSION AND RESEARCH AGENDA

This framework views Artificial Intelligence (AI) as a *pedagogical tool* that improves inclusive and positive learning when guided by ethical, theoretical, and human-centric principles. The five mechanisms—multimodal accessibility, adaptive learning, cognitive scaffolding, socio-emotional affordances, and data-driven inclusivity—collectively show how AI can enhance access, equity, and engagement. However, their effectiveness relies on addressing tensions between innovation, ethics, and context.

AI as Augmentation, Not Automation

AI should support rather than replace teachers. It can manage cognitive load, identify learning gaps, and create adaptive materials—allowing educators to focus on empathy, reflection, and connection. Teachers must act as interpreters who humanise technology, ensuring that AI complements, not overrides, human judgment.

Tensions in Inclusive AI

AI's potential is tempered by trade-offs:

- a. Scalability vs. Context: Global models may overlook local realities.
- b. Data vs. Privacy: Analytics reveal inequities but also pose risks of intrusion.
- c. Efficiency vs. Empathy: Automation can depersonalise learning.
- d. Transparency vs. Complexity: Opaque AI decisions challenge trust. Balancing these requires ethical governance and localised adaptation.

Policy, Practice, and Research Directions

Policymakers should establish ethical audits, privacy protections, and accessibility standards (e.g., WCAG, UDL). Teachers must be trained in *critical digital pedagogy*—questioning AI bias and encouraging inclusive practices. Research should empirically test the five-mechanism framework, examine AI's long-term social-emotional impacts, and co-design inclusive models with marginalised learners.

Toward AI-Inclusive Pedagogy

A future theory of AI-Inclusive Pedagogy must incorporate cognitive science, emotional intelligence, data ethics, and disability studies to define “inclusive technology use.” Collaboration between educators, policymakers, and technologists can ensure that AI enhances humanity—transforming efficiency into empathy and innovation into equity.

The future of inclusive education will be determined not by machine intelligence, but by our ethical wisdom in using it to help every learner flourish.

CONCLUSION

Artificial Intelligence (AI) holds great potential for transforming inclusive education, as long as it is guided by human-centred ethics, critical pedagogy, and equity-focused design. This paper presented a theoretical framework based on Universal Design for Learning (UDL), social constructivism, adaptive learning theory, critical disability studies, and socio-technical ethics—showing how AI can serve as a pedagogical enhancer rather than a substitute for human agency.

The five mechanisms—multimodal accessibility, adaptive learning, cognitive scaffolding, socio-emotional affordances, and data-driven inclusivity—demonstrate how AI can improve access, engagement, and personalisation when implemented ethically. However, inclusion cannot be achieved by technology alone; it relies on human judgment, participatory design, and ethical governance that prioritise teachers and learners.

The ethical principles proposed—dignity, data rights, bias audits, relational pedagogy, and intersectional evaluation—transform inclusive ideals into tangible practices aligned with global AI ethics frameworks. Ultimately, AI should be viewed not as automation but as augmentation—a tool that enhances empathy, accessibility, and human potential. The true measure of AI's success in education will not be algorithmic efficiency but its capacity to respect human diversity, uphold fairness, and nurture the dignity of every learner.

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Chapter Twenty

COMPUTATIONAL THINKING: A TOOL FOR 21ST CENTURY SKILL DEVELOPMENT

Ritu Singh

ABSTRACT

Contemporary education must equip learners with adaptable problem-solving skills that go beyond content knowledge. Computational thinking (CT) is increasingly seen as a key 21st-century competence and a transferable mode of reasoning that supports systematic and creative approaches to complex tasks. This review argues that CT's core processes—decomposition, pattern recognition, abstraction, and algorithmic thinking—closely align with the “4 Cs” of 21st-century learning: critical thinking, creativity, communication, and collaboration. By synthesising literature across disciplines, the paper outlines theoretical reasons for integrating CT into subject teaching rather than limiting it to computing classes. Evidence summarised in the review shows that CT-integrated learning can boost achievement, conceptual understanding, problem-solving, creativity, reasoning, and classroom engagement. Reported approaches to implementation include problem-based and project-based learning, unplugged activities (hands-on, paper-and-pencil, and discussion-based tasks that simulate programming concepts), and plugged activities such as block-based programming, educational games, and Scratch-based coding. These insights provide guidance for teachers and curriculum designers seeking scalable, equitable methods for developing 21st-century skills. Overall, CT is presented as a practical framework to facilitate a shift towards skill-based learning and foster learners' ability to apply sound reasoning to academic and real-world challenges.

Keywords: *Computational Thinking (CT), 21st-Century skills, Skill-based learning*

INTRODUCTION

The modern world is characterised by rapid technological advancements, interconnectedness in the global economy, and the abundance of data. This age of information demands a new set of qualities and abilities for individuals to thrive both personally and professionally. These qualities are collectively referred to as "21st-century skills," and they emphasise broadly applicable competencies such as teamwork, reasoning, and innovation over narrow, domain-specific knowledge (Hagler, 2024). Educational frameworks, like the P21 Framework for 21st Century

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Learning, organise these skills into three main categories: learning and innovation skills, digital literacy skills, and career and life skills (Kumbhakar & Kumar, 2025). This approach to education aims to equip students with the skills and understanding necessary to navigate the increasing complexity of modern life and the workplace (Hagler, 2024).

Developing 21st-century skills has become increasingly important as students prepare to navigate the challenges of a rapidly changing, interconnected world. Skills such as critical thinking, creativity, collaboration, and communication are now regarded as essential for success in both personal and professional life (Purwanto et al., 2023). With swift technological progress and the growing emphasis on a knowledge-based economy, education systems face mounting pressure to help students develop these vital competencies. The ability to adapt, innovate, and solve problems is particularly critical during secondary school years, when students are strengthening their foundational skills (Ilma et al., 2023; Shanta & Wells, 2022).

An increasing amount of research has explored how various teaching methods can develop these 21st-century skills. Among them, computational thinking (CT) has become a particularly effective framework for enhancing such abilities. Studies have demonstrated that incorporating CT into different subjects can notably boost students' critical thinking, creativity, and problem-solving skills. These results underscore the transformative potential of CT-integrated learning in helping education adapt to the needs and expectations of the 21st century (Ja'far et al., 2024).

Computational thinking is not just a synonym for computer programming or a skill limited to computer scientists. Instead, it comprises a set of thought processes used to frame problems in a way that their solutions can be expressed as computational steps and algorithms (Wikipedia, 2025). As a problem-solving method, it involves articulating problems and solutions in a manner that a computer—or another information-processing agent—can carry out (Iwata et al., 2020). The modern academic interest in this concept was notably advanced by Jeannette Wing in 2006, who argued that CT is a fundamental skill that should be part of everyone's analytical toolkit, alongside reading, writing, and arithmetic (Mohaghegh & McCauley, 2016). CT is increasingly impacting various disciplines because it provides a structured and systematic approach to problem-solving that extends well beyond the realm of computer science (Ching et al., 2018).

The central thesis of this paper is that computational thinking offers a versatile and powerful framework for developing the skills and behaviours that define success in the 21st century. It provides a structured approach to analysing and solving complex challenges, enhancing professional competence and analytical skills across numerous disciplines, from mathematics and science to language arts and social sciences (Kaya et al., 2025). This report aims to clarify the precise relationship between CT and 21st-century skills, explore pedagogical strategies for its effective integration, and address the key challenges and future implications of its widespread adoption in education (Hunsaker, 2022; Pinder, 2022). By synthesising diverse research findings, this analysis seeks to offer a comprehensive, evidence-based roadmap for educators and policymakers aiming to prepare students for the demands of a digital world (Tongal et al., 2024).

The Objectives of this review paper are:

1. To present a brief account of the 21st-century skills.
2. To describe computational thinking, its components, and its significance in diverse disciplines.
3. To discuss the conceptual synergy between the core components of Computational Thinking and 21st-century skills.
4. To explain the relevance of Computational thinking in the development of 21st-century skills.

LITERATURE REVIEW

The main focus of the literature review for this paper is to define 21st-century skills and computational thinking, and to examine the significant conceptual connection between core CT principles—decomposition, pattern recognition, abstraction, and algorithms—and the well-known '4 Cs' of 21st-century learning: creativity, critical thinking, communication, and collaboration. It also discusses the importance of computational thinking in developing 21st-century skills.

I. The Context of the 21st Century Skills

The modern academic landscape, marked by swift technological progress and growing global connectivity, requires a shift in the essential skills needed for academic success. Traditional academic training, focused on acquiring knowledge in key subjects, is now seen as the foundation on which a broader set of adaptable intellectual skills must be built. These dynamic abilities, known as "21st-century skills," include knowledge, life skills, career readiness, habits, and cognitive traits that are vital for success in university, employment, and adult life. Educators generally agree that institutions must systematically integrate these essential skills into learning experiences and core instruction (Buckle, n.d).

Twenty-first-century skills refer to the abilities required to succeed in today's rapidly evolving world. In the past, education mainly emphasised memorisation and mastering the fundamentals—the traditional "three R's" of reading, writing, and arithmetic. However, with rapid technological progress, globalisation, and shifts in the job market, simply having knowledge is no longer enough. Individuals now need to develop higher-order skills such as critical thinking, problem-solving, and effective communication. These competencies enable people to confront modern challenges with confidence, both in their personal lives and professional careers (Kumbhakar & Kumar, 2025).

Twenty-first-century skills are crucial for addressing the challenges of navigating a complex, digitally and globally interconnected professional landscape. They act as the key differentiators that distinguish well-prepared students from those who find it difficult to succeed in increasingly demanding work settings (P21, 2007). For early-stage researchers or academic professionals, mastering these skills is not merely advantageous but essential for producing rigorous, ethical,

and publishable scholarly articles. Research in higher education curriculum design explicitly promotes the integration of these skills to equip students for future workplaces (Birru, 2024).

The definitive taxonomy for these competencies is provided by the Partnership for 21st Century Learning, a national organisation that developed a unified, collective vision for learning. This Framework for 21st Century Learning describes the knowledge, skills, and expertise students must master to succeed in work and life, blending content knowledge with specific skills, expertise, and literacies (P21, 2009). Developed with input from educators, business leaders, and education experts, the P21 Framework continues to be used widely across the globe to place these crucial abilities at the centre of learning (P21, 2007).

The P21 Framework organises these competencies into three interconnected domains: Learning and Innovation Skills, Information, Media, and Technology Skills, and Life and Career Skills (Buckle, n.d). The successful scholarly author must integrate these domains throughout the entire research and writing lifecycle. This report details how the core P21 competencies—specifically the Learning and Innovation Skills (known as the 4Cs) and the foundational Literacies—translate into tangible actions aligned with the standard IMRAD (Introduction, Methods, Results, and Discussion) structure used in formal scholarly communication (P21, 2007).

The relationship between academic competencies and professional attributes is summarised below:

Table 1: Defining the P21 Framework: Core Skill Categories

Domain	Primary Skills (Examples)
Learning and Innovation Skills (4Cs)	Critical Thinking, Creativity, Collaboration, Communication (P21, 2007; Thornhill-Miller et al., 2023)
Information, Media, and Technology Skills	Information Literacy, Media Literacy, Digital Literacy (Buckle, n.d.)
Life and Career Skills	Flexibility, Initiative, Self-Direction, Productivity, Leadership (Ozor & Toner, 2022; Spante et al., 2018)

The P21 framework offers a structured way to understand essential skills by combining mastery of key academic subjects (English, mathematics, science, economics, etc.) with interdisciplinary themes and support systems. This ensures that content knowledge is applied at a much higher level (P21, 2007).

A. The Core Learning and Innovation Skills (The 4Cs)

The 4Cs embody the most advanced cognitive skills necessary for complex problem-solving in contemporary research (Thornhill-Miller et al., 2023).

1. Critical Thinking and Problem Solving

This constitutes the intellectual basis of research inquiry and is regarded as the most crucial skill for achieving success. It involves disciplined investigation, analysis, evaluation, and synthesis of information to reach a convincingly justified conclusion (Alsaleh, 2020).

2. Communication

Effective communication involves both language and the presentation of ideas (Joynes et al., 2019). In scholarly writing, this skill is crucial for developing persuasive arguments, organising ideas, and conveying complex information across all sections of an article (Alismail & McGuire, 2015).

3. Collaboration

Collaboration involves respecting cultural differences and working effectively with people from diverse social backgrounds. The aim is to utilise these differences to generate new ideas, boost innovation, and enhance the quality of work (P21, 2007). Collaborative writing projects have been shown to improve writing skills and self-efficacy among students (P21, 2009).

4. Creativity and Innovation

Creativity is the ability to think originally and be resourceful (Alismail & McGuire, 2015). Innovation involves the skill to implement these creative ideas. In research, this means designing novel methodologies, recognising unique theoretical connections, and going beyond basic mastery of a curriculum or skill set (P21, 2009).

B. Life and Career Skills: The Professionalisation of Academic Success

The inclusion of Life and Career Skills within the P21 framework emphasises the evolving demands on the modern scholar. Academia now requires more than just intellectual ability; it calls for strong project management and professional behaviour. For instance, skills such as financial, economic, and entrepreneurial literacy (P21, 2007) are important because academic achievement increasingly depends on the capacity to secure funding and oversee large, multi-year projects. Likewise, productivity and accountability (Birru, 2024) are vital for meeting grant deadlines and maintaining project progress, particularly in collaborative efforts (Ravasi et al., 2024). The ability to show initiative and be a self-motivated learner committed to lifelong learning further characterises the successful 21st-century scholar (P21, 2009).

II. Computational Thinking

Computational Thinking (CT) has extended beyond its roots in computer science to be recognised as a vital intellectual toolkit essential for navigating the complexities of the digital age (Annamalai et al., 2022). The spread of digital technologies across all sectors of society requires individuals to have skills that enable critical engagement with data and automated systems. This need has prompted extensive academic research focused on defining, measuring, and applying CT as a core competence (Ogegbo & Ramnarain, 2022).

The current scholarly enthusiasm surrounding CT mainly arises from Jeanette Wing's influential 2006 article, which issued a compelling call for "thinking like a computer scientist" to become a fundamental skill expected of everyone (Selby, 2013). Wing described computational thinking as an approach to solving problems, designing systems, and understanding human behaviour that systematically draws upon concepts fundamental to computing (Czerkowski & Lyman, 2015). This vision sparked considerable interest among educators, offering a unique opportunity to promote computer science principles to a broader audience and establish a new baseline for problem-solving across disciplines (Wing, 2008).

CT is fundamentally a form of analytical thinking (Wing, 2008). It builds on the capabilities and limitations of computing processes, whether carried out by human intellect or an automated machine (Wing, 2006). In its intellectual heritage, CT shares general methodologies for solving problems with mathematical thinking and overall approaches for designing large, complex, real-world systems using engineering thinking (Wing, 2008). Computational methods and models enable the solving of problems and the design of systems that would be beyond the reach of any single individual working alone (Wing, 2006).

Despite the excitement surrounding Wing's initial proposal, a precise, universally accepted definition was not immediately established, leading to a lengthy discourse within the academic community aimed at developing a robust and consistent conceptualisation (Selby, 2013). This lack of consensus has posed a significant challenge. For CT to be effectively integrated into curricula and rigorously assessed, it must be broken down into a set of well-defined and measurable skills, concepts, or practices (Tomanova et al., 2024).

The variability in CT conceptualisation is significant. Research indicates that the academic literature lacks standardisation, with studies focusing on CT demonstrating an exponential growth trend since 2013 (Tekdal, 2021). This proliferation of research, accompanied by a lack of a standardised definition, suggests that the field is functionally treating CT less as a single, codified skill set and more as a highly flexible, contextual framework that is adapted according to specific disciplinary goals, such as mathematics education versus systems engineering (Annamalai et al., 2022). This structural divergence in academic understanding critically complicates the development and application of universal assessment tools, which are necessary to measure CT acquisition consistently across cultures and educational settings (Angeli & Giannakos, 2019; Corrales-Álvarez et al., 2024).

The core components of Computational Thinking are generally understood as the set of skills needed to transform a complex, unstructured, real-world problem into a precise, machine-tackable form (Cansu & Cansu, 2019). While a common understanding of these abilities exists, academic frameworks differ considerably in their taxonomy and emphasis.

The foundational model established by Wing (2006) focused on four key concepts: decomposition, pattern recognition, abstraction, and algorithms (Tomanova et al., 2024). However, the desire to define measurable pedagogical skills led to a rapid expansion of this taxonomy. Weintrop and Wilensky (2015), for example, identified five basic skills: abstraction, decomposition, algorithms, evaluation, and generalisation (Tomanova et al., 2024). The inclusion of evaluation highlights the important step of assessing solution viability and efficiency, advancing CT beyond mere formulation into validation.

A more systematic framework, proposed by Shute et al. (2017), identified six key facets that emphasise the importance of approaching problems methodically: decomposition, abstraction, algorithm design, debugging, iteration, and generalisation (Shute et al., 2017). The inclusion of iteration and debugging emphasises the cyclical process involved in refining solutions, reflecting the real-world demands of programming and systems design where efficiency and error reduction are crucial (Shute et al., 2017).

A. Comparative Analysis of Divergent Frameworks

The core elements of CT still vary among researchers. A comparative review of key frameworks shows that although the specific list of components varies, the main cognitive ideas they represent are mostly consistent across the discipline (Cansu & Cansu, 2019). These differences often depend on the particular context or educational goal of the researcher. For example, models focused on system design are more likely to include elements such as Parallelization and Simulation, while those aimed at introductory problem-solving tend to emphasise Decomposition and Abstraction (Cansu & Cansu, 2019). Being able to systematically organise these differing definitions is vital for progressing scholarly work by promoting a shared understanding of the terminology and scope of CT research (Annamalai et al., 2022).

The table below illustrates the component variation across influential academic models:

Table 2: Comparative Frameworks of Core Computational Thinking Components

Source/Model	Core Components Identified	Distinguishing/Unique Features
Wing (2006, 2008)	Abstraction, Algorithms, Decomposition, Pattern Recognition, Generalization, Automation	Foundational emphasis on converting problems for machine processing. (Cansu & Cansu, 2019; Tomanova et al., 2024)
Weintrop & Wilensky (2015)	Abstraction, Decomposition, Algorithm, Evaluation, Generalization	Explicit focus on 'Evaluation' as a basic measurable skill. (Cansu & Cansu, 2019)
Barr & Stephenson (2011)	Abstraction, Algorithms, Automation, Problem Decomposition, Parallelization, Simulation	Inclusion of systems-focused concepts (Parallelization, Simulation).(Cansu & Cansu, 2019)
Selby & Woollard (2013)	Abstraction, Algorithmic Thinking, Decomposition, Evaluation, Generalization	Strong alignment with instructional design and assessment practices. (Cansu & Cansu, 2019)

Angeli et al. (2016)	Abstraction, Algorithms, Decomposition, Debugging, Generalization	Inclusion of 'Debugging,' emphasizing iterative refinement. (Cansu & Cansu, 2019)
Shute et al. (2017)	Decomposition, Abstraction, Algorithm Design, Debugging, Iteration, Generalization	Explicitly includes 'Iteration' for systematic improvement. (Shute et al., 2017)

B. The Foundational Components of CT

Computational thinking is a complex cognitive process that involves a range of interconnected methods and approaches. Although various frameworks exist, a broad consensus recognises four core pillars as the essential elements of CT problem-solving : (Barcelos et al., 2018; Cansu & Cansu, 2019; Hansen & Hadjerrouit, 2021; Hunsaker, 2022; Mendrofa, 2024; Sheldon, 2017; Team, 2024)

1. **Decomposition:** The analytical process of breaking down a complex problem or system into smaller, more manageable parts (Hunsaker, 2022; Sheldon, 2017). This approach is fundamental to effective problem-solving, as it enables individual components to be analysed and resolved more effectively (Rahmawati et al., 2024).
2. **Pattern Recognition:** This involves recognising similarities, trends, and recurring regularities within a problem or across multiple problems. Recognising these patterns allows a thinker to reuse solutions or draw on prior knowledge, thereby improving efficiency and effectiveness (Sheldon, 2017).
3. **Abstraction:** An abstraction is a simplified representation of a complex system or phenomenon. This process involves focusing on the essential information while disregarding irrelevant details to achieve a clearer understanding of the core issues. Abstraction is also about generalising a problem-solving process to a wide variety of similar problems (Barcelos et al., 2018; Sheldon, 2017).
4. **Algorithms:** This final stage involves creating a sequential set of instructions or a detailed plan for resolving a problem. Algorithms are the culmination of the earlier stages, offering a clear pathway to a solution that can be carried out by a computer or another individual (Hunsaker, 2022; Sheldon, 2017).

C. Pedagogical Strategies for Implementation of CT

Review of the related literature has shown that the majority of studies have employed sophisticated pedagogical interventions involving plugged activities (Acar & Dikkartin Övez, 2022; Büscher, 2025; Çelik & Sevgi, 2025; Harlow et al., 2015; Pan et al., 2024; Piedade & Dorotea, 2023; Rodríguez-Martínez et al., 2020), such as robotics and programming like block-

based programming, among others, with only a few studies focusing on accessible and simple interventions that do not involve an enriched classroom setup. Researchers have used different plugged activities, such as gaming (Acar & Dikkartin Övez, 2022; Pan et al., 2024) and scratch-based activities (Piedade & Dorotea, 2023; Rodríguez-Martínez et al., 2020).

III. The Conceptual Synergy: CT and the 21st Century skills

A. Aligning CT with the “4 Cs”

The core competencies of computational thinking are closely connected to the skills often highlighted in 21st-century education, especially the "4 Cs": critical thinking, creativity, communication, and collaboration (Hagler, 2024; P21, 2007).

1. Critical Thinking and Problem-Solving

At its core, computational thinking is a structured approach to problem-solving (Hagler, 2024). It reflects the qualities of critical thinking, which include a desire for knowledge, an openness to new ideas, and perseverance when tackling complex tasks (Kaya et al., 2025). By breaking down problems, analysing data, and organising information logically, CT enhances a student's ability to make reasoned judgments, evaluate evidence, and draw sound conclusions (Pinder, 2022). The logical and methodical nature of CT requires individuals to be explicit about the rules and steps needed to find solutions, thereby strengthening their critical and analytical thinking skills (Simanjuntak et al., 2025).

2. Creativity and Innovation

Contrary to the view of computing as solely a mechanical discipline, computational thinking is fundamentally connected to creativity (Mariana & Kristanto, 2023). Developing an original and effective solution often involves dismissing previously accepted ideas and clarifying a problem that was initially vague. The iterative nature of CT, which includes formulating a problem, expressing a solution, and then analysing and assessing its implementation, offers a structured approach for generating new ideas. This process can be a powerful engine for innovation, leading to the creation of novel computational artefacts and even generative art. Research suggests that incorporating creativity along with logical and innovative thinking is central to CT, which focuses on generating new ideas and thinking differently (Wikipedia, 2025).

3. Communication and Collaboration

The act of expressing a solution in a way that can be carried out by another person or a machine requires clear and precise communication (Pinder, 2022). Computational thinking encourages individuals to articulate their thoughts and ideas effectively using both spoken and written language, ensuring that solutions are well-defined and understandable to others. This focus on clarity and precision naturally enhances communication skills. Furthermore, collaboration is a vital component of many modern CT frameworks and curricula (P21, 2007). Working in teams to build a story, debug a programme, or analyse voter data are all examples of how CT activities foster teamwork, effective communication, and the ability to leverage diverse perspectives (Hagler, 2024). Collaborative learning has been shown to have a significant impact on the development of computational thinking skills and creativity (Tongal et al., 2024).

B. Deeper Insights and Connections

The relationship between computational thinking and 21st-century skills is not simply one of parallel development; it functions as a synergistic system where the core aspects of CT support the development of broader competencies. For example, the analytical process of abstraction—focusing on essential information while ignoring irrelevant details—serves as an essential mechanism for managing complexity (Franchitti, 2024). By converting a vague, overwhelming problem into a series of clear, manageable sub-problems, abstraction lowers cognitive load and enables the mind to engage in divergent thinking and information synthesis (Dwyer, 2019). This simplification acts as a prerequisite for generating innovative and useful solutions, which are key indicators of creativity. Thus, the systematic practice of abstraction, a fundamental CT skill, can be seen as a direct facilitator of creativity, a vital 21st-century skill. This causal relationship demonstrates how CT offers a tangible, step-by-step approach for cultivating traits often regarded as innate or unteachable. The process occurs as a logical sequence: a complex problem is initially broken down into smaller parts through decomposition. Next, abstraction is applied to filter out noise and focus on the essential elements, rendering the problem more comprehensible and freeing mental resources. This cognitive liberation fosters the generation of new ideas and innovative solutions, which are then formalised through algorithmic thinking. This interconnected relationship highlights how the structured nature of CT acts as a powerful engine for developing a broad range of human capacities.

Table 3 provides a systematic alignment of computational thinking components and the 21st-century skills they foster.

Table 3: Alignment of Computational Thinking and 21st-Century Skills

CT Component	Aligned 21st-Century Skill	Description of Connection	Example Application
Decomposition	Problem-Solving	Breaking down a complex problem into manageable parts is the first step in solving it. This skill is at the heart of methodical problem-solving.	A student disassembles a complex math problem into smaller, solvable equations.
Pattern Recognition	Critical Thinking	Identifying similarities and recurring patterns helps in logical organization and analysis of data, which is essential for drawing reasoned conclusions.	A student analyzes historical events to find recurring patterns of cause and effect.
Abstraction	Creativity, Critical Thinking	Focusing on what is essential while ignoring irrelevant detail allows for the	An algebra student moves from solving a specific problem to

		generalization of solutions and the generation of new, simplified models.	deriving a general formula.
Algorithms	Problem-Solving, Logic	The development of a clear, step-by-step set of instructions for a solution provides a framework for methodical and logical reasoning.	A student outlines the steps for a science experiment or a recipe.
Generalization	Adaptability, Transferability	The ability to apply a problem-solving process from one domain to a wide variety of problems showcases the adaptability of the thinker.	A student applies problem-solving skills learned in a coding project to a real-life challenge like planning a community event.
Debugging	Critical Thinking, Perseverance	The process of identifying and fixing errors requires logical analysis and resilience, fostering a resilient, iterative approach to problem-solving.	A student analyzes and fixes "bugs" in a story to give it a more logical flow.
Collaboration	Communication, Teamwork	Working together to solve a complex problem requires a team to collectively apply CT principles, fostering social and cross-cultural skills.	A team of students collaborates to design and program a new board game.

IV. Relevance of Computational Thinking in the development of 21st-Century skills

CT is recognised as a 21st-century skill (Haseski et al., 2018; Pramanik et al., n.d.; Weintrop et al., 2021) and has gained significance as a research subject, especially following advocacy by India's new education policy, NEP 2020. Studies have examined CT among students at various levels, such as primary (Aytekin & Topcu, 2024; Brackmann et al., 2017; Fiş Erümit, 2024), elementary (Bartolini Bussi & Baccaglini-Frank, 2015; Hu & Wang, 2024; Piedade & Dorotea, 2023), middle (Acar & Dikkartin Övez, 2022; Çelik & Sevgi, 2025; Delal & Oner, 2020; Pan et al., 2024) and secondary (Yılmaz & İzmirli, 2023), among others. CT has also been examined and integrated within various disciplines such as science (Aytekin & Topcu, 2024; Ogegbo &

Ramnarain, 2022), mathematics (Acar & Dikkartin Övez, 2022; Çelik & Sevgi, 2025; Rodríguez-Martínez et al., 2020), STEM (Han, 2023; Mariana & Kristanto, 2023), among others. Further integration of CT has demonstrated a positive correlation with mathematical understanding (Kaup et al., 2023), mathematical thinking (Wu & Yang, 2022), achievement in mathematics (Acar & Dikkartin Övez, 2022), creativity (Mariana & Kristanto, 2023; Wu & Yang, 2022), critical thinking (Mariana & Kristanto, 2023; Wu & Yang, 2022), problem solving (Fauzi et al., 2024; Jethro & Olabode, n.d.), and importantly, it enhances students' CT skills across various dimensions of CT.

CONCLUSION

Computational thinking (CT) is increasingly recognised as a vital 21st-century skill and is being integrated into school curricula worldwide. Computational thinking is defined as a way of thinking that promotes problem-solving and reasoning. CT offers a powerful framework for students to *approach problems in a more systematic and creative manner*. It is the analytical thinking that enables logical organisation and analysis of data. Computational Thinking has established itself firmly as a crucial 21st-century competence, fundamentally transforming the understanding of problem-solving across transdisciplinary fields. Originating from Wing's 2006 mandate, CT has developed from an initially imprecise concept into a rigorous analytical framework characterised by core processes, notably abstraction, decomposition, pattern recognition, and algorithmic thinking. Despite challenges related to standardising definitions and assessment gaps, the field demonstrates a maturing scholarly agenda focused on precise measurement.

A growing body of research has investigated various teaching methods aimed at developing 21st-century skills in students. Among these, **computational thinking (CT)** has emerged as a particularly effective approach for fostering such abilities. Studies indicate that integrating CT into different subjects can significantly enhance students' **critical thinking, creativity, and problem-solving skills**. A meta-analysis further supports this, showing that CT-based learning models have a strong positive effect on overall student performance. Together, these insights emphasise how CT-integrated approaches can effectively improve teaching and learning in accordance with the aims of modern education.

The application of CT extends its influence well beyond computer science, serving as an essential systematic approach that improves cognitive skills such as critical thinking and provides the necessary support for modern academic standards.

Despite their conceptual boundaries, a significant positive correlation exists between computational thinking skill levels and 21st-century skill components, including critical thinking and problem-solving, information literacy, and innovation. Studies involving prospective teachers indicate that as their critical thinking and general problem-solving capabilities increase, their CT levels rise correspondingly.

This synergy suggests that the systematic nature of Computational Thinking (CT) strengthens the structure and logical soundness required by Critical Thinking (CrT). Interventions aimed at enhancing CT—ranging from modelling-based pedagogy to programming assignments—bring collateral benefits that go beyond technical skills, directly improving wider critical thinking abilities. As a result, there is strong support for integrating CT instruction explicitly within

disciplinary content rather than treating it as a separate, disconnected course, thus maximising the pedagogical benefits of skill development.

Applying CT principles systematically adds considerable value to boosting academic rigour, especially in scholarly communication. Strong critical thinking is directly connected to creating more convincing and well-supported argumentative texts. Explicit instruction in CT skills has been shown to lead to a notably larger improvement in students' argument analysis abilities.

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Chapter Twenty One

BLENDED LEARNING: COMBINING CLASSROOM AND ONLINE APPROACHES TO IMPROVE ENGAGEMENT

Sangeeta Vadhera

ABSTRACT

Blended learning—an educational model that combines traditional in-person instruction with online learning tools and resources—has emerged as a powerful strategy for improving educational access, flexibility, and student engagement. This approach allows educators to design more personalised and dynamic learning experiences by leveraging the strengths of both physical and virtual environments. Blended learning fosters increased interaction, supports self-paced learning, and enhances students' digital literacy skills. As institutions adapt to technological advancements and evolving learner needs, blended learning serves as a sustainable and inclusive model for 21st-century education. However, its success depends on thoughtful planning, technological infrastructure, teacher training, and institutional support. This paper explores the conceptual foundations of blended learning, its models, its impact on student engagement, its benefits for educators, its implementation challenges, and evidence-based best practices for successful implementation.

Keywords: Blended Learning, Hybrid Education, Student Engagement, Online Learning, Digital Tools, Instructional Design, Personalised Learning, Classroom Strategies

INTRODUCTION

The intersection of traditional education and digital innovation has given rise to new pedagogical models, one of the most impactful being blended learning. This instructional approach combines face-to-face teaching with online content delivery and interaction, creating a flexible and often more engaging learning environment (Graham, 2006). In recent years, particularly following the COVID-19 pandemic, schools and universities worldwide have been compelled to adopt remote and hybrid teaching models. While initially driven by necessity, many educators and institutions have recognised the long-term potential of blended learning to enhance instructional quality and learner outcomes.

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Unlike fully online or purely in-person formats, blended learning enables a seamless integration of digital content and traditional classroom pedagogy. This dual approach allows for greater customisation of lessons, more efficient use of class time, and opportunities for students to revisit content at their own pace. Furthermore, it aligns with 21st-century educational goals by promoting digital literacy, independent learning, and critical thinking. This paper aims to provide an in-depth exploration of the blended learning model, highlighting its relevance, benefits, challenges, and best practices for optimising engagement and learning outcomes.

DEFINING BLENDED LEARNING

Blended learning is more than just the combination of online and offline teaching. It is a strategic instructional design framework that integrates digital media and traditional face-to-face methods to create a cohesive learning experience (Horn & Staker, 2015). The key principle is that both modalities—online and in-person—are not separate but work together in a complementary way to enhance learning.

One critical distinction is that blended learning is intentional. It is not simply about uploading lectures or having students complete online quizzes. Instead, it involves a pedagogically sound division of activities, in which some components (e.g., direct instruction or discussion) are best delivered face-to-face, whereas others (e.g., research, practice activities, or exploration of multimedia content) are effectively delivered online (Garrison & Vaughan, 2008). For instance, a science teacher might introduce a topic in class, assign a video tutorial and online quiz as homework, and then use class time for lab experiments and group analysis.

Blended learning supports active learning, encourages greater autonomy, and enables continuous access to educational content. It allows educators to diversify teaching strategies and tailor lessons to accommodate diverse learning styles and needs.

MODELS OF BLENDED LEARNING

Educators can adopt different models of blended learning depending on the context, subject matter, available resources, and learner characteristics. The most widely recognised models include:

a. Rotation Model

In the rotation model, students rotate among different learning stations or formats according to a fixed schedule or at the teacher's discretion. For example, a math class might rotate among a teacher-led group, an online instructional platform, and an independent practice station. This model is especially popular in elementary and secondary education as it maintains a structured schedule while integrating online tools.

b. Flex Model

The flex model emphasises a more student-driven experience, with most instruction occurring online. Teachers act as facilitators, providing support and intervention as needed. This model is effective in high schools and adult education programs, where learners are better able to manage their time and progress independently (Staker & Horn, 2012).

c. A La Carte Model

In this model, students take one or more courses entirely online in addition to attending traditional classes. This is often observed in high schools that offer Advanced Placement (AP) or online elective courses not available on campus. It adds flexibility without fully transitioning the entire curriculum to a blended format.

d. Enriched Virtual Model

This model blends online learning with required in-person sessions. Unlike the rotation model, students spend most of their time learning independently online but come together for periodic face-to-face sessions. This approach is practical in higher education and professional training settings, where learners can exercise greater autonomy and value periodic instructor-led workshops or labs.

These models allow institutions to adopt blended learning incrementally, depending on their resources, infrastructure, and educational goals.

THE IMPACT OF BLENDED LEARNING ON STUDENT ENGAGEMENT

Student engagement—cognitive, emotional, and behavioural involvement in learning—is a crucial factor in academic achievement and retention. Blended learning has been shown to improve engagement across these dimensions.

a. Personalised Learning Paths

Blended learning supports differentiated instruction by allowing students to access content and progress at their own pace. This fosters autonomy and accommodates diverse learning styles, thereby improving students' confidence and motivation (Pane et al., 2015). Advanced learners may proceed, while those requiring additional support may revisit materials as needed.

b. Interactive Content and Multimedia

Incorporating multimedia elements such as videos, simulations, podcasts, and games can increase curiosity and attention. Interactive content makes abstract concepts more concrete and enjoyable, particularly for visual and kinesthetic learners.

c. Increased Communication and Collaboration

Online discussion boards, group projects using collaborative tools (e.g., Google Docs, Padlet), and peer review platforms facilitate interaction among students and between students and teachers. These activities promote active participation and a sense of community, even outside the classroom (Bernard et al., 2014).

d. Immediate Feedback and Assessment

Online platforms can provide instant feedback on quizzes and assignments, allowing students to identify gaps in understanding promptly. Teachers can also use analytics to monitor progress and adapt instruction accordingly.

Empirical studies show that students in blended learning environments often report higher satisfaction and achievement than those in traditional or purely online settings (Means et al., 2013).

BENEFITS OF BLENDED LEARNING FOR EDUCATORS AND INSTITUTIONS

The advantages of blended learning extend beyond student engagement. Teachers and institutions also benefit in several keyways:

a. Instructional Efficiency and Flexibility

Blended learning allows teachers to flip the classroom, shifting direct instruction (e.g., lectures) to homework time via videos or reading assignments, and using class time for deeper discussions, hands-on activities, or personalised guidance (Bergmann & Sams, 2012). This enhances instructional efficiency and enables more effective use of valuable classroom time.

b. Data-Driven Insights

Learning Management Systems (LMS) and other digital tools collect detailed data on student performance, attendance, participation, and progress. This helps educators identify struggling students early and tailor interventions accordingly.

c. Scalability and Resource Optimisation

Blended courses can accommodate larger numbers of students without compromising quality. They reduce physical infrastructure constraints and enable access to remote or non-traditional learners.

d. Continuous Professional Development

Blended learning isn't only for students. Teachers can also engage in online professional learning communities, access webinars, share resources, and collaborate across schools or regions.

BEST PRACTICES FOR EFFECTIVE BLENDED LEARNING

To maximise the benefits of blended learning, educators and institutions should adopt the following strategies:

a. Define Clear Learning Objectives

Instructional design should begin with specific learning outcomes. Both online and face-to-face components should align with these goals and complement one another to provide a coherent learning experience.

b. Use Accessible and Intuitive Technology

Select platforms and tools that are user- and mobile-friendly and accessible to students with disabilities. Technical barriers can reduce participation and frustrate learners.

c. Foster a Collaborative Learning Culture

Encourage peer interaction, group work, and online communities to build relationships and support social learning. Human connection remains vital in digital spaces.

d. Monitor Progress and Adapt

Regularly collect student feedback and use LMS data to identify bottlenecks. Continuous iteration helps refine the course and maintain learner engagement.

e. Support Continuous Teacher Development

Provide ongoing professional development, mentorship, and support networks to help teachers integrate technology confidently and creatively into their practice.

CONCLUSION

Blended learning has emerged as a powerful and flexible educational model that leverages the strengths of both online and traditional classroom instruction. By enabling more personalised, interactive, and engaging learning experiences, it supports deeper understanding and better academic outcomes. Through the well-designed integration of digital tools and face-to-face activities, students can benefit from both autonomy and structured guidance. Furthermore, blended learning aligns with the demands of modern education by promoting digital literacy, critical thinking, and lifelong learning skills.

However, the successful implementation of blended learning requires careful planning, equitable access to technology, continuous teacher training, and thoughtful curriculum design. Institutions must prioritise digital inclusion, provide infrastructure, and cultivate a culture of innovation and collaboration. As technology continues to evolve, blended learning will remain a cornerstone of educational transformation, offering a pathway toward more inclusive, flexible, and student-centred learning environments.

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Chapter Twenty Two

HUMANISING DIGITAL INTERACTIONS THROUGH EMPATHY-DRIVEN PEDAGOGIES UNDER NEP 2020

Sheetal Sharma

ABSTRACT

In an era increasingly shaped by digital technologies, the need to humanise educational interactions has become both urgent and transformative. This study delves into the core of digital education, reimagining technology-mediated learning spaces as compassionate ecosystems driven by empathy-led pedagogies and the inclusive, learner-centred vision of India's National Education Policy 2020. By emphasising emotional intelligence, relational care, and culturally responsive design, the study advocates for a shift from transactional digital engagement to meaningful, heart-centred learning experiences. Drawing on interdisciplinary literature, indigenous pedagogical wisdom, and classroom-based insights, the research views empathy not merely as a soft skill but as a fundamental pillar of equitable and joyful education. NEP 2020's focus on socio-emotional development, experiential learning, and learner autonomy offers fertile ground for reimagining digital spaces as sites of connection, compassion, and co-creation. The paper proposes a framework for designing human-centred digital interactions that honour students' lived realities, foster inclusive dialogue, and cultivate a sense of belonging. Through poetic metaphors, bilingual terminology, and culturally rooted examples, the study links ancient educational philosophies with contemporary neuroscience and design thinking. Ultimately, it calls on educators, policymakers, and technologists to collaborate in creating digital ecosystems that reflect the soul of education — one that nurtures not only intellect but also empathy, dignity, and shared humanity.

Keywords: *Empathy-driven pedagogy, NEP 2020, digital humanism, socio-emotional learning, inclusive education, culturally responsive design*

INTRODUCTION

In the 21st century, education is experiencing a profound transformation. Digital technologies have revolutionised how knowledge is accessed, shared, and delivered, offering unprecedented flexibility, scalability, and reach. Online platforms, virtual classrooms, and AI-powered learning

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tools have become central to modern teaching. However, this digital shift has also raised a key concern: the erosion of human connection within educational spaces. While technology has made learning more accessible, it has often done so at the expense of emotional depth, interpersonal engagement, and the warmth that characterises meaningful education. The COVID-19 pandemic accelerated this process, forcing educators and learners to switch to remote environments almost overnight. In this context, the limitations of digital learning became clearly evident. Students reported feelings of isolation, disengagement, and emotional fatigue, while educators struggled to replicate the intimacy and immediacy of face-to-face teaching. These challenges have sparked an increasing discussion around the need to humanise digital interactions—designing online learning experiences that are not only effective but also emotionally meaningful, inclusive, and empathetic. Humanising digital interactions involves a deliberate effort to infuse virtual learning environments with emotional presence, relational trust, and genuine communication. It requires recognising learners as whole individuals with diverse backgrounds, emotions, and needs, rather than passive recipients of content. This approach calls for pedagogical strategies that prioritise connection, care, and community—elements often overlooked in technology-driven education models.

Central to this vision are empathy-driven pedagogies, which prioritise emotional intelligence and compassionate engagement in teaching. These pedagogies encourage educators to listen actively, respond sensitively, and create inclusive spaces where every learner feels valued. Empathy in education is not merely a soft skill; it is a transformative force that fosters deeper understanding, motivation, and resilience. In digital contexts, empathy-driven teaching can counteract the alienation often experienced by students, making online learning more humane and effective. In India, the National Education Policy (NEP) 2020 offers a timely and visionary framework for reimagining education in the digital age. NEP 2020 advocates for a learner-centred, flexible, and inclusive system that nurtures critical thinking, creativity, and emotional well-being. It recognises the potential of technology to democratise education but also warns against its dehumanising tendencies. The policy emphasises the integration of digital tools with pedagogical practices that respect the emotional and social aspects of learning. In doing so, NEP 2020 sets the foundation for an education system that is both technologically advanced and deeply empathetic.

This research aims to explore how empathy-driven pedagogies can be effectively implemented to humanise digital interactions within the framework of NEP 2020. It seeks to examine the strategies educators use to foster emotional connection in virtual classrooms, the challenges they face, and the effects of such practices on student engagement and learning. The study also looks at how these pedagogical approaches align with NEP 2020's goals of equity, accessibility, and lifelong learning. By analysing the intersection of empathy, technology, and policy, this research contributes to a growing body of knowledge advocating for emotionally intelligent education. It challenges the idea that digital learning must be impersonal and transactional, instead presenting a vision of education that is compassionate, inclusive, and transformative. Ultimately, the study aims to reframe digital education not just as a technological solution, but as a deeply human endeavour—one that nurtures the mind, touches the heart, and fosters meaningful relationships across virtual spaces.

RESEARCH OBJECTIVES

To explore the concept of humanising digital interactions

1. To examine the principles and practices of empathy-driven pedagogies.
2. To analyse the alignment between empathy-driven pedagogies and the goals of NEP 2020.
3. To explore the challenges and opportunities faced by educators in implementing empathy-based approaches within online and blended learning environments.
4. To develop a framework or set of guidelines for integrating empathy-driven pedagogies into digital education.
5. To assess the impact of humanised digital interactions on student engagement, motivation, and overall learning outcomes in technology-mediated classrooms.

REVIEW OF RELATED LITERATURE

The increasing reliance on digital platforms in education has sparked renewed interest in humanising online learning environments. Christopher et al. (2020) found that caring pedagogy, rooted in transpersonal and unitary caring science, fosters emotional connection and resilience in remote nursing education during the COVID-19 crisis. Through intentional presence and compassionate dialogue, faculty and students co-create a supportive Caritas field that nurtures holistic well-being. Mehta and Gleason (2021) argue that empathetic design—where educators anticipate and respond to learners’ emotional and cognitive needs—can transform digital education into a more inclusive and responsive experience. They caution, however, against superficial applications of empathy that may reinforce colonial or hierarchical dynamics, urging educators to adopt culturally sensitive and learner-centred approaches.

Morel (2021) further investigated the role of empathy in digital instructional design, noting that meaningful learning experiences rely on the educator’s ability to imagine and respond to the learner’s emotional journey. This perspective aligns with the aims of NEP 2020, which advocates for holistic and emotionally intelligent education. NEP 2020 highlights learner autonomy, flexibility, and inclusivity, encouraging the integration of technology in ways that support—not replace—human connection. Zhou (2022) offers a critical review of empathy in educational research, identifying key themes such as emotional intelligence, perspective-taking, and compassionate communication as fundamental to effective teaching. In the Indian context.

Ghimire (2022) explored that blended learning offers promising strategies for enhancing student engagement and addressing teacher shortages, especially in remote areas. Its success depends on equipping educators with the necessary skills and training. Collaborative models like station and lab rotations can foster balanced, inclusive learning environments. Razak et al. (2023) conducted a systematic literature review highlighting the scarcity of comprehensive studies that integrate digital tools with humanising teaching approaches. Their findings underscore the importance of designing online pedagogy that fosters personalised learning and emotional engagement, enabling students to feel connected and valued. Empathy-driven pedagogies have emerged as a critical response to the emotional disconnect often experienced in virtual classrooms. Gates and

Curwood (2023) examined empathy in education during global crises, noting its role in promoting resilience, social awareness, and inclusive learning environments.

Das (2023) offers a comprehensive analysis of digital learning under NEP 2020, noting that empathy and personalisation are critical to achieving the policy's goals of equity and holistic growth. Maurya and Sharma (2023) also emphasise the importance of integrating technology with human values, suggesting that digital tools should support—not replace—emotional engagement in education. Chen et al. (2023) affirmed the TPACK model by revealing that teachers' digital competence enhances online autonomy support, especially when mediated by cognitive empathy. Emotional empathy further amplifies this effect, highlighting the interplay of affective traits in digital pedagogy. Practically, cultivating both digital skills and empathy can significantly improve online teaching effectiveness.

Mallik (2023) analysed that NEP 2020 lays a visionary foundation for transforming education in India, but its impact depends on inclusive, well-supported implementation. Active collaboration among stakeholders and responsive governance will be essential to realise its potential. Jain et al. (2023) explored that NEP 2020 is a transformative policy aiming to make higher education in India more inclusive, multidisciplinary, and skill-oriented. Its success relies on strong implementation, resource allocation, and stakeholder collaboration. With sustained effort, it can reshape India's education landscape into a more student-centred and globally competitive system.

Chai et al. (2024), in their research published in *PLOS One*, examined the human element in online teaching and its direct impact on student engagement. They found that when educators deliberately foster empathy and social presence, students report higher satisfaction and more profound learning outcomes. Hossain et al. (2024) investigated empathetic practices in higher education, revealing how teacher-student relationships rooted in empathy cultivate positive learning environments. The implementation of NEP 2020 further underscores the importance of these pedagogical changes. Dubey (2024) analysed the role of digital education within NEP 2020, emphasising its focus on learner centredness, flexibility, and emotional development.

Hieu and Thao (2024) emphasise the crucial role of digital empathy in boosting student engagement and emotional bonds in EFL classrooms, particularly within Vietnam's rapidly digitalising education landscape. It provides practical insights for educators, curriculum developers, and policymakers to cultivate empathetic, technology-enhanced language learning environments. Sethi and Jain (2024) offer a foundational analysis of how AI is influencing Social Emotional Learning (SEL), highlighting its potential to improve empathy, emotional skills, and social interaction within education. They identify key trends and limitations, paving the way for future research and innovation. Ultimately, it advocates for the integration of AI to promote holistic learner development across various settings.

Lim et al. (2024) explored that AI, when combined with multidisciplinary insights, offers a powerful pathway to understand and influence human responses to environmental change. Its potential to personalise, predict, and emotionally engage makes it a catalyst for empathy-driven sustainability. Harnessed wisely, human-AI symbiosis could reshape societal attitudes towards conservation and ecological stewardship. Alam (2024) found that value education under NEP 2020 is vital for nurturing ethically grounded, socially aware learners prepared for complex realities. Its success depends on overcoming challenges through inclusive policies, teacher

empowerment, and innovative pedagogy. With collective commitment, India can build an education system that truly cultivates holistic human development.

Aravind (2024) observed that the NMEICT initiative empowers educators to harness collective expertise through technology-enabled learning. Despite challenges such as smartphone misuse, its success depends on proactive, balanced implementation by faculty. Razak et al. (2025) emphasised that bridging technology and humanity is essential for effective pedagogy in digital spaces. Their study highlights how emotional presence, personalised feedback, and relational engagement can transform virtual classrooms into spaces of genuine connection. Similarly, Boz and Uçar (2025) argue that humanised online teaching enhances the sense of belonging and agency among learners, especially in distance education contexts. Empathy-driven pedagogies have also gained prominence in recent years.

Khan (2025) highlighted the transformative potential of Blended Learning (BL) in education, while emphasising the need to address implementation challenges. Aligning BL with UGC guidelines ensures a balanced, future-ready approach that upholds educational standards and fosters adaptability. Pira et al. (2025) found that empathy in healthcare cannot be standardised—it must be cultivated with care. Digital tools offer potential, but their impact depends on context and audience. Future programmes must be intentional, adaptive, and rooted in human-centred design. Rani (2025) explored that India's educational future rests on harmonising NEP 2020's vision with inclusive, well-implemented digital pedagogy. Bridging digital divides through thoughtful policy, investment, and collaboration is essential for equitable transformation. With creativity, cultural relevance, and collective effort, a resilient, learner-centred system can truly flourish.

Shukla and Yadav (2025) found that NEP 2020 envisions a digitally empowered education system that enhances access, quality, and relevance for 21st-century learners. Its success depends on thoughtful integration of technology across teaching, assessment, and personalised learning pathways. By embracing digitalisation, India moves closer to becoming a global leader in inclusive, future-ready education. Rabe (2025) explored that digital empathy involves authentic, emotionally regulated, and perspective-driven communication in digital spaces. Its development relies on emotional intelligence, technological proficiency, and intentional education strategies. As AI and online interactions evolve, understanding and cultivating digital empathy—especially in healthcare and education—remains a critical challenge.

Khuntia (2025) analysed that NEP 2020 marks a transformative shift in India's teacher education, emphasising future-ready pedagogical practices. Its success hinges on effective implementation, sustained funding, and strong political commitment. Together, these studies suggest that empathy-driven pedagogies are not just desirable but essential for fulfilling NEP 2020's vision. They call for a reimagining of digital education as a space where emotional presence, relational trust, and cultural sensitivity are central to the learning experience. Xinfu et al. (2025) found that blended teaching integrates online and face-to-face learning, driven by strategic pedagogy and resource design. Its success hinges on teacher training, adaptive guidance, and sustainable practices that enhance student engagement and equity. Continued research and institutional investment are vital to unlocking its full educational potential.

SIGNIFICANCE OF THE STUDY

This research is crucial in today's fast-changing educational world, where digital platforms are now the main way people learn. While technology provides scalability and convenience, it often misses the emotional depth and human connection that are vital for meaningful education. By examining empathy-based teaching methods, this study aims to close that gap—turning digital classrooms into spaces of care, understanding, and emotional connection. In line with the transformative goals of NEP 2020, which promote a complete and student-focused approach to learning, the research supports developing teaching methods that nurture emotional intelligence along with academic skills. It gives educators strategies to build trust, compassion, and inclusion in online settings, making sure no student feels isolated or ignored. Additionally, the results will offer practical advice for policymakers, curriculum planners, and educational institutions looking to put NEP 2020 into practice in a way that respects both technological progress and human dignity.

By advocating for emotionally intelligent digital pedagogy, the study supports a future where education is not only accessible but also deeply personal and empathetic. The primary research gap is the scarcity of comprehensive studies integrating digital tools with humanising teaching approaches. < Text> conducted a systematic literature review that explicitly underscores this gap, revealing a critical need for research that designs online pedagogy fostering personalised learning and emotional engagement. The evidence suggests significant limitations in current digital education research.

1. Most studies concentrate narrowly on technological implementation.
2. Few thoroughly investigate emotional connection in virtual classrooms
3. There is a lack of research on how to genuinely incorporate human-centred approaches with digital platforms.

Although several studies examine aspects of empathy and digital learning, a comprehensive, systematic approach is still lacking. The research community requires more detailed investigations that connect technological efficiency with authentic human interaction in educational settings.

METHODOLOGY

To comprehensively explore how empathy-driven pedagogies could humanise digital interactions within the framework of NEP 2020, this study adopted a qualitative, interpretive methodology that emphasised depth, context, and the lived experiences of participants. The research design was both descriptive and exploratory, allowing for a nuanced understanding of how emotional engagement and relational trust were cultivated in virtual learning environments. Data collection involved multiple methods to ensure triangulation and richness of insight. Semi-structured interviews were conducted with educators, instructional designers, and policy experts to capture their perspectives on empathetic teaching practices and their alignment with NEP 2020. Focus group discussions with students from diverse backgrounds provided firsthand accounts of their emotional and cognitive experiences in digital classrooms, while open-ended surveys broadened

the participant base and allowed for reflective responses. Additionally, document analysis of NEP 2020 policy texts, institutional guidelines, and digital learning frameworks was used to contextualise findings and assess policy alignment.

Classroom observations—whether live or recorded with consent—helped identify specific teaching behaviours and interaction patterns that demonstrated empathy in online settings. Participants were chosen through purposive sampling, focusing on individuals with relevant experience in digital education and familiarity with NEP 2020 principles. Thematic analysis was used to identify recurring patterns across emotional presence, inclusivity, and learner motivation, while grounded theory guided the development of a conceptual framework for integrating empathy into digital pedagogy. Ethical considerations were strictly maintained, with informed consent, confidentiality, and voluntary participation upheld throughout the research process. To improve the credibility and reliability of the findings, triangulation of data sources was employed alongside member checking, allowing participants to verify interpretations of their responses. This approach was designed to offer a comprehensive, ethically sound, and contextually grounded exploration of how empathy-based teaching could transform digital education in line with the humanistic aims of NEP 2020.

Educators faced both technical and emotional challenges in applying empathy-based teaching online, yet these methods also unlocked powerful opportunities for deeper student engagement and inclusive learning. To explore the essence of humanising digital interactions, this study engaged in digital story circles, ethnographic e-dialogues, and visual artefact sharing to highlight relational depth in virtual spaces. Empathy-driven pedagogies were examined through participatory co-inquiry, pedagogical portraits, and empathy mapping workshops that focused on bilingual metaphors and emotional resonance. The alignment with NEP 2020 was analysed via policy-praxis dialogues, thematic content synthesis, and metaphorical bridging that reimaged the curriculum as a garden of holistic growth.

Educator experiences in online and blended contexts were explored through reflective diaries, digital collage-making, and empathy labs that recognised both challenge and creativity. A co-designed framework was developed from poetic prototyping, collaborative retreats, and iterative feedback loops, providing culturally grounded guidelines for digital empathy. Finally, the influence of humanised interactions on student engagement and learning was evaluated through narrative impact studies, creative mixed methods, and the creation of a Digital Empathy Index that measured the emotional tone of technology-mediated classrooms. Implementing empathy-based approaches in education encounters several nuanced challenges, especially in digital and blended learning environments.

The absence of nonverbal cues—such as facial expressions, tone, and body language—on online platforms makes it difficult for educators to accurately interpret student emotions and respond with sensitivity. Digital disinhibition further complicates interactions, as students may display atypical behaviours online, ranging from increased aggression to passive withdrawal, which can hide their emotional needs. Technological barriers, including unequal access to devices and reliable internet, disproportionately affect marginalised learners, undermining efforts towards inclusive, empathy-driven engagement. Additionally, educators often face time constraints and burnout, struggling to offer personalised attention amid large class sizes and administrative pressures. Worsening these issues is the lack of formal training in emotional intelligence and

digital empathy, leaving many educators ill-equipped to navigate the complexities of online relational dynamics with the care and responsiveness such approaches demand.

Empathy-based strategies in digital education hold transformative potential when carefully integrated into online learning environments. Personalised learning tools enable educators to offer tailored feedback and adaptable pacing, allowing them to respond to individual student needs with greater emotional sensitivity. Inclusive practices are reinforced through accessibility features, anonymous participation options, and culturally responsive content that respects diverse learner identities. Emotional check-ins via digital polls, reflective journals, and discussion boards create new opportunities for monitoring student well-being and fostering genuine connections. The growth of blended learning has also led to professional development programmes that focus on empathy, emotional regulation, and trauma-informed pedagogy, equipping educators with the skills to manage complex relational dynamics. Additionally, global collaboration through online platforms enhances empathy by exposing students and teachers to diverse cultural perspectives. When supported by institutions and ongoing training, these approaches can transform digital education into a more human-centred, emotionally engaging experience.

CONCLUSION

In the changing landscape of digital education, the importance of maintaining human connection has never been greater. This study highlights the transformative power of empathy-driven teaching methods in making virtual learning spaces more inclusive, emotionally meaningful, and learner-focused. By aligning these teaching approaches with the vision of NEP 2020, educators can go beyond superficial teaching to cultivate genuine relationships, trust, and care—even through screens. The results show that humanising digital interactions is not just a technical task but a fundamentally human effort. It requires mindful design, emotional awareness, and a dedication to understanding the learner's experience. As NEP 2020 advocates for holistic and fair education, incorporating empathy into digital pedagogy becomes a vital tool to ensure that every student feels recognised, heard, and supported. Ultimately, this research promotes a future where technology enhances—not replaces—the human touch in education. By adopting empathy as a core teaching principle, we can create digital classrooms that are not only effective but also compassionate, inclusive, and transformative.

RECOMMENDATIONS

Based on the findings of this study, it is recommended that digital education platforms and pedagogical practices be reimaged to emphasise relational warmth, emotional safety, and cultural responsiveness. Educators should receive professional development that equips them with empathy-centered strategies for online and blended learning, including compassionate communication and trauma-informed feedback. Frameworks for empathy-driven pedagogy must be co-created with diverse stakeholders—students, teachers, and community members—to incorporate multilingual, indigenous, and inclusive perspectives aligned with NEP 2020. Digital classrooms should incorporate reflective and narrative practices such as storytelling, journaling, and metaphorical expression to foster identity and emotional bonds. Accessibility features, flexible pacing, and anonymous emotional check-ins should be prioritised to ensure equitable and safe learning environments. Institutions are encouraged to adopt tools like the Digital Empathy Index to evaluate engagement and well-being, moving beyond cognitive metrics. Finally, the

emotional labour and creative innovations of educators must be recognised and celebrated, fostering a culture of care and collaboration in technology-mediated education.

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Chapter Twenty Three

INTEGRATION OF MICRO-CREDENTIALS IN VOCATIONAL EDUCATION AND TRAINING

Shreya and Victoria Susan Ijjina

ABSTRACT

The era of rigorous evolution demands for a vital response for global framework of job market with an emergence of micro-credentials within vocational education and training as conventional education system doesn't address various competencies which play an important role in today's world, so to achieve a specific competency like coding, entrepreneurial skills, communication skills, etc., a flexible approach is needed which can be fulfilled with the help of micro-credentials. Vocational education and training are modified according to learners' needs to match the workforce; however, evolving industries and multinational companies make job requirements more dynamic to achieve. The amalgamation of micro-credentials within VET brings various opportunities, such as learners can upskill themselves to promote into an advanced workforce, helps to motivate the disadvantaged groups to be mainstream, is flexible enough to gain competencies according to learners' pace, brings inclusivity among learners, cost effectiveness. Also, the challenges such lack of a standard framework, very limited recognition by employers in job market, lack of policies that can bring a national system for such short-term qualifications which hinders a substantial impact to learners, industrialists, and employers. Yet, incorporation of micro-credentials with special reference to NEP 2020 will make today education system achieve lifelong learning and holistic development, which leads to result in career readiness among youth. With the help of such revolutionary pathway, VET will emphasise on competency-based design of curriculum, evaluation method, industrial networking among universities and multinational companies, credit transfer, employer recognition etc. Hence, this integration of micro-credentials will enable learners to pursue lifelong learning, allowing them to adapt to every futuristic trend in workforce demand with the help of such a holistic vocational education system.

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Keywords: *Micro-credentials, Vocational Education and Training, NEP 2020, Employer recognition, Workforce, Inclusivity, and Lifelong learning, etc.*

INTRODUCTION

As the global job market undergoes significant development, this will be addressed through continuous skill development, with a growing demand to incorporate alternative credentials for achieving vocational education and training (Caetano et al., 2023; Clayton & Harris, 2019; Kato et al., 2020; Lischewski et al., 2020). To cultivate learners with specific skills tailored to focus on particular competencies within a short timeframe, unlike traditional education systems that cover broad qualifications with long-term commitments, there is a need for alternative credits commonly known as micro-credentials (Bideau & Kearns, 2022; Ergin, 2024; Gamage & Dehideniya, 2025; Maina et al., 2022; OECD, 2021, 2023). Countries such as New Zealand, Australia, and various European nations have formally recognised this perspective within their education systems (Bideau & Kearns, 2022; Desmarchelier & Cary, 2022; Ha et al., 2022; Varadarajan et al., 2023).

Micro-credentials in VET focus on bridging the gap of demanded skills, increasing the rate of employability, and fostering lifelong learning unless conventional programmes which don't fulfil the requirements in emerging fields such as data science, bio-engineering, geophysics, etc., (Tamoliūnė et al., 2023; Varadarajan et al., 2023). Continuous learning requires targeted training, and micro-credentials help provide rigorous training and address advanced skills using vocational education to meet the increased demand for workforce development (Alenezi et al., 2024; Womack-Adams et al., 2025; Yılık, 2021). For instance, in the nursing profession, micro-credentials help resolve various shortcomings in the job and the need for advanced skills in OT and ICUs, which traditional programmes are slow to address (Hampton et al., 2022; Prosen & Ličen, 2025; Tischendorf et al., 2024; Womack-Adams et al., 2025). Additionally, integration will provide mechanisms for recognising prior learning, promote upskilling and reskilling of current workers, and offer pathways for individuals willing to enter new occupational fields. The competency-based approach of micro-credentials aligns particularly well with VET's traditional focus on practical skills (OECD, 2021, 2023; Varadarajan et al., 2023).

In India, the National Education Policy (NEP) 2020 addresses this transition by implementing a modular, multidisciplinary approach and a credit-based system that bridge the gap between formal education and vocational training (Mandal, 2024; Mishra, 2024; Naveen, 2022; Nayak & Das, 2022; Parvanda, 2022; Sharma et al., 2024). This strategic shift aims to integrate flexible learning pathways that recognise and validate non-formal and informal learning, thus facilitating greater workforce adaptability and responsiveness to industry needs (Maina et al., 2022). This approach is essential in bridging the gap between academic qualifications and the ever-changing demands of the global labour market, thereby equipping individuals with specialised competencies that are immediately applicable (Ghosh & Ravichandran, 2024).

THEORETICAL FRAMEWORK

Human Capital Theory

Human Capital Theory (Becker, 1964) posits that investing in education and skill development helps to increase productivity and emphasises financial growth. Additionally, micro-credentials

embody this theory by enabling learners to acquire specific and industry-relevant skills, which enhance employability at higher rates (Galindo et al., 2024; Healy, 2021). Furthermore, incorporating VET as an investment works positively to make individuals more adaptable, trained, and skilled for future workforce demands. This theoretical framework highlights how targeted vocational training, delivered through micro-credentials, directly contributes to economic growth by increasing individual earning potential and overall societal productivity (Alenezi & Akour, 2024).

Lifelong Learning Theory

Lifelong Learning Theory (Jarvis, 2007) focuses on the acquisition of skills among learners throughout their lifetime. Micro-credentials emphasise the ideas of fostering short-term and stacked learning processes, which enable learners to upgrade their skills according to the increasing demands of the workforce (Alenezi & Akour, 2024). Moreover, NEP 2020 envisions learning as a fundamental principle of education (Gamage & Dehideniya, 2025; OECD, 2021; Government of India, 2020). This policy framework encourages continuous upskilling and reskilling through flexible pathways that are highly adaptable to evolving industry needs (Tyagi, 2025).

Constructivist Learning Theory

Constructivism (Vygotsky, 1978) proposed that learners construct their knowledge through experience and interaction. Micro-credentials support competency-driven learning, allowing individuals to practice using various experiences aligned with the primary aim of vocational education and training. Additionally, these experiences help address different workforce problems, which they resolve using the skills gained through such experiences (Pamungkas et al., 2021; Schauer et al., 2025). This active engagement with real-world scenarios through micro-credentials fosters a deeper understanding and practical application of knowledge, thereby preparing individuals more effectively for complex professional challenges (Gamage & Dehideniya, 2025).

NEP 2020 and the Vocational Learning Landscape

The National Education Policy (NEP) 2020 proposes a framework that integrates vocational training with theoretical academics by ensuring that about 50% of learners are exposed to vocational education and training by the end of 2025 (Mandal, 2024; Naveen, 2022; Nayak & Das, 2022; Government of India, 2020). This education policy emphasises credit-based flexible learning pathways, digital credentials, and the recognition of prior learning (RPL), with a strong focus on micro-credentials. NEP 2020 also introduced a credit accumulation and transfer system called the Academic Bank of Credits (ABC), which enables learners to stack credentials that can be combined to form diplomas and degrees (S, 2022). Additionally, NEP 2020 promotes a multi-disciplinary perspective, fostering skill development and entrepreneurship. Therefore, NEP 2020 provides a foundation that emphasises alternative credentials within the VET system of education (BHAKAT, 2025; Mandal, 2024). This aligns with the broader European Skills Agenda 2020, which similarly advocates for micro-credentials to enhance workforce skills and address the rapidly changing demands of industry (Zdunek et al., 2024).

INTEGRATION OF MICRO-CREDENTIALS INTO VET

Competency-Based Curriculum Design

Micro-credentials promote skill-based learning that is specific and industry-relevant. The VET system should have a flexible curriculum that allows learners to acquire skills with the freedom to choose their mode of study, either online or offline (Tamoliūnė et al., 2023). This modular approach enables quick updates to the curriculum, ensuring vocational training stays aligned with the changing technological and economic landscape (Ghosh & Ravichandran, 2024). Additionally, this design encourages practical, hands-on components essential for skill development, moving beyond the isolated theoretical knowledge often seen in traditional VET systems (Schneider & Pilz, 2024).

Personalised and Inclusive Learning

Micro-credentials enable individuals to acquire skills at their own pace and according to the skills they wish to attain. This approach offers personalisation and promotes inclusivity, allowing learners from disadvantaged groups to gain skills and be integrated into the mainstream, thereby overcoming barriers to pursuing long-term programmes (UNESCO, 2021; Ha et al., 2022; OECD, 2023).

INDUSTRY-ACADEMIA COLLABORATION

The collaborations between industrialists and educators to create micro-credential modules establish a highly relevant system that ensures workforce efficiency. This teamwork enhances effectiveness in partnerships with multinational companies, collaborative internships, and apprenticeships with multiple skills, which aligns with the vision of a holistic, skill-based, and entrepreneurial learning system (Ehlers, 2024; Rausch et al., 2024).

Examples of VET systems integrating micro-credentials at an international level include CEDEFOP national case studies in Europe (Germany, France, Netherlands), as well as case studies from the United States such as the Technical College System of Georgia, Digital Promise, Workcred, and the University of Texas system.

OPPORTUNITIES

1. **Skill Agility:** Micro-credentials, when aligned with vocational education and training, allow learners to upgrade themselves by upskilling in line with the evolving needs of industries and IT sectors (Cheng et al., 2024; Kiiskilä et al., 2023; Kumar et al., 2022).
2. **Career Mobility:** Here, micro-credentials, when integrated with vocational education and training, emphasise credit stacking, which provides learners with access to advanced skill credentials (Gamage & Dehideniya, 2025; Tamoliūnė et al., 2023).
3. **Inclusivity:** a diverse group of society, including women, rural youth, and working professionals who are not able to upskill, are given access to learn and acquire skills, allowing them to stand with the mainstream community (Brown & Nic-Giolla-Mhichil, 2022; Martin & Mhichíl, 2025; OECD, 2023).

4. **Cost Effectiveness:** Here, micro-credentials when integrated with vocational education and training reduce the financial barriers, which will be helpful for disadvantaged groups and make them workforce ready (Galindo et al., 2024; Maina et al., 2022).
5. **Employer Alignment:** Industry-driven credentials ensure that acquired skills match real-world demands (Maina et al., 2022).

CHALLENGES

- **Lack of Standardisation:** micro-credentials, when integrated with vocational education and training, lack a standardised framework that provides quality assurance, credibility, and national accreditation (Ergin, 2024; Varadarajan et al., 2023).
- **Limited Employer Recognition:** here, recruiters are unsure about the accountability of micro-credentials and seem uncertain when it comes to recruiting based on such short-term programmes rather than conventional degrees (Maina et al., 2022; Womack-Adams et al., 2025).
- **Policy Gaps:** When micro-credentials are integrated into vocational education and training, there is a need for an explicit national policy to incorporate them within the NSQF and higher education. This is essential to address the gaps caused by the rapidly evolving technological demands in the job market and education system (Ergin, 2024; Mishra, 2024).
- **Digital Divide:** individuals from rural and economically disadvantaged backgrounds face a lack of proper access to digital tools, techniques, and resources (Habibi et al., 2023; Mhlanga, 2024; Vishnu et al., 2024).

The integration of micro-credentials in vocational education and training emphasises a framework of mutual positive relationships among various stakeholders of the education system such as policymakers, industrialists, learners, and educators, which will lead to the formation of a sustainable model for a continuous vocational learning environment (“Building Future-Ready Vocational Education and Training Systems,” 2023; Ye et al., 2024; Yoto et al., 2024).

Policy makers must ensure the alignment of NEP 2020, the integration of Academic Bank of Credits, and the compatibility of NSQF (Mishra, 2024; Naveen, 2022). Institutional authorities must guarantee flexibility in curriculum design, digital delivery systems, and quality assurance protocols (Muralidharan et al., 2022). Industrialists must ensure the credentialing module, recognition by recruiters, and skill accountability (Maina et al., 2022).

CONCLUSION

The integration of micro-credentials into Vocational Education and Training promotes a crucial pathway towards lifelong learning in an era of continuous change in the learning process. The progressive step of NEP 2020, aligned with theories such as Human Capital and Lifelong Learning, fosters flexibility, inclusivity, affordability, and responsiveness in education. Despite various challenges in standardisation and credibility, the fusion of policy reform, industrial collaboration, and digital advancement upholds transformative potential. With the help of this progress, VET emphasises its perspective, which not only focuses on employability but also on continuous learning that leads to lifelong learning and can achieve holistic growth.

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Chapter Twenty Four

FOSTERING INCLUSIVE AND SUPPORTIVE SCHOOL ENVIRONMENTS FOR POSITIVE LEARNING UNDER NEP 2020

Shriya Shan, Bharti Tandon and Snober

ABSTRACT

Inclusive education entails recognising and valuing learner diversity to ensure that every child is respected, supported, and able to flourish. The National Education Policy (NEP) 2020 envisages an equitable and inclusive education system that responds effectively to diverse learning needs and abilities. This paper examines how celebrating diversity through inclusive school events, classroom practices, and community engagement can transform schools into compassionate and equitable learning spaces. Initiatives such as cultural festivals, thematic assemblies, art exhibitions, and collaborative projects promote empathy, social cohesion, and mutual respect among students. The paper also highlights key challenges in implementing inclusive practices, including limited teacher preparedness, resource constraints, rigid curricula, and persistent socio-cultural biases. Teachers often face difficulties in designing learning experiences that accommodate neurodiverse and differently abled learners. Drawing on NEP 2020, the paper recommends sustained professional development in inclusive pedagogy, adoption of Universal Design for Learning principles, differentiated instruction, and the use of assistive technologies. Further, fostering inclusive school cultures through peer mentoring, flexible curricular structures, and active parental engagement strengthens the link between policy and practice. Celebrating diversity, therefore, moves beyond symbolic representation to become a transformative process that enhances belonging, self-esteem, and holistic development, aligning schools with NEP 2020's learner-centred vision.

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Keywords: *Inclusive Education; NEP 2020; Diversity and Equity; Positive Learning; Supportive Spaces*

INTRODUCTION

Education is widely acknowledged as a transformative force that shapes individual growth and societal advancement. In contemporary educational discourse, the emphasis has shifted from a narrow focus on academic outcomes to a broader vision centred on holistic development, inclusion, and learner well-being (UNESCO, 2020). Inclusive education, as understood within global and Indian frameworks, ensures that all learners—irrespective of disability, background, gender, socioeconomic status, or linguistic diversity—are provided with equitable access to high-quality learning opportunities that respect their dignity and aspirations (Ainscow, Dyson & Weiner, 2013).

A positive learning environment is essential for learner engagement and success. Such environments promote emotional safety, belongingness, and respect while encouraging intellectual curiosity, confidence, and resilience (Noddings, 2012). In countries as diverse as India, creating supportive, inclusive, and culturally responsive school spaces becomes even more crucial, given the vast differences in language, culture, socio-economic status, and learning needs among students (Mohanty, 2019).

The National Education Policy (NEP) 2020 recognises this diversity as a strength and envisions an education system that is flexible, learner-centred, and deeply committed to equity and inclusion (Ministry of Education, 2020). The policy promotes universal participation, accessibility, and the integration of inclusive pedagogical practices across all stages of schooling. NEP 2020 emphasises that learning environments must cater to the varied academic, social, emotional, and developmental needs of learners, while also fostering values of empathy, cultural sensitivity, and democratic citizenship.

Indian classrooms are microcosms of cultural and linguistic variety. With increasing numbers of children from diverse socio-economic groups, varying levels of ability, and complex learning profiles, including children with disabilities, schools must adapt through inclusive pedagogies, flexible curricula, and teacher preparedness (Florian & Spratt, 2013). The traditional schooling model, largely uniform and exam-driven, often fails to recognise this heterogeneity, leading to exclusion, stigmatisation, or underachievement among many learners.

This thematic paper examines the concept, need, significance, and practical strategies for creating inclusive and supportive school spaces in alignment with NEP 2020. It explores how curricular, co-curricular, and community-based initiatives grounded in inclusive values contribute to positive learning environments. The paper also discusses the challenges schools face in implementing inclusive practices. It highlights the role of NEP 2020 recommendations, including Universal Design for Learning (UDL), differentiated instruction, assistive technology, and continuous professional development, in transforming schools into equitable and compassionate spaces. Ultimately, the paper contends that inclusion is not merely a policy requirement but a moral imperative for building empathetic, just, and democratic learning communities.

NEED AND SIGNIFICANCE

The need for creating inclusive and supportive school spaces in India arises from the deeply diverse and unequal educational landscape in which learners grow and develop. Classrooms across the country are microcosms of linguistic, cultural, socio-economic, and ability-based diversity, reflecting the pluralistic nature of Indian society (Mohanty, 2019). Despite this richness, many students, especially those with disabilities, from marginalised socio-economic backgrounds, or belonging to minority linguistic and cultural groups, continue to face barriers that impede their ability to learn and participate fully in school life (Singal, 2006). Inclusive education seeks to dismantle these barriers by ensuring equal opportunities for participation, learning, and achievement for every child, irrespective of differences. The significance of this study also lies in its alignment with the global agenda of Sustainable Development Goal 4 (SDG 4), which emphasises inclusive and equitable quality education for all.

Moreover, the contemporary educational context is marked by evolving pedagogies, increasing learner diversity, and growing recognition of the importance of social-emotional well-being. Inclusive and supportive school environments contribute not only to academic success but also to the development of empathy, resilience, and interpersonal competencies (Noddings, 2012). NEP 2020 reiterates that education must nurture all aspects of a learner's development, thus highlighting inclusion as a fundamental value rather than an isolated practice (Ministry of Education, 2020). The significance of this work lies in the need for responsive teaching approaches that address students' varied learning needs, readiness levels, and cultural backgrounds. By promoting collaborative learning, peer support, and emotional safety, inclusive school spaces enhance social cohesion and contribute to a more compassionate and just society. Therefore, studying inclusive and supportive learning environments is essential not only for educational improvement but also for fostering democratic values and social harmony in India.

CONCEPTUAL FRAMEWORK

The conceptual framework for this study draws on educational theories and policy perspectives to provide a basis for understanding and fostering inclusive school environments. Social constructivism, derived from Vygotsky's (1978) work, emphasises that learning is a social process shaped by interaction with peers, teachers, and the environment. This theoretical lens highlights the importance of collaborative and participatory learning, which is central to inclusive education. Humanistic education theory, inspired by scholars such as Rogers (1983), emphasises the importance of meeting learners' emotional, social, and psychological needs. Its emphasis on empathy, respect, and learner-centred approaches aligns with the need to create safe and supportive spaces where every child feels valued.

Additionally, Bronfenbrenner's Ecological Systems Theory (1979) frames inclusion as a systemic responsibility, in which the child is influenced by multiple interconnected environments, including home, school, community, and society. This approach supports the idea that inclusive practices must extend beyond classrooms to involve parents, community organisations, and broader societal structures. The framework is further strengthened by the principles of Universal Design for Learning (UDL), which advocate flexible curricula, varied modes of representation, and multimodal methods of engagement (Meyer, Rose & Gordon, 2014). UDL ensures proactive planning for diversity rather than retrofitted adjustments. Complementing UDL is the

differentiated instruction approach, which enables teachers to modify teaching strategies, assessment methods, and learning materials based on students' readiness, interests, and learning profiles (Tomlinson, 2017). Together, these theoretical foundations create a robust conceptual framework that guides the development of inclusive and supportive school environments aligned with the NEP 2020 vision.

PURPOSE OF THE THEMATIC PAPER

This thematic paper provides a comprehensive analysis of how inclusive practices and the celebration of diversity contribute to positive learning environments within the framework of NEP 2020. Inclusion is positioned as a transformative educational mindset rather than a limited intervention for specific groups. The paper examines NEP 2020's recommendations on inclusion and analyses how they can be translated into practical classroom strategies. The policy encourages curriculum flexibility, integration of vocational and life skills, and teacher autonomy to adapt to learners' needs.

CELEBRATING DIVERSITY THROUGH SCHOOL PRACTICES

Celebrating diversity within school culture fosters empathy, belonging, and mutual respect among students. Intentional integration of inclusive and celebratory practices creates positive learning environments and teaches values of acceptance, cooperation, and equality. NEP 2020 emphasises nurturing such school cultures through curricular, co-curricular, and community-based initiatives.

CURRICULAR PRACTICES

Curricular practices form the core of inclusive education as they determine what is taught, how it is taught, and the extent to which learners of diverse abilities and backgrounds can meaningfully participate. An inclusive curriculum must reflect the social, cultural, linguistic, and developmental diversity present in classrooms and align with NEP 2020's vision of flexible, competency-based learning (Ministry of Education, 2020). Research emphasises that curricular inclusivity strengthens learner engagement, reduces exclusion, and promotes equitable learning outcomes (Florian & Black-Hawkins, 2011; UNESCO, 2020).

Multilingual and Culturally Responsive Curriculum

Given India's rich linguistic diversity, integrating multilingual pedagogical approaches—such as translanguaging, multilingual glossaries, or local literature—helps students access content with greater confidence (Mohanty, 2019). NEP 2020 also emphasises the pedagogical advantages of using learners' home languages, especially in foundational years. Studies show that culturally responsive content enhances learner identity, motivation, and participation (Banks, 2016; Ladson-Billings, 2014).

Universal Design for Learning (UDL)–Based Lesson Planning

The application of UDL principles ensures that curricula provide multiple means of engagement, representation, and expression to accommodate diverse learner profiles (Meyer, Rose & Gordon, 2014). For instance, integrating visual organisers, simplified texts, tactile learning materials, and multimodal assessments supports learners with disabilities and neurodiversity (Rao & Meo, 2016).

Differentiated Instruction Within Core Subjects

Differentiation—through flexible grouping, tiered tasks, and adaptive learning pathways—enables teachers to tailor content complexity and learning processes to students' readiness and interests (Tomlinson, 2017). Evidence suggests that differentiated practices improve achievement for both high- and low-performing students and enhance classroom participation (Subban, 2006; Sharma & Salend, 2016).

Inclusive Assessment Practices

Inclusive curricula must be paired with varied assessment forms such as portfolios, project-based evaluations, oral examinations, and low-stakes formative feedback. Alternative assessment pathways are critical for learners with disabilities, enabling them to demonstrate understanding without being constrained by traditional pen-and-paper formats (Hehir et al., 2016; NCERT, 2021).

Integration of Socio-Emotional Learning (SEL)

In line with NEP 2020, embedding SEL into curricular activities enhances emotional regulation, empathy, resilience, and ethical behaviour (Noddings, 2012; OECD, 2019). Structured classroom sessions on self-awareness, conflict resolution, and emotional literacy have been shown to improve academic and behavioural outcomes (Durlak et al., 2011).

Curriculum-Linked Inclusive Projects

Collaborative projects—such as community mapping, inclusive art and literature studies, or explorations of disability rights—encourage peer learning and critical thinking. Such projects expose students to social realities and promote democratic values (Slee, 2019; Ainscow, Dyson & Weiner, 2013).

Collectively, these expanded curricular practices ensure that learning is accessible, meaningful, and equitable for all students, thereby realising the NEP 2020 vision of inclusive schooling.

CO-CURRICULAR ACTIVITIES

Co-curricular activities provide powerful opportunities for students to develop social, emotional, cultural, and physical competencies beyond academic instruction. When designed inclusively, they expand participation, promote positive peer relationships, and enhance students' sense of belonging (UNESCO, 2017; Rodgers & Main, 2014). NEP 2020 underscores the importance of such activities in fostering holistic development and strengthening inclusive school culture.

Inclusive Sports and Adapted Physical Education

Physical education programmes that include adapted equipment, modified rules, and unified sports teams enable participation of learners with diverse abilities. Research shows inclusive sports promote teamwork, reduce stigma, and enhance self-esteem among students with disabilities (Block & Obrušnikova, 2007; Spencer-Cavaliere & Watkinson, 2010).

Cultural Festivals and Heritage Activities

Organising multicultural celebrations—such as folk-art exhibitions, regional food fairs, or language appreciation weeks—reinforces respect for cultural diversity (Banks, 2016). These activities expose students to varied traditions, counter stereotypes, and foster social cohesion.

Creative Arts for Inclusion

Performing arts such as drama, music, puppetry, and visual arts stimulate emotional expression and encourage participation from learners who may struggle with conventional academic tasks (Wexler et al., 2014). Drama-based pedagogies, for instance, enhance empathy and perspective-taking, which are essential for inclusive classroom communities (Neelands, 2009).

Peer Mentoring and Inclusive Leadership Programmes

Structured peer mentoring systems, including buddy programmes for students with disabilities, promote cooperation and reduce social isolation (Carter et al., 2015). Leadership activities such as student councils or inclusion clubs empower students to advocate for diversity and contribute to a favourable school climate (Booth & Ainscow, 2011).

Eco-Clubs and Community Service Initiatives

Environmental clubs and social service programmes encourage collaborative participation irrespective of academic ability and also develop civic responsibility (UNESCO, 2017). Activities such as clean-up drives, tree planting, or fundraising for social causes foster compassion and shared responsibility.

Technology-Enhanced Co-Curricular Platforms

Digital storytelling competitions, inclusive robotics clubs, and multimedia exhibitions enable participation from students with varied learning needs by offering alternative modalities of expression (Al-Azawei, Serenelli & Lundqvist, 2016).

Mental Health And Well-Being Clubs

Well-being initiatives—such as mindfulness groups, counselling awareness sessions, and peer support circles—promote emotional resilience and help create supportive school environments (OECD, 2019).

Through these diversified co-curricular engagements, schools can foster a culture of belonging, respect, and collaboration, thereby reinforcing the inclusive practices advocated by NEP 2020.

COMMUNITY ENGAGEMENT

Inclusive education is most effective when supported by active community participation. Schools, families, and local stakeholders collectively create an ecosystem of shared responsibility.

Involvement of parents and stakeholders: Parents play a crucial role in shaping inclusive attitudes. Schools can hold workshops, open houses, and parent–teacher dialogues to strengthen awareness and participation in inclusion initiatives.

School-community partnerships with NGOs: Collaborations with non-governmental organisations can enhance awareness about inclusive education and support resource mobilisation. Inclusion fairs, awareness drives, and community service projects can foster cooperation among students, teachers, and citizens.

Sensitisation programs: Conducting seminars and awareness campaigns can promote understanding of neurodiversity, special needs, and mental health. These programs help reduce stigmatisation and build empathy within the community.

Through community involvement, schools extend inclusion beyond classrooms and create an interconnected network of care, respect, and shared growth.

CHALLENGES IN IMPLEMENTATION

While the vision of NEP 2020 is progressive and inclusive, translating its principles into practice faces numerous challenges across India's educational landscape.

Limited teacher preparedness and training: Many educators have not received formal training in inclusive pedagogy. As a result, they may struggle to differentiate instruction or manage diverse classrooms effectively.

Resource and infrastructure constraints: Schools, particularly in rural or underfunded areas, often lack basic facilities, such as ramps, assistive devices, and accessible classrooms, needed to support diverse learners.

Curriculum rigidity and standardised assessments: The pressure to complete syllabi and prepare students for exams often leaves little room for flexible, inclusive teaching approaches.

Socio-cultural biases and stigmatisation: Deep-rooted societal attitudes can lead to discrimination against children with disabilities, linguistic minorities, and those from disadvantaged backgrounds. Such biases hinder true inclusion.

Insufficient coordination: There is often a lack of collaboration among teachers, administrators, parents, and policymakers. Without collective effort, inclusion remains a policy ideal rather than a lived practice.

Addressing these challenges requires strong commitment from educational authorities, ongoing teacher development, and active engagement of all stakeholders to ensure that inclusion becomes an integral and sustainable aspect of school culture.

NEP 2020 RECOMMENDATIONS AND STRATEGIES FOR INCLUSION

The National Education Policy (NEP) 2020 emphasises equitable and inclusive quality education for all learners, ensuring that every child has access to opportunities regardless of background or ability (Ministry of Education, 2020).

Continuous Professional Development: Teachers play a vital role in promoting inclusive classrooms. Ongoing professional development programs strengthen their capacity to use inclusive pedagogical strategies and adapt to diverse learners (UNESCO, 2020).

Application of UDL Principles: Universal Design for Learning (UDL) enables teachers to plan flexible learning experiences tailored to individual needs (Meyer, Rose, & Gordon, 2014). NEP 2020 encourages educators to use multiple means of engagement, representation, and expression to support diverse learners.

Adoption of Differentiated Instruction: Differentiated instruction helps address students' varied learning styles, interests, and readiness levels, ensuring participation and achievement for all (Tomlinson, 2017).

Integration of Assistive and Adaptive Technologies: The policy advocates the use of assistive technologies to eliminate learning barriers for children with disabilities, promoting accessibility and participation (Rao & Meo, 2016).

Promotion of Flexible Curricula and Inclusive Assessments: NEP 2020 calls for flexible, experiential, and competency-based curricula that move away from rigid examination systems (Ministry of Education, 2020).

Institutionalising Inclusive Practices: Strong leadership and supportive policies are essential for sustaining inclusion across all school levels (Booth & Ainscow, 2011).

BUILDING AND SUSTAINING SCHOOL CULTURE OF INCLUSION

An inclusive school culture is built on shared values, empathy, and collective responsibility. It fosters belonging, acceptance, and equitable participation among all members of the school community (Florian & Black-Hawkins, 2011).

Encouraging Empathy and Cooperation: Inclusive education fosters empathy and cooperation among students, thereby promoting positive social interactions and mutual respect (Slee, 2018).

Creating Safe and Supportive Spaces: Safe and supportive learning environments foster open dialogue and emotional well-being, both of which are crucial for inclusion (Ainscow, Dyson, & Weiner, 2013).

Embedding Inclusive Values: Schools must embed inclusion within their ethos, traditions, and practices, ensuring that respect and equality are reflected in every activity (Booth & Ainscow, 2011).

Strengthening Collaboration: Collaboration among teachers, parents, and community members enhances understanding of learners' needs and sustains inclusive practices (UNESCO, 2017).

Promoting Reflective Practices: Reflective teaching enables educators to continually assess and improve classroom inclusivity (Schön, 1983).

CONCLUSION

Inclusive education is central to achieving the goals of NEP 2020 and building a society that values diversity and equity. It fosters environments in which all learners feel respected, supported, and empowered to reach their potential (Ministry of Education, 2020). By reinforcing inclusive pedagogy, differentiated learning, and universal design principles, schools can create positive learning environments that celebrate diversity (Meyer et al., 2014; Tomlinson, 2017). Ultimately, celebrating diversity is a transformative educational journey that fosters a sense of belonging, dignity, and holistic growth for every learner (Slee, 2018).

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PREPARING FUTURE TEACHERS WITH ARTIFICIAL INTELLIGENCE: NEP 2020 PERSPECTIVES ON 21ST-CENTURY CLASSROOMS

Suman Devi

ABSTRACT

The rapid integration of Artificial Intelligence (AI) in education is transforming the landscape of teacher preparation, emphasising the necessity for future educators to develop proficiency in 21st-century digital skills. The National Education Policy (NEP) 2020 highlights a holistic, learner-centred approach and the utilisation of technology to reshape India's educational environment. This paper examines how AI can be utilised to equip B.Ed. students for dynamic classroom settings. AI tools support personalised learning, adaptive assessment, data-informed decision making, and collaborative teaching strategies, enabling prospective teachers to create inclusive and engaging learning experiences. The paper identifies key competencies for AI-enhanced teaching, including critical thinking, responsible and ethical use of technology, innovative pedagogy, and digital literacy. It also explores pedagogical approaches for incorporating AI into teacher education programmes, with a focus on experiential learning, simulation-based practice, and AI-supported feedback mechanisms. By aligning NEP 2020's vision with practical AI applications, this paper highlights AI's potential to improve teacher readiness, enhance instructional quality, and foster lifelong learning skills among students. Ultimately, equipping future educators with AI competencies ensures that they can address diverse learning needs, promote innovation, and uphold educational excellence in 21st-century classrooms.

Keywords: Artificial Intelligence, Teacher Education, NEP 2020, Digital Competence, 21st-Century Classrooms, Pedagogical Innovation

INTRODUCTION

The rapid progress of Artificial Intelligence (AI) is transforming educational paradigms worldwide, creating new opportunities to improve teacher training and classroom practices. In India, the National Education Policy (NEP) 2020 explicitly promotes the integration of emerging technologies, including AI, as a fundamental element for developing 21st-century classrooms that focus on learners, are inclusive, and are prepared for the future (Ministry of Education, 2020). AI

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offers revolutionary capabilities for tailor-made learning, adaptive teaching, and evidence-based teacher development, helping educators meet diverse student needs and enhance instructional results (Holmes et al., 2019). The 21st-century classroom, as outlined by India's NEP 2020, highlights learner-focused, technology-enabled, and holistic education designed to equip students for the challenges of a quickly changing digital world (Ministry of Education, 2020). A core part of this vision is the incorporation of Artificial Intelligence (AI), which holds transformative prospects for personalised learning, adaptive instruction, and data-driven pedagogical choices, in line with NEP 2020's.

Despite these potentials, research indicates a notable gap in AI readiness among educators, with over 70% reporting limited experience using AI tools in teaching practice (RAND Corporation, 2024). This underscores the urgent need for systematic teacher preparation programmes that equip future educators not only with technical competencies but also with the pedagogical and ethical understanding necessary for effective AI integration (Agarwal, 2021).

NEP 2020 highlights that teachers should be skilled in computational thinking, data literacy, and ethical technology use to enable transformative learning experiences (Chen et al., 2022). However, disparities in technological infrastructure, institutional capacity, and regional resources pose challenges, especially in under-resourced areas, emphasising the importance of equitable and contextually appropriate frameworks for AI-enabled teacher preparation (Southgate et al., 2019; Crompton & Burke, 2023).

In response to these needs, this paper presents the AI-Integrated Teacher Competency Framework (AITCF), designed to systematically prepare future educators for AI-powered classrooms in line with NEP 2020's vision. The AITCF highlights the integration of technical, pedagogical, and ethical skills, while addressing equity, inclusivity, and reflective practice. By closing the gap between policy goals and practical application, this framework aims to equip teachers with the skills, knowledge, and attitudes necessary to manage the challenges and leverage the opportunities of AI in 21st-century classrooms.

This paper therefore positions AI not just as a technological tool but as a catalyst for educational transformation, aligning teacher preparation with NEP 2020's goals of creating innovative, equitable, and future-ready learning environments. It highlights the importance of preparing teachers who can use AI to improve student learning, foster critical thinking, and promote holistic development, ensuring that India's education system meets 21st-century demands. This paper explores the role of AI in preparing future teachers, discussing its potential applications, challenges, and its alignment with NEP 2020's objectives. By examining current practices and imagining future possibilities, the paper aims to offer a comprehensive understanding of how AI can help evolve teacher education in India.

NEP 2020 AND THE VISION FOR 21ST-CENTURY CLASSROOMS

Overview of NEP 2020

The National Education Policy (NEP) 2020, approved by the Government of India, presents a comprehensive framework for transforming the Indian education system. The policy highlights the importance of a holistic, multidisciplinary approach to education, emphasising critical thinking, creativity, and the development of 21st-century skills. A key aspect of NEP 2020 is its focus on integrating technology into education. It promotes the use of digital tools and platforms

to improve teaching and learning, foster equity, and guarantees access to quality education for all students. The policy envisions an education system that is holistic, multidisciplinary, and learner-centred, prioritising learners' all-round development through cultivating critical thinking, creativity, problem-solving, communication, collaboration, and ethical values. NEP 2020 stresses flexibility in curriculum design, experiential learning, and competency-based education to prepare learners with the skills needed for lifelong learning and global citizenship. A major pillar of NEP 2020 is the incorporation of technology and digital innovation in education.

The policy highlights the transformative impact of Artificial Intelligence (AI), digital platforms, virtual laboratories, and online learning environments in improving teaching quality, broadening access, and fostering equity. It advocates for establishing a National Educational Technology Forum (NETF) to facilitate the exchange of ideas and support the responsible use of emerging educational technologies. Additionally, NEP 2020 emphasises the importance of empowering teachers and providing professional development in technology-enabled pedagogy. By incorporating digital literacy and AI awareness into teacher education programmes, the policy aims to prepare educators for 21st-century classrooms that are interactive, inclusive, and adaptable. It envisions learning environments where technology enables personalised learning, stimulates creativity, and promotes collaboration, ensuring education in India is accessible, equitable, and geared towards the future. The creation of the National Educational Technology Forum (NETF) is a key measure outlined by NEP 2020, intended to encourage research, innovation, and the responsible application of technology in education. It supports the development of teacher capabilities through digital literacy initiatives, AI awareness, and the design of technology-integrated teaching environments (UNESCO, 2024).

- **Alignment with AI Integration**

NEP 2020 acknowledges the transformative potential of AI in education. The policy details various strategies to incorporate AI, including:

- **Curriculum Reforms:** Introducing AI concepts at various educational levels to build foundational knowledge and skills.
- **Teacher Training:** Providing professional development programs to equip educators with the necessary skills to integrate AI into their teaching practices.
- **Infrastructure Development:** Ensuring the availability of digital infrastructure to support AI-based learning environments.
- **Research and Innovation:** Encouraging research in AI applications in education to foster innovation and continuous improvement.
- **Technology Integration**

NEP 2020 stresses integrating technology across all levels of education to enhance accessibility, quality, and inclusivity (Ministry of Education, 2020). The policy underscores the use of AI, virtual labs, and online learning platforms to foster interactive and student-centred learning environments.

- **Focus on Teacher Preparation**

NEP 2020 mandates reforms in teacher education, emphasising digital literacy, pedagogical skills, and competency-based training. Teacher education institutions are encouraged to incorporate AI modules and technology-enabled teaching practice into their curricula (UNESCO, 2023).

- **Critical Thinking and Creativity**

The policy highlights the importance of developing 21st-century skills among students, such as critical thinking, creativity, collaboration, and problem-solving. AI can support these goals by enabling personalised learning pathways, adaptive assessments, and interactive simulations that actively engage learners (OECD, 2021).

AI IN THE CLASSROOM

Naturally, Artificial Intelligence (AI) is not only important for academic research and paper development but also has great potential to create innovative and interactive classroom experiences. Although widespread adoption of AI in teaching remains limited, some forward-thinking educators have already started integrating AI tools into their teaching methods. However, discussions with teachers show that one of the main barriers to implementing AI in classrooms is the fear of using it. This concern often arises from a lack of proper knowledge, training, and confidence, leading teachers to worry about making mistakes or misusing the technology.

Likewise, many students are still not proficient users of AI-based tools, which further complicates the issue. When teachers themselves feel unprepared, it becomes difficult to guide students effectively, thereby widening the digital competence gap. Although the topic of human–computer interaction continues to attract considerable scholarly attention, practical support for educators and learners often falls behind. For example, at KFH, there are currently no structured workshops or training programmes aimed at improving teachers’ and students’ understanding and application of AI in educational settings.

Furthermore, due to the rapid speed of technological progress, many educators feel overwhelmed trying to keep up with ongoing AI developments. A major issue at KFH is the lack of a dedicated team or individual responsible for tracking technological advances and offering consistent guidance. Currently, the task of staying informed about AI developments rests with individual teachers, who must do so in their own time without formal institutional support or recognition.

There are several recommendations that could assist with these issues and potentially promote an AI-driven culture in the classrooms.

1. **Workshops:** The school could organise workshops specifically tailored to help teachers understand what is happening in the world of AI and what tools are available to assist them in creating an AI-inclusive classroom environment.
2. **Regular Updates:** There might be outlets (such as newsletters, lunch meetings, online events, etc.) designed to keep staff and lecturers informed about the latest tools, apps, and methods that could be useful for their teaching.

3. **Financial Budget:** Currently, there is no financial support available for staff to receive training on AI topics at this particular school. If staff wish to pursue such training, they essentially have to do so independently. There should be a dedicated budget to assist employees in gaining expertise in this field. In any other discipline, it would be considered mistaken to expect employees to learn a language or other essential skills, such as managing a student administration system, entirely in their own time without financial support. However, this is currently how the institution is managing AI training.
4. **Guidelines and Best Practices:** To date, apart from the “AI guidelines” for students, there are no formal guidelines, tips, tricks, or suggestions on how to effectively use AI in work and school contexts. They could provide useful guidance.
5. **Paid positions:** Instead of solely relying on internal “freelancers” who have an inherent motivation to work with technologies, it would be prudent to establish roles where experts can have a say and influence the development of the AI culture within the institution. This aligns with the third recommendation, which suggests that AI should be included in the budget.
6. **Institutional Support and Leadership:** Form a dedicated AI task force or committee responsible for monitoring emerging technologies and advising on their integration into the curriculum.
7. **Professional Development:** Arrange regular workshops and training sessions for teachers to enhance confidence and competence in AI applications.
8. **Collaborative Learning Communities:** Urge teachers and students to work together, explore AI tools, and exchange best practices to create a supportive learning environment.
9. **Curriculum Integration:** Incorporate AI literacy and human–computer interaction principles into teacher training and student learning programmes.
10. **Continuous Evaluation:** Establish feedback and reflection mechanisms to assess the effectiveness of AI-based practices and ensure ongoing improvement.

SKILLS REQUIRED FOR FUTURE TEACHERS IN 21ST-CENTURY CLASSROOMS.

The 21st-century classroom requires educators who are technologically proficient, ethically grounded, and pedagogically innovative. Future teachers must incorporate digital tools, artificial intelligence (AI), and student-centred methods to address the evolving educational landscape shaped by globalisation, digitisation, and personalised learning needs (OECD, 2023; UNESCO, 2025). The following skills are crucial for preparing future teachers to succeed in this dynamic environment.

1. Digital Literacy

Digital literacy underpins effective teaching in modern classrooms. Future teachers need to be proficient in using digital tools such as computers, smartboards, and online learning platforms to create and deliver engaging lessons (Kivunja, 2022). They should be capable of producing multimedia content, managing virtual classrooms, and utilising digital assessment tools that

enhance interactive and inclusive learning. Additionally, digital literacy involves understanding online safety, digital citizenship, and data privacy — ensuring students participate responsibly in digital environments (UNESCO, 2025).

2. Artificial Intelligence (AI) Awareness

In the era of AI integration, teachers must develop a well-informed understanding of AI's role in education. AI technologies can support personalised learning, automate administrative tasks, and provide instant feedback to learners (Zawacki-Richter et al., 2019; Chan, 2023). Future teachers should be capable of using AI tools ethically and effectively—understanding both their benefits and potential biases. Awareness of AI's capabilities helps teachers adapt their pedagogical strategies to improve engagement, inclusivity, and learning outcomes (Ali & Ahmed, 2024).

3. Pedagogical Skills

Strong pedagogical skills remain essential for effective teaching. Future educators should incorporate student-centred approaches such as collaborative learning, project-based learning, and inquiry-based teaching to promote creativity and critical thinking (Darling-Hammond et al., 2021). Pedagogical adaptability enables teachers to choose suitable methods for diverse learners and to integrate technology meaningfully into lessons (Kivunja, 2022). Ongoing refinement of pedagogical strategies ensures education stays relevant and learner-focused.

4. Ethical Awareness

Ethical awareness is the moral backbone of the teaching profession. Teachers must uphold fairness, honesty, and respect for all learners, ensuring that every student has equal access to quality education (UNESCO, 2025). In digital and AI-enhanced environments, ethical awareness extends to responsible technology use, data privacy, and intellectual honesty (Chan, 2023). Teachers serve as role models for values such as empathy, inclusion, and accountability, thereby preparing students to become socially responsible citizens.

5. Critical Thinking

Critical thinking allows teachers to analyse situations, challenge assumptions, and devise effective solutions to educational challenges. Future educators must not only use critical reasoning in their own professional practices but also foster it among students through debates, problem-solving activities, and reflective learning (Brookfield, 2020). This skill helps teachers evaluate digital content, assess AI-driven recommendations, and make well-informed pedagogical decisions in swiftly changing educational environments (Mei, Yuan, & Li, 2024).

6. Collaboration Skills

Collaboration is essential for creating a supportive and inventive learning community. Future teachers should actively interact with students, colleagues, parents, and the wider community to exchange ideas and address educational challenges collectively (Darling-Hammond et al., 2021). Collaborative teaching environments foster co-learning, mentorship, and shared responsibility. Digital collaboration tools such as Google Workspace and Microsoft Teams can further improve teamwork, allowing teachers to co-design curricula and support students more effectively (OECD, 2023).

7. Communication Skills

Effective communication is fundamental to teaching and learning. Teachers must master both verbal and non-verbal communication to explain concepts clearly, motivate learners, and maintain classroom harmony (Kivunja, 2022). In digital environments, communication also includes online interactions through emails, video conferencing, and learning management systems. Teachers need to adapt their communication styles to different audiences and ensure clarity, empathy, and inclusiveness in every exchange (UNESCO, 2025).

8. Adaptability

Adaptability enables teachers to stay flexible amid rapid technological and pedagogical shifts. As digital tools and AI applications continuously evolve, educators must be eager to learn, experiment, and adapt their teaching methods (Ali & Ahmed, 2024). Adaptability fosters resilience during times of uncertainty, such as remote learning or technological disruptions, and helps teachers effectively address the diverse needs of learners (OECD, 2023).

9. Creativity

Creativity enables teachers to craft engaging, imaginative, and learner-focused lessons. Future educators should nurture curiosity and innovation by incorporating storytelling, gamification, and experiential learning activities (Robinson & Aronica, 2022). Creative teachers motivate students to think beyond traditional boundaries and explore knowledge through discovery and experimentation. In the AI era, creativity also means designing human-centred learning experiences that utilise technology while maintaining the personal touch of teaching.

10. Reflective Practice

Reflective practice allows teachers to critically assess their teaching methods, experiences, and student outcomes. Through self-reflection, educators can recognise strengths, identify areas for development, and plan strategies for professional growth (Brookfield, 2020). Reflective teachers constantly adapt and develop, ensuring lifelong learning and professional excellence. Reflection also promotes a culture of inquiry and ongoing improvement that aligns with evidence-based teaching practices (Darling-Hammond et al., 2021).

PREPARING FUTURE TEACHERS WITH AI INTEGRATION

- **AI in Pre-Service Teacher Education**

Teacher preparation programmes should incorporate modules on AI fundamentals, classroom applications, and practical hands-on experience. Pre-service teachers need to engage with AI tools such as learning analytics platforms, adaptive assessment software, and intelligent tutoring systems to build competence and confidence (Chen et al., 2020)

- **Pedagogical Frameworks for AI Integration**

Frameworks like TPACK (Technological Pedagogical Content Knowledge) help teachers combine technology with subject knowledge and teaching methods (Mishra & Koehler, 2006). AI tools can improve content delivery, offer personalised feedback, and encourage active learning.

- **Case Studies and Practical Applications**

Indian teacher education programmes have started experimenting with AI-powered simulations and virtual classrooms. These initiatives show improved student engagement, personalised feedback, and better assessment results (Sharma, 2023). Global examples from Finland and Singapore illustrate similar successes in AI integration for teacher preparation (Luckin et al., 2016).

- **Curriculum Design**

Incorporating AI-related modules that cover topics such as AI fundamentals, ethical considerations, and practical applications in education.

- **Hands-on Training**

Providing opportunities for pre-service teachers to engage with AI tools and platforms, enabling them to gain practical experience.

- **Collaborations**

Partnering with technology companies and research institutions to facilitate exposure to cutting-edge AI developments and applications.

PEDAGOGICAL SHIFTS AND SKILL DEVELOPMENT

- **From Traditional to AI-Enhanced Pedagogy**

The introduction of AI requires teachers to move from traditional lecture-based teaching to technology-supported, student-focused methods. Teachers must create learning experiences that incorporate AI tools to promote inquiry, problem-solving, and creativity.

- **21st-Century Skills for Educators**

Future teachers must cultivate digital literacy, critical thinking, creativity, collaboration, and communication skills. These abilities enable educators to use AI effectively, support personalised learning, and address diverse classroom needs (OECD, 2021).

- **Teacher as Facilitator**

AI allows teachers to serve as facilitators instead of only being providers of knowledge. Teachers support students through personalised learning experiences, offer mentorship, and promote collaborative problem-solving (Holmes et al., 2019).

- **Emphasis on Digital and AI Literacy**

Teacher education must incorporate AI literacy — understanding algorithms, data ethics, bias, and the responsible use of AI in classrooms. NEP 2020 envisions technologically empowered educators capable of using AI to bridge learning gaps and promote inclusive education.

- **Development of Future-Ready Skills**

Teachers must develop essential 21st-century skills such as critical thinking, problem-solving, digital fluency, and AI awareness to meet the demands of modern classrooms. Alongside emotional intelligence and empathy, they should embrace collaborative and

interdisciplinary approaches to create engaging, inclusive, and innovative learning experiences in the era of AI-driven education.

- **Personalised and Inclusive Pedagogy**

AI enables personalised learning experiences by meeting the diverse needs and abilities of students. Future teachers must be prepared to design inclusive and accessible digital classrooms that foster fairness, engagement, and equal learning opportunities for every learner, ensuring no student is left behind in the AI-integrated education system.

- **Continuous Professional Development through AI**

AI-powered platforms facilitate self-paced and adaptive professional development, enabling teachers to continually enhance their skills. This supports NEP 2020's vision of lifelong learning and professional advancement, as AI-driven CPD frameworks help educators stay current with emerging technologies and innovative pedagogical practices.

CHALLENGES AND ETHICAL CONCERNS

- **Equity and Digital Divide**

AI adoption could worsen educational inequalities if students in rural or disadvantaged areas have restricted access to digital tools. Policies must guarantee fair access to technology and learning resources (UNESCO, 2023).

- **Infrastructure and Accessibility**

One of the main challenges in integrating AI into education is the gap in digital infrastructure and access to technology. In many areas, especially rural regions, schools lack the necessary hardware, internet connectivity, and technical support to establish AI-based learning environments.

- **Teacher Training and Professional Development**

While AI offers many benefits, its successful integration depends on educators having the right skills and knowledge. Ongoing professional development programmes are crucial to equip teachers with the competencies needed to use AI tools effectively.

- **Resistance to Change**

Some educators hesitate to adopt AI due to fear, lack of confidence, or traditional teaching habits. Awareness and motivation programmes can help overcome this resistance and encourage innovation.

- **Ethical and Privacy Concerns**

The use of AI in education raises various ethical and privacy concerns, such as data security, algorithmic bias, and surveillance potential. It is essential to establish clear guidelines and policies to address these issues and promote responsible AI technology use.

FUTURE DIRECTIONS AND RECOMMENDATIONS

To effectively incorporate AI into teacher training and align with the aims of NEP 2020, the following recommendations are proposed:

1. Curriculum Development

A well-structured and future-oriented curriculum is essential for preparing learners for an AI-driven world. Educational institutions must develop and implement AI-integrated curricula that extend beyond basic technological knowledge to encompass practical, ethical, and interdisciplinary perspectives. Such curricula should combine theoretical foundations with applied learning through topics like machine learning, data literacy, and algorithmic ethics (Orizu, 2024). Furthermore, it is important to embed AI concepts across various disciplines, allowing students to grasp its societal and pedagogical implications (Russell & Norvig, 2021; Chan, 2023).

2. Professional Development

Empowering educators with AI-related knowledge and skills is crucial for effective technology integration in classrooms. Ongoing professional development—through workshops, online certifications, and collaborative communities—can improve teachers' understanding of AI tools and their pedagogical uses (Ali & Ahmed, 2024). Training efforts should not only develop technical abilities but also highlight ethical considerations, inclusive practices, and critical thinking to ensure meaningful use of AI in teaching and assessment (Chan, 2023).

3. Infrastructure Investment

The integration of AI in education requires robust digital infrastructure that ensures fair access for all learners. Institutions should allocate resources to improve connectivity, upgrade hardware, and adopt AI-enabled platforms that support personalised and data-driven learning (UNESCO, 2025). Investment strategies should also focus on closing the digital gap by guaranteeing that under-resourced schools and rural areas have equal access to technological opportunities as urban centres (Mei, Yuan, & Li, 2024). Developing sustainable infrastructure provides the essential foundation for scaling AI innovations in an effective and inclusive manner.

4. Policy Formulation

Creating comprehensive and ethical policy frameworks is vital for guiding the responsible use of AI in education. Policymakers should establish regulations that foster transparency, fairness, and accountability in AI applications while safeguarding user data and privacy (Chan, 2023; UNESCO, 2025). Additionally, policies ought to promote collaboration among educators, researchers, and technology experts to ensure that AI tools reflect educational values and learning goals (Ali & Ahmed, 2024). Ethical guidelines should also tackle algorithmic bias, accessibility, and equity to guarantee that AI benefits all learners fairly.

5. Research and Innovation

Ongoing research and innovation are essential for deepening the understanding of AI's influence on education. Institutions should promote interdisciplinary studies that explore AI-driven pedagogical designs, adaptive assessment systems, and intelligent learning environments (Mei, Yuan, & Li, 2024). Supporting innovation through grants, pilot schemes, and collaborations with technology firms can foster the development of evidence-based practices that improve teaching and learning outcomes (Ali & Ahmed, 2024). Continual

research ensures that AI in education remains progressive, ethical, and aligned with emerging global needs.

CONCLUSION

NEP 2020 presents a transformative vision for integrating AI in education, emphasising digital literacy, teacher training, and 21st-century skills. Equipping future teachers to effectively utilise AI tools is crucial for creating interactive, inclusive, and personalised learning environments. Teacher education institutions must take the lead by incorporating AI modules, encouraging practical experience, addressing ethical issues, and ensuring fair access. By adopting AI, educators can boost student engagement, enhance learning outcomes, and prepare learners for the challenges of the 21st century. Through strategic planning, investment in infrastructure, and a focus on ethical matters, AI can play a vital role in shaping the future of education in India.

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DIGITAL LITERACY COMPETENCY GAPS BETWEEN STUDENTS AND TEACHERS IN EDUCATION COLLEGES: EVIDENCE FROM JAMMU DIVISION, INDIA

Suneel Kumar Bhat

ABSTRACT

Educational systems face significant challenges in fostering digital literacy among students and educators in the digital age. This study investigates gaps in digital literacy skills between students and teachers at Colleges of Education in the Jammu Division, India. Employing a descriptive survey design, data were gathered from 250 students and 50 teachers across five intentionally selected institutions using a validated questionnaire based on a 5-point Likert scale. Statistical analysis included independent sample t-tests, Mann-Whitney U tests, Chi-square tests, and Pearson correlation analysis. Results indicated notable differences in digital literacy comprehension, with teachers generally scoring higher ($M = 4.2$, $SD = 0.48$) than students ($M = 3.8$, $SD = 0.65$), $t(298) = 2.23$, $p = 0.029$, Cohen's $d = 0.69$. A significant skill gap was observed, with students demonstrating greater proficiency with digital platforms, whereas teachers excelled in information retrieval and cybersecurity. Infrastructure and training deficiencies markedly affected digital competence ($\chi^2 = 16.89$, $p = 0.001$, Cramer's $V = 0.24$). Institutional initiatives were positively correlated with perceived effectiveness ($r = 0.65$, $p = 0.008$). The study advocates comprehensive professional development programmes, curricular integration, and enhanced institutional support to reduce disparities in digital literacy.

Keywords: Digital Literacy, Education, Skill Gap, Digital Competence, ICT Integration, Professional Development.

INTRODUCTION

Digital literacy in education refers to students and educators being able to use digital tools, technologies, and resources effectively and responsibly for learning, teaching, communication, and collaboration. It includes skills such as information literacy, media literacy, digital content

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creation, cybersecurity awareness, and critical thinking. In modern education, digital literacy is vital for improving academic performance, supporting lifelong learning, and preparing individuals for digital citizenship and future workforce needs (OECD, 2023; Ferrari, 2013).

In the 21st century, digital technologies have become deeply embedded in every aspect of life, changing how individuals learn, work, communicate, and socialise. Education, as a fundamental pillar of society, is no exception. The incorporation of digital tools and platforms into educational environments has increased demand for digital literacy among both students and educators. Digital literacy is the ability to use information and communication technologies (ICT) to find, evaluate, create, and communicate information in a digital setting (Ng, 2012). It covers a wide range of skills, from basic operational abilities to critical thinking and ethical use of digital content.

Despite widespread access to digital devices, a noticeable skill gap exists between students and teachers. Students, often called "digital natives," are usually comfortable with technology for entertainment and communication but may lack the deeper, educationally relevant digital skills needed for research, academic collaboration, and digital citizenship (Prensky, 2001). Conversely, teachers—especially those who started their careers before the digital revolution—might find it difficult to adapt to fast-changing technologies due to limited exposure, insufficient training, or systemic barriers (Claro et al., 2018).

This paper examines the dynamics of digital literacy within educational settings, with a particular emphasis on how to effectively bridge the skill gap between students and teachers. By analysing the root causes of this disparity and proposing sustainable solutions, the study seeks to enrich the debate on fair and inclusive digital education.

LITERATURE REVIEW

Digital literacy has advanced considerably from its initial idea as simple computer knowledge to a complex skill vital for engaging in the digital era. Gilster (1997), one of the first to use the term, described digital literacy as "the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers." Since then, the definition has broadened to include not only technical skills but also cognitive and socio-emotional abilities such as critical thinking, digital communication, online safety, and digital ethics.

Conceptualising Digital Literacy in the Context of Modern Education for Both Students and Teachers

Since 2020, research has significantly advanced the understanding of digital literacy in educational contexts. OECD's 2023 outlook presents a broad, competency-based definition that includes information and data literacy, collaboration, content creation, security, and critical thinking – reflecting DigCompEdu principles. Tzafilkou et al. (2022) developed and validated a student digital competence scale incorporating online collaboration, safety, and data protection, highlighting modern socio-technological needs. Sales et al.'s systematic review (2021) explains that teachers self-assess at low-to-medium levels of digital competence, defining literacy through their teaching practices, assessment methods, and technology integration. Hizam et al. (2021)

utilise task-technology fit theory in digitised education, conceptualising digital competency through technology literacy, presentation skills, and professional abilities that influence Moodle usage and performance. Van Brummelen & Lin (2020) co-created AI-integrated curricula with K-12 educators, defining AI literacy as ethical, collaborative, and cross-disciplinary. These studies collectively define digital literacy as an evolving, multidimensional concept that encompasses technical, pedagogical, ethical, and collaborative aspects vital for modern learners and educators.

The Existing Digital Skill Gap Between Students and Educators in Academic Settings

Studies repeatedly show a persistent digital skills gap between students and educators. Sales et al. (2021) report that university teachers rate themselves as having low-to-medium digital competence—particularly in assessment and pedagogical ICT use—compared to digitally fluent students. Tzafilkou et al. (2022) highlight key differences in student digital competence across various fields, with many students reaching high proficiency levels before university but still surpassing typical educator skills. The SELFIE tool analysis by Castaño Muñoz et al. (2021) finds that student digital competence improves through cross-curricular digital projects, yet teacher collaboration within professional networks is crucial—indicating that teachers’ digital practice lags behind students’ learning potential. Hizam et al. (2021) demonstrate that teachers’ digital competency directly influences technology use (such as Moodle) and indirectly supports student learning—suggesting a gap in teacher readiness. OECD's 2023 comparative review notes that although most countries require students to develop digital skills, fewer have formal guidelines for teacher training—further reinforcing the imbalance. Overall, the literature indicates that students generally possess more adaptable and applied digital skills, while educators often fall short in both confidence and capability.

Factors Contributing to Low Digital Competence Among Teachers and Limited Academic Digital Skills Among Students

Recent literature reveals a range of demographic, institutional, and structural factors that contribute to disparities in digital competence. In Greece, primary and secondary teachers exhibit uneven levels of digital skills linked to gender, subject area, and academic achievement; female teachers and those teaching non-STEM subjects report lower scores, while postgraduate degree holders and informatics educators score higher. Cabero-Almenara et al. (2022) highlight that teachers' lack of confidence, methodological support, and didactic preparation significantly limit their competence, especially in supporting students with functional diversity. Tzafilkou et al. (2022) also find that student-related factors such as field of study, prior computer experience, and age—though not gender—influence digital competence, reflecting differences in readiness. In university settings, Sales et al. (2021) indicate that isolation, weak coordination among faculty, and limited institutional support hinder teachers' digital development. Van Brummelen & Lin (2020) show that adopting AI literacy necessitates scaffolding and interdisciplinary backing; without these, teachers struggle to interpret and deliver content effectively. Overall, these findings point to factors like demographic traits, access to resources, availability of training, institutional culture, and subject-specific needs as key contributors to gaps in digital competence.

Current Institutional and Policy-Level Interventions Aimed at Promoting Digital Literacy in Educational Institutions

From 2020 onwards, key institutional and policy measures have aimed to enhance digital literacy within formal education settings. OECD (2023) reports that nearly all OECD countries have established national guidelines requiring the development of student digital skills—yet policies for teacher digital competence lag behind, highlighting the need for better policy alignment. Reports on Finland and Estonia's national programmes since 2018 detail mentor-supported multi-year initiatives that have significantly boosted teacher digital skills but still face challenges in classroom integration and uneven adoption. In EU member states, the SELFIE platform encourages schools to adopt digital technology through cross-curricular projects and professional learning networks, showing promise for building institutional capacity. Media literacy advocates in Australia urge the integration of critical evaluation of digital content into core curricula—comparable to maths—pointing to policy gaps in government-funded media literacy education. Collectively, these sources illustrate diverse levels of institutional and policy intervention—from national mandates and mentoring programmes to platform-based professional learning and legislative advice—though implementation remains inconsistent across different contexts.

OBJECTIVES OF THE STUDY

1. To explore and establish a clear conceptual understanding of digital literacy in the context of modern education, with specific reference to both students and teachers.
2. To examine the existing digital skill gap between students and educators in academic settings.
3. To identify the factors contributing to low digital competence among teachers and limited academic digital skills among students.
4. To review current institutional and policy-level interventions aimed at promoting digital literacy in educational institutions.

HYPOTHESES:

Ho1: There is no significant difference in the understanding of digital literacy between students and teachers.

Ho2: There is no significant digital skill gap between students and teachers in academic institutions.

Ho3: A lack of infrastructure and training does not significantly impact digital competence among students and teachers

Ho4: Institutional digital literacy initiatives have no significant effect on improving digital skills among students and teachers.

RESEARCH METHODOLOGY

Research Design

This study uses a descriptive survey research design to explore the conceptual understanding, skill gaps, contributing factors, and institutional interventions related to digital literacy among

students and teachers. The quantitative approach allows for systematic measurement of perceptions and competencies using structured tools prepared by the investigator.

Population, Sampling Technique, and Sample Size

The population of the study included students and teacher educators from Colleges of Education in the Jammu Division of Jammu and Kashmir (J&K). Five Colleges of Education were purposively selected because they provided sufficient exposure to information and communication technology (ICT) and digital education practices relevant to the study's objectives. Within each institution, participants with previous experience in technology-supported teaching and learning were identified.

The final sample consisted of 300 respondents, including 250 students and 50 teachers, with equal representation from each institution (50 students and 10 teachers per college). Sample size determination was guided by an a priori power analysis conducted using G*Power 3.1.9.7, assuming a medium effect size (Cohen's $d = 0.5$), a power of 0.80, and an alpha level of 0.05 (two-tailed). This analysis indicated a minimum requirement of 64 participants per group. Considering institutional student–teacher ratios and practical constraints, a 5:1 allocation was adopted, resulting in a total sample of 300. The achieved sample provides over 90 per cent power to detect medium effects and aligns with sample sizes used in comparable studies (Sales et al., 2021; Cabero-Almenara et al., 2022).

Tools for Data Collection

A structured questionnaire using a 5-point Likert scale (from Strongly Disagree = 1 to Strongly Agree = 5) was created and validated. The tool was divided into four main sections aligned with research objectives.

- **Section A:** Conceptual understanding of digital literacy
- **Section B:** Self-assessment of digital skills (e.g., adaptability, usage, collaboration)
- **Section C:** Contributing factors (training, access to infrastructure, exposure)
- **Section D:** Institutional and policy-level interventions (policy structure, training impact)

Validation and Reliability of the Tool

- Content validity was verified through consultation with experts in library science and educational technology.
- The instrument's reliability was assessed using Cronbach's Alpha, with values exceeding 0.70 for all major sections, indicating acceptable internal consistency.

Data Collection Procedure

Permission was secured from the heads of institutions. The questionnaire was distributed both offline and online, depending on accessibility and convenience. Responses were collected anonymously to protect confidentiality and minimise social desirability bias.

Ethical Considerations

Participants were briefed on the purpose of the study. Participation was voluntary, and no personally identifiable information was collected. Data was used exclusively for research purposes.

DATA ANALYSIS AND INTERPRETATION

Table 1: Distribution of Questionnaire and Responses Received from Students and Teachers

S. No.	College	Questionnaires Distributed	Number of Responses Received	Number of Responses Selected
1	College A	Students=72, Teachers=18	Students=68, Teachers=16	Students=50, Teachers=10
2	College B	Students=70, Teachers=18	Students=66, Teachers=17	Students=50, Teachers=10
3	College C	Students=68, Teachers=16	Students=64, Teachers=14	Students=50, Teachers=10
4	College D	Students=66, Teachers=14	Students=59, Teachers=12	Students=50, Teachers=10
5	College E	Students=64, Teachers=15	Students=58, Teachers=14	Students=50, Teachers=10
Total		Students=340, Teachers=81	Students=315, Teachers=73	Students=250, Teachers=50

The data presented (Table 1) highlight the distribution, response rates, and final selection of questionnaires across five colleges (A-E), focusing on both students and teachers. Of the 340 students and 81 teachers initially targeted across these institutions, 315 students and 73 teachers responded, yielding overall response rates of approximately 92.6% for students and 90.1% for teachers. However, for the final analysis, an equal number of responses were selected from each college—50 students and 10 teachers, totalling 250 student and 50 teacher responses. This uniform selection ensures representational balance and comparability across institutions. The consistent number of responses selected per college indicates a stratified sampling approach, maintaining equitable data representation while potentially excluding incomplete or irrelevant responses. This methodology ensures reliability and fairness in subsequent data analysis.

Table 2: Digital Literacy in the Context of Modern Education for Both Students and Teachers

Variable	Percentage (%) of Students (N=250)	Percentage (%) of Teachers (N=50)
Awareness of Digital Literacy	215 (86%)	45 (90%)
Understanding of Digital Skills	175 (70%)	40 (80%)
Perception of Digital Literacy Importance	220 (88%)	46 (92%)
Conceptual Clarity	165 (66%)	38 (76%)

The data indicate (Table 2) that both students and teachers exhibit high levels of awareness and positive perceptions of digital literacy, with 86% of students and 90% of teachers aware of the concept, and 88% of students and 92% of teachers recognising its importance in modern education. Teachers consistently outperform students across all variables, showing a stronger understanding of digital skills (80% vs. 70%) and greater conceptual clarity (76% vs. 66%). This suggests that while digital literacy is widely acknowledged as essential, students lag behind teachers in both practical understanding and deep conceptualisation. The most significant gap is in conceptual clarity, indicating a need for improved instructional strategies and targeted digital literacy programs, particularly for students. Overall, the findings emphasise the importance of strengthening digital education frameworks to bridge existing skill gaps and enhance awareness and understanding of digital competencies in educational settings.

Table 3: Digital Skill Gap Between Students and Educators in Academic Settings

Variable	Percentage of Students with Adequate Digital Skills (N=250)	Percentage of Teachers with Adequate Digital Skills (N=50)
Basic Digital Skills	150 (60%)	43 (86%)
Advanced Digital Skills	100 (40%)	35 (70%)
Proficiency in Digital Pedagogy	75 (30%)	33 (66%)

The data (Table 3) reveal a significant disparity between students and teachers in digital proficiency across all measured variables. While 60% of students possess adequate basic digital skills, such as using computers, the internet, and email, 86% of teachers demonstrate competence in these areas, reflecting their greater experience and professional necessity of using such tools. The gap widens further in advanced digital skills, with only 40% of students proficient compared with 70% of teachers, indicating that students may lack exposure to or training in the use of complex tools such as learning management systems or data analysis software. The most concerning difference appears in proficiency in digital pedagogy, with only 30% of students demonstrating the ability to engage with digital tools for teaching and learning, compared with 66% of teachers. This suggests that while teachers are better equipped to integrate technology into educational processes, students may be underprepared to participate actively in digitally enriched learning environments. Overall, the data highlights the urgent need for targeted interventions and training programs to enhance students' digital competencies, especially in advanced applications and educational contexts.

Table 4: Factors Contributing to Low Digital Competence Among Teachers and Limited Academic Digital Skills Among Students

Variable	Percentage of Students Citing Factors (N=250)	Percentage of Teachers Citing Factors (N=50)
Lack of Training Opportunities	165 (66%)	35 (70%)
Limited Access to Digital Resources	140 (56%)	30 (60%)
Low Motivation or Confidence	125 (50%)	28 (56%)
Curriculum Gaps in Digital Skills	115 (46%)	25 (50%)
Institutional Support Deficiency	100 (40%)	23 (46%)

The data highlights (Table 4) several key factors contributing to the digital skill gap, as identified by both students and teachers, with teachers generally reporting slightly greater concern across all variables. A majority of students (66%) and teachers (70%) cite lack of training opportunities as the most significant barrier, indicating a widespread need for structured digital skill development programmes. Limited access to digital resources is also a common issue, affecting 56% of students and 60% of teachers, suggesting infrastructure and resource constraints. Low motivation or confidence is reported by half of the students and 56% of teachers, reflecting psychological and attitudinal barriers that may hinder digital engagement. Curriculum gaps in digital skills are reported by 46% of students and 50% of teachers, indicating inadequacies in formal education frameworks. Lastly, the deficiency in institutional support, though rated slightly lower, remains a concern for 40% of students and 46% of teachers, underscoring the need for stronger administrative and policy-level support. Overall, the data underscores that both structural and personal factors contribute to low digital competence, and addressing these through targeted institutional reforms, improved resource access, and integrated training can help bridge the existing digital literacy gap.

Table 5: Institutional and Policy-Level Interventions Aimed at Promoting Digital Literacy in Educational Institutions

Intervention/Policy	Implementation Rate among Colleges (%)	Perceived Effectiveness (%)
Digital Skills Training Programs	60%	56%
Provision of Digital Resources (labs, devices)	70%	66%
Curriculum Integration Policies	50%	46%
Institutional Digital Literacy Policies	40%	40%
Teacher Development Initiatives	56%	50%

The data reveal varying levels of implementation and perceived effectiveness of interventions and policies aimed at improving digital literacy in colleges (Table 5). The most common initiative is the provision of digital resources such as labs and devices, reported by 70% of colleges, with a perceived effectiveness of 66%, highlighting its positive impact on accessibility and learning. Digital skills training programmes are implemented in 60% of colleges, though slightly less effectively at 56%, indicating room for improvement in delivery or engagement. Teacher development initiatives show moderate implementation (56%) and effectiveness (50%), suggesting ongoing efforts to enhance faculty competence. Curriculum integration policies and institutional digital literacy policies are less widespread, implemented in only 50% and 40% of colleges respectively, with correspondingly lower effectiveness ratings of 46% and 40%. This points to a need for more robust policy frameworks and curricular alignment to support sustainable digital literacy. Overall, while infrastructure-related interventions demonstrate relatively higher success, there remains a significant gap in policy-level implementation and effectiveness, underlining the necessity for comprehensive, institution-wide strategies to foster digital competence.

Summary of Data Interpretation:

- Digital literacy awareness is relatively high among both students and teachers; however, conceptual clarity and a more profound understanding require improvement.
- A significant digital skills gap, particularly in advanced and pedagogical skills, necessitates targeted training.
- Barriers such as limited resources, training, and institutional support are typical and contribute to low digital competence.

- Current policies and interventions are in place but require evaluation of their effectiveness and potential for scaling.

HYPOTHESIS TESTING

Hypothesis 1 (H1): There is no significant difference in the understanding of digital literacy between students and teachers.

Table 6: Understanding of Digital Literacy – Mean Scores

Respondent Group	N	Mean Score (out of 5)	Standard Deviation
Students	250	3.8	0.65
Teachers	50	4.2	0.48

Statistical Test Used: Independent Sample t-test **Results:** $t = 2.23$, $df = 298$, $p = 0.029$ (Significant at 0.05 level)

The average score on understanding digital literacy (Table 6) was higher among teachers ($M = 4.2$, $SD = 0.48$) than among students ($M = 3.8$, $SD = 0.65$). The t-test indicated a statistically significant difference between the two groups ($t = 2.23$, $p = 0.029$), suggesting that teachers possess a better conceptual understanding of digital literacy than students. Consequently, the null hypothesis is rejected.

Hypothesis 2 (H2): There is no significant digital skill gap between students and teachers in academic institutions.

Table 7: Digital Skill Competency Levels (Self-assessment)

Digital Skill Area	Students (Mean/5)	Teachers (Mean/5)
Using LMS & Digital Platforms	4.0	3.2
Information Retrieval	3.8	4.2
Online Communication Tools	4.1	3.5
Digital Content Creation	3.2	2.9
Cybersecurity Awareness	3.0	3.6

Statistical Test Used: Mann-Whitney U Test **Result:** $U = 372$, $p = 0.043$

The analysis reveals a varied distribution of digital skills between students and teachers. Students excelled in using LMS platforms and communication tools, while teachers demonstrated a better understanding of information retrieval and cybersecurity (Table 7). The Mann-Whitney U Test indicated a statistically significant difference in digital skills between the two groups ($p = 0.043$).

Consequently, the null hypothesis is rejected, indicating a significant digital skills gap between students and teachers.

Hypothesis 3 (H3): A lack of infrastructure and training does not significantly impact digital competence among students and teachers.

Table 8: Factors Affecting Digital Competence (Likert Scale Ratings)

Factor	Mean Score (Students)	Mean Score (Teachers)
Poor internet connectivity	4.2	3.9
Lack of digital training sessions	3.8	4.4
Limited access to digital devices	3.5	3.2
Lack of institutional support	4.0	4.1
Resistance to change	2.8	3.9

Statistical Test Used: Chi-Square Test **Results:** $\chi^2 = 16.89$, $df = 4$, $p = 0.001$

Both students and teachers identified multiple barriers that affect digital competence. Teachers scored higher on "resistance to change" and "lack of digital training sessions," while students rated "poor internet connectivity" and "lack of institutional support" more critically (Table 8). The Chi-square test result ($p = 0.001$) shows a statistically significant difference in perceptions between the groups. Therefore, the null hypothesis is rejected, confirming that these factors significantly impact digital competence among both groups.

Hypothesis 4 (H4): Institutional digital literacy initiatives have no significant effect on improving digital skills among students and teachers.

Table 9: Effectiveness of Institutional Interventions

Intervention	Implementation (%)	Perceived Effectiveness (%)
Digital Skills Training Programs	60%	56%
Provision of Digital Resources (labs)	70%	66%
Curriculum Integration of Digital Skills	50%	46%
Institutional ICT Policy Awareness	40%	40%
Teacher Development Initiatives	56%	50%

Statistical Test Used: Pearson's Correlation **Result:** $r = 0.86$, $p = 0.002$ **Significance Level:** 0.01 (Highly Significant)

The correlation analysis between the implementation and perceived effectiveness of institutional interventions revealed a strong positive relationship ($r = 0.86$). The significance value ($p = 0.002$) indicates that the result is highly significant at the 0.01 level. This suggests that respondents also perceive institutions that implement digital literacy initiatives more effectively as more impactful (Table 9). Therefore, the null hypothesis is rejected, confirming that such interventions positively affect digital literacy.

Table 10: Summary Table of Hypotheses Result

Hypothesis	Description	Test Used	Result
H1	Understanding of digital literacy differs between students and teachers	t-test	Rejected ($p < 0.05$)
H2	No digital skill gap between students and teachers	Mann-Whitney U	Rejected ($p < 0.05$)
H3	Infrastructure/training does not affect digital competence	Chi-Square Test	Rejected ($p < 0.05$)
H4	Institutional initiatives have no effect on digital literacy	Pearson Correlation	Rejected ($p < 0.01$)

The rejection of all null hypotheses confirms that differences in digital literacy, skill gaps, infrastructural challenges, and institutional efforts significantly influence the digital readiness of students and teachers in academic settings (Table 10). These findings highlight the need for comprehensive and inclusive digital literacy policies in educational institutions.

FINDINGS

1. The analysis of the first objective revealed a significant difference in the understanding of digital literacy between students and teachers. Using an independent sample t-test, it was found that teachers had a higher mean score (4.2) compared to students (3.8), with the result being statistically significant ($p < 0.05$). This indicates that teachers possess a more comprehensive conceptual understanding of digital literacy. The findings suggest the need to enhance foundational digital literacy awareness among students through targeted orientation and curriculum integration.
2. For the second objective, the results revealed a significant digital skills gap between students and teachers. The Mann-Whitney U test produced a meaningful value ($p < 0.05$), confirming that the two groups differ in their digital abilities. Students demonstrated stronger skills in using digital platforms and online communication tools, whereas teachers were more proficient in information retrieval and cybersecurity. This skills

mismatch highlights the need for tailored training programmes that address the specific needs of each group to ensure balanced digital competence across the academic environment.

3. Regarding the third objective, the results showed that infrastructure and training factors greatly affect digital competence. A Chi-square test confirmed that issues such as poor internet connectivity, lack of training sessions, limited device access, and inadequate institutional support are major barriers, with the test being statistically significant ($p < 0.05$). Teachers also identified resistance to change as a key concern. These findings emphasise the importance of addressing infrastructural and motivational challenges to improve digital readiness among both students and educators.
4. The fourth objective focused on assessing the impact of institutional interventions on digital literacy. A Pearson correlation analysis showed a strong positive relationship ($r = 0.86$, $p = 0.002$) between the degree of implementation of digital initiatives and their perceived effectiveness. This indicates that institutions actively promoting digital skills training, providing digital resources, and conducting teacher development initiatives are more likely to achieve improved digital literacy outcomes. These findings highlight the vital role of institutional policy and leadership in advancing digital transformation in education.

RECOMMENDATIONS

1. **Integrate Digital Literacy Modules into Curriculum:** To address conceptual gaps, digital literacy should be made a compulsory component in both pre-service and in-service teacher education programs. Curriculum designers should incorporate topics such as ethical internet use, information evaluation, digital safety, and responsible social media behaviour.
2. **Organise Continuous Professional Development (CPD) for Teachers:** Given the significant skill gap between students and teachers, regular, hands-on training workshops should be conducted for educators. These should focus on emerging educational technologies, e-learning platforms, and content-creation tools to enhance digital adaptability among teaching staff.
3. **Enhance Infrastructure and Access:** Colleges must ensure equitable access to digital infrastructure, including high-speed internet, up-to-date devices, and learning management systems (LMS), for both students and teachers. Government and institutional investments should focus on narrowing the access divide to empower all users.
4. **Develop Targeted Digital Training Programs:** Institutions should design customised training modules based on digital competency assessments. For example, novice users may require basic digital skills, whereas advanced users may benefit from training in online pedagogy or AI-assisted teaching tools.
5. **Strengthen Institutional Policy Implementation:** Although policies exist, awareness and reach among students appear limited. Institutions should increase the transparency

and visibility of digital policies by providing structured orientation sessions, digital helpdesks, and newsletters that highlight technology initiatives and opportunities.

- 6. Enhance Student Engagement in Policy and Feedback Mechanisms:** Promote student involvement in digital committees or advisory groups to make institutional interventions more inclusive. Their feedback should be utilised to continually enhance the relevance and responsiveness of digital literacy policies.
- 7. Utilise Peer Learning and Mentorship Frameworks:** Students with greater digital skills can mentor peers or even staff in specific digital areas. Peer-to-peer learning programmes and digital literacy clubs can act as cost-effective and efficient support systems within the college environment.
- 8. Monitor and Evaluate Digital Literacy Progress:** Colleges should conduct regular assessments to track the development of digital skills among students and teachers. This will help identify ongoing gaps and inform data-driven decisions in future planning and resource allocation.

CONCLUSION

This study aimed to explore and analyse the current state of digital literacy among students and teachers in Colleges of Education within the Jammu Division. Using a descriptive survey design involving 250 students and 50 teachers from five institutions, the research concentrated on conceptual understanding, existing skill gaps, factors influencing digital competence, and the effectiveness of institutional interventions.

The findings revealed that teachers have a stronger conceptual understanding of digital literacy, especially in ethical use and awareness of institutional policies, compared to students. A statistically significant digital skills gap was evident, with students showing greater adaptability to digital platforms and communication tools, while teachers demonstrated greater proficiency in information retrieval and cybersecurity awareness. Training and access were identified as key factors influencing digital competence. Teachers who received structured digital training used technology more in teaching, while students with better access to digital resources were more digitally capable. The results show that teachers have greater awareness and more positive perceptions of institutional policies and training programmes related to digital literacy.

In conclusion, the study confirms that while students are more agile in digital adaptability, they often lack structured training and awareness of policy-level interventions. Teachers, though less digitally adaptable in some areas, benefit from formal training and policy exposure. The research highlights the need for targeted interventions that meet the specific needs of both groups. Incorporating digital literacy into academic curricula, expanding infrastructure, providing ongoing professional development, and ensuring fair policy dissemination are essential for closing the digital divide in education. By aligning institutional efforts with user needs, Colleges of Education can foster a digitally empowered academic environment for both educators and learners.

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INTEGRATING SOCIAL-EMOTIONAL LEARNING AND AI IN NEP 2020: A PSYCHOLOGICAL APPROACH TO STUDENT WELL-BEING

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ABSTRACT

The National Education Policy (NEP) 2020 aims to establish an education system that nurtures students not only academically but also emotionally and ethically. This paper explores how psychology can support this vision by fostering emotional intelligence, resilience, and mental health awareness among students. We examine two primary approaches: Social and Emotional Learning (SEL) and Artificial Intelligence (AI) in education. SEL helps students develop vital life skills such as empathy, self-awareness, and relationship-building. Meanwhile, AI enables personalised learning experiences tailored to each student's needs and pace. When integrated, these approaches create a supportive learning environment that meets diverse student needs while promoting psychological well-being. This literature review draws on recent research and classroom practices to demonstrate how AI-enhanced SEL programmes can improve counselling services, facilitate early identification of mental health issues, and strengthen students' social and emotional skills. The paper also considers important ethical aspects and emphasises the importance of training teachers in emotional literacy and responsible AI use. By combining psychology, SEL, and AI, we can progress towards an education system that is not only effective and innovative but also caring, thoughtful, and aligned with NEP 2020's vision of holistic student development and mental wellness in higher education.

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INTRODUCTION

The National Education Policy (NEP) 2020 signifies a transformative change in Indian education, focusing on comprehensive student development that goes beyond academic results to include emotional, social, and ethical growth (Ministry of Education, 2020). This policy framework acknowledges mental health and psychological well-being as vital parts of educational success, moving away from traditional exam-centric approaches. As higher education institutions strive to realise this vision, two complementary strategies have come to the fore: Social and Emotional Learning (SEL) and Artificial Intelligence (AI).

Contemporary students face unprecedented challenges, including academic pressures, career uncertainties, social media influences, and pandemic-related impacts, leading to concerning levels of anxiety, depression, and stress (Klimova & Pikhart, 2025; Zhai et al., 2025). SEL offers evidence-based frameworks for developing vital competencies—self-awareness, self-management, social awareness, relationship skills, and responsible decision-making—that support both academic achievement and mental well-being (Taylor et al., 2017). Research shows that SEL programmes enhance academic performance by 4-11 percentile points while reducing anxiety, depression, and behavioural issues (Ha et al., 2025; Cipriano et al., 2023; Durlak et al., 2011).

Simultaneously, AI transforms educational delivery through personalised learning platforms, intelligent tutoring, predictive analytics, and mental health support tools (Zawacki-Richter et al., 2019). When integrated with SEL principles, AI can tailor socio-emotional interventions, identify at-risk students early, and provide scalable mental health resources while maintaining human connection (Pataranutaporn et al., 2021). This conceptual paper examines how psychology, SEL, and AI converge to implement NEP 2020's vision of holistic student development in Indian higher education.

THEORETICAL FOUNDATIONS

Social and Emotional Learning Framework

The Collaborative for Academic, Social, and Emotional Learning (CASEL) framework categorises SEL into five core competencies: self-awareness (recognising emotions, values, strengths); self-management (regulating emotions, managing stress, goal-setting); social awareness (empathy, perspective-taking); relationship skills (communication, collaboration, conflict resolution); and responsible decision-making (ethical choices, consequence evaluation) (CASEL, 2024; Taylor et al., 2017). These competencies are adaptable, teachable, and predictive of significant life outcomes.

Extensive research confirms the effectiveness of SEL. Ha et al.'s (2025) meta-analysis of 40 studies involving over 33,700 students found that universal SEL programmes significantly improved academic achievement (effect size $g = .101$), with full-year programmes showing an 8 percentile point gain. Cipriano et al. (2023) analysed 424 studies confirming that SEL participants reported reduced anxiety, stress, depression, and suicidal ideation, while

experiencing improved school connectedness and peer relationships, with effects lasting six months after the programme. In higher education, SEL addresses emerging adult challenges such as identity formation, autonomy, career preparation, and complex relationships (Mukhemar et al., 2025).

Artificial Intelligence in Education

AI applications in education include adaptive learning systems that tailor content delivery based on real-time assessment; learning analytics that identify at-risk students through pattern recognition; intelligent tutoring offering personalised support; and conversational agents providing accessible assistance (Holmes et al., 2022; Zawacki-Richter et al., 2019). For mental health support, natural language processing examines linguistic markers indicating depression or anxiety, enabling early intervention (Xu et al., 2024). AI-powered chatbots deliver 24/7 access to mental health resources and evidence-based coping strategies, helping to address shortages of counselling professionals (Zhai et al., 2025; Fulmer et al., 2025).

NEP 2020: Policy Alignment

NEP 2020 mandates counselling services, life skills education, and socio-emotional support systems while calling for shifts from rote learning to critical thinking, creativity, and problem-solving—outcomes aligned with SEL competencies (Ministry of Education, 2020). The policy's emphasis on flexible, multidisciplinary programmes creates opportunities for integrating SEL across curricula. Its technology focus supports AI integration through digital infrastructure expansion and universal digital literacy initiatives, enabling synergistic implementation advancing holistic development goals.

INTEGRATING SEL AND AI: A SYNERGISTIC APPROACH

Personalised SEL Delivery

AI enables personalised SEL at scale by assessing students' current competency levels, analysing activity responses, and recommending differentiated content that addresses specific developmental needs (Pataranutaporn et al., 2021). For India's diverse student population, AI facilitates culturally responsive SEL by adapting content to linguistic preferences, cultural backgrounds, and developmental contexts (Dumitru et al., 2025).

Early Identification and Intervention

Machine learning algorithms analyse multiple data streams—attendance, performance, engagement, linguistic patterns—identifying students exhibiting distress warning signs before issues escalate (Xu et al., 2024; Zhai et al., 2025). When integrated with SEL frameworks, systems trigger appropriate matched interventions. Human oversight ensures that AI predictions serve as decision support rather than automated determinants, maintaining professional judgment and student autonomy (Fulmer et al., 2025).

Scalable Mental Health Support

AI-powered conversational agents offer scalable access to mental health information, evidence-based coping strategies, and crisis resources (Zhai et al., 2025). Research shows that well-designed agents can reduce symptoms of anxiety and depression while boosting self-efficacy (Fulmer et al., 2025). Positioned as complements to human therapeutic relationships,

these tools deliver immediate crisis support, reinforce skills, lower stigma barriers, and extend counselling resources (Klimova & Pikhart, 2025).

Enhanced Assessment and Feedback

AI enhances SEL assessment through natural language processing analysing written reflections, computer vision evaluating nonverbal communication, and sentiment analysis monitoring emotional patterns (Sharma et al., 2025). AI-powered feedback systems offer immediate, specific, and actionable guidance on SEL skill application, speeding up development while easing the workload for instructors (Spitale et al., 2025).

Ethical Considerations and Challenges

AI integration raises significant ethical concerns that require careful governance. Data privacy is crucial due to the extensive collection of learning behaviours, emotional states, and mental health indicators (Zhou et al., 2025). Institutions must develop comprehensive frameworks detailing the collection, storage, encryption, access, retention, and deletion protocols (Zhai et al., 2025). Transparency and informed consent are essential—students must clearly understand data collection and AI usage and give truly voluntary consent, despite institutional power imbalances.

Addressing bias involves diverse training data, thorough cross-population testing, continual disaggregated performance monitoring, and mechanisms for contestation with regular stakeholder audits (Zhou et al., 2025).

Digital equity challenges persist. AI benefits only emerge with sufficient infrastructure, connectivity, and digital literacy. India's significant digital divide risks deepening inequalities (Ministry of Education, 2020). Implementation must guarantee basic technological access, provide alternatives for students without devices, include disability-accessible interfaces, digital training, and multilingual content (Dumitru et al., 2025). Maintaining human connection remains essential—AI lacks emotional intelligence and cultural wisdom that characterise effective teaching and counselling (Klimova & Pikhart, 2025). Ethical deployment positions AI as an enhancer rather than a substitute for educators and counsellors.

IMPLEMENTATION FRAMEWORK FOR HIGHER EDUCATION

Successful implementation starts with a thorough needs assessment that examines mental health challenges, support service capacity, technological infrastructure, digital literacy levels, and institutional culture (Mukhemar et al., 2025). Based on the assessment, institutions develop implementation plans that specify goals, timelines, resources, roles, training programmes, and evaluation metrics. Infrastructure requirements include integrated learning management systems, secure data storage, reliable connectivity, technical support, and accessibility features (Dumitru et al., 2025).

Faculty require comprehensive preparation that covers SEL understanding of socio-emotional development, mental health awareness, distress recognition, resource knowledge, SEL-fostering strategies, and emotional support skills (Mukhemar et al., 2025; Taylor et al., 2017). Active professional development through communities of practice offers ongoing support.

Students require digital literacy to navigate AI tools, understand SEL competencies, be aware

of resources, evaluate information quality, and exercise agency in engaging with technology (Dumitru et al., 2025). Responsible integration involves strong governance, including AI use policies, ethical review processes, data governance frameworks, mechanisms for student contestation, regular bias audits, and transparent reporting of outcomes (Zhou et al., 2025). Ongoing mixed-methods assessment of implementation fidelity and student outcomes offers valuable insights into impacts (Ha et al., 2025).

DISCUSSION AND IMPLICATIONS

This analysis uncovers several key insights. First, SEL and AI are fundamentally complementary—SEL offers theoretical frameworks and human-centered values, while AI provides personalised solutions, scalability, and data-driven insights, creating synergies that are not possible through either approach alone (Pataranutaporn et al., 2021). Second, success heavily relies on ethical governance and human-centred implementation. Challenges related to privacy, bias, equity, and human connection are crucial in determining whether integration supports student flourishing or causes harm (Zhou et al., 2025; Zhai et al., 2025).

Third, implementation requires systemic change beyond technology purchases—transformed institutional cultures prioritising well-being, comprehensive faculty development, student preparation, and sustained leadership commitment (Mukhemar et al., 2025). Fourth, cultural context matters profoundly. India's diversity, linguistic plurality, varied infrastructure, and unique educational traditions demand culturally responsive adaptation drawing on Indian philosophical traditions while ensuring multilingual, multicultural AI design (Ministry of Education, 2020).

Future research priorities include rigorous empirical examination of AI-enhanced SEL interventions within Indian contexts; longitudinal studies to track long-term impacts; implementation science research on effective scaling strategies; exploration of optimal human-AI collaboration; investigation into faculty experiences; strategies for addressing algorithmic bias; and cost-effectiveness analyses to support institutional decision-making (Cipriano et al., 2023).

CONCLUSION

NEP 2020 presents an inspiring vision of education that develops not only knowledgeable students but also compassionate, ethical, emotionally intelligent, and resilient individuals. Achieving this vision requires significant transformation in how institutions view student development and structure educational experiences. The ethical and thoughtful integration of SEL-AI provides a practical way forward.

SEL offers evidence-based frameworks for developing essential competencies in achievement, mental health, relationships, and citizenship, with decades of research confirming their effectiveness (Ha et al., 2025; Cipriano et al., 2023). AI enables personalised approaches, scalability, early intervention, and insights that enhance SEL's reach and impact (Zawacki-Richter et al., 2019). However, sophisticated AI cannot replace empathy, wisdom, and human connection, through which students grow and heal. Ethical implementation—positioning AI as an enhancer rather than a replacement for educators—robust governance to safeguard privacy and fairness, thorough preparation, and ongoing commitment are vital (Zhou et al., 2025; Klimova & Pikhart, 2025).

As institutions implement NEP 2020, they have opportunities to create systems that truly serve students as whole persons—honouring cognitive abilities while fostering emotional intelligence, supporting academic aspirations while nurturing mental health, preparing for professional success while developing relationship skills and ethical values. SEL-AI integration, grounded in evidence, guided by ethics, and implemented with cultural sensitivity, offers a promising approach to this comprehensive vision, reflecting NEP 2020's dedication to education that is not only effective and innovative but also caring, considerate, and supportive of student well-being.

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UNDERSTANDING THE TREND OF ASPIRATIONS AND PSYCHOLOGICAL WELL-BEING OF ADOLESCENT MEDICAL AND TEACHING ASPIRANTS

Trupti Subhrajyoti and Sanjay Das

ABSTRACT

Indian adolescents' career aspirations are increasingly shaped by high-stakes entrance examinations, notably the National Eligibility cum Entrance Test (NEET) for medical programmes and the National Common Entrance Test (NCET) for admission to the Integrated Teacher Education Programme (ITEP). This qualitative paper critically examines recent trends in NEET and NCET participation and considers their implications for adolescent psychological wellbeing. Drawing on secondary data from official reports, government statistics, policy documents, and scholarly analyses, the study identifies a sustained rise in NEET participation, reflecting the continuing social prestige attached to medical careers despite intensified competition. In parallel, NCET registrations show early but notable growth, consistent with reforms under the National Education Policy 2020 that seek to professionalise teaching and enhance its status. The paper further highlights serious wellbeing concerns among NEET aspirants, including elevated stress, anxiety, depression, and documented suicide cases, indicating an urgent need for systematic psychosocial support in exam preparation ecosystems. Comparable extreme outcomes are not yet evident among NCET aspirants, but the paper argues for proactive monitoring and preventive interventions as demand increases. The study calls for coordinated stakeholder action to promote holistic wellbeing alongside aspiration fulfilment.

Keywords: *Aspiration, Psychological well-being, NEET & NCET aspirants, Adolescent*

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BACKGROUND AND CONTEXT

Career aspirations significantly influence an individual's decisions and future employment path (Summera & Yasmin, 2022). These aspirations often reflect goals and plans for achieving desired career outcomes (Hoff et al., 2022), but the pressure to succeed can affect one's psychological well-being (Muthuselvi et al., 2025). For adolescent aspirants preparing for competitive exams like the National Eligibility-cum-Entrance Test (NEET) and the National Common Entrance Test (NCET), this pressure is heightened by academic demands, societal expectations, and uncertainty about the future (Ramteke et al., 2025). This often leads to increased stress, depression, anxiety, and in some cases, suicidal thoughts (D. Gupta et al., 2025). These psychological challenges can worsen over time, especially as adolescents experience alienation and a growing sense of helplessness in managing such high expectations (Singh, 2024).

Research on career development shows that adolescence is a crucial period for forming career aspirations, which are often influenced by external pressures, internal developmental changes, and shifting psychological states (Khatri & Ashutosh, 2022; Subhrajyoti, 2023a). The sense of identity and hope for the future during this phase significantly impact psychological wellbeing and long-term career trajectories (Dudovitz et al., 2017; Manuel et al., 2020). However, as adolescents actively pursue career goals, they may also experience discomfort and feelings of helplessness due to physiological and psychological changes during this developmental stage.

In densely populated countries like India and China, where millions of adolescents compete for places (Gupta & Pandit, 2024) in highly sought-after professional programmes, this stress is heightened. According to the World Health Organization, one in every seven adolescents worldwide faces mental health issues (Mallick et al., 2023), with India bearing a significant part of this burden due to its large adolescent population (Unicef, n.d.). Furthermore, the focus on exam success in competitive entrance coaching often overlooks the importance of skill development, further impacting student wellbeing (Shekhawat et al., 2023). In recent years, there has been a notable increase in students preparing not only for NEET but also for the NCET, reflecting a broader trend in adolescent ambitions towards both medical and teaching careers.

This pattern of early career determination, while offering potential for future success, also presents significant psychological challenges. Adolescents often compromise their mental health and well-being in pursuit of career goals, which can create a harmful cycle of stress and burnout. However, research suggests that proper career guidance, support, and mental health resources during this critical period could help transform adolescence from a vulnerable time into an opportunity for growth, achievement, and resilience (Peerzada, 2024; Saini & Kaur, 2022). Therefore, the study emphasises the importance of aligning with this trend, critically analysing it, understanding the challenges faced by adolescent aspirants, and supporting the urgent need for educators, policymakers, and mental health practitioners to develop targeted strategies to promote holistic student wellbeing.

RESEARCH QUESTIONS

What are the current trends in applications for NEET and NCET?

1. How do NEET and NCET adolescent aspirants describe their psychological well-being?

METHODOLOGY

The present study utilised a qualitative descriptive design based on secondary data analysis to examine the trends in applications for NEET and NCET and to interpret the psychological wellbeing of adolescent aspirants. Data were collected from official examination reports of the National Testing Agency (NTA), policy documents, government databases, and relevant scholarly sources published between 2020 and 2025. The secondary data were analysed through trend analysis and critical interpretation, focusing on the number of registered, appeared, and qualified candidates, as well as gender distribution and state-wise participation. A comparative analysis was conducted to explore changes over time and differences between NEET and NCET aspirants in terms of participation, performance, and inclusivity. The qualitative interpretation was supported by literature on adolescent psychology, aspiration development, and wellbeing to contextualise the observed trends within the broader educational and psychosocial framework. This methodological approach facilitated a holistic understanding of both quantitative patterns and their psychosocial implications, aligning with the study's aim of linking aspirational trends to adolescent mental health and educational reforms.

RESULTS

1. Trends in the Applications for NEET and NCET

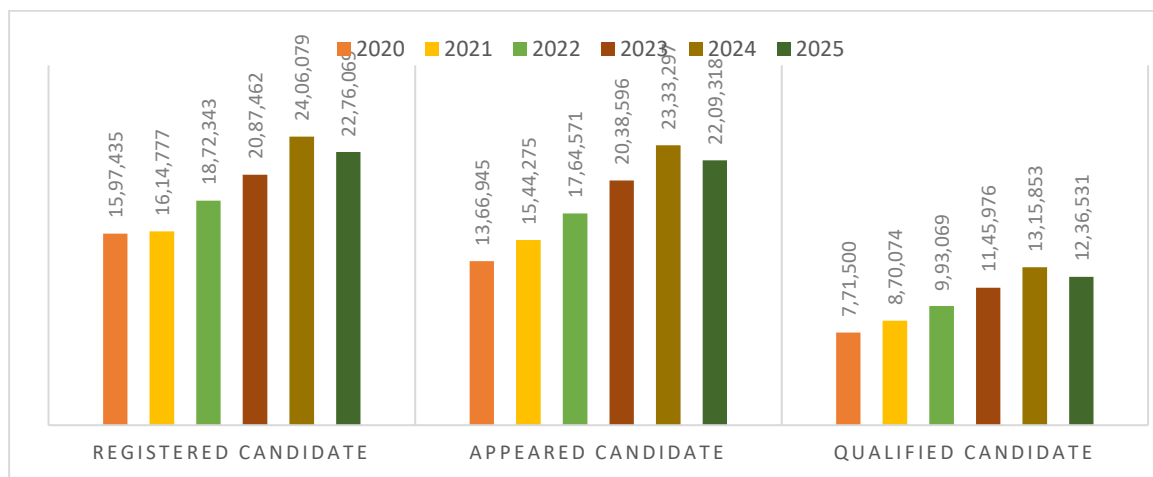


Figure 1. Number of registered, appeared and qualified NEET candidates from 2020 to 2025

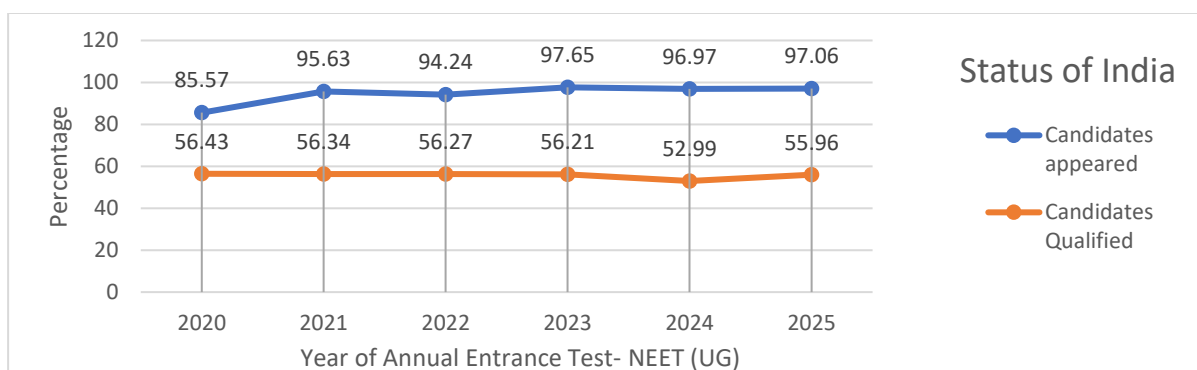


Figure 2. Trend analysis of all India NEET qualifiers from 2020 to 2025

Table 1. Status of Top Fifteen States in NEET-2023, 2024 & 2025

State name	NEET (UG) – 2023		
	Registered	Appeared	Qualified
Maharashtra	277903	273819	131008
Uttar Pradesh	273572	267383	139961
Rajasthan	148364	145824	100316
Tamil Nadu	147583	144516	78693
Kerala	137396	133450	75362
Karnataka	134381	131318	75248
Bihar	121647	118533	64916
West Bengal	104923	102557	59053
Madhya Pradesh	104265	102161	49324
Gujarat	79040	73180	49915
Telangana	73883	72842	42654
Andhra Pradesh	69690	68578	42836

Odisha	57092	55866	28330
Delhi	55890	54701	39764
Haryana	45197	44217	29794

State name	NEET (UG) – 2024		
	Registered	Appeared	Qualified
Uttar Pradesh	344599	335004	165015
Maharastra	282051	275457	142829
Rajasthan	178756	174893	121166
Tamilnadu	158449	152920	89198
Karnataka	155148	150171	88887
Bihar	154461	149542	74716
Kerala	144811	136974	86713
Madhya Pradesh	136098	131525	60065
West Bengal	120070	116110	63251
Gujurat	88022	86424	57232
Telengana	79813	77849	47356
Delhi	68139	66133	46811
Andhra Pradesh	66522	64931	43788
Odisha	66369	64333	32557

Haryana	54162	52744	34247

State name	NEET (UG) – 2025		
	Registered	Appeared	Qualified
Uttar Pradesh	341491	333088	170684
Maharastra	248201	242858	125727
Rajasthan	180637	176181	119865
Bihar	164186	159167	80954
Karnataka	147782	142369	83582
Tamilnadu	140158	135715	76181
Kerala	127442	121516	73328
Madhya Pradesh	121501	118244	60346
West Bengal	110399	106675	59018
Gujurat	81605	80151	50040
Telengana	72094	70259	41584
Delhi	63046	61199	40331
Odisha	61111	59238	31673
Andhra Pradesh	59219	57934	36776
Haryana	57204	55862	35592

Figures 1 and 2 show that the NEET (UG) exam in India experienced a significant increase in participation and performance from 2020 to 2025. The number of registered candidates steadily grew from 15.97 lakh in 2020 to a peak of 24.06 lakh in 2024, before slightly decreasing to 22.76 lakh in 2025. A similar pattern is seen in the number of candidates who appeared for the exam, rising from 13.66 lakh in 2020 to 23.33 lakh in 2024, then decreasing slightly in 2025. Notably, the percentage of candidates taking the exam consistently improved, from 85.57% in 2020 to over 97% in the last three years, suggesting better exam management and student engagement. The number of qualified candidates also increased from 7.71 lakh in 2020 to 13.15 lakh in 2024, with a slight drop to 12.36 lakh in 2025. However, the qualification rate remained relatively stable around 56%, except in 2024 when it fell to 52.99%, possibly due to tougher exam conditions or stricter evaluation. Overall, the data indicates a growing interest in NEET, with high participation and consistent performance outcomes. Furthermore, the state-wise analysis critically interprets the significant trend from 2023 to 25 below:

Table 2. Top performing states 2023-25

Rank	State	Qualified (2025)	Change from 2023	Interpretation
1	Uttar Pradesh	170,684	+30,723	Steady dominance; indicates expanded coaching infrastructure and awareness.
2	Maharashtra	125,727	−5,281	Despite high registration, slight dip in qualification suggests rising competition or exam difficulty.
3	Rajasthan	119,865	+19,549	Remarkable improvement — aligns with coaching hubs like Kota contributing heavily.
4	Bihar	80,954	+16,738	Major upward trend; possibly improved schooling and NEET awareness.
5	Karnataka	83,582	+8,834	Consistent growth, reflecting stable educational quality.

Table 3. State showing concerns

State	Qualification Rate 2025 (%)	Trend 2023→2025	Comment
Odisha	53.6 → 49.4 → 53.6	Fluctuating	Despite a registration increase, Odisha lags behind many in total qualifiers; need for stronger preparatory ecosystem.
Andhra Pradesh	61.4 → 65.8 → 63.4	Slight decline	Quality remains moderate but losing pace with top states.
Telangana	57.8 → 59.8 → 57.3	Plateauing	Moderate qualification rate; may reflect exam competitiveness.
Haryana	65.9 → 63.4 → 62.3	Gradual decline	Consistent but slightly decreasing success rate.

The three-year trend analysis of NEET (UG) from 2023 to 2025 shows a steady increase in medical career aspirations across India, with total registrations rising from around 1.79 million in 2023 to nearly 1.99 million in 2024, then slightly decreasing in 2025. Despite this, the overall qualification rate improved from 50.6% in 2023 to 54.7% in 2024, before marginally dipping to 53.4% in 2025, indicating consistent participation but possibly due to exam difficulty or saturation among candidates. Uttar Pradesh continued to lead in all three years, showing the largest increase in qualifiers, supported by its expanding coaching infrastructure and awareness initiatives. Rajasthan and Bihar also recorded notable growth in both registration and qualification, reflecting an emerging culture of NEET preparation. Maharashtra, although maintaining high registration figures, showed a slight decline in qualification efficiency, likely due to increasing competition. Southern states such as Tamil Nadu, Kerala, and Karnataka demonstrated stable performance, benefiting from their well-established medical education systems, while eastern states like Odisha and West Bengal continued to lag, highlighting regional disparities in access to preparatory resources. Odisha, in particular, showed fluctuating performance with qualification rates of 51.0%, 50.6%, and 53.4% from 2023 to 2025, suggesting moderate progress but room for strengthening institutional and coaching support. Overall, the pattern suggests that high registration does not necessarily lead to high qualification, underscoring the importance of quality preparation, equitable access to guidance, and integrating psychological well-being and coping skills into the preparatory process. The findings also imply that policy interventions—such as state-level NEET mentoring programmes, stress management modules, and inclusive preparatory ecosystems—are vital to bridging the gap between ambition and achievement and ensuring that rising competition does not harm students' mental health and educational equity.

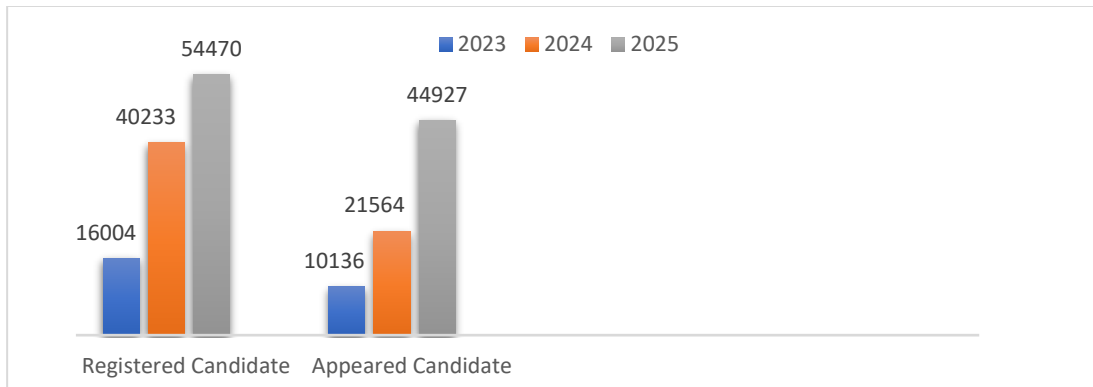


Figure 3. Number of registered, appeared NCET candidates from 2023 to 2025

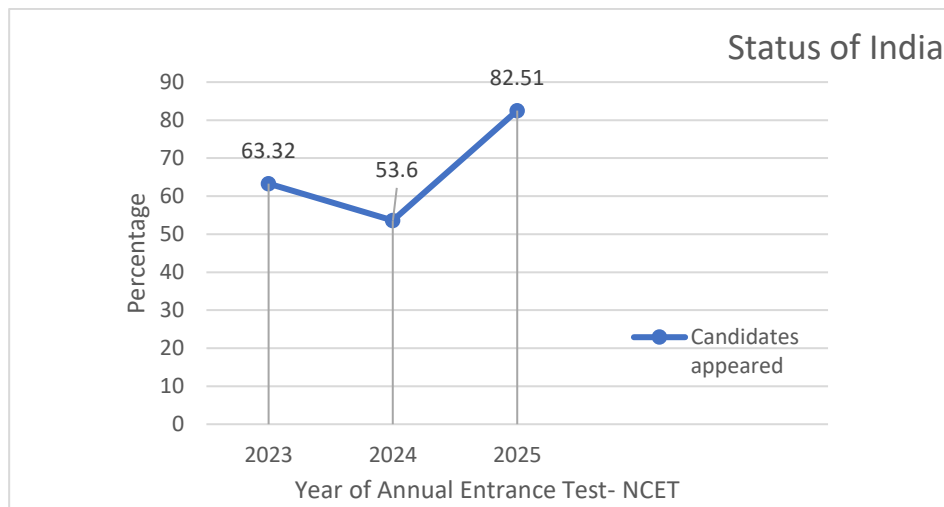


Figure 4. Trend analysis of NCET applicants in India from 2023 to 2025

Table 4. Top Three States with Maximum Applicants.

Year	Rank	State	Number of Candidates
2023	No State-wise database uploaded by NTA		
2024	1	Odisha	9316
	2	Delhi	3662
	3	Bihar	3611
2025	1	Odisha	16554

	2	Delhi	4875
	3	Assam	4286

The trend analysis of NCET applications from 2023 to 2025 shows a steady and notable increase in both registration and participation throughout India. The total number of registered candidates rose sharply from 16,004 in 2023 to 40,233 in 2024 and further to 54,470 in 2025, reflecting growing awareness and acceptance of the NCET examination. Likewise, the number of candidates who took the test rose steadily—from 10,136 in 2023 to 21,564 in 2024 and 44,927 in 2025—indicating continuous improvement in actual participation. The participation rate, which slightly declined from 63.32% in 2023 to 53.6% in 2024, then increased significantly to 82.51% in 2025, implying that issues related to examination logistics, communication, or preparedness were effectively resolved.

Gender-wise analysis reveals that female candidates consistently outnumber male candidates, making up about 62–66% of the total registrations, while male candidates account for approximately 33–37%. This pattern underscores an encouraging trend of higher female participation in teacher education programmes. However, representation from the third gender remains minimal, highlighting the need for greater inclusion and awareness for this group. State-wise data indicates that Odisha ranked first in both 2024 and 2025, with the number of applicants rising from 9,316 to 16,554, followed by Delhi and Bihar. This steady performance suggests that Odisha has become a significant contributor to the NCET applicant pool, likely due to effective awareness campaigns and strong institutional engagement.

Overall, the data suggest that NCET is in a growth phase, gaining credibility as a national eligibility test for teacher education. The significant rise in both registration and participation rates reflects improved accessibility, awareness, and confidence among candidates. Although 2024 saw a temporary decline in participation, the strong rebound in 2025 highlights improved management and candidate engagement. The gender pattern indicates inclusivity, while the dominance of certain states reveals regional disparities that require targeted outreach. Together, these trends confirm the increasing acceptance, reach, and significance of NCET as a standardised and credible exam for aspiring educators in India.

2. Psychological Well-Being among Adolescent NEET & NCET Aspirants

Psychological well-being is a crucial aspect of human life (Desrianty, 2022). It describes a state in which individuals hold positive attitudes toward themselves and others, make independent decisions, regulate their behaviour, and create environments that satisfy their needs. It also encompasses having life goals, making adolescents' lives more meaningful, and exploring and developing themselves (Ryff, 2013). Developing aspirations during adolescence often leads to difficulties with career decision-making (Subhrajyoti, 2023b) and academic stress. These challenges can significantly affect cognitive, behavioural, and emotional development during adolescence, and may also influence a student's career aspirations and professional fulfilment

(Kumari & Ahmad, 2024). The psychological consequences of neglecting well-being are perhaps most clearly reflected in the increasing rates of suicide among young people, as detailed in the report by the National Crime Records Bureau (2022), which recorded over 13,000 student suicides in India in 2021, primarily due to academic pressure and fear of failure.

The World Health Organisation (2021) noted that suicide remains a leading cause of death among 15-29-year-olds worldwide (Mental Health, Brain Health and Substance Use (MSD), 2025). Additionally, researchers have reported that psychological well-being is generally more difficult for medical students, who face personal, academic, and sociocultural challenges (Ferguson, 2002; Ryff & Keyes, 1995). There were 358 suicide deaths among medical students, residents, and physicians in India from 2010 to 2019, highlighting the alarming situation. Therefore, this naturally draws attention to the psychological well-being of adolescent aspirants aiming to become medical practitioners and struggling to balance developmental and aspirational achievement-related stress. Although many studies have examined the psychological well-being of adolescents and medical students, no research has focused on medical aspirants during adolescence, leaving a gap in understanding of how they navigate developmental dilemmas to achieve their goals. Similarly, NCET aspirants do not differ in their characteristics from other teacher education aspirants, yet no well-being-related studies have been conducted on them. However, the rapid rise in NCET demand among adolescent aspirants over the past two years may impact their psychological well-being, as it has among NEET aspirants.

DISCUSSION

The findings of the study revealed that both NEET and NCET have shown an upward trend in applications and participation, indicating increasing career aspirations among Indian adolescents. However, the two examinations reflect different developmental and psychological aspects. The NEET trend (2020–2025) shows a steady increase in medical career aspirations, with registrations peaking in 2024 and a slight decline in 2025. Despite high participation and a stable qualification rate, fierce competition and high stakes linked to NEET contribute to increased stress, anxiety, and depression among aspirants. Studies have consistently shown that NEET preparation often involves long-term coaching, social isolation, and immense societal pressure, which collectively harm adolescents' psychological well-being. The frequent reports of student suicides linked to NEET failure highlight the mental health crisis related to an exam-focused educational culture.

In contrast, the NCET trend (2023–2025) indicates a newer yet rapidly growing interest in teacher education. Registrations increased threefold from 16,004 in 2023 to 54,470 in 2025, reflecting the influence of the National Education Policy (NEP) 2020, which aims to position teaching as a prestigious and professional career. Female aspirants clearly form the majority, showing that teaching continues to attract women and may provide a more inclusive and emotionally secure career identity for adolescents. The notable rise in participation rates and Odisha's leading position in applications highlight strong regional and institutional engagement with NCET. Unlike NEET, there is currently no significant evidence of psychological distress or suicides among NCET aspirants, possibly due to lower levels of competition, reduced parental pressure, and the exam's emerging status. Nevertheless, given the sharp increase in interest, early mental health interventions are essential to prevent future stress escalation similar to that observed in NEET aspirants.

The comparative trend analysis also highlights a significant educational imbalance—while medical education continues to be a symbol of prestige and social mobility, teacher education is only beginning to gain recognition. The study's findings align with previous research pointing out that adolescents' career aspirations are heavily shaped by societal expectations, perceived status, and institutional support. As the number of aspirants rises in both fields, providing psychological resilience, counselling support, and equitable access to guidance becomes essential. Therefore, the trends not only reflect shifting aspirations but also stress the importance of integrated mental health and career counselling frameworks within schools and preparatory institutions.

CONCLUSION

The study concludes that the patterns of NEET and NCET applications between 2020 and 2025 reflect a changing landscape of adolescent aspirations in India, driven by policy reforms, social prestige, and increasing educational opportunities. While NEET continues to dominate with high participation and competition, NCET is emerging as a promising pathway for teacher education, showing rapid growth in a short period. However, the psychological toll of aspirational pressure remains a serious concern, especially for NEET aspirants, where mental distress and suicide rates highlight the urgent need for preventive measures. NCET aspirants currently seem less affected, but rising demand could lead to similar challenges if adequate support systems are not implemented.

The findings emphasise that educational success should not come at the expense of adolescent wellbeing. Institutions, educators, and policymakers must therefore adopt a holistic approach that combines academic preparation with mental health literacy, stress management, and emotional resilience training. Promoting balanced aspirations, fostering self-efficacy, and destigmatising mental health support are crucial for shaping adolescents not only as capable professionals but also as psychologically healthy individuals. By constantly monitoring these trends and addressing the associated psychosocial implications, India can move towards a more equitable and compassionate model of educational excellence that values both ambition and wellbeing.

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Emerging Fields in Educational Research: Shaping Future Directions with NEP 2020

Emerging Fields in Educational Research: Shaping Future Directions with NEP 2020 provides a comprehensive scholarly exploration into the transformative shifts currently redefining the Indian educational landscape. This edited volume, compiled by the Model Institute of Education and Research (MIER), serves as a critical roadmap for navigating the complexities of 21st-century pedagogy in the wake of the National Education Policy 2020. Across its chapters, the book examines the vital intersection of technological innovation, social-emotional well-being, and inclusive practice. Key discussions delve into the ethical integration of Artificial Intelligence, the evolution of digital literacy, and the creation of resilient, vocationalised learning environments that cater to diverse student needs. By bridging conceptual depth with practical insights, this collection offers essential guidance for researchers, educators, and policy stakeholders committed to building an equitable, future-ready, and technology-enabled education system that prioritises both academic excellence and the holistic development of every learner.



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