



The Role of Research and Innovation in Strengthening the Integrated Teacher Education Programme (ITEP) in India

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Abstract

The ITEP is a transformative reform in India's teacher education arena, integral to the vision of National Education Policy (NEP) 2020 of creating teachers who are reflective, competent and caring. In this paper, we examine the central contribution of research and innovation to enhancing ITEP in quality, relevance and sustainability. It emphasizes how research serves to promote evidence-based teaching strategies, curriculum design and policy decision making, while innovation promotes new levels of pedagogical engagement via technology use, practical learning and interdisciplinary collaboration. The study highlights the importance of institutional research culture, communities of practice and innovation hubs in teacher education institutions for supporting on-going professional development. By basing on effective models and identifying problems, this paper argues for a research-embedded and innovation-guided framework in cultivating future-oriented teachers who can meet the changing needs of 21st-century learners.

Keywords: Integrated Teacher Education Programme (ITEP), Research, Innovation, NEP 2020, Pedagogical Practices, Teacher Education, Professional Development

Introduction

Teacher education in India is witnessing a radical change by announcement of the Integrated Teacher Education Programme (ITEP), envisaged under National Educational Policy (NEP) 2020. The ITEP strives to cultivate a professional teacher within for years of multidisciplinary education that combines content, pedagogy, and experience designed to foster an informed, effective, inquiring practitioner (Ministry of Education 2020). This is a paradigm shift which underscores the content and pedagogy of teacher education as well as acknowledging the crucial role played by research and innovation in ensuring its quality, relevance and global competitiveness.

For teacher education, research offers the platform to develop evidence-based practices, curriculum changes and teaching methods that would work (Cochran-Smith & Lytle, 2009) ^[2]. It helps school people to know what is happening in an atmosphere of learning, how diverse the learners are and how they can manage their classroom with inquiry-based reflection. Innovation meanwhile, brings in contemporary creative and Technological Factor-Driven approach to promote experiential learning, interdisciplinary amalgamation and inclusive pedagogy (UNESCO, 2017) ^[8]. Therefore, research and innovation fill the gap to enhance ITEP framework in enhancing continuous proficiency development, accountability and professional growth for pre-service teachers.

Finally, the realization of ITEP requires an institutional culture that nurtures inquiry, experimentation, and collaboration across boundaries of discipline. Innovation labs, teacher research cells and action research projects in teacher education institutions could provide a strong field of reflective practice and pedagogical innovation (NCERT 2022). Such programs can contribute to

closing the theory-practice divide, ensuring that teacher education responds to national needs, and producing teachers who are ready for the work of teaching in 21 st century classrooms.

In this light, the current paper focuses on research and innovation efforts to reinforce ITEP in India. It examines how evidence-based practices, technological integration, and innovative pedagogies enhances quality in the preparation of teachers.

Review of Literature

The process of teacher preparation in India has undergone a series of reforms with focus on quality, equity and creativity. Integrated Teacher Education Programme (ITEP) notified in the National Education Policy (NEP), 2020 is a departure from fragmented teacher preparation to an integrated and multidisciplinary approach in preparing teachers as reflective practitioners (Ministry of Education, 2020). Key to achieving this vision is the role of research and innovation to reimagine teacher education as an evidence-informed, inquiry-led and future-ready enterprise.

Teacher education research is a key driver for better pedagogical practice, policy and curriculum development. Practitioner inquiry, as Cochran-Smith and Lytle (2009) [2] describe it, enables teachers to be knowledge producers rather than users, to reflect on classroom practice critically. Zeichner likewise (2010) [9], argues that theory- focused teacher education also narrows the rift between theory and practice by promoting action research and reflective inquiry among pre-service teachers.

In Indian perspective NCERT (2022) identified that integrating research components in ITEP will contribute to evidence-based decision making, promote contextualized innovations and improve institutional accountability. The studies of Borg (2013) [1], lend further support to the role of teacher research in stimulating professional autonomy and lifelong learning, that are essential for responding to the changing educational contexts. Therefore, including research methodologies, field studies and small-scale action research projects in ITEP may greatly enhance teacher preparation and professional development.

Teacher education innovation could mean innovative pedagogical practices, the integration of technology and new ways/ideas that can sustain a better quality of student learning. Schleicher (2018) [7], remarked on the importance of flexibility, student centricity and technology in meeting challenging classroom needs through innovation. UNESCO (2017) [8] further emphasized the role of digital tools, blended learning and open educational resources for democratizing access to quality education and promoting innovation in teaching and learning practices.

In India, ITEP emphasizes the use of creative teaching methods like experience-based learning, simulative pedagogy and inter-disciplinary curriculum structure in institutes (Ministry of education, 2020). Kumar and Sharma (2021) noted that teacher preparation based on ICT, digital pedagogy, and collaborative learning leads to innovative ways of fostering engagement in teaching and learning, creativity, and inclusivity. By incorporating innovation labs and technology-supported classrooms, the teacher trainees are able to practice multiple teaching-learning designs driven by 21st-century skills.

An increasing research base highlights the mutually

reinforcing relationship between research and innovation in fostering high-quality teacher education. Castagneta-Darling-Hammond (2017) [3], contended that teacher education programs that integrate research and cutting-edge practice develop educators who are flexible, critical, and can promote transformative learning. Research and innovation have a mutually reinforcing dynamic where research drives the emerging morality toward evolution, which in turn leads to new questions for research (Gupta & Agarwal, 2020). This network enhances the ITEP system through reflexive teaching, curriculum innovation and evidence-based reform. In addition, the setting up of Teacher Research Networks (TRNs), innovation incubators and institutions of teacher education can help in institutionalizing this synergy (NCERT, 2022). These efforts can be drivers of ongoing professional growth and long-term elevations in the quality of teaching and learning.

The literature presented above highlights that inter-linking of research and innovation is critical for unlocking the transformational prospects associated with ITEP in India. Research promotes reflection, questioning, and professionalism, while innovation supports creativity, flexibility and technological competence. Together, they comprise the building blocks of a strong, dynamic and forward-looking teacher education system that meets the changing demands of learners and society.

Objectives of the Study

1. To realize the significance of research in the enhancement of the standard of ITEP.
2. To investigate the role of innovation for successful teaching and learning in ITEP.
3. To pinpoint how research and innovation can be used to make teacher education more applied.
4. To recommend actions for fostering the research and innovation climate in teacher education entities.

Research Methodology

Methodology The present study is of qualitative and descriptive nature conducted through secondary data analysis for exploring the research innovation in reuse power of ITEP. The study draws on information extracted from various secondary sources, including policy documents (the NEP 2020); reports of the National Council of Educational Research and Training (NCERT); and publications by the Ministry of Education. This is complemented with an analysis of relevant academic articles, research papers, books, and international reports drawn from bodies such as UNESCO and OECD to offer a theoretical and empirical perspective. Using a content analysis (CA) method, examination of the literature revealed patterns and served to identify new factors towards determining how research and innovative practices may lead to higher quality teacher education. This procedure allows for in-depth analysis of current practices, issues, and policy implications for subsuming ITEP within India.

Results and Discussion

The findings show that embedding research and innovation into ITEP greatly contribute to the quality of teacher education, fostering reflective practice, evidence-based pedagogy and the infusion of technology. Schools that adhere to research-based and innovation-oriented methodologies

have better qualified teaching staff, greater instructional relevance, and increased student engagement. The results underscore the importance of institutional support and policy coherence for ongoing innovation-oriented teacher education reform.

The Importance of Research in Improving the Quality of the Integrated Teacher Education Programme (ITEP) in India

The Integrated Teacher Education Programme (ITEP), launched by NCTE under NEP 2020, which offers for a four-year multidisciplinary approach with an emphasis on practice-based and learner-centered training seeks to restructure the teacher education. Research too emerges as a critical driver for quality, innovation and continuous improvement if ITEP is to realise its aims.

1. Strengthening Relevance and Effectiveness of Curriculum

Research is also the backbone in strengthening ITEP by making its curriculum more vibrant, relevant and effective. It serves as a form of reflection on the extent to which the joint programmes courses, pedagogical elements and practicum experiences fit with authentic needs for current classrooms. With research-based evidence, faculty will be able to determine if gaps, redundancies or obsolete information exists in curricular offerings, enabling institutions to change them as needed. Furthermore, the curriculum remains contemporary, contextually anchored and future looking through research informed by child development, learning sciences and NEP oriented pedagogy to enable student-teachers to be ready for changing challenges of school education in India.

2. Pedagogical Practices as Strengthened through Collaboration:

ITEP is to be grounded in experiential learning, constructivist approaches and technology-embedded pedagogy where research becomes inevitable for perpetuating progress. Classroom research action research and reflective practice allow teacher-educators as well as student-teachers, an opportunity to experiment with innovative teaching strategies, in addition it helps to sharpen the classroom management skills; adapt pedagogic practices according to different types of learners. It is through systematic inquiry and reflection that ITEP produces adaptive, research-based and reflective teachers who feel better prepared to meet the fluid demands of today's classroom.

3. Enhancing Competence of Teacher Educators:

Research keeps the teacher educators updated, reflective and responsive to changing demands of education and providing them opportunities for CPD throughout the career. Research in new trends, such as artificial intelligence in education, inclusive pedagogy and socio-emotional learning is essential if teacher educators are to learn how best to address contemporary classroom requirements. It is this exposure that allows them to enhance their teaching practice, pick modern practices and lead student-teachers better. Participating in research also changes teacher educators into more than conduits of knowledge toward other practitioners, but rather scholars and scholarly practitioner who critically consider educational matters, advance what is known about education,

and contribute to the larger good of teacher learning.

4. Advocating Evidence-Based Policy and Institutional Decisions

Evidence from research is key in helping teacher education programs move toward continuous improvement and innovation. They support institutions in creating creative teaching-learning spaces that are learner-sensitive, sweat the details on field-based internship models, and foster greater partnerships with schools for mutual development. At the policy level, research offers indispensable evidence to support policymakers in ensuring that ITEP is consistent with national quality benchmarks, world-wide educational developments as well as dictates of NEP 2020. Through such efforts, research connects institutional practice and policy reform which guarantees that teacher preparation stays in-step with an ever-changing world context.

5. Fostering Solutions to Inclusive and Equitable Teacher Preparation

Assessment of students in rural, tribal, or socio-economically disadvantaged settings informs teacher education institutions in developing more inclusive and context-responsive policies. This scholarship enables the construction of inclusive pedagogies and culturally responsive teaching practices as well as multilingual educational models, which correspond more precisely to India's disparate classrooms. This is especially important in the Indian context, as the Integrated Teacher Education Programme (ITEP) is attempting to train teachers who are able to cater for diverse, multi-level learners and offer a sense of equity within learning to all students.

6. Technology integration and Digital Pedagogy

Research has a crucial role in identifying strategies that prove effective for integrating digital tools, AI-based learning systems, and virtual labs/simulation based teacher training within Teacher Education Programmes. Through studying how these new tools affect learning practices, engagement and teaching effectiveness, research supports the use of digital innovations in education through a proper kind of implementation that truly adds value to pedagogical practice. This way, technology integration is purposeful and not just shallow; future teachers would have digital literacy for the modern classroom.

7. Improving Practicum and School Internship Quality

Practice-teaching is a fundamental component of the ITEP, and research on practice-teaching provides insight for improving the quality of practicum and school internship. Institutions also benefit by being able to use systematic studies as a way to refine mentor-mentee models, create more reliable and valid classroom observation rubrics, understand the structure and sequencing of internships. These enhancements also support that student-teachers will be guided both with more quality and explicit feedback, improved chances to link theory and practice in the real classroom. This, in turn, leads to stronger school-institution partnerships and more meaningful and authentic fieldwork experiences for pre-service teachers.

8. Sustaining Quality Assurance

The monitoring and evaluation systems informed by research

provide teacher education institutions with tools to monitor the effectiveness of programmes, student-teacher learning outcomes as well as institutional governance. They surface what's working, and what isn't, all based on data, not gut feeling. These evidence-based reviews promote a culture of accountability, transparency and excellence, and ensure that the programme remains adaptive to evolving needs and quality standards.

9. Promoting Innovation and Experimentation

Research seeks to open up significant windows for developing educational innovation labs, running pilots on novel pedagogical approaches, field-testing community-based learning through teacher education institutions. This kind of work allows teacher educators and student teachers to experiment, improve, and assess ideas in real or simulated educational environments. Through promoting experimentation and creative problem solving, research changes teacher education from authoritarian 'training' to a culture of dynamic innovation and steady improvement.

10. Designing a Scholarly Teacher Workforce

NEP 2020 recognizes teachers as the second pair of professional policy-makers and people who continue learning throughout their lives and research in ITEP is pivotal towards preparing scholarly, reflective and innovative teachers. Through continued investment in inquiry-based practices, ITEP develops teachers who are critical problem solvers who engage in the creation and dissemination of knowledge for academics. This is to help boost the general professional status and image of the teaching profession, raising teachers from one who deliver programme to creators of knowledge.

After all, research is not added onto ITEP as an extra just-in-case component; it is its beating heart the activity that ensures that a programme progresses, continues to be of salience and runs true to itself. It is by internalizing research in its very design that ITEP has the potential to develop able, reflective, inclusive and future-oriented cadre of teachers who can reshape the school education sector of India for years to come.

Innovation Supporting Effective Teaching and Learning in ITEP in India

Innovation is a key driving force for catalyzing Integrated Teacher Education Programme (ITEP) in India, especially when the National Education Policy (NEP) 2020 focuses on 'contemporary', 'holistic' and 'competence-based' teacher training. Comprising digital technology and creative pedagogies, modernists ion addresses the need for future teachers to be mediators of learning and in contributing to quality school education with a contextual multicultural focus.

The use of technology enriched learning is one important carrier point of ITEP. Such resources as smart classrooms, digital content repositories, multimedia resources and learning management system (LMS) have been found effective in enhancing student-teachers interaction with content. Moreover, models of learning that mix both online and offline can add flexibility a well as accessibility. Emerging solutions such as AI-based assessments and adaptive learning alike bolster the case of personalization both in terms of preparation and readiness for the classroom.

It is in the area of pedagogy, however that innovation is most likely to drive pedagogical reform in ITEP through the pursuit of student-centred and constructivist strategies. Pedagogical styles such as activity based learning, project-based learning, flipped classrooms and collaboration based learning prompts active involvement compared to passive listening. These methods actually foster student-teachers with the power of time management, creativity and problem solving that will help them to generate resourceful exciting learning for school children.

Another innovation in ITEP is promotion of multidisciplinary and holistic learning as an initiative supported by NEP 2020. The curriculum integrates arts, sciences, humanities and vocational elements to help student teachers gain broader perspectives and get to know learners in a more holistic way. Psychology, environmental studies, digital literacy and value education concurrently enrich their pedagogical capability and holistic development.

Innovation also enriching school-based learning and internships -- the essence of ITEP. Trainees are involved in microteaching, school practice and peer teaching, classroom observation and action research projects which validate the application of theory into practice. Video-based feedback, reflective diaries and community based projects prepare them to be effective teachers as well as a reflective practitioner who can keep on learning.

Further, the adoption of OER (DIKSHA, SWAYAM, e-Pathshala and NROER) enables availability to quality learning resources. These digital channels facilitate collaborative learning, self-paced study and ongoing industrial up-skilling. They also promote the use of innovative teaching methods for teachers and to be informed of modern educational trends.

A second important area of innovation in ITEP is assessment. These traditional test questions are complemented by portfolio assessments, rubrics, peer-evaluations, self-assessments, digital quizzes and other competency-based evaluation models. Such contemporary assessment tools give a broader picture of the trainee teachers' competencies and promote earnest involvement in teaching learning tasks.

Lastly, innovation encourages the integration of inclusive education in ITEP. The programme combines UDL, assistive technologies and multilingual classroom strategies to prepare teachers' in meeting diverse learning needs. This guarantees fairness, access and full participation for all learners, especially people with disabilities or from disadvantaged communities.

In the ITEP innovations enrich pre-service teacher preparation through: improved pedagogy, technology integration, including diversity, new methods of assessment and school site-based practice. With these developments, ITEP is on its way to forming conscientious and future ready teachers to fill gaps in India's dynamic education scenario.

Ways Research and Innovation Can Make Teacher Education More Relevant and Practical

Research and development can provide an important contribution to the reinforcement of teacher education by linking academic knowledge with real classroom action. Teacher education is more accountable to the changing needs of learners, schools and society through systematic inquiry and creative practices. Research provides the "what works,"

the evidence base for why something is effective and how it can be brought into teaching practice in a more robust manner, while innovation presents new tools, devices, techniques or strategies that improve student learning. All this together means that teacher education goes beyond traditional lectures and is increasingly practical, reflective, and contextualized.

A key contribution of the research is that it offers some evidence-based approaches to teacher preparation. Teacher educators and preservice teachers can avoid exclusively using traditional or unproven practices and instead tap into these researches based guides to plan lessons, handle classroom dynamics, or apply effective pedagogical strategies. Studies of lesson plan development, child psychology and learning outcomes can teach preservice teachers how students learn, teacher candidates can develop an understanding of how to modify the teaching strategies they have learned to meet the needs of all learners. This also means teacher education is more practical; it makes sense and is closer to real life.

Innovation also modernizes teacher training through the use of technology in teaching-learning. Teacher candidate can use digital technologies and digital class room equipment such as smart classes, learning management systems, virtual simulators and artificial intelligence-based assessment tools for covering different teaching practices. By giving them an opportunity to practice lessons, classroom control and choice architecture in a safe environment without risk of humiliation or embarrassment. The technology narrows the gap between theory and practice, particularly for trainees who require additional hands-on experience before going into real classrooms.

Inquiry reinforces teacher preparation by research and reflection. When, for example, student-teachers carry out tiny action research projects during internships, they gain experience of identifying a problem in the classroom and then testing interventions at a small level while reflecting on their own teaching. This culture of enhancement enables them to become critical practitioners as opposed to mechanical teachers. Action research also develops problem-solving capabilities, risk-taking behaviors and a commitment to lifelong learning, all of which are critical for the contemporary teacher.

Innovations in pedagogy wherby education for teachers are more meaningful. Practices like project-based learning, collaboration, flipped class and differentiations of instruction break trainee teachers' encounter with new practices that plug better into their learner's worlds. Trainees are more likely to bring these innovative practices with them into the class-room if they have experienced them themselves. This is to make sure that teacher training does not remain in the book but matches the 21st century learning context.

Research also endorses curriculum up-gradation in the teacher education colleges. By analyzing trends, employer needs, feedback from schools and learning gaps, researchers can recommend how to redesign the curriculum so that teacher training becomes more practical. Digital literacy, life skills, inclusive education, socio-emotional learning can be incorporated in curriculum articulation as well classroom assessments and school internships. These changes are in tune with the changing educational landscape and NEP 2020 in India.

In addition, innovation strengthens school-based learning by improving internships and on-site experiences. Digital

portfolios, video reflections, peer feedback tools and community-based projects can all be leveraged by student-teachers to ensure the practice teaching process is more authentic and more productive. These are some of the innovations that make sure trainees have the real professional skills and grounded understanding of what happens in the classroom before they start their first jobs as full-time teachers.

Research and innovation are also aiding inclusivity by enabling teachers to effectively manage heterogeneous classrooms. Research highlights best practice for children with additional needs - from those using English as an Additional Language, to children living in poverty. With advances such as assistive technologies, Universal Design for Learning (UDL), and personalized learning plans, inclusive classroom is a feasible reality. This better prepares new teachers to provide equitable learning opportunities for all students.

Measures for Promoting a Research and Innovation Culture in Teacher Education Institutions

Creating the conditions for a vibrant research and innovation culture in teacher education institutions is necessary, but it demands a strategic approach whereby faculty are authorized, students-teacher are engaged and an enabling academic environment is established. One of the best methods, we have learnt so far, is to form institutional research committees/cells at all levels which could plan, initiate and monitor research efforts in the institute, and help promote a culture of evidence-based practice for both teachers as well as students. Such committees also have a role in facilitating collaborations, guaranteeing ethical standards and underpinning a formal research climate.

The other significant step involve the infusion of research in the curriculum and include action research, reflective journals, seminars on research work, courses on research methods and the dissertation work as compulsory one. When pre-service teachers conduct small-scale, classroom-level research as a part of their internship experiences they learn to...solve problems with evidence to make decisions; and reflect on what counts as reasoning and how it is performed in specific cases. This enhances both their professionalism and the motivation to employ research as a means of quality improvement.

Teacher education institutes should also offer capacity building programmes like workshops, FDPs, short term courses and training in research methods, analysis of data, writing academic papers and publication ethics. Hosting scholars, practitioners and experts in the areas of research for lectures and mentorship may also improve faculty and student-teachers' ability to conduct their own research.

Providing infrastructure that can be leveraged for research is as important. The academic institutions should ensure access to good libraries with online databases, information and communication technology (ICT) facilities, anti-plagiarism software and digital learning platforms. Specialized research labs, innovation hubs and incubation centers can facilitate experimentation, project development and cross-disciplinary innovation.

Colleges and universities, K-12 schools, NGO's, and government entities can collaborate to encourage multidisciplinary research to inspire innovation. Industry-academia connectivity can also help by providing teacher

trainees real-life challenges and new inventions in the education (sector). National and International conferences/seminars/competition Regular attendance in national/international Conferences/Seminars/competition help the students/Faculty on their paper work as well to be updated about world research.

Incentive and recognition systems can be other powerful solutions to prevent the phenomenon. Scholarships, fellowships, seed money, publication grants and certificates of appreciation incentivize faculty/students to participate more actively in R&D activities.

Last but not least, organizations must foster a culture of reflection, experimentation and openness to innovative ideas. You want to support the staff in using new teaching approaches and trying out playful methods and different kinds of material; such processes of innovation should take place as an everyday political practice. As long as institutions prize creativity, inquiry, and ongoing professional learning, they will develop a culture of research and innovation that sustains them over time.

Findings

The research suggests that research and innovation is adding value to the quality, relevance, and effectiveness of the ITEP in India. The research informed training then serves to provide evidence-based pedagogical practice thus supporting teacher educators and their ITEP participants in basing decisions in the classroom on empirical data not tradition. The incorporation of the research action in school internal internships, gives the training teachers to recognize reality classroom problems themselves, proving innovative interventions and constructing reflexivity thought process, thus shortening the distance between theory and practice.

‘Innovation’ is identified as a key factor driving the contemporary changes in teaching and learning across ITEP. Engaging with ICT tools, digital platforms, virtual simulations and AI-supported learning systems support teachers for the future while promoting Prioritizing Education to achieve better classroom performances How? Novel pedagogic models, namely project-based learning, blended learning, flipped classrooms and collaborative methods allow student-teachers to experience modern teaching methods which will better prepare them for the multifaceted realities of current classrooms. Another critical discovery is that innovative practices advance inclusivity, as it encourages the use of assistive technologies, Universal Design for Learning (UDL), and multilingual teaching tools so future teachers can support diverse learners.

The investigation also indicates that research promotes curriculum development and policy-related studies. Ongoing feedback from education research informs revision of ITEP curricula to incorporate social emotional learning, digital literacy, inclusive educational practices, and competency-based assessment. The results also underline the significance of infrastructure facilities like research cells, faculty development programmers (FDPs), and provision for online databases to develop a research culture in academia. The cooperation between the schools, universities, governmental organizations and NGOs has been recognised for increasing technological novelty as well as offering concrete field exposure to teacher trainees.

Conclusion

Finally, research and innovation have a transformative significance in enhancing the ITEP system. Investigation provides teacher candidates and faculty with empirically driven perspectives about instructional quality, reflective practice, and classroom effectiveness. Innovation is integral to this by integrating contemporary pedagogical approaches, digital tools and accessible technologies into ITEP that reflect 21st-century teaching and learning practices. Research and innovation in unison make ITEP increasingly relevant, feasible and sensitive to the variety of learners and schools within the context of a constantly changing educational environment.

In its entirety, the infusion of sound research-based practices and creative strategies into ITEP produces more professionally prepared teachers who have higher-level thinking skills, technological literacy and the expertise necessary to create significant learning opportunities. Building institutional capacity, encouraging partnership and promoting a culture of enquiry are key to maintaining these improvements. Now, with India striving towards NEP 2020's goal of holistic and future-ready education, research and innovation become the cornerstones upon which high-quality teacher education should be constructed.

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