

INTEGRATED TPACK ASSESSMENT TECHNO-SKILLS IN TEACHER EDUCATION INSTITUTES

(Technology, Pedagogy, Advanced Research/Academic Administration, Content Knowledge)

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Abstract:

This is a conceptual review study of TPACK towards Integrated Technological, Pedagogical, Advanced research with innovations, Academic administration of the institution and Content Knowledge blended in INTEGRATED TPACK Techno Skills framework. This constitutes eight domains of technology-enhanced with four main forms of knowledge-technology, pedagogy, advanced research /academic administration, content knowledge interrelated for designing, implementing, and evaluating holistic development of the resources knowledge techno-skills at different academic level teacher education Programmes, integrated teacher education programs (ITEP) in teacher education Institutes exploring the teachers and teacher educator's comprehension with the analysis of TPACK, INTEGRATED TPACK and AI learning tools assessment skills reflecting - What are the knowledge areas educators need to incorporate technology into their teaching? How can we analyze the TPACK Model? How can we structure the teacher education Programmes with TPACK? How to develop the INTEGRATED TPACK framework for teacher education institutions? How can we analyze the INTEGRATED TPACK Model? How can we structure the teacher education institutions with INTEGRATED TPACK? What are the challenges in implementing INTEGRATED TPACK framework for modern, digitally driven classrooms in teacher education institutions? How can we improve the digital literacy with INTEGRATED TPACK framework in teacher education institutions? This conceptual study is based on the review of TPACK that constitute seven domains of knowledge interrelated with three main forms of knowledge- technology, pedagogy and content. Research and innovation for the academic excellence, transforming for the future global development has identified in the TPACK four main forms of knowledge as INTEGRATED TPACK for Teacher Education Institutes, adapting digital technologies, improving digital literacy and developing the global techno digital skills from the teacher education community population of teacher education programmes in the teacher education institutes towards the global digital excellence for the national development.

Key words: TPACK, INTEGRATED TPACK, ITEP, TPACK AI Assessment Skill

Introduction

TPACK framework was first developed by Shulman (1986), then expanded by Mishra & Koehler (2006) adding the technology element. TPACK Framework according to Koehler (2010), Technological Pedagogical and Content Knowledge (TPACK) is about what teachers need to know regarding technology integration in the classroom. TPACK framework is gaining significant progress in India, accelerated by NEP 2020, to bridge the digital skill gap in teacher education. Research, innovations and transforming teacher education programmes, from mere ICT adoption to integrating AI-TPACK scale, TPACK scale, INTEGRATED TPACK assessment skill technology-rich teacher education institutes. Educators often focus on content and technology separately, struggling to blend them together for transformed pedagogy, with limited shift in the "Technology-Pedagogy" dimension. The future focus is shift towards INTEGRATED TPACK strengthening Teacher education institutes for holistic resources development knowledge with techno skills and the "Contextual Knowledge" within the TPACK framework, emphasizing how local, socioeconomic, and infrastructural conditions in India affect technology, integration.

Vision

1. To integrate with the input of 5- E approach like engage, explore, explain, elaborate and evaluate on the concept TPACK and INTEGRATED TPACK that consists of “deep knowledge and understanding the pedagogy, deep knowledge of the approaches and methods, deep knowledge on the advanced research, academic administration of the institution, deep knowledge of the content & blend of technology to improve the teacher education Programmes with TPACK and Teacher Education Institutions with INTEGRATED TPACK framework.

2. To adapt digital technologies for improving digital teaching skills, seeking better educational and employment opportunities as an initiative under India’s National Education Policy (NEP) 2020 in teacher education Institutions having Teacher Education Programmes fostering 21st-century skills.

3. To constitute technology-enhanced teaching interrelated for designing, implementing, and evaluating teacher education curriculum and instruction, based on the educator’s comprehension with the analysis and assessment of TPACK, INTEGRATED TPACK and AI teaching learning tools.

4. To adapt digital technologies, develop digital literacy/instruction, improve digital/technology skills, experiment and innovate to implement and evaluate with advanced research and academic administration for betterment and excellence with new strategies and approaches in the teacher education Programmes of teacher education institutes.

5. To improve the effectiveness and efficiency of digital literacy, techno skills in Vernacular and English medium of instruction teachers and teacher educators, rural and urban located teacher education institutions with the TPACK and INTEGRATED TPACK framework for the development of different academic level teacher education programmes.

Need of the study: This study is a significant focus on Teacher Education Programmes at different academic teacher education levels, ITEP(Integrated Teacher Education Programmes) towards developing and adapting digital tools, improve digital literacy, improve online teaching-learning techno skills, develop TPACK skills for teacher education programmes and INTEGRATED TPACK for teacher education institutes , utilize AI teaching learning tools for practicum involvement in engaging, exploring, extending, evaluating educators skills for professional competency and adapting to AI-based digital instruction in teacher educational institutes to develop and improve techno skills for the future students, prospective teachers, teachers, and teacher educators in education enhancing global digital literacy for their lifelong learning.

Research Questions

1.What are the areas of knowledge that educators need to incorporate technology into their teaching?

2.How can we analyze the TPACK Model?

3.How can we structure the teacher education Programmes with TPACK?

4.How to develop the INTEGRATED TPACK framework for teacher education institutions?

5.How can we analyze the INTEGRATED TPACK Model?

6.How can we structure the teacher education institutions with INTEGRATED TPACK?

7.What are the challenges in implementing INTEGRATED TPACK framework for modern, digitally driven classrooms in teacher education institutions?

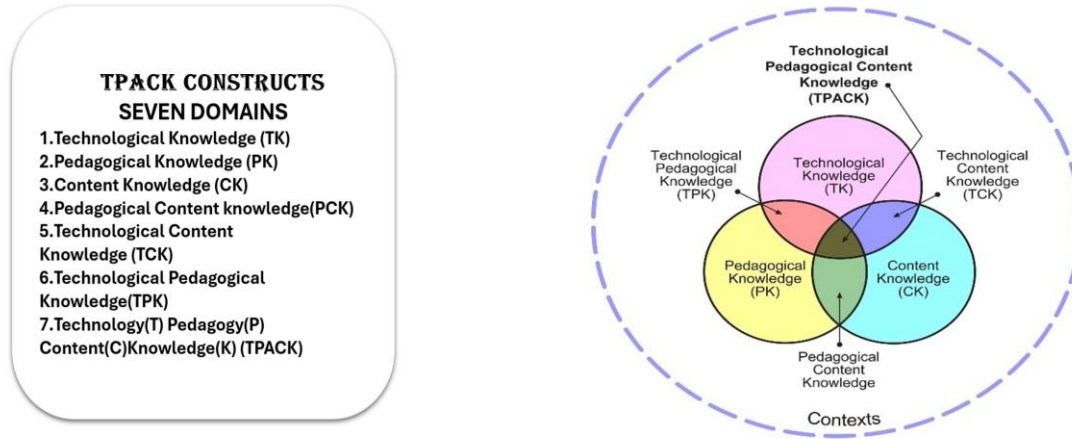
8.How can we improve the digital literacy with INTEGRATED TPACK framework in teacher education institutions?

1. What are the areas of knowledge that educators need to incorporate technology into their teaching?

WHAT ARE THE AREAS OF KNOWLEDGE THAT EDUCATORS NEED TO INCORPORATE TECHNOLOGY INTO THEIR TEACHING?

TPACK in Teacher Education Programmes

Seven domains knowledge skills TK,PK,CK, PCK, TCK, TPK, TPACK.



First developed by by Shulman (1986), then expanded by Punya Mishra and Matthew J. Koehler 2006.

Fig 1: TPACK Model

The Technological Pedagogical Content Knowledge (TPACK) framework, developed by Mishra and Koehler (2006), has served as a foundational model for aligning technology with pedagogy in educational research and practice. This framework introduces the relationships and the complexities between all three basic components of knowledge (technology, pedagogy and content) necessary to design great learning for the learners' needs, provides educators with an approach to intentionally combine subject matter, instructional best practices, and educational technology planned for instruction in order to maximize student learning, guiding the effective integration of technology by combining content (what is taught?), pedagogy (how is it taught?), and technology (what are the tools used in teaching?). It empowers educators to use digital tools in their teaching learning process to enhance in depth practicum and tutorial engaging learning environment. The framework highlights the blend of three main knowledge domains - 1. Content Knowledge (CK)- The subject matter to be taught. (What do you teach?) .2. Pedagogical Knowledge (PK)-The methods, processes, and practices of teaching. (How do you teach?) 3. Technological Knowledge (TK)-Understanding both traditional and advanced technologies. (what are the technological tools used in teaching?).4. Pedagogical Content Knowledge (PCK) knowing how to teach specific content, Technological Content Knowledge.5. (TCK)- Understanding how technology can change or represent content, Technological Pedagogical Knowledge.6. (TPK)-knowing how technology can change teaching methods 7. (TPACK) identifies how Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK) and Technological Pedagogical Knowledge (TPK) domains overlap to form more complex, effective knowledge

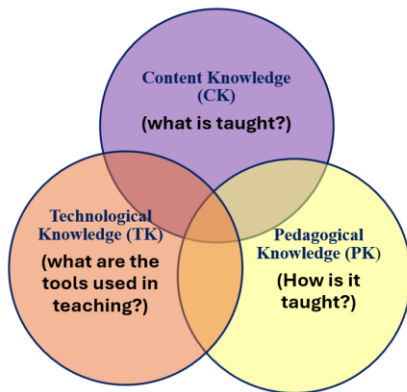
2. How can we analyze the TPACK Model?

HOW CAN WE ANALYZE THE TPACK MODEL?

Analysis of TPACK MODEL

Three Primary Forms of Knowledge - Technological (TK), Pedagogical (PK), Content (CK) blended (PCK, TCK & TPK)

Three Primary Forms of Knowledge

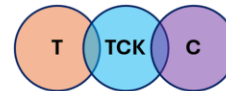


Primary forms of knowledge blended (PCK, TCK, & TPK)

1. **Pedagogical Content Knowledge (PCK)**: Knowledge about how to combine pedagogy



2. **Technological content knowledge (TCK)**: Knowledge about how technology may be used to provide new ways of teaching content.



3. **Technological Pedagogical knowledge (TPK)**: Understanding of how teaching and learning can change when a particular technology is used in a particular way.

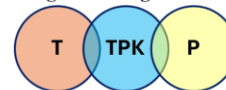


Fig 2: Analyze TPACK Model

TPACK MODEL: (TK, PK, CK, PCK, TCK, TPK & TPACK) Seven Domains

Three main forms of knowledge (TK, PK & CK) - technological knowledge (TK), pedagogical knowledge (PK), content knowledge (CK) are blended to form three more forms of knowledge (PCK, TCK & TPK) - pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK). Six forms of knowledge (TK, PK, CK, PCK, TCK & TPK) together get intersected/blended to form the seventh form of knowledge as TPACK Framework to develop digital pedagogy skill for the educators at the different academic level teacher educational programmes in teacher education institutions.

3. How can we structure the teacher education Programmes with TPACK?

TPACK framework is Koehler and Mishra (2005) effort in developing general contexts, multiple content areas, and multiple approaches for the professional development in teacher education programme. Effective technology integration depends on content and pedagogy blend. Content is the actual information ("what"), while context is the framework that shapes surrounding circumstances ("where," "when," and "why") that give meaning to the information, situation, culture, or background, and shapes interpretation. Same content can have vastly different meanings depending on its context. What is the Pedagogy knowledge and content educators must have? How to develop this Pedagogy knowledge for effective learning? Why to integrate technology into teaching?

1. Content is - what is designed to inform or engage 2. Knowledge is - how and why? (context/expertise to apply information effectively). Good teaching framework with technology integration needs - Understanding towards the concepts/content of technology usage, analysing Pedagogical techniques that use technologies in practical ways to teach content and evaluating how technologies can be used to build on existing knowledge with the strategies. Teacher educators teaching experiences related to Pedagogy, Content, Knowledge with technology must be specific to the different TPACK domain areas.

HOW CAN WE STRUCTURE THE TEACHER EDUCATION PROGRAMMES WITH TPACK?
IMPORTANCE OF TPACK IN TEACHER EDUCATION PROGRAMMES-
(Technology+ Pedagogy+ Content)Knowledge

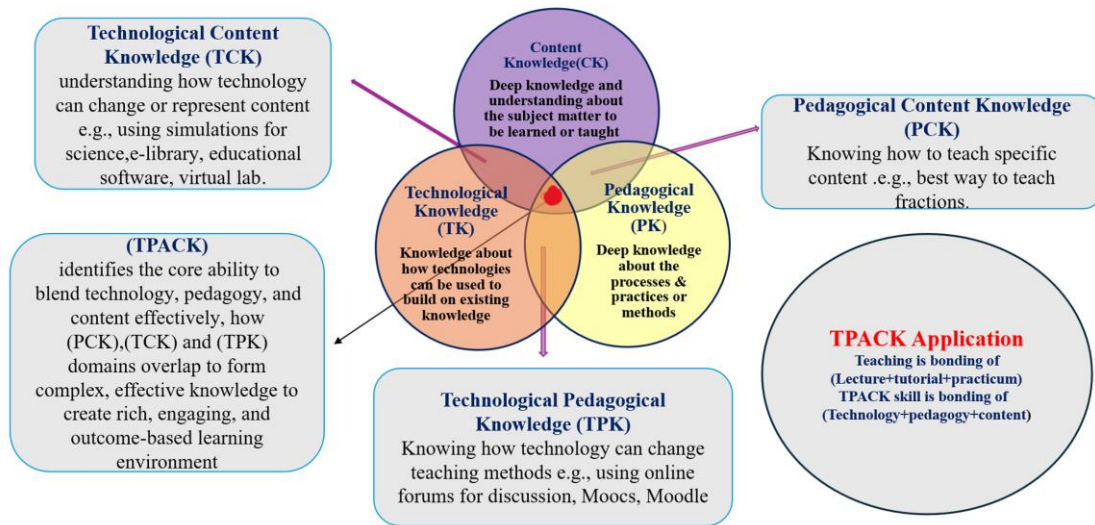


Fig 3: Importance of TPACK Model in Teacher Education Programme

4.How to develop the INTEGRATED TPACK framework for teacher education institutions?

INTEGRATED TPACK: (TK, PK, AK, CK, PACK, TACK, TAPK, INTEGRATED TPACK) Eight Domains

1. Technological Knowledge/Skills (TK): Basic /core technology skills, proficiency in using various digital tools, basic applications of Microsoft office, advanced AI tools, software apps, and their application in educational platforms

2. Pedagogical Knowledge/Skills (PK): Advanced pedagogical application skills in lesson planning, school internship programmes, teaching and learning methods, strategies, evaluation and assessment techniques

3. Content Knowledge (CK): Skills related technology application to subject or content in teaching and learning abstract concepts, tutorial and practicum activities, assignments, projects to enhance educational academic competency level.

4. Academic administration/Advanced research skills (AK): technology enhanced-planning, administration and decision-making in teacher education institutes:

a) Academic administrative skills in teacher educational institutions -organize seminars, workshop programmes, guest lectures, organize advisory committee meetings, examination committee meetings, governing body meetings for the review of academic programmes at present development aspects -faculty, students, administrative staff, examination results and pass percentage, admission percentage enrolled, infrastructure ,report on the total annual income and expenditure , report of correspondences done with the higher regulatory authorities for a particular annual academic programme etc., presentation of annual report for the academic programmes , continuous comprehensive evaluation techniques, prospective teachers' holistic development related activities, collaboration of college activities with school , society and alumni. Initiation for the plan of action towards future resources and institution development aspects related to improvement, new staff appointments, enhancement of admission intake, new course programmes, academic programmes financial budget related activities for future development are explored in institutes.

b) Advanced research skills -continuous professional competency and research development related research activities- motivating teacher educators for Ph.D. research ,research publications, engage prospective teachers for action research and project based activities, developing techno-skills to research scholars in searching thesis related activities- concepts, review of literature, research methodology, data analysis (SPSS Package), testing and interpretation of research hypotheses related educational research activities explored in the institute .

5. Pedagogical Advanced research/Academic administration Content Knowledge (PACK) Knowledge about how to combine pedagogy with Advanced research/ Academic administration in the institution-preparing ICT enriched pedagogy modules, evaluation strategies/techniques etc.

6. Technological Advanced research/Academic administration content knowledge (TACK): Knowledge about how technology may be used to provide new ways of teaching content of Advanced research/ Academic administration in the institution -spss package, multimedia package, blended learning, AI-Powered Lesson Planning & Content Generation, AI-Powered Assessment, Flipped Classrooms, AI-driven virtual classrooms and simulations etc.

7. Technological Advanced research/ Academic administration Pedagogical knowledge (TAPK): Understanding of how teaching and learning can change when a particular technology of Advanced research/ Academic administration is used in a particular way in the institution. Facial recognition app for attendance, AI-Powered Project-Based Learning etc.

HOW TO DEVELOP THE INTEGRATED TPACK FRAMEWORK FOR TEACHER EDUCATION INSTITUTIONS?

INTEGRATED TPACK in Teacher Education Institutions

Eight domains knowledge skills TK,PK,AK,CK,TACK,PACK,TAPK,INTEGRATED TPACK

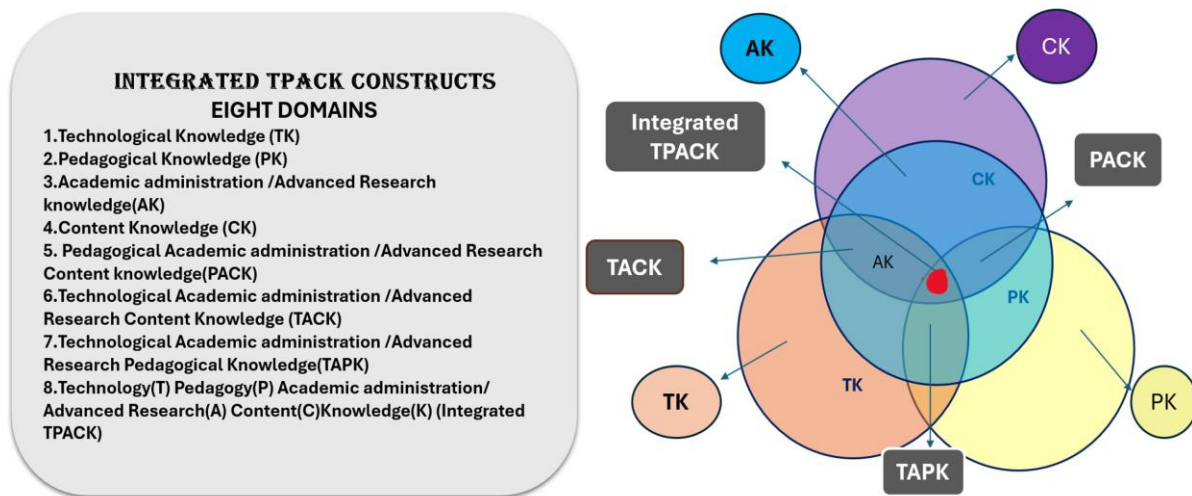


Fig 4: INTEGRATED TPACK Model in Teacher Education Institutes

8. INTEGRATED TPACK

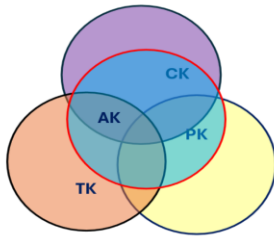
The core ability to blend technology, pedagogy, Advanced research/ Academic administration and content effectively to create rich, engaging, and outcome-based learning environment that promotes critical thinking and collaboration for innovative, effective teaching with technology increases to adapt digital technologies for seeking better digital teaching skill ,digital literacy to the staff members for the development of the Teacher Education Programmes in the Teacher Education Institutions.

5. How can we analyse the INTEGRATED TPACK Model?

HOW CAN WE ANALYZE THE INTEGRATED TPACK MODEL?

Analysis of INTEGRATED TPACK Model

Four Primary Forms of Knowledge -Technological (TK),Pedagogical (PK),Advanced Research/Academic Administration(AK),Content(CK) blended to form (PACK,TACK&TAPK)



1. Pedagogical Advanced research/ Academic administration Content Knowledge (PACK)
 Knowledge about how to combine pedagogy with Advanced research/ Academic administration in the institution



2. Technological Advanced research/ Academic administration content knowledge(TACK)
 Knowledge about how technology may be used to provide new ways of teaching content of Advanced research/ Academic administration in the institution .



3. Technological Advanced research/ Academic administration Pedagogical knowledge(TAPK)
 Understanding of how teaching and learning can change when a particular technology of Advanced research/ Academic administration is used in a particular way in the institution.



Fig 5: Analyze the INTEGRATED TPACK Model in Teacher Education Institutes

Integrated TPACK Model-Four main forms of knowledge(TK,PK,AK&CK)- technological knowledge TK, pedagogical knowledge PK, Academic administration/Advanced research knowledge AK, content knowledge CK are blended to three forms of knowledge(PACK,TACK&TAPK) -pedagogical Advanced research/Academic administration content knowledge PACK, technological Advanced research/Academic administration content knowledge TACK, technological Advanced research/Academic administration pedagogical knowledge TAPK. Seven forms of knowledge (TK, PK, AK&CK, PACK, TACK&TAPK) together get intersected to form the eight forms of knowledge as INTEGRATED TPACK Framework for the different academic level teacher educational programmes in teacher education institutions.

6. How can we structure the teacher education institutions with INTEGRATED TPACK?

HOW CAN WE STRUCTURE THE TEACHER EDUCATION INSTITUTIONS WITH INTEGRATED TPACK?

IMPORTANCE OF INTEGRATED TPACK IN TEACHER EDUCATION INSTITUTIONS

Holistic Development of Resources Knowledge Techno Skills in the Teacher Education Institutes

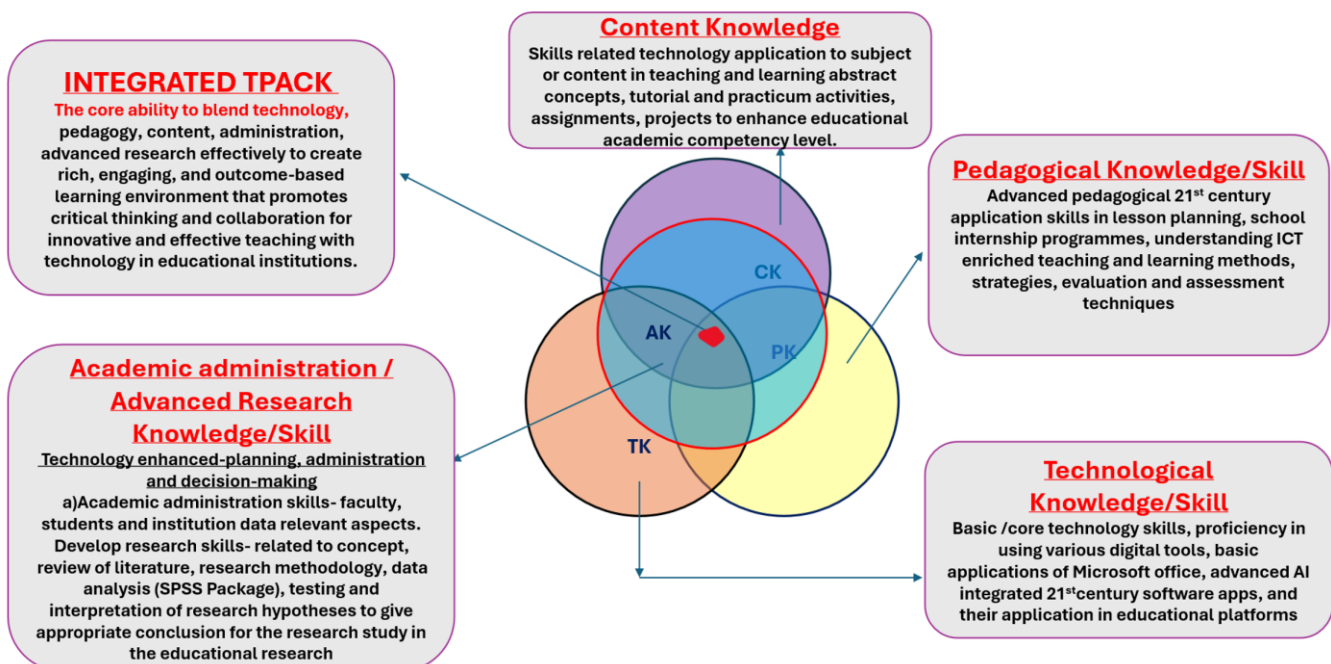


Fig 6: Importance of INTEGRATED TPACK Model in Teacher Education Institutes

Holistic Development of Resources Knowledge Techno Skills in Teacher Education Institutes (INTEGRATED TPACK):

Integrated Technological, Pedagogical, Content Knowledge (TPACK) framework has eight domains focuses on digital literacy knowledge skill and core ability/efficiency of the staff members in the teacher education institutions:

- a) Teaching pedagogy of languages and pedagogy of non-languages in teacher education institutions to blend technology, pedagogy, and content effectively to create rich, engaging, and outcome-based learning environment to the prospective teachers, that promotes critical thinking and collaboration of various academic calendar curricular activities in the educational institutions related to technology applications at the different academic level teacher education programmes. (e.g. language/non-language Pedagogy Faculty)
- b) Teaching course/content subjects of education with the blend of technology to the prospective teachers at the different academic level teacher education programmes. (e.g. Education Faculty)
- c) Teach and supervise advanced research with the blend of technology to the prospective teacher educators and education research scholars in teacher education programmes. (e.g. Post Graduate Faculty & Research Supervisors in Education)
- d) Teach course subjects, plan schedules, organize programmes, execute curriculum activities, monitor the data and take responsibility for the various academic administration activities for the smooth conduct of curriculum academic calendar programmes in the institutions that need the blend of technology at the different academic level teacher education programmes from the institutions. (e.g. Principals & Head of the Departments in Education)
- e) Prepare data, documents and take responsibility for the administrative input data that must be monitored and communicated need the blend of technology for the different academic level teacher education programmes from the institutions. (e.g. administrative staff in the institutes- librarians/clerks/computer operators/accountants /Supportive staff)

7. What are the challenges in implementing INTEGRATED TPACK framework for modern, digitally driven classrooms in teacher education institutions?

1. Access to resources limitations in teacher education institutes: Limited access to modern digital tools, poor internet connectivity, inadequate, outdated equipment's.
2. Limitation in the variation of educator's digital literacy for digital professional development in teacher education institutes as prevalence of English language online content dominated restricts vernacular language learners to access and interact with digital tools.
3. Limitations in the variation of providing technological infrastructure, human resources, financial resources in the teacher education institutions.
4. Limitations in basic Microsoft office application knowledge of teacher educators and administrative staff members in teacher education institutes.
5. Limitations in the appointment of teaching staff members and administrative staff members (librarians/clerks/computer operators/accountants) in the teacher education institutes
6. Limitation of teacher educators with support of technical staff in teacher education institutes.
7. Limitations of variation in pedagogy teacher educators acquired medium of instruction to justify deep pedagogy, content knowledge in both medium of instruction TPACK application to educate prospective teachers in teacher education institutes is a digital divide-
E.g., variation in the teacher educators school internship programme demonstration practices to prospective teachers in teacher education institutes- assessment of deep pedagogy content knowledge of school textbooks classes from 6th to 12th both medium separate applications to blend technology with pedagogy and content. How can I do pedagogy micro skills demonstrations to prospective teachers in both medium from 6th to 12th school class textbooks? How can I do pedagogy macro lesson demonstration to prospective teachers in both medium selecting a lesson from 6th to 12th school class textbooks? How can I write a pedagogy macro lesson plan for demonstration in both medium to prospective teachers selecting a lesson from 6th to 12th school class textbooks?

8. Limitations in the variation of medium of instruction delivered in the teacher educational institutes to prospective teachers for different academic level teacher education programmes is found as a digital divide. E.g. 1. School internship programme practices to both medium prospective teachers in teacher education institutions - pedagogy teacher educators' observation of lesson plans, development of teaching skill and practicum evaluation of macro teaching 6th to 12th classes for both medium prospective teachers.
2. Medium of instruction (vernacular language medium of instruction and English medium of instruction separate) in Government/Model/(KGBV) Kasturba Gandhi Balika Vidyalaya/Private/Kendriya Vidyalaya schools: Can a corporate medium of instruction experienced secondary school teacher teach 6th to 12th school class textbook deep pedagogy content knowledge to government secondary school students? Can a government vernacular medium of instruction experienced secondary school teacher teach 6th to 12th school class textbook deep pedagogy content knowledge to corporate secondary school students?
9. Limitations of variation in educators' attitude, aptitude, and passion in the profession towards innovative digital learning
10. Limitations of rural and urban area digital divide as urban education institutes often demonstrate higher techno pedagogical competency, compared to rural teacher education institutes.
11. Limitations of the advanced evaluation approaches.

8. How can we improve the digital literacy with INTEGRATED TPACK framework in teacher education institutions?

1. Professional development training for pedagogy teacher educators on the blend of TPACK in the institution.
2. Identify separate medium of instruction teacher education institutes or one teacher education institute with separation of both mediums of instruction. How does a teacher education institute of one medium of instruction enrolls maximum admission intake to another medium prospective teachers?
3. There is a need to insert a separate column for medium of instruction in the profile of teacher education institutions displayed in the admission portal of the state to give scope and equity for both medium prospective teachers in selecting the institute for deep pedagogy, content and technology digital literacy training. How does a teacher education institute of one medium of instruction provide maximum pass percentage to another medium of prospective teachers?
4. There is a need for teacher education institutions to verify the teacher educators secondary medium of schooling certificate that reflects educators training medium acquired in teacher education college during staff appointment to have proficiency in both medium deep pedagogy, content and technology digital literacy training skills for the learners in integrated TPACK framework and AI tools to balance the curriculum input and outcome of teacher education Programme that provide employment opportunities, develop techno pedagogy skill to the future teachers from teacher education institutions in the state.
5. Support in teacher education institutions providing technology infrastructure, technical support, mentoring, and collaborative planning time to educators.
6. Need for strategic planning and aligning technology use with learning goals and teacher education Programmes academic curriculum standards in teacher education institutes.
7. Initiation from universities towards selected sample digital training skills & techniques to have public private partnership in developing INTEGRATED TPACK for teacher educators of the teacher education institutes E.g. Providing digital literacy to the course discipline pedagogy teacher educators from the university educators staff members- selecting one faculty from each college of education affiliated to university, framing cluster of faculties from affiliated colleges under one university and training them to learn digital literacy skills, in return the trained techno skilled trainer would mentor to the total faculty members in their college. This develops digital literacy skills in the cluster groups of colleges of education affiliated with universities in the state.
8. Initiation from universities towards selected sample digital training skills for administrative staff members (librarians/clerks/computer operators/accountants) of teacher education institutes

9. Composite institutions with various subject discipline Programmes in the same campus, teacher educators can utilize the techno-infrastructure to develop digital literacy to prospective teachers at the teacher education institutes
10. State government authorities, State higher education authorities, authorities of State Universities, NCTE, NCERT, SCERT need to take the initiation towards implementation of digital literacy in Teacher Education Institutes of the State.

Conclusion

Technology-enhanced pedagogy, advanced research and academic administration content knowledge are interrelated for designing, implementing, and evaluating teacher education pedagogy, content curriculum and instruction, advanced research and innovations transforming future pathways, academic administration with new approaches, strategies based on the comprehension with the analysis and assessment of TPACK, INTEGRATED TPACK, TPACK AI Assessment and AI learning tools that are needed to develop technology skills and to improve the quality and effectiveness of digital skills at different academic level teacher education Programmes.

INTEGRATED TPACK framework is crucial for the Integrated Teacher Education Program (ITEP) under NEP 2020 policy to future teachers with digital literacy, aligns with the goal of creating tech-proficient, reflective practitioners, fostering holistic, student-centered learning and need of holistic development of resources knowledge techno-skills. There is a necessity to rethink the quality in school internship preparation practices as teacher education institutes are transforming to Integrated Teacher Education Programmes with the extension of school internship Programmes at different academic levels, innovations in lesson plans, enhance blended teaching and learning with AI tools, application of advanced methods and strategies in teaching, learning, advanced research and academic administration to improve and develop digital literacy skill with TPACK and holistic development of resources knowledge techno skills in the teacher education institutes with INTEGRATED TPACK. Inculcate global digital literacy skills with INTEGRATED TPACK in universities and teacher education institutions extending, exploring case studies, action research, empirical research, experimental studies and AI-TPACK research skills, strengthening context-specific module preparation and their applications, research publications in the teacher education platform. Engage, explore, experiment, explain, elaborate and evaluate the programme outcomes with the research innovations to integrate technology, pedagogy, advanced research/academic administration, content knowledge in INTEGRATED TPACK at different educational academic level programmes to develop global digital literacy and techno- skills in teacher education institutes enhancing lifelong learning.

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