

Integrating Technological Pedagogical Content Knowledge (TPACK) into Gauhati University's B.Ed. Curriculum: A Syllabus Analysis and Proposed Instructional Framework

Jharna Choudhury

*Research Scholar, Department of Education
Bhattadev University, Bajali, Assam*

Abstract

The ubiquity of technology in teacher education requires future teachers to learn to link technological resources with pedagogical strategies and subject-matter knowledge. The Technological Pedagogical Content Knowledge (TPACK) framework offers a theoretical basis for understanding this incorporation. The present study analysed two courses in the B.Ed. Gauhati University Academic Session 2025-26 Curriculum of ICT and Classroom Transaction (BED0100502) Semester I Educational Technology (BED0200304) Semester II. The qualitative document-analysis approach was used to investigate the course outcomes, units, listed topics, practical activities, and references concerning the seven domains of TPACK. The analysis revealed that both courses have significant technology-related content while the Semester II course offers further opportunities to link technology to teaching-learning processes, digital assessment, and technology-integrated lesson planning. A fundamental article on TPACK is also part of the prescribed reference list for Semester II. However, the seven knowledge domains are not used explicitly to organise the course units. The study thus proposes a TPACK-oriented instructional framework that builds on the existing syllabus and encourages more systematic connections among technology, pedagogy, and subject content. The framework is a research-based recommendation and needs expert review before implementation. The study adds to curriculum-level discussions on strengthening technology-integrated teacher preparation.

Keywords: *B.Ed. curriculum, educational technology, Gauhati University, pre-service teachers, syllabus analysis, TPACK, teacher education.*

Date of Submission: 06-10-2026

Date of Acceptance: 16-10-2026

I. Introduction

Digital technology is an important aspect of the education of today. It affects lesson planning, delivery of subject content, classroom interaction, assessment of learning and access to educational resources. The advent of digital platforms, multimedia applications, learning management systems, online assessment tools and artificial intelligence applications has created new opportunities for teaching and learning. But knowing how to use digital devices is not enough for technology to be integrated effectively. Teachers need to understand how technological tools can be selected and used in relation to subject content, pedagogical strategies, and learners' needs (Mishra & Koehler, 2006; Koehler et al., 2013).

The theoretical foundation for understanding this relationship can be traced to the concept of Pedagogical Content Knowledge (PCK), which emphasises the relationship between subject-matter knowledge and the ways teachers make that knowledge accessible to learners (Shulman, 1986). Building on this Mishra and Koehler (2006) developed the Technological Pedagogical Content Knowledge (TPACK) framework to describe the complex interaction of technology, pedagogy and content in teaching. The framework includes seven interrelated domains: Technological Knowledge (TK), Pedagogical Knowledge (PK), Content Knowledge (CK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and integrated Technological Pedagogical Content Knowledge (TPACK) (Technological Pedagogical Content Knowledge of Secondary Mathematics Teachers – CITE Journal, n.d.).

TPACK has become an important framework in educational technology research because it focuses on the knowledge required to integrate technology meaningfully into teaching. The theoretical base, contextual features and the development of teacher education and assessment have been researched (Graham, 2011; Voogt et al., 2013; Rosenberg & Koehler, 2015). The results of these studies suggest that technology needs to be seen as a pedagogical tool, not as a catch-all technical skill. The appropriate use of a digital tool depends on the subject being taught, the intended learning outcomes, the instructional strategy, and the characteristics of learners.

Teacher education programmes play a vital role in facilitating the integrated development of knowledge for future teachers. Pre-service teachers should be provided with opportunities to select digital resources, design technology-enhanced lessons, develop digital teaching-learning materials, use technology for assessment and reflect on their instructional decisions. Research on preparing pre-service teachers to use technology has emphasised the significance of structured learning experiences and meaningful curriculum design (Tondeur et al., 2012, 2020). Therefore, teacher education curricula should not only provide an introductory knowledge of ICT tools, but also support the use of technology in authentic teaching situations.

In India, the significance of technology in teaching, learning, assessment and teacher professional development has been recognised in the National Education Policy 2020 (Ministry of Education, 2020). The UNESCO ICT Competency Framework for Teachers also emphasises the development of teachers' competencies to use ICT in support of curriculum, pedagogy, assessment, and professional learning (UNESCO, 2018). These policy directions strengthen the rationale for examining how technology integration is represented in teacher education curricula.

The present study is related to B.Ed. curriculum of Gauhati University, Assam in the session 2025-26. The two courses studied are ICT and Classroom Transaction (BED0100502) offered in Semester I and Educational Technology (BED0200304) offered in Semester II. The syllabus documents include ICT tools, educational software, multimedia resources, digital platforms, technology supported assessment and practical activities related to technology integration. The reference list of Semester II also contains an article that describes the TPACK framework. Nevertheless, the inclusion of technology-related topics and a TPACK reference does not necessarily mean that the seven TPACK domains are explicitly used to structure the courses.

Against this background, the study analyses the representation of the seven TPACK domains in the selected syllabus documents and identifies opportunities to strengthen the connections among technology, pedagogy, and subject content. TPACK is not the total absence of TPACK but an instructional framework that built on the existing courses. The study is limited to documentary evidence and does not evaluate classroom implementation or directly measure the TPACK competencies of B.Ed. trainees.

II. Theoretical Framework: Technological Pedagogical Content Knowledge

2.1. Development of the TPACK Framework

The TPACK framework is an extension of the Pedagogical Content Knowledge (PCK) concept introduced by Shulman (1986) (Phillips et al., 2017). PCK stresses on the fact that teachers should know the subject matter and the pedagogical ways that will make the subject matter accessible to learners. Mishra and Koehler (2006) built on this view by adding technological knowledge to describe the interaction between pedagogy and content with technology in teaching practice (Null Lovell-Johnston & Lakehead University, 2019).

The framework proposes that effective technology integration depends on the interaction of three foundational knowledge domains-TK, PK, and CK-and their intersections. These intersections are PCK, TCK, TPK, and the integrated domain of TPACK. The framework is particularly relevant to teacher education because it helps explain why knowing how to use a technological tool is not, by itself, sufficient for effective teaching (Koehler et al., 2013).

2.2. The Seven Domains of TPACK

Table 1. The Seven Knowledge Domains of the TPACK Framework

TPACK domain	Focus of analysis
Technological Knowledge (TK)	Knowledge and use of technological tools and digital resources.
Pedagogical Knowledge (PK)	Understanding of teaching methods, instructional strategies, classroom management, and learning processes.
Content Knowledge (CK)	Knowledge of subject matter and disciplinary concepts.
Pedagogical Content Knowledge (PCK)	Understanding how to represent and teach particular subject matter effectively.
Technological Content Knowledge (TCK)	Understanding how technology can represent, explore, or teach particular subject content.
Technological Pedagogical Knowledge (TPK)	Understanding how technology can support or change teaching and learning strategies.
Technological Pedagogical Content Knowledge (TPACK)	Integrated understanding of technology, pedagogy, and subject content in a particular teaching context.

Note: The domains are interrelated. Their application depends on the instructional context, subject matter, and learning objectives (Mishra & Koehler, 2006; Koehler et al., 2013).

2.3. Relevance of TPACK to B.Ed. Curriculum Design

The TPACK framework can help in curriculum design by encouraging prospective teachers to link digital resources with teaching methods and with learning goals specific to the subject matter. For example, a trainee may demonstrate TK by operating presentation software, TPK by using it to facilitate a particular instructional strategy, and TCK by selecting a digital visualisation to represent a specific concept. Integrated

TPACK is demonstrated when the trainee makes these choices coherently in planning and conducting a lesson (Graham, 2011; Voogt et al., 2013).

In B.Ed. programmes, these connections can be developed through lesson planning, digital resource creation, microteaching, technology-supported assessment, school-based practice, and reflective activities. The framework therefore provides a basis for analysing whether a curriculum merely introduces technology or also encourages its pedagogically and contentually appropriate use.

III. Review of Related Literature

3.1. Theoretical Development of TPACK

The TPACK framework emerged from the need to explain how teachers integrate technology with subject knowledge and pedagogical practices. The framework builds on PCK and conceptualises technology integration as an interaction among multiple forms of teacher knowledge (Mishra & Koehler, 2006). Subsequent scholarship has examined the theoretical boundaries of TPACK and the challenges involved in distinguishing its interconnected domains (Graham, 2011).

A review of TPACK research identified its relevance to technology integration in education while highlighting continuing questions about conceptualisation, measurement, and practical application (Voogt et al., 2013). Research examining context also emphasised that TPACK should be interpreted in relation to educational settings, including subject areas and institutional circumstances (Rosenberg & Koehler, 2015). These perspectives support the use of TPACK as an analytical framework for examining technology integration in a specific teacher education curriculum.

3.2. TPACK Development among Pre-Service Teachers

Teacher education programmes provide opportunities for prospective teachers to develop the knowledge needed for integrating technology in the teaching of the classroom. Qualitative synthesis of the research on pre-service teacher preparation suggests the importance of providing structured learning opportunities that support technology integration (Tondeur et al., 2012). Such preparation may include planning of technology-enhanced lessons, developing of digital resources, practicing of instructional strategies, and determining the appropriateness of technology tools.

TPACK has also been discussed as a framework for teacher educators to design and evaluate professional learning experiences (Baran et al., 2011). Further research has examined approaches to enhancing pre-service teachers' TPACK through teacher education programmes (Tondeur et al., 2020). Collectively, these studies support the inclusion of opportunities for trainees to connect technological knowledge with pedagogy and subject-specific instructional decisions.

3.3. Assessment of TPACK

Research has also focused on assessing TPACK among prospective and practising teachers. An influential study developed and validated an instrument for measuring pre-service teachers' TPACK (Schmidt et al., 2009). Other work has considered the structure of the framework and the difficulties of measuring the interconnected knowledge domains (Archambault & Barnett, 2010).

The development of the TPACK.xs instrument further illustrates attempts to create practical assessment tools for examining TPACK (Schmid et al., 2020). These studies are relevant to the design of future investigations into teacher competencies. However, the present study differs from instrument-based research because it examines the representation of TPACK in curriculum documents rather than measuring trainees' knowledge.

3.4. Technology Integration in Teacher Education Curricula

In the literature, the integration of ICT tools into a course is not enough for effective technology integration. The TPACK framework underscores the relationship between technology, pedagogy and subject content (Mishra & Koehler, 2006). Hence the design of the curriculum should provide opportunities for trainees to apply technology in subject specific teaching situations. Research on pre-service teacher education supports purposeful learning experiences that help trainees develop technology-integrated teaching practices (Tondeur et al., 2012, 2020). These experiences could be lesson planning, digital resources development, collaborative learning, microteaching and assessment supported by technology.

These findings provide a rationale for examining the selected Gauhati University courses. The relevant question is not simply whether ICT and educational technology appear in the syllabus, but whether the prescribed content and activities create explicit opportunities to connect technology with pedagogy and subject content.

3.5. Research Gap

TPACK has been conceptually founded, contextualized, developed and evaluated in the past. These general findings do not establish how the seven TPACK domains are represented in the specific Semester I and Semester II courses examined in this study.

The present study addresses this curriculum-level question by analysing the course outcomes, units, topics, practical activities, and references in the selected Gauhati University B.Ed. syllabus. It also proposes an instructional framework to strengthen explicit connections among technology, pedagogy, and subject content. The study does not claim that TPACK is absent from the curriculum but asks to what degree current offerings fit the framework and where further alignment may be explored.

IV. Objectives and Research Questions

4.1. Objectives

The objectives of the study were:

1. To analyse the content of the Semester I course ICT and Classroom Transaction (BED0100502) and the Semester II course Educational Technology (BED0200304) in relation to the TPACK framework.
2. To examine the extent to which the seven TPACK domains were explicitly represented in the selected course syllabi.
3. To identify gaps and opportunities for strengthening the integration of technology, pedagogy, and subject content in the selected courses.
4. To propose a TPACK-oriented instructional framework for consideration within the B.Ed. curriculum of Gauhati University.

4.2. Research Questions

1. How were technology-related knowledge and instructional practices represented in the selected B.Ed. course syllabi?
2. To what extent did the selected syllabi explicitly address the seven TPACK domains?
3. What opportunities were identified for strengthening the integration of technology, pedagogy, and subject content?
4. What instructional framework could be proposed to strengthen TPACK-oriented learning in the selected courses?

V. Research Methodology

5.1. Research Design

The study was developed using a qualitative document analysis. Document analysis is a systematic examination and interpretation of documents so as to understand their content and significance (Bowen, 2009). This approach was appropriate because the study focused on the formal representation of TPACK in existing syllabus documents rather than on trainees' competencies or classroom outcomes.

5.2. Sources of Data

The analysis was based on the Gauhati University B.Ed. syllabus for the 2025-26 academic sessions. Two courses were selected:

Table 2: Gauhati University B.Ed. syllabus for the 2025-26 academic sessions

Semester	Course title	Course code
Semester I	ICT and Classroom Transaction	BED0100502
Semester II	Educational Technology	BED0200304

The documents were examined for course outcomes, unit-wise content, practical activities, and prescribed references. The analysis was restricted to the content available in these syllabus documents.

5.3. Analytical Framework

The seven domains of TPACK served as the principal analytical framework (Mishra & Koehler, 2006). Each syllabus topic and activity was examined to determine its explicit relationship with one or more domains.

Table 3: Analytical Framework for Mapping the Seven TPACK Knowledge Domains to the B.Ed. Curriculum

TPACK domain	Focus of analysis
Technological Knowledge (TK)	Knowledge and use of technological tools and digital resources.
Pedagogical Knowledge (PK)	Teaching methods, instructional strategies, and learning processes.
Content Knowledge (CK)	Subject-matter knowledge and disciplinary understanding.

Pedagogical Content Knowledge (PCK)	Methods of teaching and representing particular subject matter.
Technological Content Knowledge (TCK)	Use of technology to represent, explore, or teach subject content.
Technological Pedagogical Knowledge (TPK)	Use of technology to support particular teaching and learning strategies.
Technological Pedagogical Content Knowledge (TPACK)	Integrated use of technology, pedagogy, and subject content.

Note: The domains were used to guide the analysis; a topic was not classified as integrated TPACK merely because it mentioned ICT or educational technology.

5.4. Procedure for Document Analysis

The document analysis involved the following steps:

1. The two syllabus documents were identified and examined.
2. The course outcomes, units, topics, practical activities, and references were reviewed.
3. Coding categories were established using the seven TPACK domains.
4. Each topic and activity was examined for its explicit relationship with the domains.
5. The two courses were compared to identify similarities, differences, and opportunities for stronger TPACK integration.
6. A proposed instructional framework was developed based on the analysis.

5.5. Data Analysis

The syllabus content was analysed qualitatively using the TPACK mapping framework. The analysis focused on the meaning and instructional orientation of listed topics rather than treating the number of topics as a direct measure of curricular quality. Where a topic could relate to more than one domain, the classification considered the nature of the stated content and activity.

The findings were organised by course and TPACK domain. The analysis distinguished between explicit curricular content, potential alignment with a domain, and areas where a connection among technology, pedagogy, and subject content could be made more explicit.

5.6. Trustworthiness and Limitations of the Method

To support transparency, the analysis was based on identifiable topics and activities in the syllabus documents. The interpretations were distinguished from the formal content of the documents. The study did not involve interviews, classroom observations, or direct assessment of B.Ed. trainees. Consequently, the findings describe curricular representation and do not establish how the courses were implemented or how much TPACK trainees developed.

VI. Findings and Interpretation

6.1. Semester I: ICT and Classroom Transaction

The Semester I course ICT and Classroom Transaction includes computer fundamentals, software applications, use of internet, communication and collaboration tools, and digital resources for educational purposes. The course outcomes are based on use of ICT tools/ software in teaching-learning process, selection of tools as per classroom needs and exploration of emerging technologies like interactive smart boards and artificial intelligence. The course also includes practical activities associated with educational websites, digital resources, and online learning opportunities.

These topics primarily represent Technological Knowledge (TK). Computer applications for preparing lesson plans, worksheets, test papers and multimedia materials also provide opportunities of connecting technology with instructional practices. Similarly, selecting tools according to classroom needs and using ICT to support teaching-learning processes indicate potential connections with Technological Pedagogical Knowledge (TPK).

However, the course's technology-related content should not automatically be classified as integrated TPACK. A stronger TPACK connection requires an identifiable relationship among a technological tool, a pedagogical strategy, and particular subject content.

6.2. Semester II: Educational Technology

Educational Technology is a Semester II course. It focuses on concepts of educational technology, programd instruction, self-learning modules, multimedia packages, learning management systems, online collaborative applications, educational apps, gamification, teaching-learning processes, communication and ICT integration in education. It also addresses digital platforms, AI-powered educational tools, technology-assisted assessment, e-portfolios, online feedback, and OER.

The course provides opportunities to connect technology with teaching strategies and assessment practices. In particular, the prescribed practical activity requiring trainees to design and implement a technology-enhanced lesson plan is relevant to integrated TPACK development. The case study on technology

integration and the exploration of digital learning platforms also offer opportunities to examine the educational value of technology-supported teaching.

An important finding is that the Semester II reference list includes Koehler and Mishra's (2009) article on TPACK. This indicates that the framework is acknowledged in the prescribed references. However, the seven TPACK domains are not explicitly used to organise the course units. Thus, the framework is acknowledged, but its systematic application across the listed course content is not made explicit.

6.3. Comparative Mapping of TPACK Domains

Table 4: Comparative Mapping of TPACK Domains in the Selected Gauhati University B.Ed. Courses

TPACK domain	Semester I: ICT and Classroom Transaction	Semester II: Educational Technology
TK	Strong representation through computer fundamentals, software, internet tools, and emerging technologies.	Strong representation through multimedia, LMS, educational applications, digital platforms, and AI tools.
PK	Classroom teaching-learning applications are addressed, although general pedagogy is not the principal focus of the course.	Teaching-learning processes, communication, programmed instruction, and self-learning modules are included.
CK	Subject-specific content knowledge is not a major explicit focus of the course.	Subject-specific content knowledge is not a major explicit focus of the course.
PCK	Lesson-planning applications are included, but explicit subject-specific pedagogical integration is limited in the listed topics.	Technology-enhanced lesson planning offers opportunities to connect content with teaching strategies.
TCK	Digital resources and multimedia could support subject teaching, but explicit TCK organisation is not evident in the listed units.	Multimedia and digital resources could support subject representation, but explicit TCK organisation is not evident in the listed units.
TPK	ICT-supported classroom transaction, digital applications, and selecting tools for classroom needs provide relevant connections.	LMS, collaborative applications, digital assessment, and technology-integrated teaching activities provide relevant connections.
TPACK	The syllabus provides opportunities for integration, but the seven-domain framework is not explicitly used to organise the course.	The prescribed TPACK reference and technology integration project provide a stronger basis for integrated TPACK development, but the seven domains are not explicitly used to organise the course.

Note. "Strong representation" refers to the prominence of related content, not a measured level of trainee competence. The mapping describes syllabus content and does not establish the effectiveness of classroom implementation.

6.4. Major Findings

The analysis yielded four principal findings.

First, both courses have a large technology component. Semester I emphasises computer applications, internet resources, ICT tools, and emerging technologies, while Semester II includes educational technology, teaching-learning processes, digital platforms, and technology-assisted assessment.

Second, Semester II provides more explicit opportunities to connect technology with instructional practice through technology-enhanced lesson planning, case study analysis, and digital assessment activities.

Third, TPACK is acknowledged in the prescribed references for Semester II through the inclusion of Koehler and Mishra's (2009) article. Nevertheless, the seven domains are not explicitly used to structure the course units.

Fourth, the main opportunity for curricular development is to strengthen the explicit relationship between technological tools, pedagogical strategies, and subject-specific content. This is more accurate than concluding that TPACK is entirely absent from the existing curriculum.

6.5. Interpretation of the Findings

The findings suggest that the selected courses offer a basis for the preparation of teachers in the integration of technology. The curricular opportunity is to make the links between technology, pedagogy and subject content more systematic and visible.

The TPACK framework suggests that the educational value of technology depends on how it is selected and used in relation to particular learning objectives and instructional approaches (Mishra & Koehler, 2006; Koehler et al., 2013). Therefore, existing practical activities could be strengthened by requiring trainees to explain why a particular technology is appropriate for a subject concept, how it supports the selected teaching strategy, and how learning will be assessed.

This recommendation builds on the syllabus rather than proposing an entirely separate technology course.

VII. Proposed TPACK-Oriented Instructional Framework

7.1. Rationale

The analysis results showed that both courses have subjects related to technology. In Semester II, there is a practical activity in which trainees have to design and implement a lesson plan with technology enhancement. The proposed framework extends further to explicitly link technological tools, pedagogical strategies and subject content.

The framework is a research recommendation, not an officially approved addition to the Gauhati University curriculum.

7.2. Proposed Components

Table 5: Proposed TPACK-Oriented Instructional Framework for B.Ed. Trainees

Component	Proposed activity	Expected learning outcome
Technological Knowledge (TK)	Explore digital tools and educational platforms.	Select and operate appropriate technologies.
Pedagogical Knowledge (PK)	Identify appropriate instructional strategies for a learning objective.	Select teaching methods that support learning.
Content Knowledge (CK)	Identify key concepts and objectives in a school subject.	Demonstrate accurate subject knowledge.
Pedagogical Content Knowledge (PCK)	Prepare explanations, examples, and subject-specific learning activities.	Represent content in ways that support understanding.
Technological Content Knowledge (TCK)	Use simulations, visualisations, or digital resources to represent subject concepts.	Select technologies suited to particular content.
Technological Pedagogical Knowledge (TPK)	Design collaborative learning, digital formative assessment, or technology-supported discussion.	Use technology to support appropriate teaching strategies.
Integrated TPACK	Design and conduct a technology-integrated lesson in a selected school subject.	Coordinate technology, pedagogy, and content coherently.

Note: These activities and outcomes are proposed by the researcher and require expert review before implementation.

7.3. Suggested Implementation Process

The framework comprises six stages:

1. Identify learning objectives: Select a school-subject topic and specify the intended learning outcomes.
2. Analyse subject content: Identify the key concepts and possible learning difficulties.
3. Select a pedagogical strategy: Choose a teaching approach appropriate to the learning objectives.
4. Select suitable technology: Choose a digital resource that supports both the content and teaching strategy.
5. Conduct microteaching: Deliver the technology-integrated lesson and gather feedback.
6. Evaluate and reflect: Examine whether the technology supported the intended learning and identify areas for improvement.

These stages are intended to help trainees make deliberate decisions about the relationship between technology, pedagogy, and subject content rather than choosing digital tools independently of instructional goals.

7.4. Proposed Assessment

The framework could be accompanied by a rubric covering:

- Alignment between learning objectives and subject content.
- Appropriateness of teaching strategies.
- Suitability of technological resources.
- Integration of technology, pedagogy, and content.
- Opportunities for learner participation.
- Assessment of learning and reflective improvement.

The rubric should be reviewed by experts in teacher education and educational technology. Any claim that the framework improves TPACK would require subsequent empirical evaluation.

VIII. Discussion

The study has considered two courses in B.Ed. curriculum of Gauhati University with the help of TPACK framework. The analysis found technology-related content in both courses and practical possibilities to connect digital resources with teaching-learning processes. It also made a distinction between acknowledging TPACK as a prescribed reference and explicitly using the seven domains to organise curricular content. This distinction is important because the presence of technology-related topics does not, by itself, establish integrated TPACK development. TPACK concerns the relationship among technological knowledge, pedagogical

knowledge, and content knowledge in a particular teaching context (Mishra & Koehler, 2006; Rosenberg & Koehler, 2015). The proposed framework therefore builds on existing curricular provisions. It does not recommend the deletion or substitution of existing topics, but rather a more explicit relationship between them and subject-specific teaching through lesson planning, microteaching, the development of digital resources and assessment.

The study has practical implications for curriculum discussion, but its findings must be interpreted within its methodological scope. Document analysis can identify how TPACK-related knowledge is represented in formal curriculum documents; it cannot establish whether the courses are implemented effectively or whether trainees have acquired the intended competencies. These questions need further investigation via expert review, classroom evidence and empirical assessment.

IX. Conclusion

The study has been done in the course of ICT and Classroom Transaction (BED0100502) of Semester I and Educational Technology (BED0200304) of Semester II of B.Ed. of Gauhati University for the session 2025–26. The analysis indicated that both courses include technology-related knowledge and applications. Semester II provides additional opportunities to connect technology with teaching-learning processes, assessment, and technology-integrated lesson planning. The analysis also established that TPACK is acknowledged in the Semester II prescribed references, although the seven knowledge domains are not explicitly used to organise the course units. The main opportunity for curricular development is therefore to strengthen the systematic connections among technology, pedagogy, and subject content. The proposed instructional framework offers one possible approach to this task. It builds on existing courses and activities and encourages trainees to make more deliberate decisions about technology-integrated teaching. However, the framework remains a recommendation requiring expert review and further evaluation. The study doesn't say that it has improved teacher competencies or learning outcomes.

X. Limitations and Future Research

There are some limitations of the study. First of all it was only limited to two of the courses of Gauhati University B.Ed. curriculum. Secondly, it was based on formal syllabus documents and did not investigate how the courses were implemented by teacher educators. Third, it did not measure the TPACK competencies of B.Ed. trainees or evaluate the effectiveness of the proposed framework.

Future research could extend the analysis to other courses, obtain expert feedback on the TPACK mapping, examine technology-integrated lesson plans prepared by trainees, and investigate how teacher educators use the prescribed syllabus. A subsequent intervention study could evaluate whether structured TPACK-oriented activities contribute to improvements in pre-service teachers' knowledge and teaching practices.

References

- [1]. Archambault, L. M., & Barnett, J. H. (2010). Revisiting technological pedagogical content knowledge: Exploring the TPACK framework. *Computers & Education*, 55(4), 1656–1662. <https://doi.org/10.1016/j.compedu.2010.07.009>
- [2]. Baran, E., Chuang, H.-H., & Thompson, A. (2011). TPACK: An emerging research and development tool for teacher educators. *The Turkish Online Journal of Educational Technology*, 10(4), 370–377.
- [3]. Bowen, G. A. (2009). Document analysis as a qualitative research method. *Qualitative Research Journal*, 9(2), 27–40. <https://doi.org/10.3316/QRJ0902027>
- [4]. Graham, C. R. (2011). Theoretical considerations for understanding technological pedagogical content knowledge (TPACK). *Computers & Education*, 57(3), 1953–1960. <https://doi.org/10.1016/j.compedu.2011.04.010>
- [5]. Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education*, 9(1), 60–70.
- [6]. Koehler, M. J., Mishra, P., & Cain, W. (2013). What is technological pedagogical content knowledge (TPACK)? *Journal of Education*, 193(3), 13–19. <https://doi.org/10.1177/002205741319300303>
- [7]. Ministry of Education. (2020). National Education Policy 2020. Government of India.
- [8]. Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, 108(6), 1017–1054. <https://doi.org/10.1111/j.1467-9620.2006.00684.x>
- [9]. Rosenberg, J. M., & Koehler, M. J. (2015). Context and technological pedagogical content knowledge (TPACK): A systematic review. *Journal of Research on Technology in Education*, 47(3), 186–210. <https://doi.org/10.1080/15391523.2015.1052663>
- [10]. Schmid, M., Brianza, E., & Petko, D. (2020). Developing a short assessment instrument for Technological Pedagogical Content Knowledge (TPACK.xs) and comparing the factor structure of an integrative and a transformative model. *Computers & Education*, 157, Article 103967. <https://doi.org/10.1016/j.compedu.2020.103967>
- [11]. Schmidt, D. A., Baran, E., Thompson, A. D., Mishra, P., Koehler, M. J., & Shin, T. S. (2009). Technological pedagogical content knowledge (TPACK): The development and validation of an assessment instrument for preservice teachers. *Journal of Research on Technology in Education*, 42(2), 123–149. <https://doi.org/10.1080/15391523.2009.10782544>
- [12]. Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, 15(2), 4–14. <https://doi.org/10.3102/0013189X015002004>
- [13]. Tondeur, J., Pareja Roblin, N., van Braak, J., Fisser, P., & Voogt, J. (2012). Preparing pre-service teachers to integrate technology in education: A synthesis of qualitative evidence. *Computers & Education*, 59(1), 134–144. <https://doi.org/10.1016/j.compedu.2011.10.009>

- [14]. Tondeur, J., Scherer, R., Siddiq, F., & Baran, E. (2020). Enhancing pre-service teachers' technological pedagogical content knowledge (TPACK): A mixed-method study. *Educational Technology Research and Development*, 68, 319–343. <https://doi.org/10.1007/s11423-019-09692-1>
- [15]. UNESCO. (2018). UNESCO ICT competency framework for teachers (Version 3). United Nations Educational, Scientific and Cultural Organization.
- [16]. Voogt, J., Fisser, P., Pareja Roblin, N., Tondeur, J., & van Braak, J. (2013). Technological pedagogical content knowledge—A review of the literature. *Journal of Computer Assisted Learning*, 29(2), 109–121. <https://doi.org/10.1111/j.1365-2729.2012.00487.x>