East African Scholars Journal of Education, Humanities and Literature

OPEN ACCESS

Abbreviated Key Title: East African Scholars J Edu Humanit Lit
ISSN: 2617-443X (Print) & ISSN: 2617-7250 (Online)
Published By East African Scholars Publisher, Kenya
Volume-9 | Issue-4 | Apr- 2026 | DOI: https://doi.org/10.36349/easjehl.2026.v09i04.002

Original Research Article

Exploring TPACK on Preservice Teacher Educators in West Bengal

Ranabrata Majumdar[1*], Mallika Mondal[2], Md Sajjad Hossain Ansari[3], Mainak Saibya[4], Muktipada Sinha[5]

[1,2,3]Research Scholar, Department of Education, Jadavpur University, Kolkata, India
[4]Assistant Professor, Department of Education, Vijaygarh Jyotish Ray College, Kolkata, India
[5]Professor, Department of Education, Jadavpur University, Kolkata,India

Article History
Received: 22.02.2026
Accepted: 31.03.2026
Published: 03.04.2026

Journal homepage:
https://www.easpublisher.com

Quick Response Code

Abstract: TPACK, or 'Technological Pedagogical Content Knowledge', is a model that describes the knowledge teachers need to integrate technology into their teaching. This study is all about the technological pedagogical content knowledge of preservice teachers who studied at various private and government colleges in West Bengal. For this study, a total of 189 preservice teachers from various private and government institutions were used. The primary goal of this research is to determine the extent to which preservice teachers incorporate pedagogical technological content knowledge into their teaching. The research findings indicate that students from government institutions possess a higher level of technological pedagogical content knowledge compared to those from private institutions. Additionally, their choice of stream significantly influences TPACK, while other socio-demographic variables do not have a significant impact.

Keywords: Technological Knowledge, Pedagogical Knowledge, Content Knowledge, Pre-Service Educators.

INTRODUCTION

Technological Pedagogical Content Knowledge (TPCK) is a theory that was brought to the field of educational study as a way to figure out what teachers need to know in order to effectively use technology in the classroom (Mishra & Koehler, 2006). To make it easier to remember, the TPCK framework acronym was changed to TPACK, which is pronounced "tee-pack." This makes the three types of knowledge it addresses more unified: technological knowledge, pedagogical knowledge, and content knowledge (Thompson & Mishra, 2007–2008).

The Technological Pedagogical Content Knowledge (TPACK) framework is a conceptual framework designed to integrate technology into teaching in a meaningful way. It builds upon earlier models of pedagogical content knowledge (PCK) introduced by Lee Shulman in 1986, emphasizing the importance of teachers understanding both subject matter (content knowledge) and how to effectively teach it (pedagogical knowledge). The framework highlights seven distinct domains: content knowledge (CK), pedagogical knowledge (PK), technological knowledge (TK), pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), and the intersection of all three, known as technological pedagogical content knowledge (TPACK). 'TPACK' has gained widespread attention as a valuable tool for teacher training and professional development, helping educators critically examine how technology can enhance teaching and learning.

It has been used to design curricula, develop teacher education programs, and assess the effectiveness of technology integration in classrooms. Studies have demonstrated that a nuanced understanding of 'TPACK' enables educators to select appropriate technologies, adapt teaching methods, and design innovative instructional strategies tailored to specific content and student needs. The framework has been subject to ongoing refinement and adaptation, with scholars exploring its application across different subject areas, grade levels, and cultural contexts. Critics have noted challenges in operationalizing and measuring 'TPACK' in practice, leading to efforts to develop more robust assessment tools and methodologies. TPACK has evolved from Shulman's foundational concept of pedagogical content knowledge into a comprehensive framework that addresses the complexities of teaching in a technology-rich era.

Koehler & Mishra, (2005) affirm that, educators must comprehend the connections between users, technology, and practices, especially how technologies can enhance the teaching of educational concepts and

***Corresponding Author:** Ranabrata Majumdar
Research Scholar, Department of Education, Jadavpur University, Kolkata, India

enhance comprehension of these concepts**.** Subsequent research emphasised the significance of context. As previously indicated, Koehler and Mishra developed the TPACK framework by expanding Shulman's (1986, 1987). The pedagogical content knowledge framework is being developed to incorporate technology in education. Mishra and Koehler's (2006) indicate that the description and representation of TPACK, with minor adjustments over the years, became widely adopted, despite the fact that other scholars had proposed similar concepts '(Hughes, 2005; Keating & Evans, 2001; Lundeberg *et al*., 2003; Margerum-Leys & Marx 2002)'.

This Framework is a tool that helps educators integrate technology into their classrooms. Specifically, it shows up as a Venn diagram alongside three overlapping circles representing content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK). The fourth circle, contextual knowledge (XK), covers these circles. This framework suggests that successful technology integration in education requires integrating the four TPACK knowledge domains, which are interconnected and must be balanced to ensure the best possible learning experience. This approach acknowledges that these domains exist in conflict and requires a careful balance to ensure effective integration.

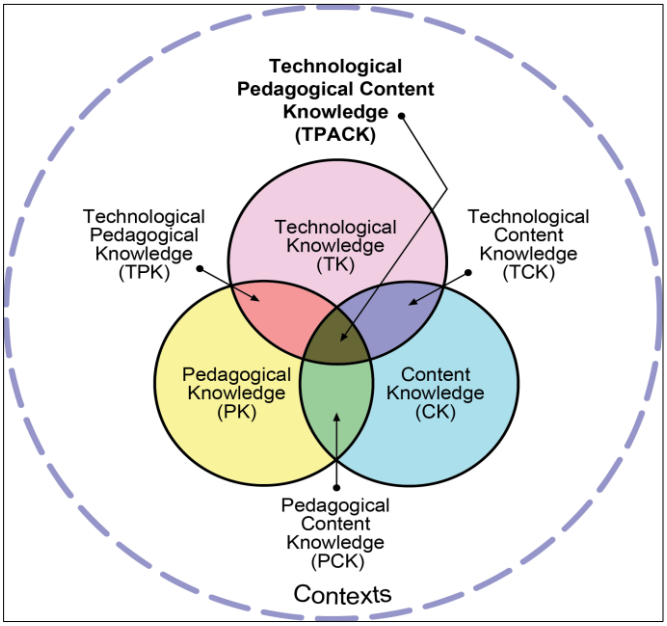

Fig. 1: The Technological Pedagogical Content Knowledge (TPACK) Framework (Mishra, 2019)
Source: http//tpack.org

As a define by Koehler & Mishra, (2008, 2006) the 'TPACK' framework outlines the interplay between technology, pedagogy, and knowledge (Figure 1: TPACK framework content). The TPACK structure, consisting of seven parts, provides an intuitive understanding of teaching materials using appropriate pedagogical techniques and technology, focusing on three kinds of knowledge.

1. Technological Knowledge (TK)

Technical knowledge (TK) refers to the understanding and proficiency in using various technology tools and resources effectively. This includes knowledge of hardware, software, apps, and new technologies like virtual reality and artificial intelligence. Teachers with strong TK can use tools like Google Classroom and educational games to make learning more enjoyable. TPACK and PCK are defined as the ability to use new technologies. TPACK is relatively transient and does not focus on the technologies used by educators. The purpose of this conversation is to focus on emerging technologies, such as books, which were initially considered a form of technology due to their simplicity and capacity. However, after several centuries, books have become so pervasive that they are no longer considered a form of technology. This highlights the importance of recognizing emerging technologies in the context of education. The TPACK framework is a transient approach to understanding the use of technology in education.

2. Content Knowledge (CK)

Content knowledge (CK) is a measure of a teacher's understanding of a subject matter, including concepts, theories, facts, and regulations. For instance, a math instructor needs a deep understanding of algebra, geometry, and calculus to effectively teach their students. CK ensures that the instructor can explain concepts in a straightforward and honest manner, addressing any uncertainties and demonstrating how concepts fit into the larger context. Content knowledge

is also understood as understanding various ways a topic can be presented, such as using graphics like grids in social studies, graphs of data in mathematics, and electron flow models in the mathematical discipline. However, this information is not directly related to educational activities or the use of these knowledge in teaching.

3. Pedagogical Knowledge (PK)

Refers to an awareness of various teaching methods, instructional tactics, approaches for managing classrooms, and assessment processes. It emphasizes the ways in which students learn and how teachers can successfully promote that learning. This includes PK: developing lesson plans, teaching students with varying learning styles using differentiated methods, managing classroom dynamics, and evaluating learning results.

4. Pedagogical Content Knowledge (PCK)

Teaching methods and subject matter expertise intersect in pedagogical content knowledge (PCK), which focuses on effective teaching of specific subjects. PCK involves finding effective ways to communicate ideas, avoiding mistakes, making topic-specific assessments and activities, and involving students in practical projects to enhance learning. Pedagogical content knowledge is rooted in a specific field of study, and it is subject-specific. Subject-specific tasks and topic-specific tasks are essential components of PCK. For example, a social studies educator may use original sources to teach about the American Revolution or the Civil War. Topic-specific activities introduce students to specific ideas within a field. Teachers need to know the conceptual power of a particular activity to effectively aid students in understanding that idea. Peripheral knowledge of subject-specific representations (RT) in a particular field and how to incorporate them into lesson plans is also part of having pedagogical content knowledge. For example, a teacher with PCK can aid student learning through the use of subject-or topic-specific activities and topic-specific representations. PCK is a crucial aspect of teaching methods and subject matter expertise, focusing on effective communication, avoiding mistakes, and involving students in practical projects to enhance learning.

5. Technological Content Knowledge (TCK)

Relates to the comprehension of how technological advancements may enhance and transform the way specific subjects are taught and studied. Being knowledgeable about the best technological means for conveying specific subjects and how to use them effectively is an important part of technology-centered knowledge (TCK). Scientific simulations, mathematical graphing tools, and digital timelines used to put historical events in context are all examples of TCK. Within this context, the term "technological knowledge" refers to the ability to make effective use of newly developed technology. In order to show how TPACK differs from PCK, the definition is limited to new technology. The TPACK framework is only a short-term fix to highlight the technology that educators utilise, according to a number of the TPACK professionals I interviewed.

In order to keep the conversation focused on technologies that aren't completely clear in this particular setting just yet, I'm going to define technology as emerging technologies here. To illustrate the point, books were formerly thought of as technology—a more user-friendly and capacious instrument.

6. Technological Pedagogical Knowledge (TPK)

Aims to enhance the learning process by combining various instructional approaches, such as the "flipped classroom" concept, video applications, online examinations, and collaborative work technologies. TPK refers to teachers' awareness of general teaching tasks (AG) they can perform with these new tools. Knowledge of how to use technology to make students interested in learning or to encourage collaborative study is part of technology professional knowledge (TPK). These activities are applicable to any content area and can transform into instructional knowledge when technologies are easy to understand or common. For example, overhead projectors were once considered a novel tool for simplifying presentations in college classrooms. Today, projectors are a common practice in educational settings. Interactive whiteboards, on the other hand, are relatively new technologies that use digital screens to engage both instructors and students with content. The ability to use these interactive boards for general instruction is referred to as training and practice (TPK). In contrast, the ability to perform the same tasks with a conventional whiteboard is considered PK.

7. Technological Pedagogical Content Knowledge

The intersection of CK, PK, and TK results in the creation of a comprehensive knowledge, symbolised by TPACK, which allows educators to integrate technology into the classroom in a way that aligns with the subject matter and teaching style. The successful use of teaching techniques and tools in the classroom relies on factors such as subject knowledge, pedagogy expertise, technology knowledge, and TPACK information. TPACK refers to a teacher's understanding of how to coordinate subject-specific activities (AS) or topic-specific activities (AT) with topic-specific representations (RT) using emerging technologies to support student learning. The transformation of TPACK into PCK occurs when the technologies used in these activities and representations become more widespread. For example, a teacher may be familiar with using an online dissection simulator as part of inquiry-based learning, while PCK refers to conventional dissection using transparent technologies like scalpels and paper schematics. The "sliding" character of TCK, TPK, and TPACK satisfies the researchers' goal of ensuring that the framework is no longer necessary after technologies have gained widespread acceptance. It also highlights the

need for TPACK as long as new technologies remain a part of the teaching profession's toolkit. The extended model of the framework offers more precise definitions and differences of TPACK constructs, which should help in future identification and categorization of examples of each construct.

Objectives of the Study

1. To find out the present status on TPACK of preservice teacher in West Bengal.
2. To determine the variation of different demographic variable of preservice teacher on TPACK in West Bengal.

Hypothesis of the Study

1. Mean score of TPACK does not significantly vary between government and private institution's preservice teachers of west bengal.
2. Mean score of TPACK does not significantly vary between UG and PG preservice teachers of west bengal.
3. Mean score of TPACK does not significantly vary between Male and Female preservice teachers of West Bengal.
4. Mean score of TPACK does not significantly vary between English and Bengali medium preservice teachers of west Bengal.
5. Mean score of TPACK does not significantly vary between rural and urban preservice teachers of West Bengal.
6. Mean score of TPACK does not significantly vary among guardians' government job, private job and cultivation of preservice teachers.
7. Mean score of TPACK does not significantly vary among language, social science, and science group preservice teachers in West Bengal.

METHODS

The study utilized a cross-sectional survey method to gather data from students as the primary source. A sample size of 189 was acquired using a purposive sampling method from various areas of West Bengal showing related demographic characteristics. Given the various contextual factors affecting pre-service teachers, the researchers developed and distributed an original questionnaire of 51 items instead of utilizing current standardized assessments of T-PACK knowledge among pre-service teachers. The researchers examined Types of institutions, previous level of education, gender, medium of instruction, guardian occupations, place of residence, and school stream as explanatory variables in evaluating the association with the dependent variables, primarily the T-pack of pre-service teachers. The study's population consisted of students in the first and second years of the Bachelor of Education program, who regularly attended school within various districts. The research sampled various B.Ed colleges in West Bengal. The investigation used a purposive sampling technique, choosing people from various districts in West Bengal with comparable demographic characteristics. Given the various contextual factors affecting pre-service teachers, the researchers developed and distributed a distinctive questionnaire of 51 items instead of utilizing established, standardized assessments of T-PACK knowledge among pre-service teachers. The researchers examined types of institutions, previous education level, gender, language of instruction, guardian occupations, place of residence, and school stream as explanatory variables in evaluating the association with the dependent variables, particularly the T-pack of pre-service teachers. The study's population consisted of students in the first and second years of the Bachelor of Education program, who regularly attended school in various districts. The study chose a sample drawn from various B.Ed colleges in West Bengal.

RESULTS

Table 1.1: Mean and Standard deviation of TPACK on Preservice Teachers

	I.V	Mean	Std	Std Error
Type of Institution	Government(100)	136.58	10.770	1.077
	Private(89)	115.65	30.215	3.203
Previous Educational Level	Undergraduate(60)	127.15	25.082	3.238
	Postgraduate(129)	126.53	24.256	2.136
Gender	Male(80)	126.89	24.970	2.792
	Female(109)	126.61	24.188	2.317
Medium of Instruction	Bengali(130)	128.66	23.997	2.105
	English(59)	121.15	24.997	3.608
Guardians' Occupation	Government Job(46)	128.30	26.817	3.954
	Private Job(69)	127.14	21.298	2.564
	Cultivation(74)	126.72	25.901	3.011
Locality	Rural(87)	125.60	23.409	2.510
	Urban(102)	127.69	25.391	2.514
Stream	Language(74)	127.22	25.469	2.884
	Social Science(91)	130.23	21.624	2.267
	Science(18)	108.85	26.045	5.824

Table 1.1 reflects the mean scores across various demographic and institutional categories, providing insights into the determinants of academic performance. Government institutions display a higher mean (136.58) over private schools (115.65), indicating a potential advantage in public education. The educational level indicates compared mean scores for undergraduates (127.15) and postgraduates (126.53), indicating comparable performance across both of these groups. The gender differences are not significant, with males (126.89) and females (126.61) expressing almost identical performance. The medium of instruction indicates a benefit for Bengali-medium students (128.66) compared to English-medium students (121.15), maybe signifying linguistic ease. Guardians' occupations exhibit minor discrepancies, with government employment (128.30) somewhat surpassing private sector roles (127.14) and agricultural work (126.72). Urban students (127.69) outperform those from the rural (125.60), perhaps attributable to superior resources or more exposure. Stream-wise performance reveals a pronounced disparity, with Social Science students achieving the highest score (130.23), followed by Language students (127.22), whilst Science students get the lowest score (108.85). This discrepancy may arise from differing curricular requirements or support mechanisms. These findings highlight the impact of institutional type, language of instruction, and geographic location on academic performance, necessitating additional exploration of fundamental reasons and policy measures.

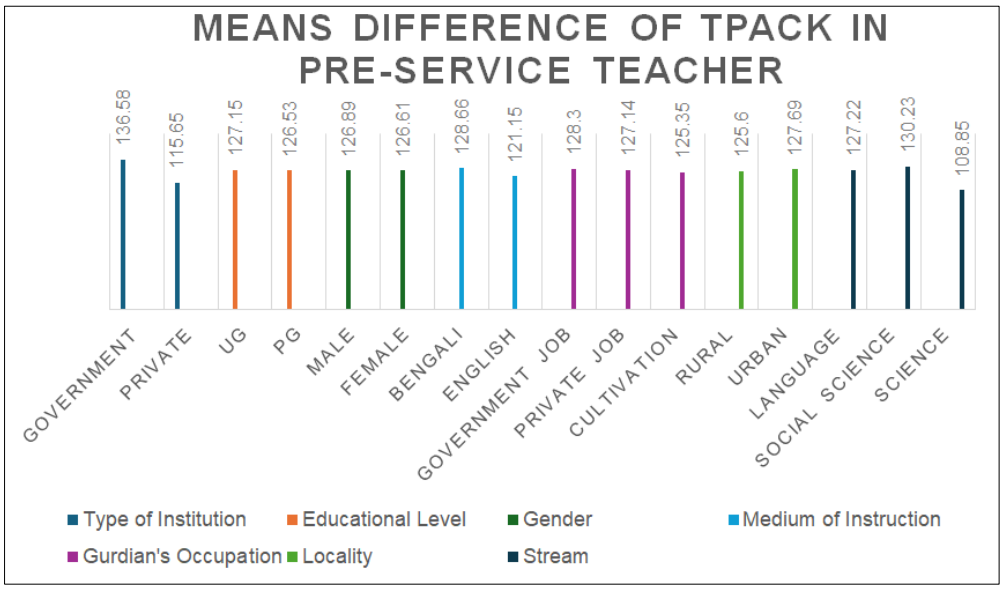

Figure 2: Means Difference of T-Pack in Pre-Service Teacher

Table 1.2: Showing t-test and Anova based on H1 to H7

Categorical Variable	Independent Variable	Test value	df	p-value	Remarks
Type of Institution	Government	6.481	187	.000	**S
	Private				
Previous Educational Level	Undergraduate	.163	187	.620	*NS
	Postgraduate				
Gender	Male	.078	187	.902	*NS
	Female				
Medium of Instruction	Bengali	1.834	187	.146	*NS
	English				
Locality	Rural	-.584	187	.905	*NS
	Urban				
Guardians' Occupation	Government job	.221	188	.802	*NS
	Private job				
	Cultivation				
Stream	Language	6.673	188	.000	**S
	Social Science				
	Science				

Table 1.2 indicates that the t-test carried between government and non-government organisations obtained a t-value of 6.481 and a p-value of 0.620. The study illustrates a significant relationship between

Government and Non-Government Institutions. The t-test examining previous undergraduate and postgraduate students revealed a t-value of 0.163 and a p-value of 0.620. This indicates no substantial disparity between these two educational levels. The T-test conducted between males and females yielded a t-value of 0.78 and a high p-value of 0.902. The T-test comparing the Medium of Instruction in Bengali and English yielded a t-value of 1.834 and a p-value of 0.146. The T-test yielded a t-value of -0.584 and a strong p-value of 0.905 when comparing rural and urban populations. The ANOVA test conducted on several Guardians' Occupations (Government work, Private job, Cultivation) produced an F-value of 0.221 and a p-value of 0.802. The elevated p-value indicates a lack of meaningful heterogeneity among the various Guardians' occupations. The ANOVA test for streams (Science, Social Science, Language) yielded an F-value of 6.673 and a p-value of 0.000. This indicates that choice of stream significantly influences the T-pack of pre-service teachers.

CONCLUSION

The study reveals that academic performance is influenced by various demographic and institutional factors. It reveals a significant relationship between institution type and outcomes, with government institutions showing an advantage over private ones. Factor like academic stream have significant effects. Bengali-medium students perform better than English-medium students, possibly due to linguistic familiarity. Social Science students achieve higher mean scores than Language and Science students, suggesting curricular or instructional differences. Urban students slightly outperform rural ones, likely due to better resources or exposure. The study underscores the complex interplay of institutional and demographic factors on academic performance and calls for further investigation into the underlying causes and targeted interventions to optimize educational outcomes for diverse student populations.

Conflicts of Interest: There are no conflicts of interest among the authors

REFERENCES

- Baran, E., Canbazoglu Bilici, S., Albayrak Sari, A., & Tondeur, J. (2019). Investigating the impact of teacher education strategies on preservice teachers' TPACK. British Journal of Educational Technology, 50(1), 357-370.
- Chai, C. S., Koh, J. H. L., & Tsai, C. C. (2010). Facilitating preservice teachers' development of technological, pedagogical, and content knowledge (TPACK). Journal of Educational Durdu, L., & Dag, F. (2017). Pre-service teachers' TPACK development and conceptions through a TPACK-based course. Australian Journal of Teacher Education (Online), 42(11), 150-171.Technology & Society, 13(4), 63-73.
- Chandra, V. (2016). Handbook of Technological Pedagogical Content Knowledge (TPACK) for Educators. In Routledge eBooks. https://doi.org/10.4324/9781315771328
- Class, B. (2023). Teaching research methods in education: using the TPACK framework to reflect on praxis. International Journal of Research & Method in Education, 47(3), 288–308. https://doi.org/10.1080/1743727x.2023.2270426
- Cox, S., & Graham, C. R. (2009). Diagramming TPACK in practice: Using an elaborated model of the TPACK framework to analyze and depict teacher knowledge. TechTrends: Linking Research & Practice to Improve Learning, 53(5).
- Harvey, D. M., & Caro, R. (2017). Building TPACK in preservice teachers through explicit course design. TechTrends, 61, 106-114.
- Jang, S. J., & Chen, K. C. (2010). From PCK to TPACK: Developing a transformative model for pre-service science teachers. Journal of Science Education and Technology, 19, 553-564.
- Joo, Y. J., Park, S., & Lim, E. (2018). Factors influencing preservice teachers' intention to use technology: TPACK, teacher self-efficacy, and technology acceptance model. Journal of Educational Technology & Society, 21(3), 48-59.
- Kabakci Yurdakul, I. Ş. I. L., & Çoklar, A. N. (2014). Modeling preservice teachers' TPACK competencies based on ICT usage. Journal of Computer Assisted Learning, 30(4), 363-376.
- Lachner, A., Fabian, A., Franke, U., Preiß, J., Jacob, L., Führer, C., ... & Thomas, P. (2021). Fostering pre-service teachers' technological pedagogical content knowledge (TPACK): A quasi-experimental field study. Computers & Education, 174, 104304.
- Lee, H., Chung, C., & Wei, G. (2022). Research on Technological Pedagogical and Content Knowledge: A Bibliometric analysis from 2011 to 2020. Frontiers in Education, 7. https://doi.org/10.3389/feduc.2022.765233
- Lehtinen, A., Nieminen, P., & Viiri, J. (2016). Preservice teachers' TPACK beliefs and attitudes toward simulations. Contemporary issues in technology and teacher education, 16(2), 151-171.
- Margerum-Leys, J., & Marx, R. W. (2002). TEACHER KNOWLEDGE OF EDUCATIONAL TECHNOLOGY: A CASE STUDY OF STUDENT/MENTOR TEACHER PAIRS. Journal of Educational Computing Research, 26(4), 427–462. https://doi.org/10.1092/kqcf-blx2-tchv-aga4
- Mouza, C. (2016). Developing and assessing TPACK among pre-service teachers: A synthesis of research. In Handbook of technological pedagogical content knowledge (TPACK) for educators (pp. 169-190). Routledge.
- Pamuk, S. (2011). Understanding preservice teachers' technology use through TPACK framework. Journal of Computer Assisted Learning,

28(5), 425–439. https://doi.org/10.1111/j.1365-2729.2011.00447.x

- Pamuk, S. (2011b). Understanding preservice teachers' technology use through TPACK framework. Journal of Computer Assisted Learning, 28(5), 425–439. https://doi.org/10.1111/j.1365-2729.2011.00447.x
- Pamuk, S. (2012). Understanding preservice teachers' technology use through TPACK framework. Journal of computer assisted learning, 28(5), 425-439.
- Pramanik, A., Deb, J. P., & Dash, N. (2023). A STUDY OF TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE OF SCIENCE TEACHERS AT THE HIGHER SECONDARY STAGE. Zenodo (CERN European Organization for Nuclear Research). https://doi.org/10.5281/zenodo.8238601
- Research: TPACK | Punya Mishra's web. (n.d.). https://punyamishra.com/research/tpack/
- Sahin, I. (2011). DEVELOPMENT OF SURVEY OF TECHNOLOGICAL PEDAGOGICAL AND CONTENT KNOWLEDGE (TPACK). the Turkish Online Journal of Educational Technology, 10(1), 97–105. http://files.eric.ed.gov/fulltext/EJ926558.pdf
- 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.
- Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. In Educational Researcher (Vols. 15–15, Issue 2, pp. 4–14). American Educational Research Association. https://www.wcu.edu/webfiles/pdfs/shulman.pdf
- Tondeur, J., Scherer, R., Siddiq, F., & Baran, E. (2017). A comprehensive investigation of TPACK within pre-service teachers' ICT profiles: Mind the gap!. Australasian Journal of educational technology, 33(3).
- TPACK and Web 2.0: Transformation of Teaching and learning. (2009). TechTrends, 53(5), 80–87. https://doi.org/10.1007/s11528-009-0329-z
- Valtonen, T., Leppänen, U., Hyypiä, M., Sointu, E., Smits, A., & Tondeur, J. (2020). Fresh perspectives on TPACK: pre-service teachers' own appraisal of their challenging and confident TPACK areas. Education and Information Technologies, 25(4), 2823-2842.
- Wang, W., Schmidt-Crawford, D., & Jin, Y. (2018). Preservice teachers' TPACK development: A review of literature. Journal of digital learning in teacher education, 34(4), 234-258.

Cite This Article: Ranabrata Majumdar, Mallika Mondal, Md Sajjad Hossain Ansari, Mainak Saibya, Muktipada Sinha (2026). Exploring TPACK on Preservice Teacher Educators in West Bengal. *East African Scholars J Edu Humanit Lit, 9*(4), 123-129.