

# Self-Perceived TPACK and its Determinants among Teachers in Malaysia's Gifted Education Program

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## Abstract

This paper explores teachers' self-perceived Technological Pedagogical Content Knowledge (TPACK) within Malaysia's gifted education context specifically among educators in the Permata Pintar program. The TPACK framework developed by Mishra and Koehler (2006) is a framework that combines technological, pedagogical and content knowledge to enable effective and meaningful integration of technology into teaching. This conceptual paper emphasizes how teachers perceive their own competence in integrating these domains and how this perception influences their instructional practices. The literature reveals that self-perception plays a key role in shaping a teacher's confidence, willingness to innovate and readiness to adopt technology in the classroom. However, limited studies have focused on self-perceived TPACK among teachers of gifted students in Malaysia. Furthermore, the paper examines various influencing factors such as professional development opportunities, frequency of technology use, availability of digital resources, institutional support and collaboration with colleagues. These contextual elements have been shown to significantly shape how teachers evaluate their technological integration skills particularly in high-performance learning environments. This paper highlights current gaps and provides direction for future research and policy development. It offers a foundation for improving technological integration through a better understanding of teachers' beliefs about their own capabilities.

**Keywords:** TPACK, Gifted Education, Self-Perceptions

## Introduction

The TPACK model has become highly relevant in Malaysia as the integration of technology in education has been identified as a national priority in line with the Malaysian Education Blueprint 2013–2025 (Ministry of Education, 2013). Studies in Malaysia have shown varying levels of TPACK implementation among educators. For example, a study by Gozali et al. (2023) found that language teachers experienced shifts in their self-perceived TPACK particularly when faced with the need to integrate these competencies within the context of online

learning. These findings are further supported by other studies which emphasize that successful technology integration depends on educators' ability to balance the interrelated components of TPACK (Hidayat et al., 2024). This highlights the need for continuous professional development and targeted support to ensure teachers can confidently apply TPACK principles in diverse instructional settings.

Globally, the TPACK framework has been recognized as a crucial foundation for 21st-century education. However, the Malaysian context offers unique perspectives on its implementation especially in environments that differ culturally and technologically. A study by Aziz et al. (2022) which assessed the readiness of English lecturers at a public university in Malaysia, found that institutional support and professional training played a vital role in enhancing the effectiveness of TPACK integration particularly in the implementation of Open and Distance Learning (ODL). As education systems around the world continue to embrace digital transformation, understanding the nuances of TPACK within national contexts such as Malaysia provides valuable insights for shaping effective educational policies and practices. Nonetheless, there remains a lack of research that specifically examines teachers' TPACK levels based on self-perception within the context of gifted and talented education in Malaysia.

The Permata Pintar program is an innovative initiative in Malaysia aimed at identifying and nurturing gifted and talented students. Launched under the Permata Negara initiative, it provides an enriched curriculum designed to maximize the intellectual and creative potential of these students. The program emphasizes holistic development by integrating academic, leadership and personal growth within its framework with the aim of producing well-rounded individuals who can contribute significantly to society. Permata Pintar is located within Universiti Kebangsaan Malaysia (UKM) and is known for its rigorous selection process and specialized teaching approaches tailored for high-performing students. Therefore, it is essential to examine the TPACK levels of teachers in this program as integrated technological competence plays a vital role in delivering a differentiated and challenging curriculum.

Given the cognitive and emotional complexity of gifted learners, teachers in such programs require not only strong pedagogical and content expertise but also high technological fluency to meet diverse instructional demands. When educators lack an accurate understanding of their own TPACK, they may struggle to design effective technology-integrated lessons which can result in instructional approaches that are misaligned with students' learning needs. This issue is especially critical in gifted education where instruction must be flexible, differentiated and intellectually challenging. The findings of this study will directly benefit teachers by identifying their strengths and areas for development, support administrators in planning focused professional training and ultimately improve learning outcomes for high-ability students. Given the ongoing digital transformation of education and Malaysia's national emphasis on technology integration through the Education Blueprint 2013–2025, this research is both timely and essential. It addresses the rising need for data-informed strategies to enhance instructional readiness in high-performance learning environments.

This study provides a valuable contribution to the understanding of teachers' competencies in integrating technology through the TPACK framework particularly within the specialized context of gifted and talented education in Malaysia. By examining the self-perceived TPACK

levels of Permata Pintar teachers, the study highlights key strengths and areas requiring support in their technology-enhanced teaching practices. These insights are crucial for navigating the growing demands of digital education and can assist stakeholders in identifying specific professional development needs. The findings also reinforce the importance of continuous, context-sensitive training that evolves alongside technological and pedagogical advancements, ensuring that teachers are well-equipped to deliver meaningful instruction in high-performance learning environments that demand flexibility, innovation and a deep understanding.

From a practical and policy-oriented perspective, this study offers guidance for school administrators and education policymakers in designing professional development programs that are more targeted and aligned with the real challenges faced by teachers in gifted education. It underscores the need to move beyond generic training models and instead develop modules tailored to the specific demands of teaching high-ability learners. Additionally, the study helps address a notable gap in local educational research by providing benchmark data on TPACK within the context of gifted programs. These findings can inform future research that explores how teachers apply their TPACK knowledge in practice and can support broader efforts to improve education quality. Ultimately, the study serves as a foundation for strengthening teacher training strategies, enhancing instructional effectiveness and aligning education policies with the digital transformation of the curriculum.

## Literature Review

### *TPACK Model as a Theoretical Framework*

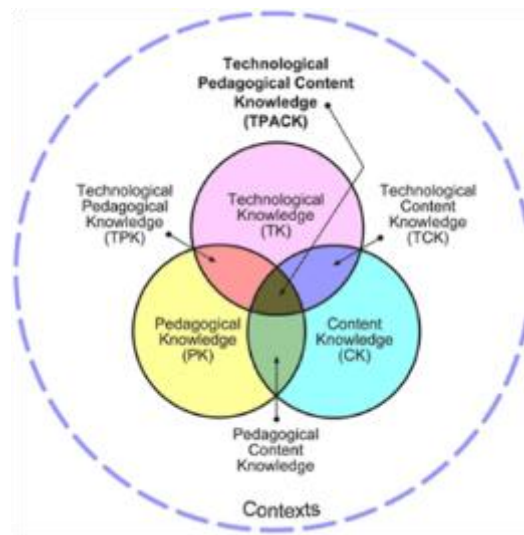


Figure 1: Component of TPACK model (Mishra & Koehler, 2006)

The TPACK framework introduced by Mishra and Koehler (2006) provides a comprehensive model for integrating technology in education by combining three core domains: technological knowledge (TK), pedagogical knowledge (PK) and content knowledge (CK). This framework emphasizes the importance of understanding the relationships among these three domains which work together to produce effective and innovative teaching practices. As noted by Koehler and Mishra (2009), TPACK is not merely the sum of these three areas of

knowledge but rather the dynamic integration of these competencies to meet the demands of modern education. Recent studies such as Wahono et al. (2025) have shown that TPACK has been widely used as a foundation for teacher professional development as well as in evaluating the effectiveness of technology-based teaching. The TPACK model is considered superior to traditional teaching models because it offers a holistic approach that is aligned with contemporary educational needs. According to a study by Ortiz et al. (2023), the TPACK approach allows teachers to make more flexible, responsive and innovative teaching decisions.

The TPACK model comprises three fundamental domains: Technological Knowledge (TK), Pedagogical Knowledge (PK) and Content Knowledge (CK). TK refers to a teacher's proficiency in using software, applications and other digital tools for educational purposes. PK encompasses a teacher's understanding of teaching principles, theories and strategies including classroom management and instructional approaches. Meanwhile, CK involves mastery of the subject matter being taught including its conceptual structures, theories and relevant facts. These three domains form the foundation of a teacher's professional competence and are essential for delivering effective and meaningful instruction.

When these three domains interact, they give rise to four more integrative and complex domains: Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK) and ultimately the comprehensive Technological Pedagogical Content Knowledge (TPACK). PCK represents the ability to deliver subject matter using appropriate teaching strategies. TCK involves using technology to convey and enhance understanding of content more effectively. TPK refers to the understanding of how technology can support and improve pedagogical strategies. The integration of all these elements forms TPACK, a holistic competence that enables teachers to design and implement teaching that simultaneously integrates technology, pedagogy and content in a cohesive and effective manner, allowing for adaptive, student-centered instruction that responds to diverse learning needs, leverages digital tools for deeper engagement and fosters higher-order thinking skills.

#### *Teachers' Self-Perception of TPACK*

The concept of self-perception is crucial in educational research as it reflects teachers' internal beliefs about their capabilities which can either facilitate or hinder the integration of technology into teaching practices. Gozali et al. (2023) found that during the COVID-19 pandemic, language teachers' self-perception of their TPACK competence particularly in higher-order thinking skills (HOTS) shifted significantly as they adapted to online teaching environments. This illustrates the dynamic nature of TPACK self-perception which is influenced by contextual factors. Therefore, the definition of self-perception in this study encompasses not only teachers' confidence in their technological, pedagogical and content knowledge but also their adaptability to new educational contexts.

The selection of TPACK self-perception as the dependent variable in this study is appropriate because it has a direct impact on teaching effectiveness and professional development needs. A study by Aydın Yıldız (2024) showed that language teachers' self-perception of their TPACK in gifted education highlighted the importance of both TPACK competencies and self-efficacy in supporting effective technology integration within gifted education settings. Additionally,

Kosiol and Ufer (2024) found that self-perceived TPACK competence does not always align with actual knowledge, thus emphasizing the importance of self-reported data as an indicator for identifying competency gaps and training needs. By focusing on self-perception as the dependent variable, this study aims to offer meaningful insights into teachers' professional development needs.

#### *Gifted and Talented Education in Malaysia*

Gifted and talented education in Malaysia has begun to receive serious attention through various policies and initiatives that support academic excellence and the development of student talents. According to the Fully Residential School Management Division (Ministry of Education, 2021), gifted students require learning support that encompasses not only academic aspects but also emotional and social development. Therefore, teachers in such programs must possess a deep understanding of differentiated pedagogical approaches and be able to adapt teaching methods to the varying levels of achievement and learning styles of their students. A one-size-fits-all teaching approach is no longer sufficient to meet the needs of students in this more complex group. In this regard, the ability of teachers to apply TPACK is crucial for delivering complex content through the effective and meaningful integration of technology.

The study by Stanley (2021) emphasizes that teachers in gifted education must apply differentiated teaching strategies such as inquiry-based learning, higher-order problem-solving and individual projects to challenge students' potential. These approaches enable gifted learners to explore complex issues, devise solutions and produce meaningful projects, thereby enhancing their creativity and critical thinking. Additionally, research by Ayık and Gül (2025) reveals that the success of gifted and talented education programs largely depends on the teachers' ability to tailor instruction according to students' needs including the use of technology that is responsive to diverse learning styles. Teachers with high technological self-efficacy are more likely to integrate digital tools such as augmented reality and design software into their instruction, ultimately increasing the engagement and achievement of gifted learners.

However, research on TPACK among teachers in gifted and talented education programs in Malaysia remains limited. Most existing studies tend to focus on mainstream school's teachers or specific subject areas, often overlooking the unique pedagogical demands of educating gifted learners. This has created a significant knowledge gap that must be addressed to ensure that teacher training strategies and education policies are aligned with the realities of teaching in high-performance learning environments. Teachers in specialized programs such as Permata Pintar not only require strong pedagogical skills and content mastery but also the ability to strategically adapt technology to support complex and differentiated instruction. Therefore, examining the level of TPACK among Permata Pintar teachers is essential to assess their technological readiness and to identify additional support needed to enhance instructional effectiveness for high-ability learners within complex and dynamic classroom environments.

#### *Determinants of TPACK*

The development of TPACK among teachers is shaped by a combination of interrelated factors including teaching experience, professional development, frequency of technology use,

institutional support, access to digital resources and collaborative school culture. Understanding these factors is crucial for designing effective teacher training interventions and ensuring meaningful technology integration in the classroom. While teaching experience is often assumed to enhance instructional competence, research by Sahrir et al. (2022) suggests that it does not necessarily correlate directly with technological proficiency. Instead, factors such as exposure to professional development programs, availability of digital tools and supportive leadership have a more substantial impact on teachers' TPACK levels.

One of the main factors that has a significant impact is training and professional development. Lachner et al. (2021) found that teachers who participated in continuous training related to technology and pedagogy showed significant improvements in their TPACK capabilities. Regular use of technology also contributes meaningfully to TPACK development. For instance, Özen and Kurtuluş (2023) reported that mathematics teachers who frequently utilized assessment tools on the EBA platform demonstrated higher levels of TPACK compared to their peers. The availability of interactive digital content further enhances this process. According to Aldalalah et al. (2025), digital resources designed based on the TPACK model significantly improve teachers' ability to develop effective instructional materials and contribute to better cognitive outcomes among students.

Institutional support and proactive school leadership play an equally important role by fostering a conducive environment for innovation and continuous learning. Maipita et al. (2023) emphasized that strong organizational backing and a culture that encourages pedagogical innovation can significantly strengthen TPACK among teachers. Lastly, peer collaboration, particularly through professional learning communities, enriches teaching practices. The "Lesson Study" approach, as illustrated by Jiménez et al. (2023) encourages collective lesson planning, implementation and reflection ultimately enhancing teachers' integrative knowledge and technological competence. Overall, these literatures affirm that the development of TPACK is not solely dependent on individual teacher knowledge but is significantly shaped by a comprehensive learning ecosystem and a supportive professional environment.



*Past Related Studies*

	Title	Authors	Year	TPACK	Gifted Education	Self-Perception	Data Analysis	Country
1	The Impact of Teachers' Technological Self-Efficacy on Gifted Technological Pedagogical Content Knowledge: A Case Study.	Zekai Ayik, Muhammet Davut Gül	2025	/	/	/	Qualitative	Turkey
2	Teachers' self-perceptions for technology integration in teaching through the lens of TPACK framework.	Firdous Bugti, Fatima Dar, Pir Suhail Ahmed Sarhandi	2022	/		/	Quantitative	Pakistan
3	Examining the preschool and primary school teachers' perception of self-confidence about their TPACK in Turkey.	Yalcin BAY, Dondu Neslihan BAY, Douglas K. HARTMAN	2021	/		/	Quantitative	Turkey
4	Malaysian Primary School Teachers' Self-Assessment of TPACK and their Blended Learning Practice.	Andy Lim Teik Hong, Mahani Stapa, Kiang Xin Tian.	2025	/		/	Mixed-methods	Malaysia
5	The Relationship between TPACK and Self-Efficacy of the English Teachers of Gifted Students in Science and Art Centres: A Sample of Türkiye.	Tugba Aydın Yıldız	2024	/	/	/	Quantitative	Turkey
6	Technological pedagogical content knowledge of preservice elementary	Ika Ratih Sulistiani, Punaji Setyosari, Cholis Sa'dijah,	2024	/		/	Quantitative	Indonesia

	teachers: Relationship to self-regulation and technology integration self- efficacy.	Henry Praherdhiono						
7	Development of the teacher's technological pedagogical content knowledge (TPACK) from the Lesson Study: A systematic review.	Ángel Alfonso Jiménez Sierra, Jorge Mario Ortega Iglesias, Julio Cabero- Almenara, Antonio Palacios- Rodríguez	2023	/		/	Systematic literature review	Colombia & Spain
8	Technology as a tool: Uses in differentiated curriculum and instruction for gifted learners.	M. S. McGuire	2012	/	/	/	Mixed- methods	United States.
9	A Sequential Explanatory Investigation of TPACK: Malaysian science teachers' survey and perspective	You Eng Chieng, Choon Keong Tan	2021	/		/	Mixed- methods	Malaysia
10	Beliefs and Knowledge for Pre-Service Teachers' Technology Integration during Teaching Practice: An Extended Theory of Planned Behavior	Akhmad Habibi, Yasir Riady, Ahmad Samed Al- Adwan, Nour Awni Albelbisi	2022	/		/	Quantitative	Indonesia
11	Enhancing teachers' GTPACK competencies in gifted education: the impact of GIFTLED AR integrated enrichment method.	Zekai Ayik, Muhammet Davut Gül	2025	/	/	/	Qualitative	Turkey
12		Riyan Hidayat,	2024	/		/	Quantitative	Malaysia



	The relationship between technological pedagogical content knowledge and belief among preservice mathematics teachers	Zamzami Zainuddin, Nurul Hijja Mazlan						
13	TPACK, Organizational Support, and Technostress in Explaining Teacher Performance During Fully Online Learning	Indra Maipita, Faisal Rahman Dongoran, Dedy Husrizal Syah, Gaffar Hafiz Sagala	2023	/		/	Quantitative	Indonesia
14	Self-perception of Teachers in Training on the Ethics of Digital Teaching Skills: A Look from the TPACK Framework	Isabel María Gómez-Trigueros	2025	/		/	Mixed-methods	Spain

The above articles examined 14 studies related to the concept of TPACK in various educational contexts spanning from the year 2012 until 2025. The participants in these studies largely consisted of educators from both primary and secondary levels with a subset of research focused specifically on teachers working with gifted learners. Among these studies, ten targeted primary education while four were conducted in gifted education settings. A considerable number of studies specifically seven out of fourteen focused on the integration of TPACK within STEM or mathematics-related subjects. In terms of research methodology, seven studies employed quantitative approaches, two used qualitative designs, four utilized mixed methods and one was based on a literature review. Geographically, the literature showcases a broad distribution with three studies conducted in Malaysia, four in Turkey, three in Indonesia and the remaining studies from the United States, Spain, Colombia and Pakistan. This diversity highlights the global relevance and adaptability of the TPACK framework across different educational systems, cultural settings and teaching contexts.

A notable research gap emerges in the context of gifted education particularly within the Malaysian setting. While global studies have increasingly explored the application of TPACK across various disciplines, limited research has been conducted to examine how teachers in gifted programs such as Permata Pintar perceive and implement TPACK in their instructional practices. Most existing literature tends to focus on mainstream education or specific subjects like mathematics and science with minimal attention given to the unique pedagogical demands of teaching high ability learners. Furthermore, few studies have investigated how contextual factors such as professional development, access to digital tools and institutional

support shape teachers' TPACK in gifted education environments. Addressing these gaps would provide critical insights for tailoring professional learning programs, enhancing instructional strategies and informing policies that support effective technology integration for gifted and talented learners in Malaysia.

### **Conclusion**

This concept paper highlights the importance of understanding teachers' self-perceived Technological Pedagogical Content Knowledge (TPACK) within the unique context of gifted education in Malaysia. Grounded in the TPACK framework developed by Mishra and Koehler (2006), this study emphasizes the critical role of self-perception in shaping how teachers integrate technology with pedagogical strategies and subject content. Research shows that while many teachers are confident in their pedagogical and content knowledge, their perceived competence in combining these with technology often varies especially in demanding educational environments like the Permata Pintar program.

The literature reviewed also underscores those factors such as teaching experience, access to digital resources, institutional support and the frequency of technology use significantly influence the development of TPACK. Yet, despite growing interest in technology integration in Malaysian schools, studies that focus specifically on self-perceived TPACK in the context of gifted and talented education remain limited. This gap highlights the need for further empirical investigation to understand how teachers in such specialized programs assess their own competencies and how these perceptions affect classroom practices.

In conclusion, this paper lays the foundation for future research and educational planning by drawing attention to the dynamic and context-sensitive nature of TPACK development. By examining self-perceived TPACK, stakeholders including policymakers, school administrators, and teacher educators can design more targeted professional development programs that enhance technology integration skills and ultimately improve teaching and learning outcomes in gifted education settings.

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