

Exploring Technological Pedagogical Content Knowledge (TPACK) Among Industrial Arts Teachers: Implications for Digital Teaching Competence

Arnel L. Gamez

School of Teacher Education- Biliran Campus, Biliran Province State University-Biliran Campus 6566

Corresponding Email: arnelgamez1996@gmail.com

In the era of digital transformation, education is constantly reshaping itself to address the growing demands of a technology-driven world. Industrial Arts, a traditionally hands-on field, now faces the challenge of integrating digital tools and innovative teaching strategies into its practice. The intersection of pedagogy, content, and technology has given rise to a new framework of teacher competence—Technological Pedagogical Content Knowledge (TPACK)—which describes how teachers effectively combine these elements to enhance learning outcomes (Koehler & Mishra, 2006).

TPACK emphasizes that teaching with technology is not merely about using digital tools but about understanding how technology transforms both content delivery and student learning. In Industrial Arts, this means reimagining how teachers teach drafting, woodworking, metalwork, and other skills within digital learning environments. The challenge lies in aligning traditional, skill-based education with emerging technologies such as Computer-Aided Design (CAD), 3D modeling, and online simulation tools. Research trends show a growing focus on TPACK as a framework for preparing teachers to adapt to these technological shifts (Irwanto, 2021).

However, the integration of technology in Industrial Arts education is not without barriers. Teachers often encounter challenges related to lack of equipment, insufficient training, and limited access to professional development programs. These barriers affect their ability to fully implement digital tools and methods in teaching (Dinc, 2019). In particular, many Industrial Arts teachers express uncertainty in connecting their mastery of technical skills with pedagogical and technological competence. As a result, while they excel in craftsmanship and technical content, their digital teaching competence remains underdeveloped.

A study on in-service computer science teachers measuring TPACK revealed that digital competence requires continuous training and contextual adaptation, especially in practical subjects like Industrial Arts (Doukakis et al., 2021). Teachers must develop confidence not only in using technology but also in designing lessons where technology meaningfully supports learning objectives. Effective integration demands creativity, critical thinking, and collaboration—skills aligned with 21st-century learning goals.

The Philippine context further underscores these challenges and opportunities. Domingo and Mina (2024) found that technology integration in the Technical-Vocational-Livelihood (TVL) track of Senior High School remains inconsistent due to infrastructural and policy limitations. Despite this, teachers exhibit strong positive attitudes toward adopting new teaching technologies when given institutional and administrative support. This suggests that with proper guidance, Industrial Arts

educators can evolve into digitally competent practitioners capable of bridging the gap between traditional craftsmanship and digital innovation.

Ultimately, building TPACK among Industrial Arts teachers is essential for future-ready education. It ensures that students not only gain practical skills but also develop digital literacy and adaptability—competencies that align with Industry 4.0 demands. Schools must invest in continuous professional development, provide access to digital tools, and encourage innovation in teaching methods. By doing so, Industrial Arts education can sustain its relevance in the modern classroom and beyond, fostering both creativity and technical excellence through technology-enhanced learning.

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