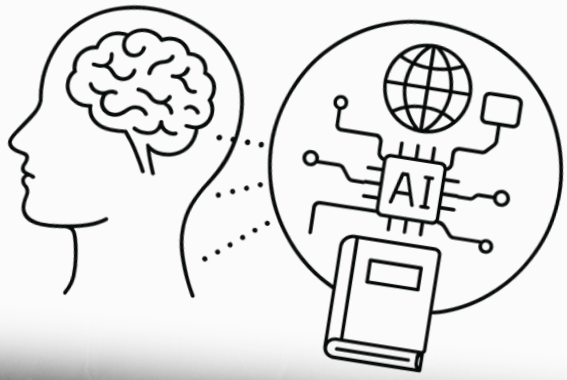
AI-TPACK

Content Knowledge

Pedagogical Knowledge

Rethinking TPACK in the Age of AI



Technological Knowledge

Contextual Knowledge

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Introduction

TPACK is one of my favorite frameworks for thinking about educational technology integration, and I have used it often in workshops with teachers.

TPACK highlights the role and agency of teachers in the integration process which is one of its main strengths. As Mishra, Warr, and Islam (2023) remind us, TPACK "recognizes that the teacher plays a pivotal role in the educational context." (p. 244).

Beyond highlighting teacher agency, TPACK offers a pedagogically grounded roadmap to help teachers think critically about why, how, and when to bring technology into their teaching.

Needless to mention, the framework has been based on extensive research and has been adapted across a wide range of educational settings including K–12, higher education, online and in-person teaching (Mishra et al. 2023; see also Heering et al., 2016; Niess et al., 2018).

Revisiting the Foundations of TPACK

In their seminal paper *Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge*, Mishra and Koehler (2006) argue that "thoughtful pedagogical uses of technology require the development of a complex, situated form of knowledge that we call Technological Pedagogical Content Knowledge (TPCK)." (p. 1017).

In doing so, they position teachers as designers who work at the intersection of **content**, **pedagogy**, and **technology**, three core dimensions of every learning environment.

TPACK builds on Shulman's (1986) concept of pedagogical content knowledge (PCK) by adding technological knowledge, creating a more comprehensive model for teacher decision-making in the digital age.

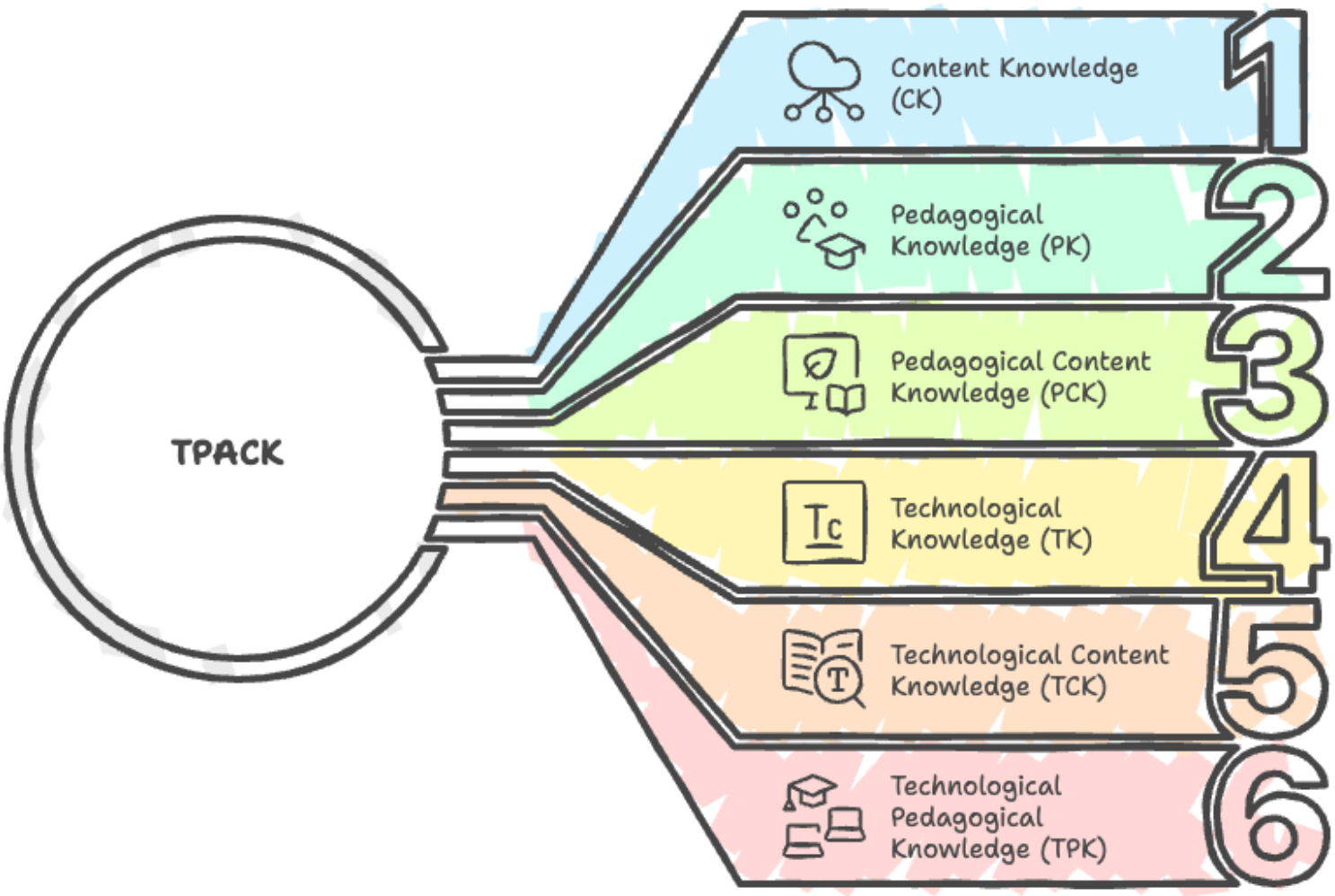
As Mishra, Warr, and Islam (2023) put it, TPACK is meant to provide "a scaffold for considering what teachers need to know to use any technology effectively" (p. 238).

The Components of TPACK

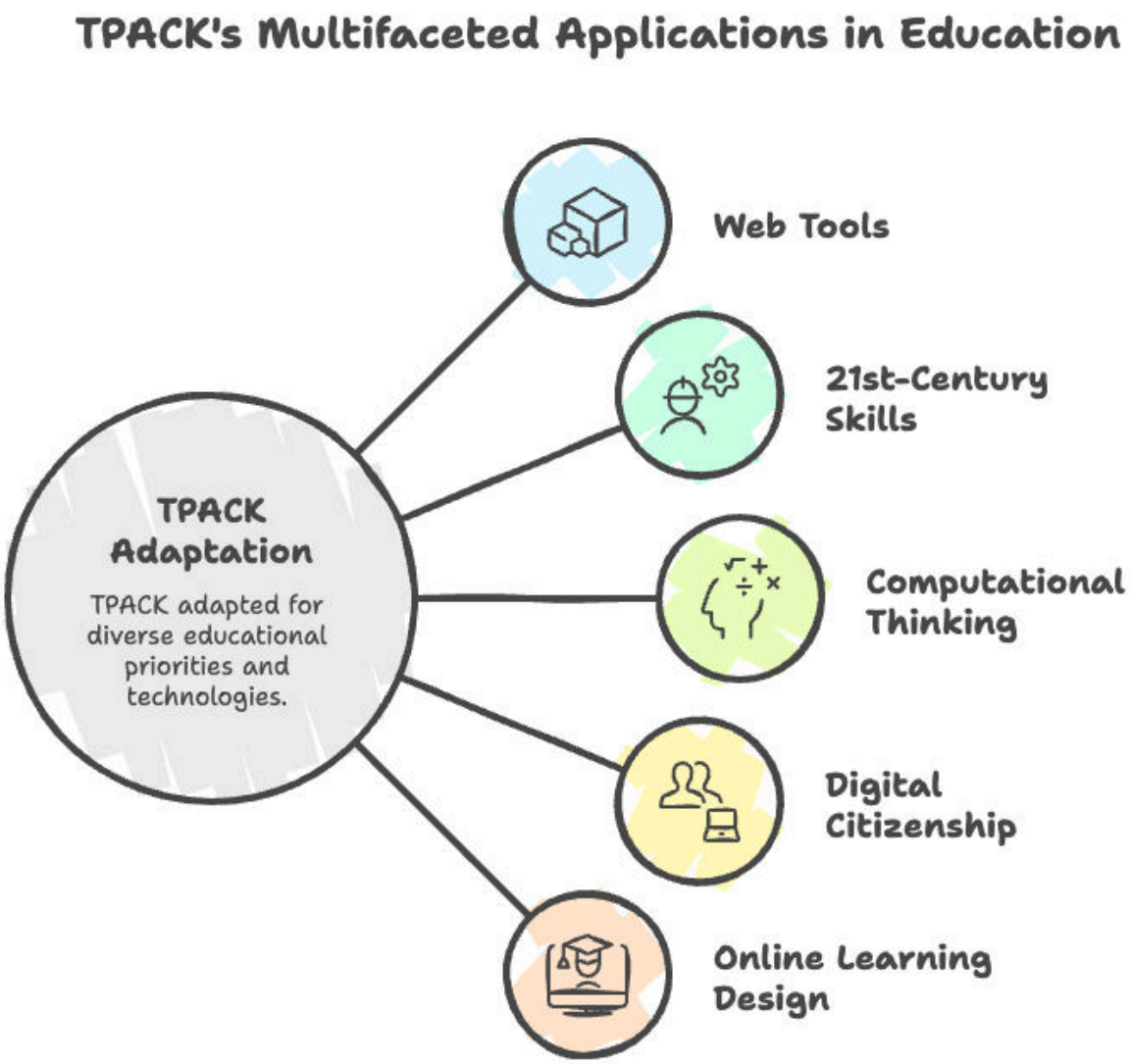
TPACK is composed of the following knowledge domains:

- **Content Knowledge (CK):** A deep understanding of the subject matter being taught.
- **Pedagogical Knowledge (PK):** Knowledge of how teaching and learning work, instructional strategies, classroom management, assessment methods.
- **Pedagogical Content Knowledge (PCK):** Knowing how to teach specific content in ways that make it accessible and meaningful to learners.
- **Technological Knowledge (TK):** Understanding how to use digital tools and platforms.
- **Technological Content Knowledge (TCK):** Knowing which technologies are best suited to represent and explore specific content areas.
- **Technological Pedagogical Knowledge (TPK):** Understanding how technology can support or transform particular pedagogical approaches.
- **TPACK:** The integrated knowledge of all previous components. Using technology to teach specific content effectively through sound pedagogy.

Exploring the Dimensions of TPACK



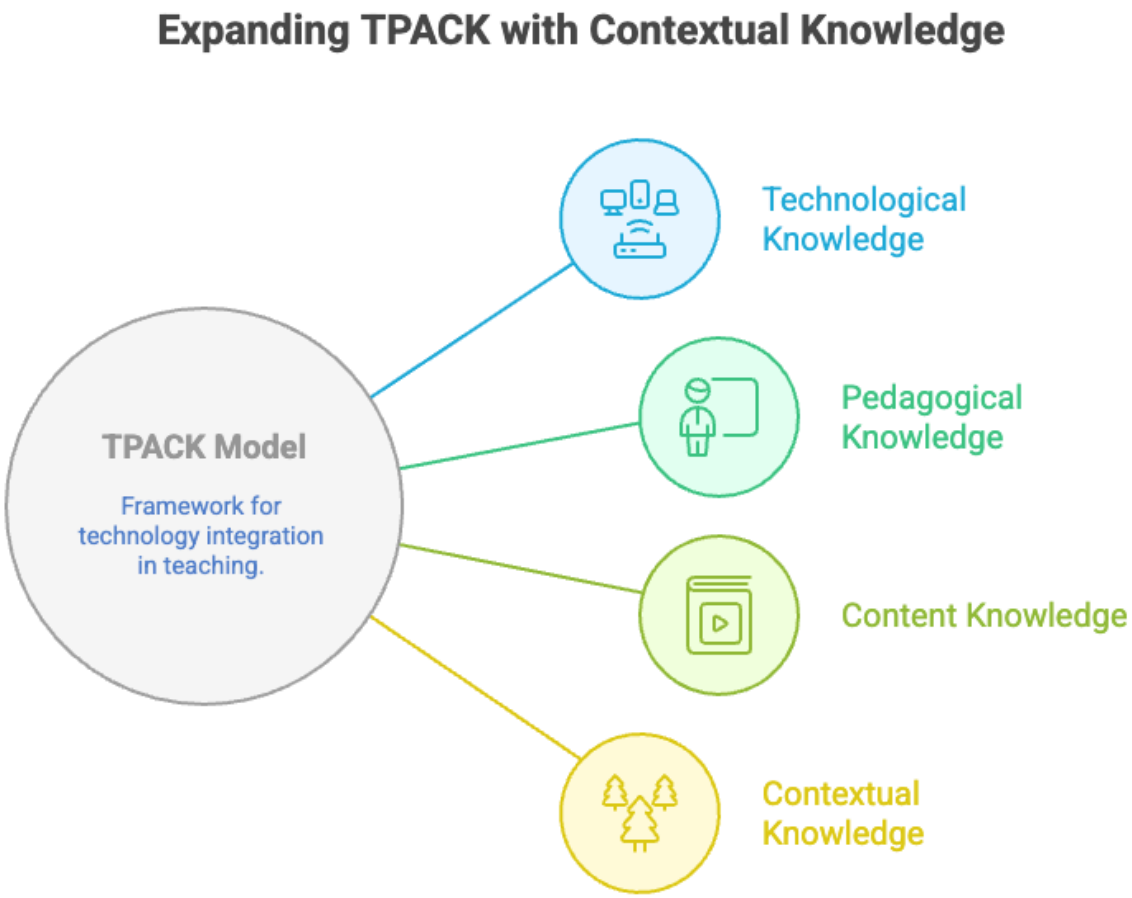
Over the years, researchers and educators have adapted TPACK to support many priorities, including the use of web tools (Lee, M. H., & Tsai), the development of 21st-century skills (Valtonen et al., 2017) , computational thinking (MacCallum, 2025), digital citizenship (Abd Manaf et al., 2025), and online learning design (Ma et al., 2024).



Why AI Pushes Us to Rethink TPACK

With the advent of generative AI, and given that TPACK is one of "the defining framework for teacher knowledge for intelligent and intentional technology integration in teaching." (Mishra, Warr, & Islam, 2023, p. 244), it becomes crucial to revisit and expand the model.

Mishra et al. (2023) themselves revisited TPACK in an AI-driven context and emphasized the growing importance of **Contextual Knowledge** (XK), that is, the ability to understand the institutional, ethical, and social conditions surrounding technology use.

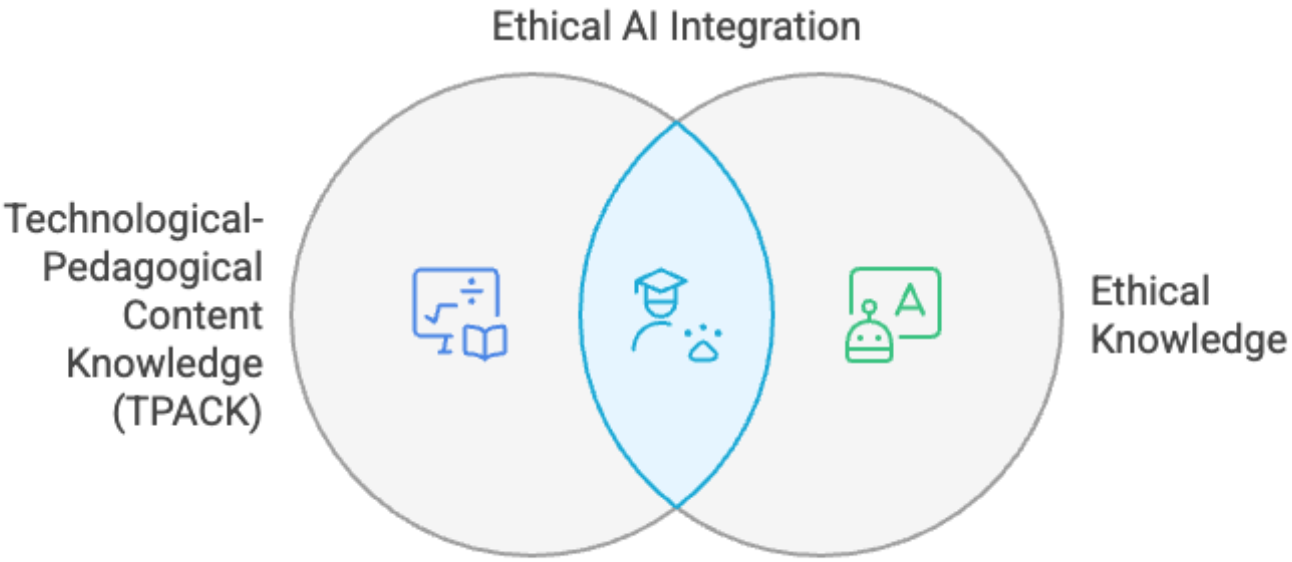


Intelligent-TPACK

One of the most direct applications of TPACK for the AI era is the work of Ismail Celik (2023), who has introduced Intelligent-TPACK to better capture the teacher knowledge required for AI-based learning and teaching.

For Celik, the advent of generative AI requires that teachers develop AI-specific technological and pedagogical knowledge with a specific focus on the ethical aspects of this integration process.

Given the ethical implications of AI-based instruction and assessment, Celik proposes the extension of TPACK to include another knowledge component that he identifies as 'ethical knowledge' that teachers should have for ethical integration of AI-based tools' (p. 2).

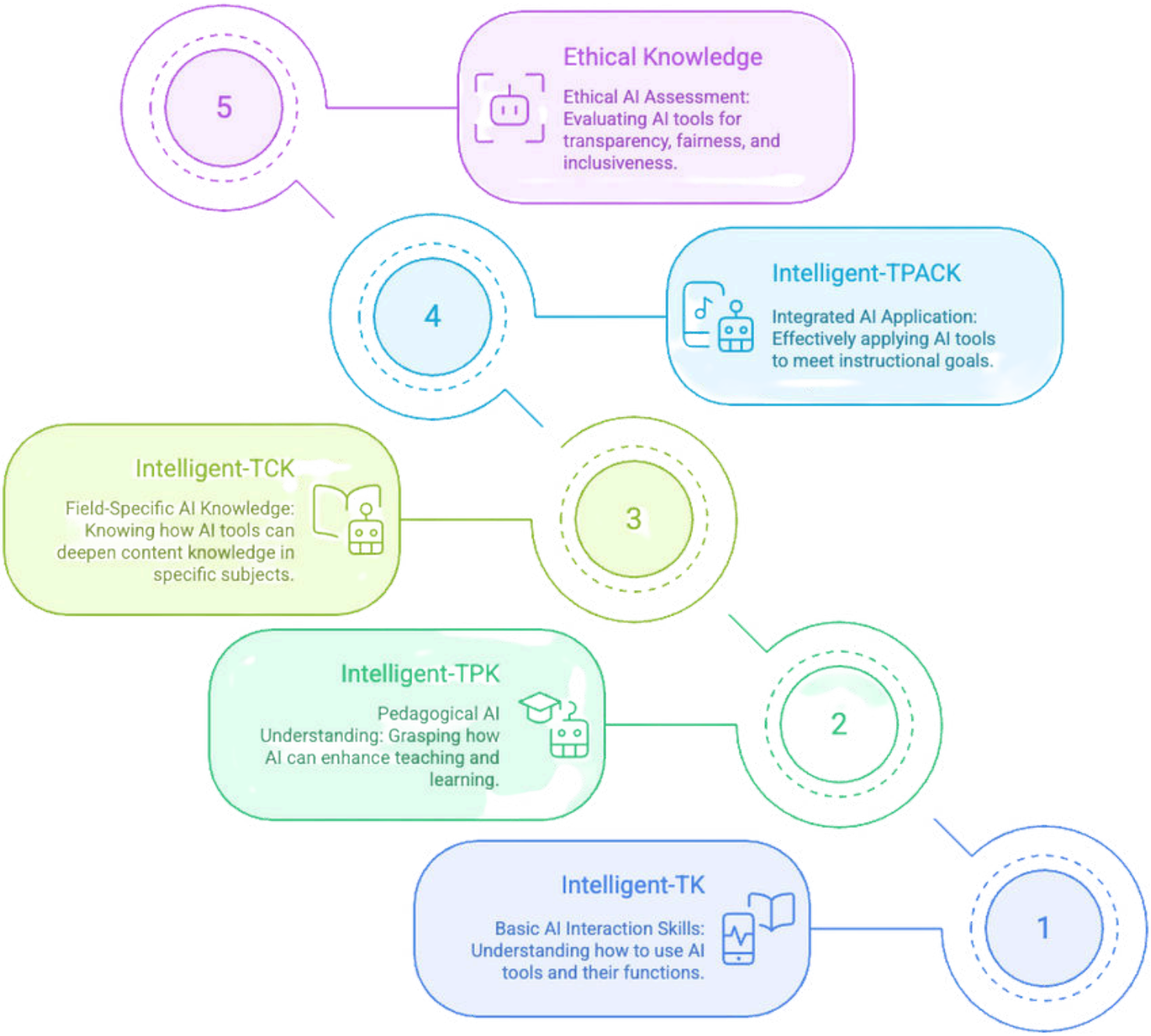


Intelligent-TPACK

Celik updates the TPACK model and calls it Intelligent-TPACK to capture this expanded vision. The framework consists of:

- **Intelligent-TK:** Knowledge of how to interact with AI tools and use their core functions.
- **Intelligent-TPK:** Understanding of the pedagogical affordances of AI (e.g., personalized feedback, learning analytics).
- **Intelligent-TCK:** Knowledge of field-specific AI tools and how they can deepen content knowledge.
- **Intelligent-TPACK:** Integrated professional knowledge to choose and apply AI tools effectively for instructional goals.
- **Ethical Knowledge:** Teachers' ability to assess AI tools based on transparency, fairness, accountability, and inclusiveness.

Intelligent-TPACK



Intelligent-TK (Technical Knowledge of AI Tools)

1. Can I explain how AI tools like ChatGPT or Gemini generate their responses (e.g., from training data)?
2. Do I know how to log in, set up, and access the basic features of at least one AI tool for education?
3. Can I adjust settings (e.g., prompt style, model output length) to get more useful results?
4. Do I know how to input my own material (lesson plans, rubrics, student work) into an AI tool?
5. Can I troubleshoot common issues like unclear outputs or factual errors?
6. Do I understand the limitations of AI (e.g., hallucinations, lack of live knowledge)?
7. Can I compare different AI tools (e.g., ChatGPT vs. Gemini) based on what they do best?
8. Do I know which AI tools can generate text, images, quizzes, or lesson plans?
9. Can I save, export, or share AI outputs in a format I can use in class?
10. Do I regularly explore new AI tools and stay updated on their capabilities?

Intelligent-TPK (Pedagogical Affordances of AI)

1. Can I identify how AI can give students personalized feedback?
2. Do I know how AI tools can help me monitor student progress over time?
3. Can I use AI to create differentiated learning activities for students at different levels?
4. Do I understand when AI-generated explanations or examples might confuse rather than help students?
5. Can I design AI-supported group work or peer review activities?
6. Do I use AI to save time on routine tasks so I can focus on higher-order teaching activities?
7. Can I use AI tools to generate questions that align with Bloom's taxonomy?
8. Do I know how to scaffold student use of AI tools to support independent learning?
9. Can I evaluate when AI is pedagogically valuable versus when it might create dependency?
10. Do I integrate AI into formative assessment (e.g., low-stakes quizzes, practice exercises)?

Intelligent-TCK (Field-Specific AI Knowledge)

1. Do I know which AI tools are designed specifically for my subject area (e.g., math, science, language learning)?
2. Can I use AI to generate domain-specific examples, problems, or scenarios for my students?
3. Do I understand how AI can help me stay updated on new developments in my field?
4. Can I guide students to use AI to explore subject content more deeply?
5. Do I know which AI tools have the best datasets for my content area?
6. Can I evaluate whether an AI tool is accurate for my discipline's standards or curriculum?
7. Do I use AI tools to adapt my subject content to different grade levels?
8. Can I generate subject-specific visuals, simulations, or models using AI?
9. Do I know which AI tools offer field-specific analytics (e.g., reading level, science simulations)?
10. Can I integrate AI outputs into my content lessons while ensuring alignment with learning goals?

Intelligent-TPACK (Integrated Application)

1. Can I select AI tools that align with a specific learning objective?
2. Do I plan lessons where AI is meaningfully embedded rather than an add-on?
3. Can I blend AI outputs with my own teaching strategies to improve student engagement?
4. Do I use AI in ways that promote critical thinking, not just content delivery?
5. Can I design full lesson cycles (introduction, practice, assessment) supported by AI tools?
6. Do I know how to combine multiple AI tools for a single instructional goal (e.g., ChatGPT for ideas + Canva AI for visuals)?
7. Can I adapt AI use to the needs of diverse learners (ELLs, students with disabilities)?
8. Do I evaluate the impact of AI integration on student outcomes and adjust accordingly?
9. Can I teach students to critically reflect on AI outputs and compare them with human-created resources?
10. Do I collaborate with colleagues to share AI integration strategies and reflect on results?

Ethical Knowledge

1. Can I explain to students how AI systems make decisions (e.g., based on training data)?
2. Do I consider issues of bias in AI outputs, especially for my subject area?
3. Can I evaluate whether an AI tool respects student privacy and complies with school policy?
4. Do I know how to check if an AI tool is transparent about how it works?
5. Can I identify when an AI tool's output might reinforce stereotypes or exclude certain groups?
6. Do I discuss with students the ethical implications of relying on AI?
7. Can I judge whether an AI-generated assessment is fair and valid?
8. Do I choose AI tools that allow teacher oversight and control of outputs?
9. Can I model responsible use of AI (e.g., citing AI-generated work, avoiding over-reliance)?
10. Do I stay informed about new policies, laws, and guidelines related to AI in education?

References & Further Reading

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