Faculty of Education
CUHK 中大教育

A Holistic Approach to Assessing AI Literacy and Competency

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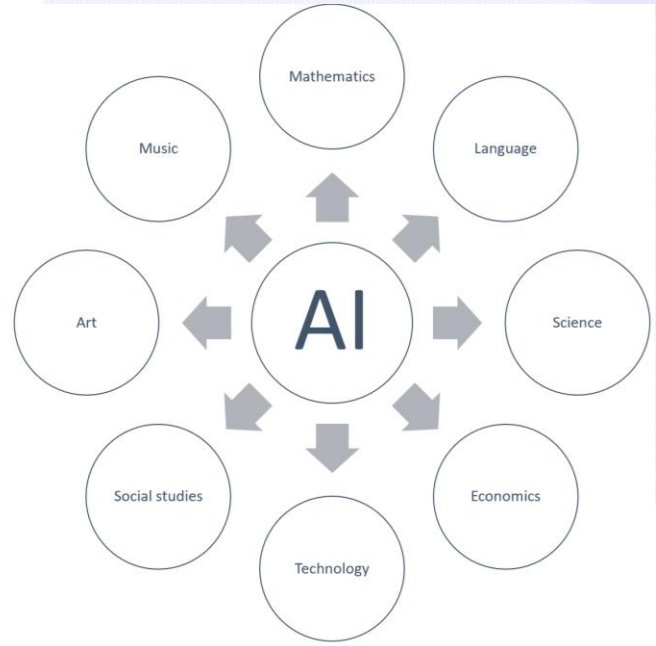
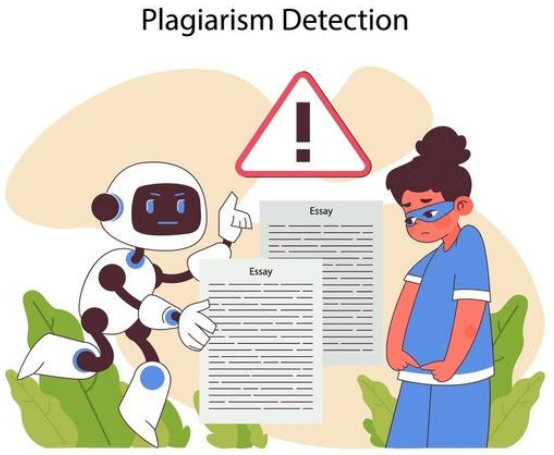
Today

- Current Research on AI literacy and Competency
- Various Measurement Approaches
- Assessment in the AI Era
- A Holistic Approach: Hybrid Assessment

What is AI?

- **Technology:** machine learning, ChatGPT, deepseek, large language model, nature language processing,
- **Capability:** human-like, driverless cars, chatbots, search engine
- **Social:** human behavior, interactions with AI, academic integrity, interdisciplinary nature





Bearman & Ajjawi (2024)

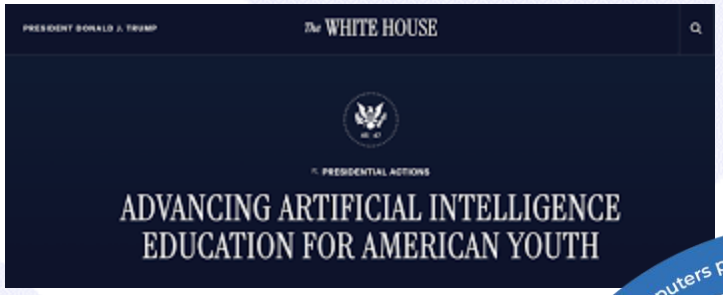
AI literacy

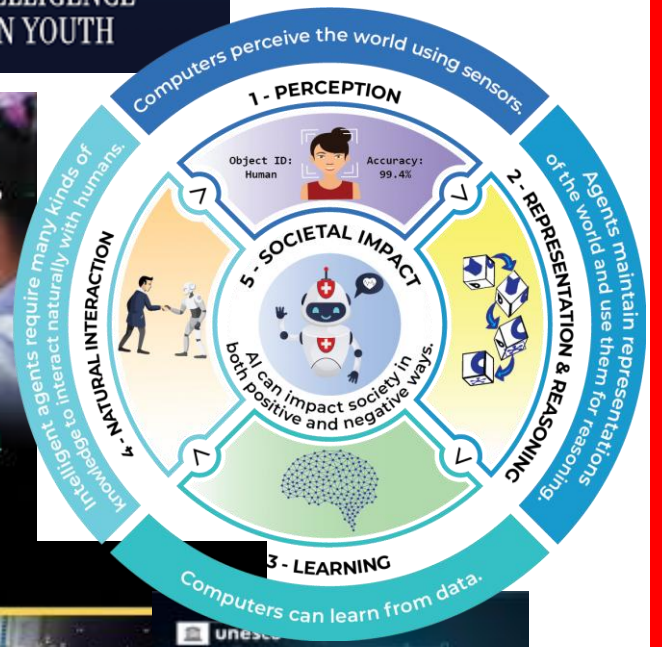
Long and Magerko (2020) defined AI literacy as a set of competencies that enable people to thoughtfully analyze AI technologies, interact and collaborate effectively with AI, and utilize AI as a tool in various online, personal, and professional contexts. The definition is very comprehensive and has 17 competencies and 15 design considerations

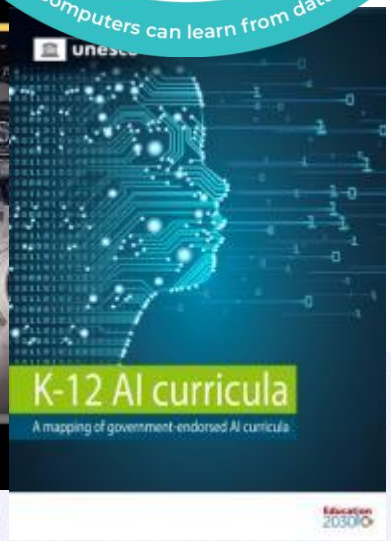
- The term literacy as it was originally construed refers to the ability to express ourselves and communicate using written language.
- Digital literacy, Data literacy, Scientific literacy **(related)**
- Computational literacy **(not necessary)**

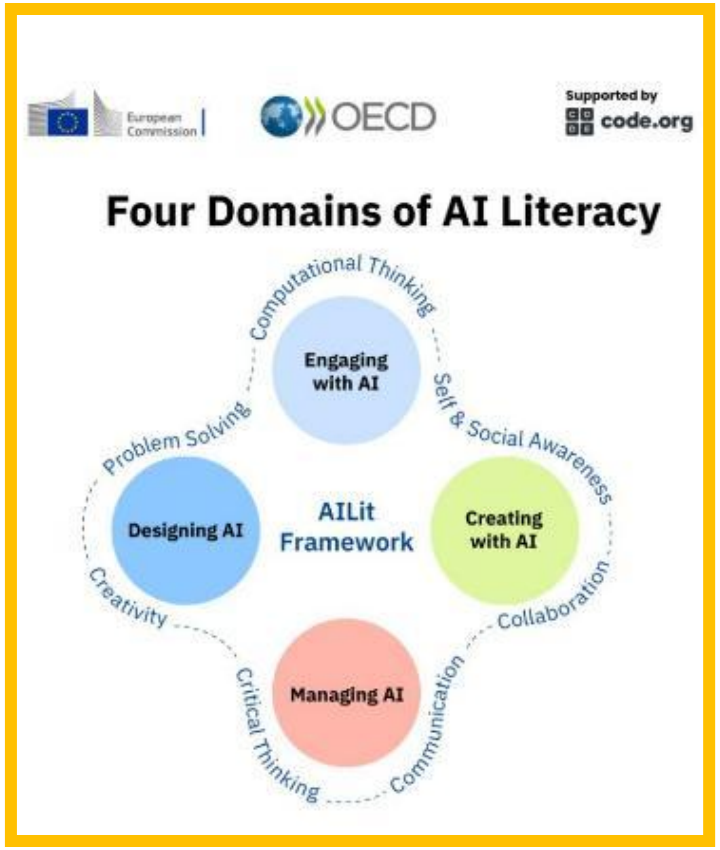
- Other studies on AI literacy

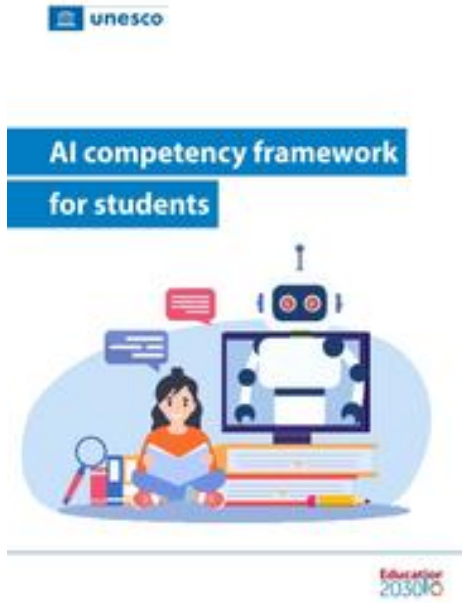
Global Initiatives



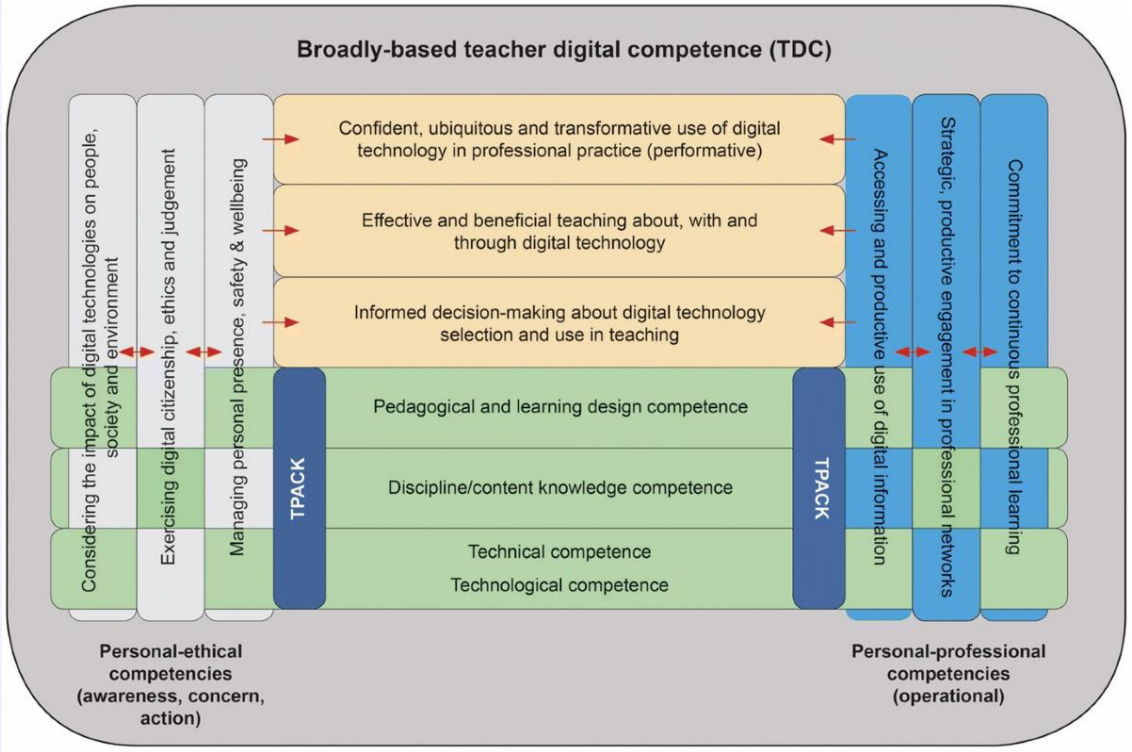








Falloon, G. (2020). From digital literacy to digital competence: the teacher digital competency (TDC) framework. *Educational Technology Research and Development, 68*(5), 2449-2472.



DigComp 2.2 digital competence (European commission)

Literacy vs Competency

Oxford dictionary

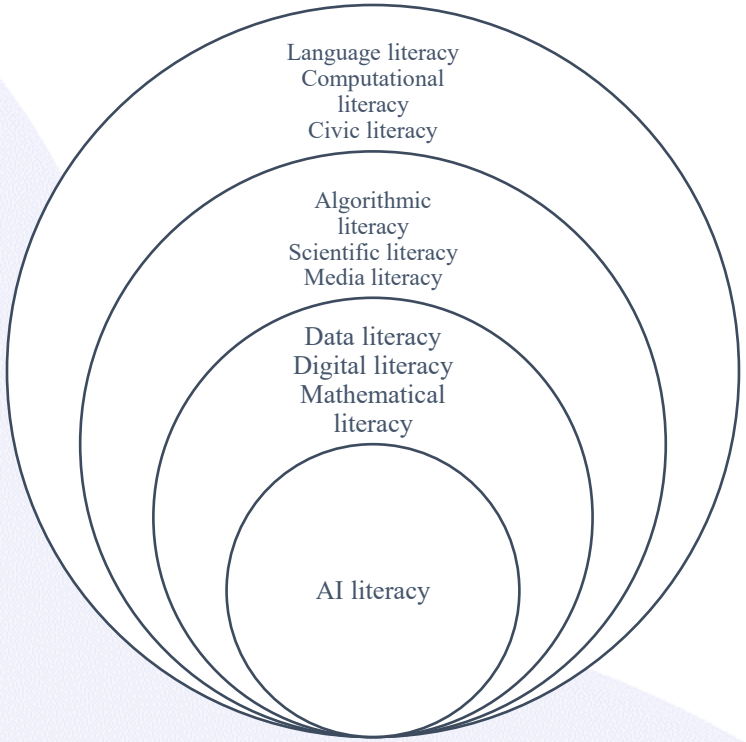
- Literacy - knowledge or skills in a specific area
- Competency (in doing something) - the ability to do something well

Some business domains: literacy ~ competence.

Examples

- Academic writing
- Public speaking
- Driving
- Cooking
- Admissions (IETLS)

AI literacy and competency



UNESCO AI Competency Framework for Students

Competency aspects	Progression levels		
	Understand	Apply	Create
• Human-centred mindset	• Human agency	• Human accountability	• Citizenship in the era of AI
• Ethics of AI	• Embodied ethics	• Safe and responsible use	• Ethics by design
• AI techniques and applications	• AI foundations	• Application skills	• Creating AI tools
• AI system design	• Problem scoping	• Architecture design	• Iteration and feedback loops

Aspects	Progression		
	Acquire	Deepen	Create
1. **Human-centred Mindset**	Human agency	Human accountability	AI social responsibility
2. **Ethics of AI**	Ethical principles	Safe and responsible use	Co-creating AI ethical rules
3. **AI Foundations and Applications**	Basic AI techniques and applications	Application skills	Creating with AI
4. **AI Pedagogy**	AI-assisted teaching	AI-pedagogy integration	AI-enhanced pedagogical transformation
5. **AI for Professional Development**	AI enabling lifelong professional learning	AI to enhance organizational learning	AI to support professional transformation

AI Literacy vs Competency

	AI Literacy: The "What"	AI Competency: The "How"
Focus	Foundational knowledge and under standing (applying on textbook)	Practical skill and proficiency (applying on the job)
About	Grasping core AI concepts (e.g., ML, neural networks), applications, and societal implications (bias, privacy).	The ability to use, develop, and manage AI tools effectively, ethically, and responsibly in real-world contexts.
Goal	To be an informed citizen.	To achieve superior outcomes by integrating AI into specific tasks.
Audience	Everyone	Teachers, researchers, healthcare, students, and etc.
Type	Baseline	Ongoing
Idea	Compass (understanding)	Engine (skillful application)

Chiu, T. K. F. (2025). AI literacy and competency: definitions, frameworks, development and future research directions. *Interactive Learning Environments*, *33*(5), 3225-3229.

AI literacy and Competency in Education

- AI literacy and competency interchangeably in research.
  - Literacy is closely linked to skills, is more about knowing, and mostly concerns knowledge (Falloon, 2020; also see PISA and TIMSS.
  - Competency is the capacity to carry out a task productively, ethically, and healthy.
- Integrating AI in school education.
  - Teaching AI (AI literacy): STEAM education and etc.
  - Use AI in learning and teaching (AI competency): TPACK, disciplines based

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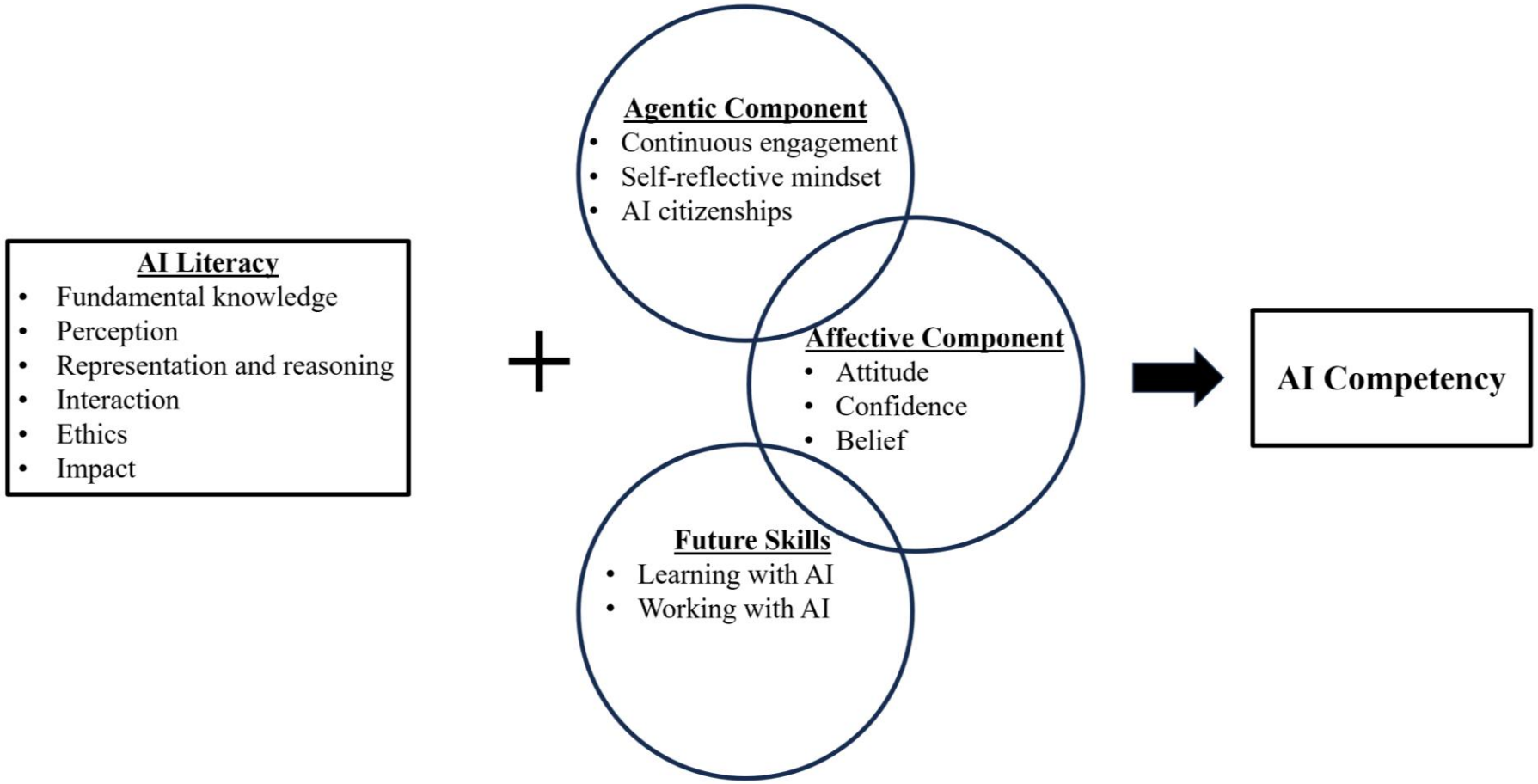
AI Literacy and Student AI Competency



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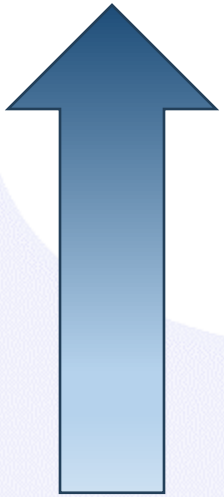
My Human-centred Approach to Design Assessment for AI Literacy and Competency

Cognitive and Emotional Domains

AI Competency

- Emotional aspects of using AI **on a specific task**



- Application ethically and productively (**on the job**)
- Application superficially (on textbook)

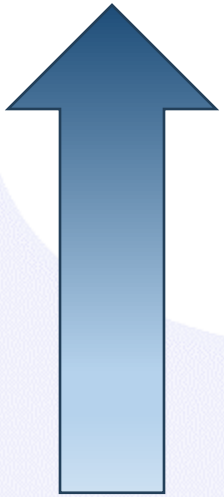
AI Literacy

- Knowledge (learning by creating and discussing)

An example: Assessment Approaches for Students

Frequency / Appropriateness

AI Competency



AI Literacy

Approaches	**Measures**
• Assessment as learning • Assessment for learning	➢ Self-reported Survey ➢ Classroom observations ➢ Interviews ➢ Rubrics
• Assessment of learning	➢ tests

Chiu, T. K. F., Chai, C. S., Chen, Y., Yau, K. W., Meng, H., King, I., Wong, S., & Yam, Y. (2024). Developing and validating measures for **AI literacy tests: From self-reported to objective measures**, *Computer & Education: Artificial Intelligence,* 7, 100282. https://doi.org/10.1016/j.caeai.2024.100282

Chiu, T. K. F., Çoban, M., Sanusi, I. T., Ayanwale, M. A. (2025). Validating **student** AI competency self-efficacy (SAICS) scale and its framework, *Educational Technology Research and Development, 73*, 2785–2807. https://doi.org/10.1007/s11423-025-10512-y

Chiu, T. K. F. Ahmand, Z., & Çoban, M (2024). Development and validation of **teacher** Artificial Intelligence (AI) competence self-efficacy (TAICS) scale. *Education and Information Technologies, 30*, 6667–6685. https://doi.org/10.1007/s10639-024-13094-z

Xia, Q, Yang, Y., Weng, X. J., & Hatice, C-S, Cheng, W. K., & Chiu, T. K. F. (accepted). Generative artificial intelligence competency self-efficacy scale for **teachers and researchers** (GAICS-TR). Journals of Computers in Education

Chiu, T. K. F. (2025). Developing **Intelligent-TPACK (I-TPACK) framework** from unpacking AI literacy and competency: Implementation strategies and future research direction, Interactive Learning Environments, 33(7), 4189-4192. https://doi.org/10.1080/10494820.2025.2545053.

AI Literacy Test

Learning areas	Topic number	Topics
Knowledge of AI	1	What is AI?
	2	How AI works?
Process in AI	3	See
	4	Hear
	5	Speak
	6	Read
	7	AI Reasoning
	8	Simulation
	9	Think and Create
Impact of AI	10	Social Good, Social Impacts and Challenges of AI
	11	AI and Ethics
	12	AI and Future of Work

Chiu, T. K. F., Chai, C. S., Chen, Y., Yau, K. W., Meng, H., King, I., Wong, S., & Yam, Y. (2024). Developing and validating measures for AI literacy tests: From self-reported to objective measures, *Computer & Education: Artificial Intelligence,* 7, 100282. https://doi.org/10.1016/j.caeai.2024.100282

SAICS	TAICS
Interdisciplinary learning with AI	AI knowledge
Assessment with AI	AI pedagogy
Multimedia creation with AI	AI assessment
Decision making with AI	AI ethics
Human centred learning	Human centred education
Designing AI	Professional engagement
Data, ethics and AI	
Confidence with AI	

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Rubrics for SRL with LLMs

Learning activities	Forethought	Performance	Self-reflection
search information	A		
get examples	A		
check their answers			C
generate review questions to check for their understanding			C
create new problems for practice			C
create challenging problems			C
get insight into complex problems		A	
ask ideas for their improvement			C
make lists or outlines	A		
summarize their own work		R	
ask for definitions	C		
generate questions for discussions		A	

Rubrics for SRL with LLMs

Learning activities	Forethought	Performance	Self-reflection
get feedback for their work			C
generate questions for essays		A	
practice peer feedback		C	
prepare for tough conversations		C	
visualize a problem		R	
anticipate ChatGPT's outputs			C
grade ChatGPT's outputs			C
debate with ChatGPT		A	

Chiu, T. K. F. (2024). A Classification Tool to Foster Self-Regulated Learning with ChatGPT by Applying Self-Determination Theory from A Teacher Perspective, *Educational Technology Research & Development, 72,* 2401–2416. https://doi.org/10.1007/s11423-024-10366-w

Strategy 1: Authentic Learning Assessments

- **Focus:** Real-world application of knowledge and skills.
- **Examples:**
  - Project-based assessments
  - Case studies
  - Portfolio evaluations
  - Performance-based tasks
- **Key Idea:** Students create, perform, and solve realistic problems, focusing on higher-order thinking skills.

Xia, Q., Weng, X., Ouyang, F., Lin, T. J., & Chiu, T. K. F. (2024). A scoping review on how generative artificial intelligence transforms assessment in higher education. *International Journal of Educational Technology in Higher Education*, *21*(1), 40.

Strategy 2 & 3: Hybrid & Formative Models

- **Strategy 2: Combine AI & Human Evaluation**
  - AI's Role: Grade objective items; provide preliminary feedback on essays.
  - Teacher's Role: Verify grades, evaluate context, and creativity.
  - Example: AI checks grammar; teacher assesses ideas and logic.
- **Strategy 3: Implement AI-Enhanced Formative Assessments**
  - AI's Role: Provide instant analysis and personalized feedback.
  - Benefit: Helps teachers tailor instruction and helps students track progress in real-time.
  - Example: AI-powered dashboards that show student performance instantly.

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Strategy 4 -7: Diversity, Self-Regulation & Future skills

- **Strategy 4: Design for Multiple Modes**
  - Goal: Cater to diverse learning styles and provide a comprehensive picture of progress.
  - Methods: Mix reports, posters, videos, oral presentations, and portfolios.
  - Example: A year-long math portfolio including problems, video explanations, and peer comments.
- **Strategy 5: Promote Self-Regulated Learning (SRL)**
- **Strategy 6: Prioritize 21st Century Skills**
- **Strategy 7: Assess Student AI Literacy & Competency**

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A framework for empower education with AI

Automating teacher tasks with AI

Automated MC scoring,
Automated essay scoring,
Automated solution providers
Leading cognitive disengagement

Replace

Enhancing teacher tasks with AI

Personalized reading recommendations
Making slides and videos
Minutes dropping
Hybrid assessment

Enhance

Empowering teachers with AI for challenging tasks

Instant multilingual support for ESL students
Assessing generic skills
Foster project based learning

Solve

Shall we talk

- Developed modules including Chinese values, creativity, problem solving, communication skills, ethical awareness, empathy, leaderships

Student AI competency – using AI to support SRL

- Students can analyze their chat activities with LLMs based on the SRL framework table – Chiu (2024). The table maps learning activities to three SRL phases: forethought, performance, and self-reflection.

Learning activities	Forethought	Performance	Self-reflection
search information	A		
get examples	A		
check their answers			C
generate review questions to check for their understanding			C
create new problems for practice			C
create challenging problems			C
get insight into complex problems		A	
ask ideas for their improvement			C
make lists or outlines	A		

🔍 Forethought Phase

Planning and preparation before learning

Activities you likely engaged in:

- **#1 – Search information** ✅ (e.g., asking for explanations, concepts, or resources)
- **#2 – Get examples** ✅ (e.g., requesting code snippets, essay structures, or problem solutions
- **#9 – Make lists or outlines** ✅ (e.g., structuring essays or study plans)
- **#11 – Ask for definitions** ✅ (e.g., clarifying terms or concepts)

Strengths:
You seem to use AI effectively for **pre-learning support**—gathering information, examples, and structure. This is a strong start for SRL.

🧠 Performance Phase

Active engagement during learning

Activities you likely engaged in:

- **#7 – Get insight into complex problems** ✅ (e.g., breaking down difficult questions)
- **#10 – Summarize their own work** ❓ (less common in chat, but possible)
- **#12 – Generate questions for discussions** ✅ (e.g., preparing for debates or group talks)
- **#13 – Generate questions for essays** ✅
- **#15 – Practice peer feedback** ❓ (possible if you asked for feedback on your ideas)
- **#17 – Visualize a problem** ✅ (e.g., asking for diagrams or step-by-step reasoning)
- **#20 – Debate with ChatGPT** ✅ (e.g., challenging responses or exploring counterarguments)

Strengths:
You actively use AI to **deepen understanding** during learning, especially through debate, visualization, and generating discussion points.

📝 Self-Reflection Phase

Reviewing and improving after learning

Activities you likely engaged in:

- **#3 – Check their answers** ✅ (e.g., verifying solutions or interpretations)
- **#14 – Get feedback for their work** ✅ (e.g., asking for improvements on your writing or code)

Activities you may have missed:

- **#4 – Generate review questions**
- **#5 – Create new problems for practice**
- **#6 – Create challenging problems**
- **#8 – Ask ideas for their improvement**
- **#18 – Anticipate ChatGPT's outputs**
- **#19 – Grade ChatGPT's outputs**

Weakness:
This is the phase with the **most underused potential**. You're using AI to check answers and get feedback, but not yet to **generate self-assessment tools** (like review questions or new problems) or to **critically evaluate AI outputs**.

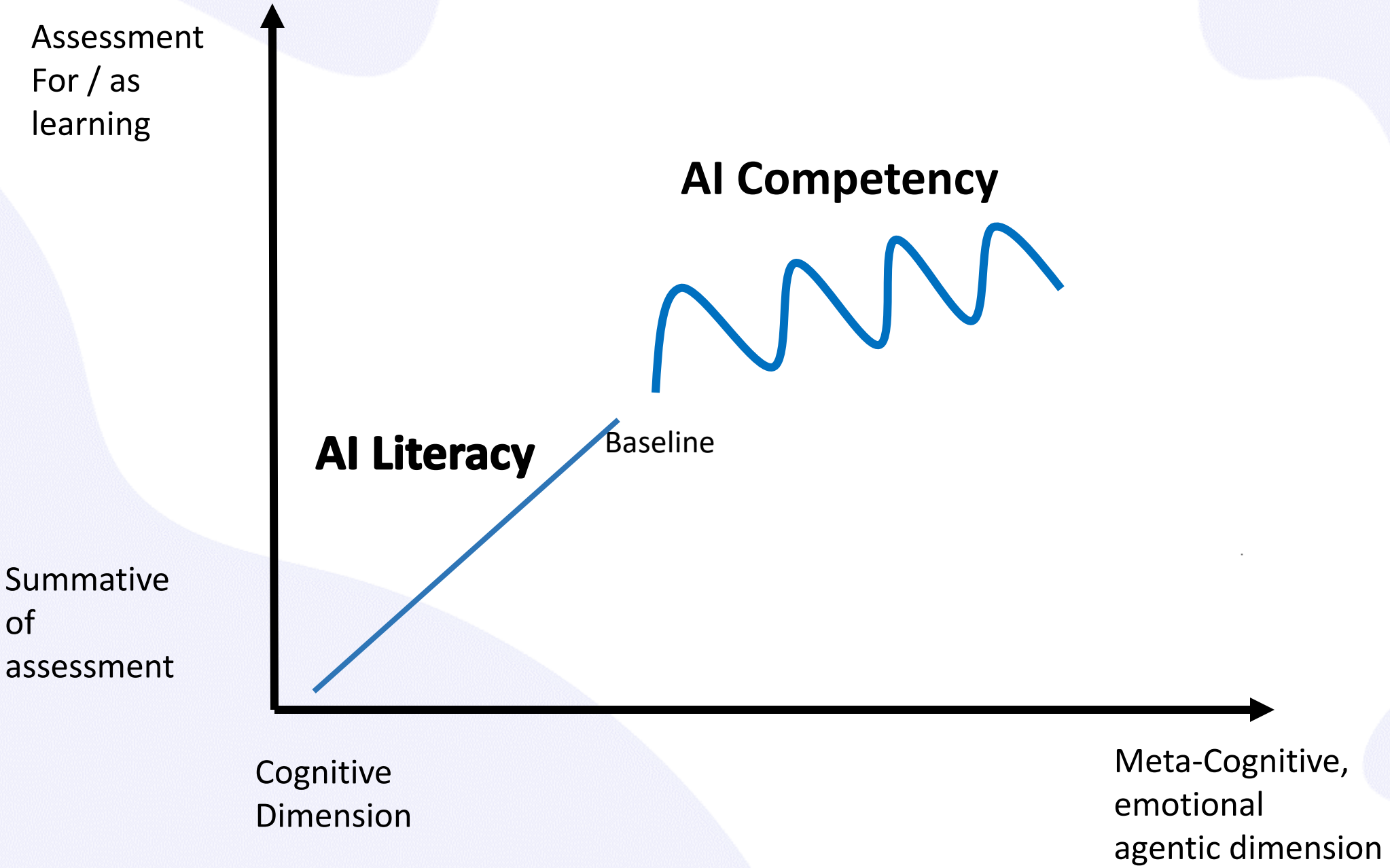
✅ Summary and Suggestions

Phase	Strength	Suggestion
Forethought	✅ Strong	Keep using AI for planning and examples.
Performance	✅ Strong	Great for deepening understanding and interaction.
Self-Reflection	⚠️ Limited	**Start using AI to create review questions, generate new problems, a AI responses.**

🚀 How to Improve Your AI-Supported SRL

Try these in your next chats:

- After learning a topic, ask me:
  "Can you generate 5 review questions to test my understanding?"
  "Create a challenging problem for me to solve."
  "How could I improve this answer or approach?"
- Practice **metacognition**:
  "What would you have said if I asked this differently?" (anticipating outputs)
  "Grade the response you just gave and explain why."


Assessment
For / as
learning
AI Competency
AI Literacy
Baseline
Summative
of
assessment
Cognitive
Dimension
Meta-Cognitive,
emotional
agentic dimension

A holistic approach

AI Literacy → Baseline → **AI Competency for specific tasks**

Assessment of learning

AI Knowledge and understanding

Outcomes oriented

Assessment for / as learning

Cognitive, emotional and agentic dimension

Process oriented

Human – AI Hybrid assessment

From Knowledge to Skillful Practice

The Development Pathway:

Literacy → Deliberate Practice → Critical Refinement → Ethical Integration → Competency

- Start with a foundation of AI literacy.
- Identify small, ethical tasks in your domain to use AI tools.
- Iterate, critique outputs, and refine your approach.
- Anchor everything in ethical use: audit for bias, ensure transparency.

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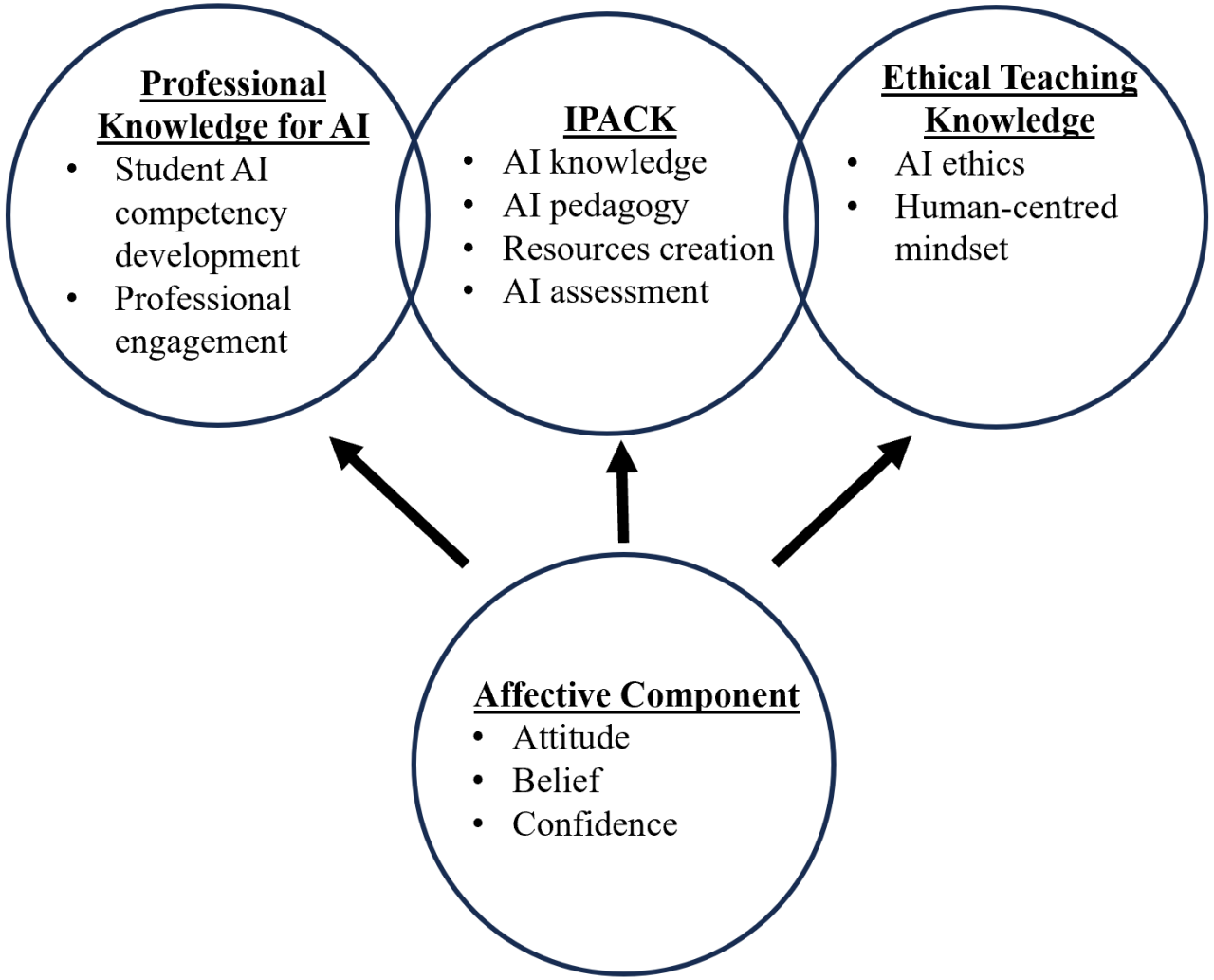
Teacher AI Competency



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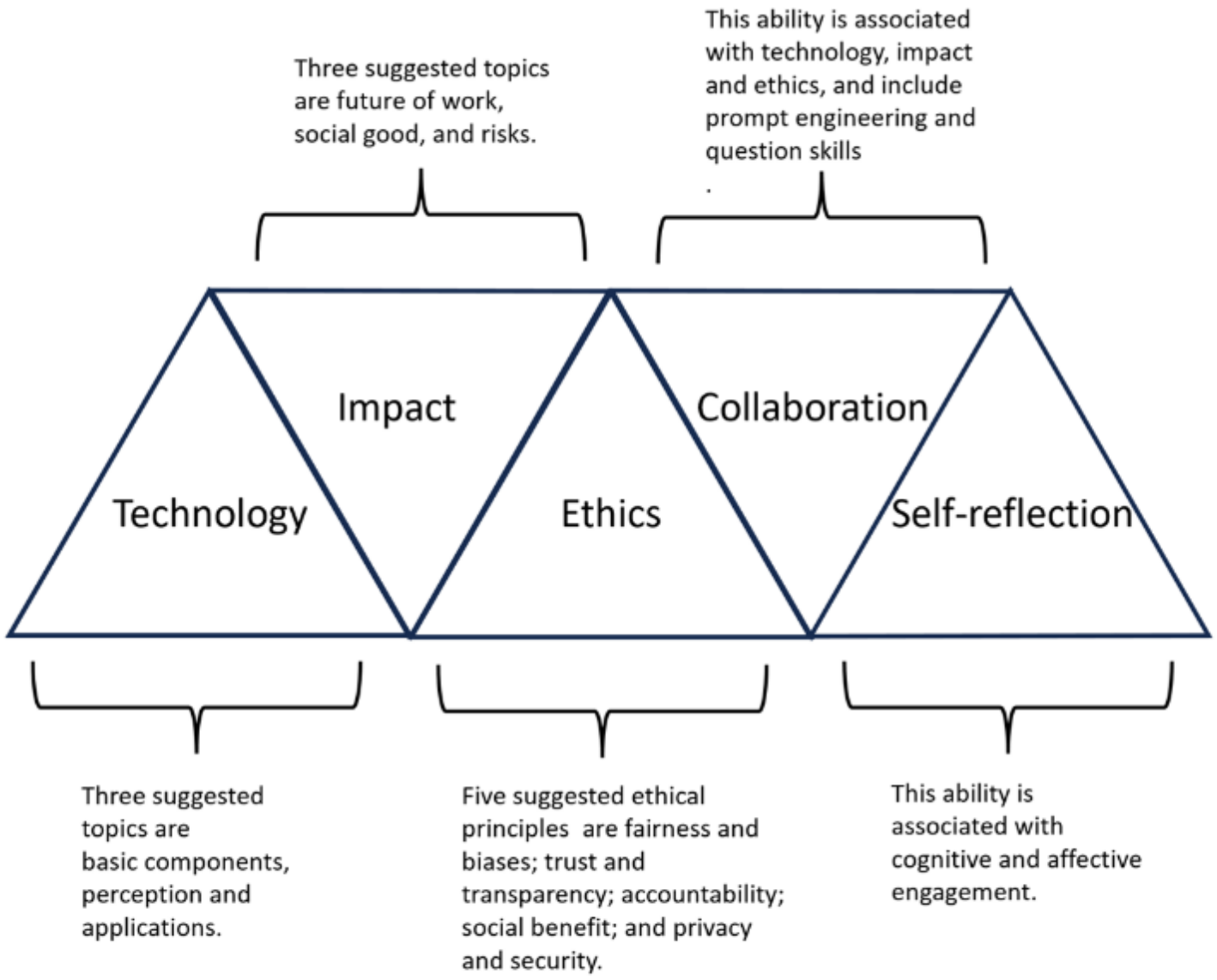
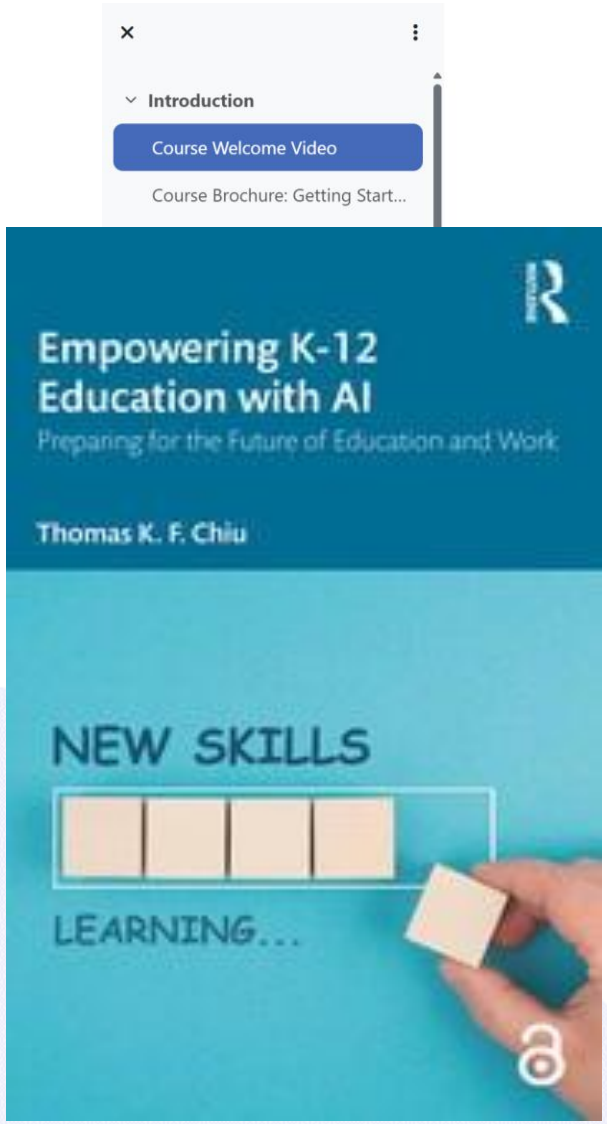


Figure 3. The five key components in the comprehensive framework

Chiu, T. K. F., Ahmand, Z., Ismail, M., & Sanusi, I. T. (2024). What are Artificial Intelligence Literacy and Competency? A Comprehensive Framework to Support Them, *Computers & Education Open, 6*, 100171. https://doi.org/10.1016/j.caeo.2024.100171



Faculty of Education
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Hello and welcome! 👋

👉 Use this course as a playground to:

- Explore artificial intelligence and its impact on education. 🤖
- Experiment with AI applications for generating educational text, images, videos, sounds, and more. 🤳
- Gain an understanding of how everything works, including the roles of ethics and security. 👥

Welcome to the **Teaching with AI: From Literacy to Competency** Course. Watch this video to get a grasp of the course. 📽️

LookUp
Hong Kong

Your task

- Create you teacher AI competency scale and student AI Competency scale. In each scale, you should suggest at least five dimensions; each dimension has 4 items (Questions).
-

Thank You

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