The opportunities and challenges of using technology to support critical thinking

Kairit Tammets – 17/02/2025

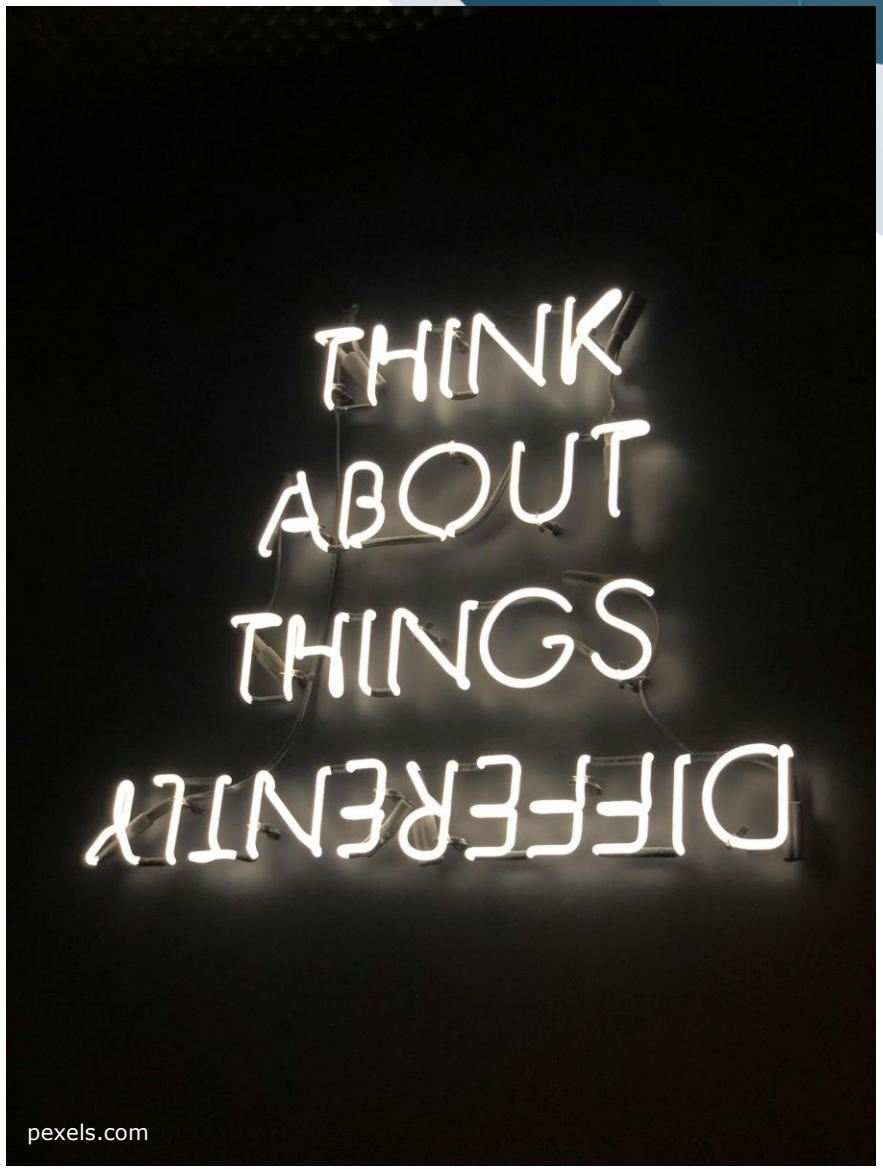
About me..

- Professor of Technology-Enhanced Learning at Tallinn University, Estonia
- Working in Technology-Enhanced Learning since 2009
- Background: Educational Technology, Special Education, Educational Sciences
- Focus: Teacher professional learning to integrate technology into teaching practices
- Core interest: Supporting teachers in using technology for student learning
- Research question: What conditions shape teachers' professional learning experiences for technology integration?

Pre-activity

We will start by thinking about **what critical thinking means**. To get us warmed up, we will take a short poll with a few common statements.

The goal is not just to get the 'right' answer but to reflect on how we evaluate information and make decisions - the heart of critical thinking.



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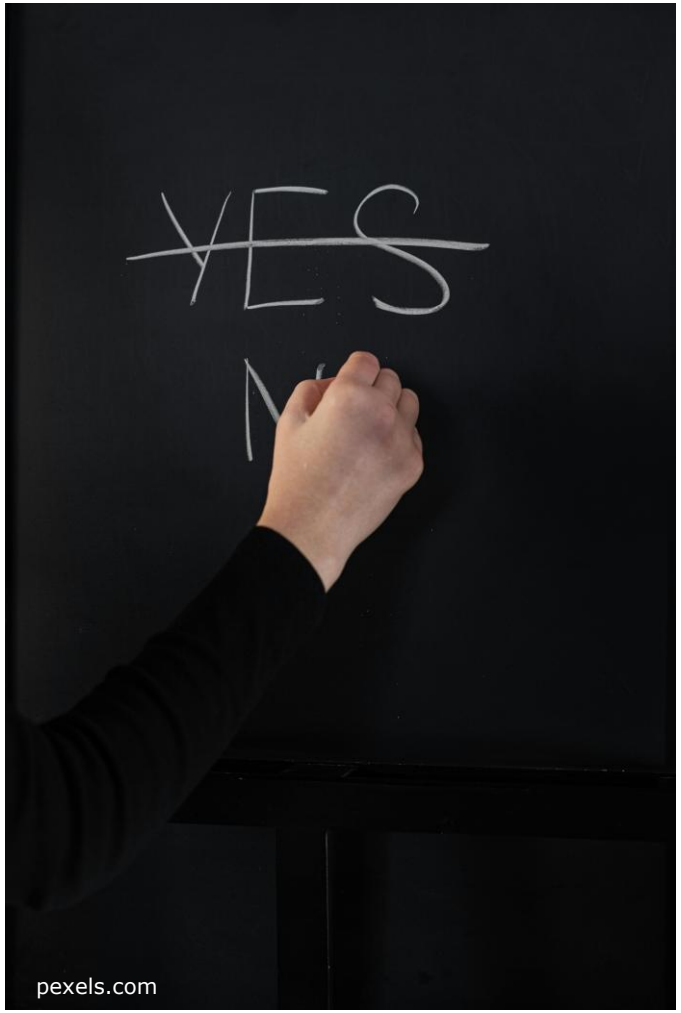
Pre-activity



What we just did was practice the elements of critical thinking: **analyzing**, **evaluating**, **interpreting**, and **reflecting**. These are the same processes that help us **make better decisions** - not just in using technology but in our everyday teaching practice.

Critical thinking is about **reasoning** through **uncertainty** and **recognizing** when **further evidence** is needed.

Critical thinking is a **reflective** and **purposeful thought process** aimed at analyzing, weighing and evaluating information to understand complex problems and make well-reasoned decisions.

Unlike problem-solving with a correct answer, critical thinking focuses on **broader, often poorly defined issues that may have no clear solutions**.

It emphasizes evaluating the **reasoning process** rather than just the outcome and is an essential part of learning across all subjects and age groups.

The goal is to critically assess and evaluate information to **make well-reasoned decisions**. It often **involves a belief or opinion** that one seeks to understand more precisely.

Often related to the meta-cognitive awareness and also the higher levels of thinking skills from Bloom taxonomy (analyse, evaluate)

Cognitive processes in Critical thinking

- **Analysis**: Breaking down complex information and identifying relationships.
  - Example: Analyzing articles to identify bias and assumptions.
- **Evaluation**: Judging the credibility, relevance and accuracy of information.
  - Example: Evaluating whether online sources are trustworthy.
- **Interpretation**: Understanding and clarifying meaning from multiple sources.
  - Example: Interpreting data from multiple perspectives.
- **Inference**: Drawing conclusions based on evidence and logic.
  - Example: Reasoning consequences of a historical event from sources.
- **Reflection**: Thinking about one's thinking to improve future reasoning.
  - Example: Reflecting on why certain arguments seemed persuasive.

Why it is important skill?

- PISA 2025 draft: Critical thinking is crucial for enabling young people **to navigate the overwhelming amount of online information**, distinguish credible scientific facts from misinformation, and make informed decisions in an era where false information spreads rapidly, part of science competence
- Critical thinking helps individuals analyze, evaluate and **make sound decisions** in a complex world;
- Promotes informed decision-making: **Avoids impulsive decisions** based on emotions or misinformation.
- Enhances problem-solving: enables people to **break down complex problems**, explore solutions, and choose the most effective one.
- Protects against manipulation: critical thinkers can **discern facts from propaganda, manipulation**, and biased content
- Essential for democratic participation: In Dewey's view, critical thinking is a foundation for democracy. Citizens need to think critically to evaluate policies, political rhetoric, and social issues.

What about TEL environment?

- In TEL environments, learners are **exposed to vast digital resources**, collaborative tools and adaptive learning technologies. Critical thinking ensures that technology is used effectively and ethically to enhance learning, rather than being a distraction or limiting critical engagement. Critical thinking helps learners evaluate the credibility and relevance of information.
- Technology **may tempt learners into passive consumption** (e.g., videos, pre-packaged quizzes). Critical thinking encourages **deeper learning,** reflection and knowledge construction.
- TEL environments offer personalized learning experiences, but students must learn to **critically reflect on their own progress** and adjust their strategies.

And AI...?

- With GenAI tools (e.g., ChatGPT) capable of generating texts, images and solutions at scale, critical thinking is now more essential than ever.
- GenAI can produce plausible but incorrect or biased information. Critical thinking is vital to verify facts and assess the reliability of AI outputs.
- While (Gen)AI can automate tasks, critical thinking ensures that learners remain in control of their learning process and can distinguish when human judgment is required.
- Critical thinking helps learners and teachers recognize ethical dilemmas in AI use (e.g., plagiarism, data privacy, bias) and make informed decisions about how to use these tools responsibly.

Scenario 1

- Goal: Develop students' ability to critically evaluate online information by analyzing multiple perspectives, identifying bias, and assessing the credibility of online sources.

- In this scenario, *students are asked to* ***select three articles*** *on climate change from* ***any online source****. Each student reads the articles* ***individually and writes a summary****.*
- *They are allowed to use ChatGPT to assist with the summarization. After summarizing, students are* ***instructed to identify biases in the articles*** *and a****dd their observations*** *to a shared* ***Padlet****.*
- *Once the Padlet is updated,* ***students are encouraged to give feedback to their peers*** *by commenting on each other's posts. Some students leave brief, generic feedback such as "Great point" or "I agree."*
- *Finally,* ***the work is submitted to the teacher for review****.*
- *While the activity introduces key concepts of media evaluation, the lack of structured guidance and depth in peer interaction limits the development of critical thinking skills.*

Scenario 2

- **Goal**: Develop students' ability to critically evaluate online information by analyzing multiple perspectives, identifying bias, and assessing the credibility of online sources.
- *Students are guided **to select three articles** on climate change from diverse sources (mainstream news, an independent blog and a government report). They first read the articles and **summarize the main arguments**. Next, students are introduced to a structured evaluation framework to assess each source based on criteria such as credibility, relevance, and bias. They document their evaluations in a shared Padlet using a template to categorize the biases they identify and provide evidence.*
- *In the second phase, **students use ChatGPT** to generate AI-generated summaries of the same articles and compare them with their own summaries. They analyze the differences, focusing on the depth, accuracy, and presence of bias or omissions in the AI-generated content. This comparison leads to a reflective discussion on the reliability of AI tools and how they can complement - but not replace - critical human judgment. Finally, students revise their evaluations, incorporating insights from the comparison and peer feedback provided through structured prompts (What did the AI summary miss or simplify? How can you refine your assessment based on these insights?). They **document their evaluations in a shared Padlet** using a template to categorize the biases they identify and provide evidence to support their assessments.*
- *After posting, students are required **to give constructive feedback** to at least two peers by responding to guiding questions. A class discussion follows, where students reflect on how their understanding evolved and what patterns they observed across the different sources. The teacher monitors the discussion and offers formative feedback to deepen students' insights.*

Aspect	Well-supported	Less-supported
Article selection	Guided selection from diverse sources	Selection with no guidance
Use of AI	Students compare AI output with own summaries	Full reliance on AI-generated summaries
Bias and credibility	Structured assessment with pre-given framework	Minimal guidance, no evaluation criteria
Collaboration	Guided reflection and evidence-based responses	Generic comments, no meaningful discussion

Key cognitive processes fostered:

Analysis – Examining and breaking down arguments to identify key claims, evidence, and patterns.

Example: Analyzing how each article presents climate change to reveal differences in focus (scientific facts vs. personal opinions).

Evaluation – Assessing the credibility, relevance, and accuracy of information, as well as identifying biases and logical inconsistencies.

Example: Evaluating whether an independent blog provides verifiable evidence or relies primarily on emotional appeals.

Interpretation – Making sense of information by comparing and clarifying the meaning of different perspectives and underlying messages.

Example: interprets how language choices (e.g., neutral vs. emotionally charged) shape the perception of climate change.

Inference – Drawing logical conclusions based on evidence, recognizing implications, and predicting potential outcomes.

Example: Reasoning that a government report is credible than a blog post due to the use of peer-reviewed data and referenced studies.

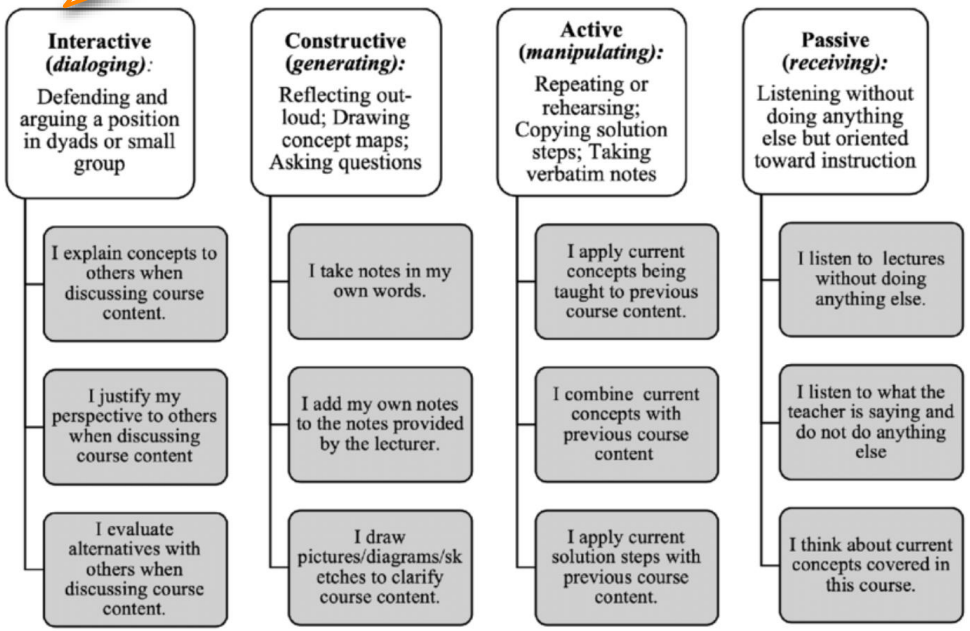
Reflection – Reviewing one's own thought processes, identifying biases, and revising conclusions in light of new insights or feedback.

Example: Reflecting on peer feedback and realizing that an important counterargument was overlooked, leading to a revised conclusion.

Some practical tools

- The ICAP framework (Chi & Wylie, 2014) provides an approach to **fostering deeper cognitive engagement**, which aligns closely with the development of critical thinking.
- By progressing from **passive to interactive engagement**, ICAP encourages students to move beyond surface-level understanding toward higher-order skills like analysis, evaluation, and collaborative reasoning - **core elements of critical thinking.**
- Cognitive engagement refers to the **mental effort and strategies learners use** to process, understand, and apply information meaningfully. It involves actively thinking, analyzing, and reflecting on content rather than passively receiving it, promoting deeper learning and skill development.

Have you heard about ICAP framework before? (Share in Chat)



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ICAP framework & critical thinking

Passive engagement

Cognitive Process: Limited; mostly involves receiving information (listening, reading).

Critical Thinking potential: Low. Little opportunity for analysis, evaluation, or interpretation. However, it may serve as the foundation for higher levels by providing initial exposure to information.

Active Engagement

Cognitive Process: Recognizing and organizing information (e.g., highlighting key points, answering simple questions).

Critical Thinking potential: Moderate. Encourages basic analysis and identification of key concepts, a precursor to deeper critical thinking. **Example**: Identifying factual claims and opinions in a text.

Constructive Engagement

Cognitive Process: Generating new ideas, connecting concepts, and applying knowledge.

Critical Thinking potential: High. Promotes higher-order thinking processes like analysis, synthesis, and interpretation. **Example**: Comparing different arguments on climate change and generating a summary with personal insights

Interactive Engagement

Cognitive Process: Collaborative reasoning and co-construction of knowledge through discussion and debate.
Critical Thinking potential: Very High. Fosters evaluation, reflection, and multiple perspectives, key elements of critical thinking.
Example: Collaborative concept mapping to analyze media bias, where students challenge each other's assumptions and refine their conclusions.

Example..

Passive → Active

Task: Evaluating source credibility

Tool: Online news platforms, Google, and ChatGPT

Instructions:

- Read two online articles about climate change from different sources.
- Use ChatGPT to summarize the key arguments.
- Highlight the claims and supporting evidence in each article.

Cognitive process: Recognizing information, identifying claims.

Critical Thinking focus: Distinguishing reliable information from biased content.

2. Active → Constructive

Task: Students analyze how different media sources report on climate change to identify patterns in bias, language, and tone.

Tool: Online news articles, Google Sheets, collaborative tools (Padlet, Miro)

Instructions:

- Select three articles from diverse sources and document details in Google Sheets (language, tone, evidence).
- Compare sources to identify factual vs. emotional language, tone, and credibility of evidence.
- Use Miro or Padlet to create a visual summary (e.g., chart)
- Present findings and reflect on source credibility

Cognitive process: Connecting, organizing, and applying concepts

Critical Thinking focus: Analysis (Breaking down content into key elements), Evaluation (Judging credibility and bias), Interpretation (Making meaning from patterns in data), Reflection (Considering how media shapes public perception)

3. Constructive → Interactive

Task: Collaborative Blog Analysis

Tool: Padlet, Miro, or Google Docs

Instructions:

- In groups, students analyze three different blogs on climate change, focusing on the use of persuasive language and claims.
- Use a collaborative Padlet to organize findings.
- Give feedback on each other's analysis: "What assumptions might this author be making? What evidence supports or contradicts their claims?"

Cognitive process: Collaborative reasoning

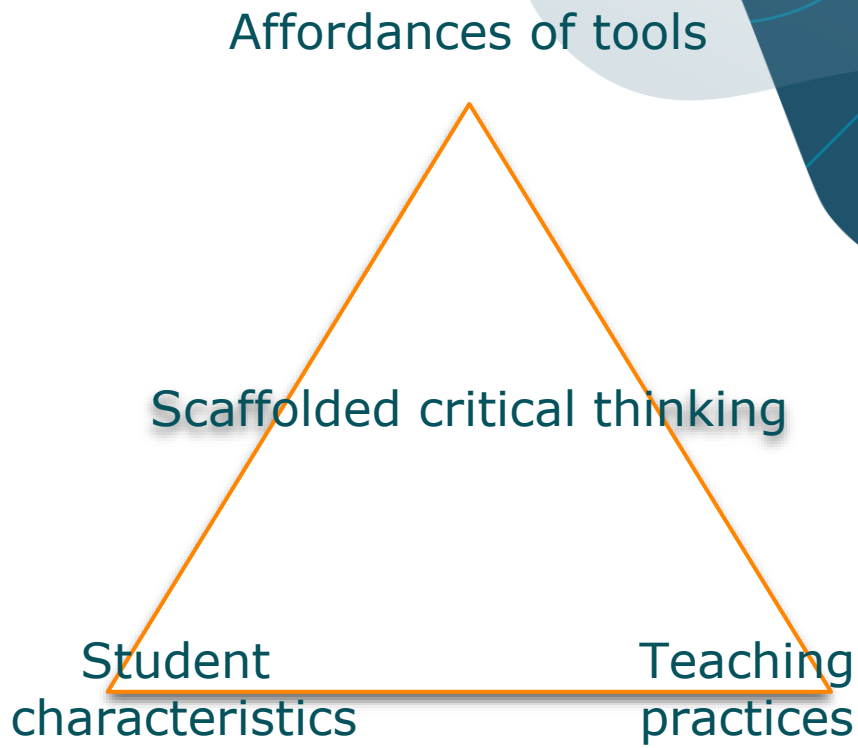
Critical Thinking focus: Analyzing arguments, evaluating assumptions, and integrating multiple perspectives.

Takeaway about ICAP

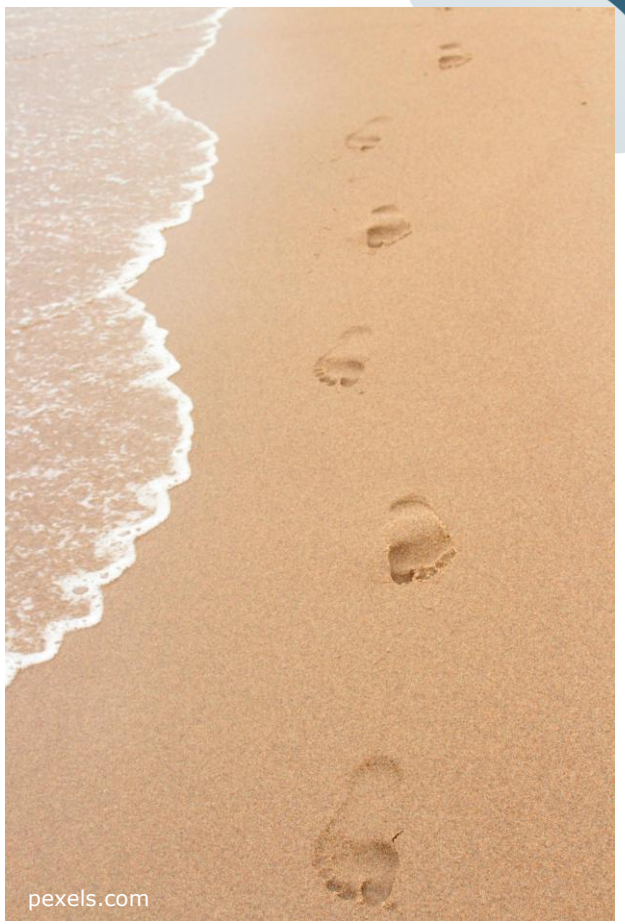
- Designing teaching based on ICAP **moves students from passive receipt of information to active participation, knowledge construction** and **collaborative reasoning**, which are essential for critical thinking (**Progressive depth of engagement)**
- Especially in the constructive and interactive phases, students are required to construct knowledge based on reliable information, reflect on their ideas, justify them, and evaluate alternative viewpoints.
- The interactive stage supports **dialogical thinking**, where students engage in critical dialogue, exposing them to multiple perspectives and fostering deeper understanding

Challenges..

- **Technology tools alone do not ensure deeper thinking -** critical thinking requires well-designed tasks and scaffolding. Overreliance on AI may lead to passive consumption rather than active reasoning.
- **Teaching practices need improvement** - Many teachers lack the expertise to design tasks that promote higher-order thinking (analysis, evaluation, reflection) and align them with cognitive processes. TPACK is critical - Teachers need Technological Pedagogical Content Knowledge to select the right tools and design activities that genuinely support critical thinking instead of passive consumption.
- **Lack of domain knowledge** limits students' ability to analyze and evaluate information accurately.
- **Self-regulation is crucial in TEL environments**, where distractions can hinder focus and engagement.Without self-regulation, students may skim through tasks, rely on quick solutions (e.g., AI summaries), and avoid deeper reflection.



- **Critical thinking is essential** in navigating information-rich, technology-enhanced environments **to solve complex problems**
- **Design intentional tasks.** Focus on higher-order thinking and promote and scaffold problem-solving and inquiry-based learning.
- **Balance technology use and human judgment**. AI tools can enhance learning, but self-regulation and reflective practices remain key.
- Critical thinking cannot flourish without a solid foundation in **subject-specific knowledge** and students' self-regulated learning skills



> Teaching critical thinking in the digital age is like handing students a compass in an ocean of information - just make sure they know not to follow every friendly-looking fish. :-)

Thank you

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