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Subject knowledge and skills matter more than ever in the age of AI

Why teachers remain at the heart of meaningful learning

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Future-ready: preparing learners to thrive

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Agenda

- Self-reflection
- What do we really mean?
- Your thoughts
- What does meaningful learning look like?
- The Cambridge approaches in action
- Knowledge, skills and understanding
- Q&A

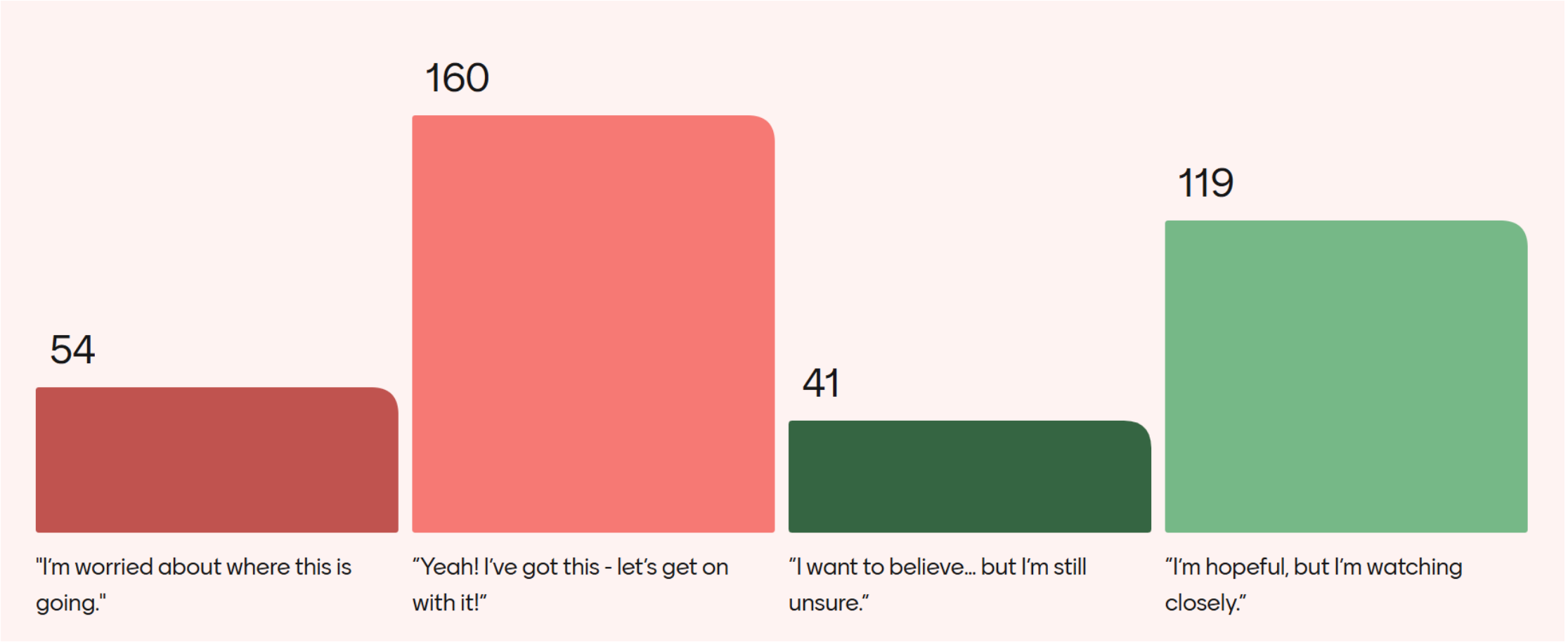
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Self reflection

In the session we used Menti.com with the following responses

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EdTech & Ai in education – where are you?



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3 words for your current thoughts on EdTech & AI in education



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Our focus

- Subject knowledge and skills matter more than ever in the age of AI
- Why teachers remain at the heart of meaningful learning

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Why teachers remain at the heart of meaningful learning



Your learners can now generate an explanation, an essay, an image, a solution or a revision guide in seconds.



The professional challenge is no longer simply helping them find an answer.

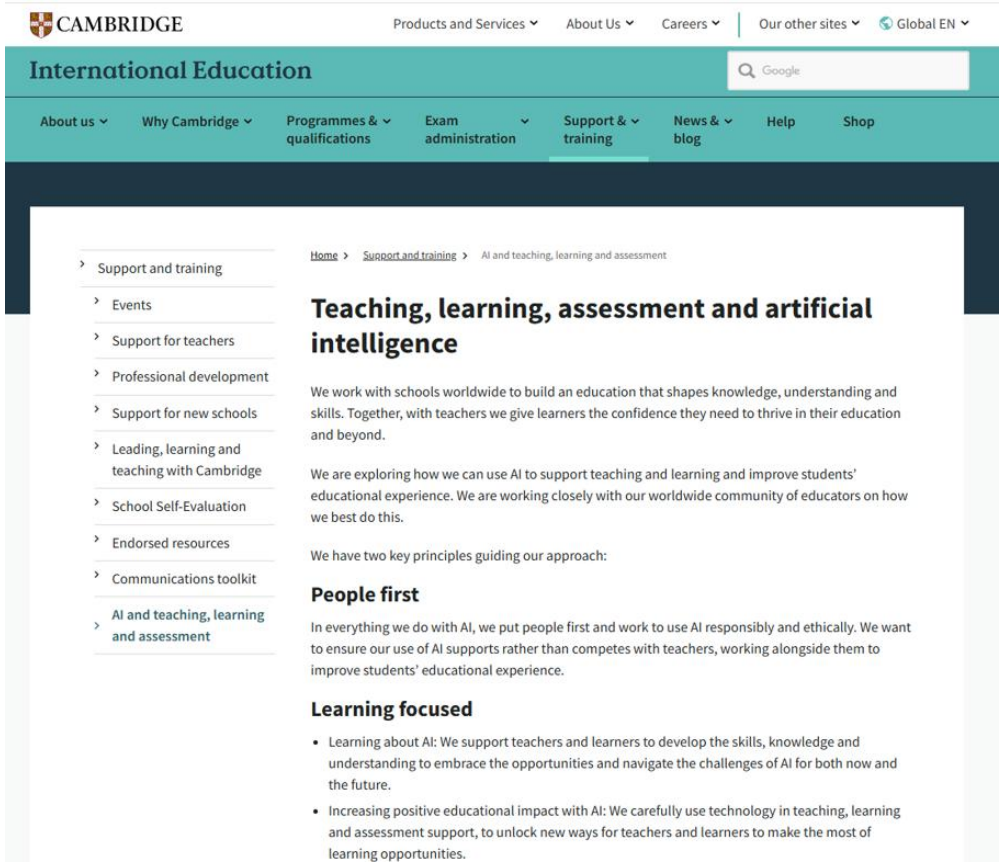


It is helping them know what makes an answer worth having.

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People first. Learning focused.

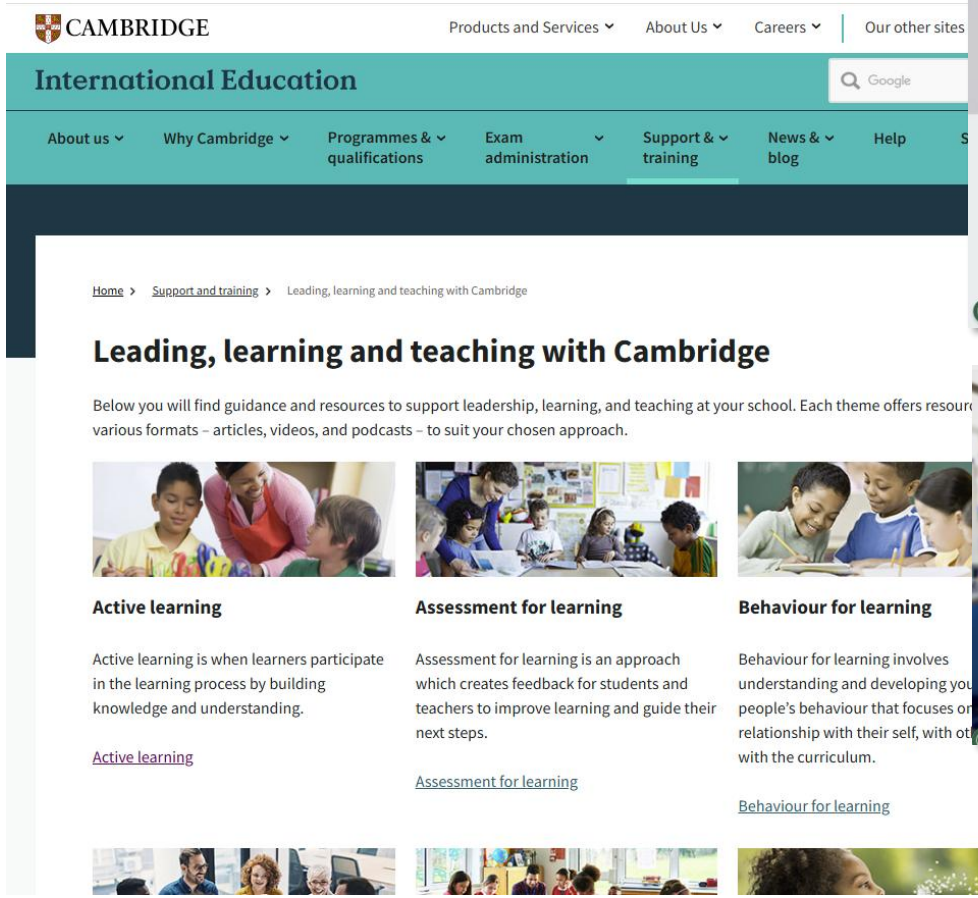
- AI should support rather than compete with teachers
- Technology should increase positive educational impact
- Teachers and learners need the knowledge, skills and understanding to navigate AI responsibly

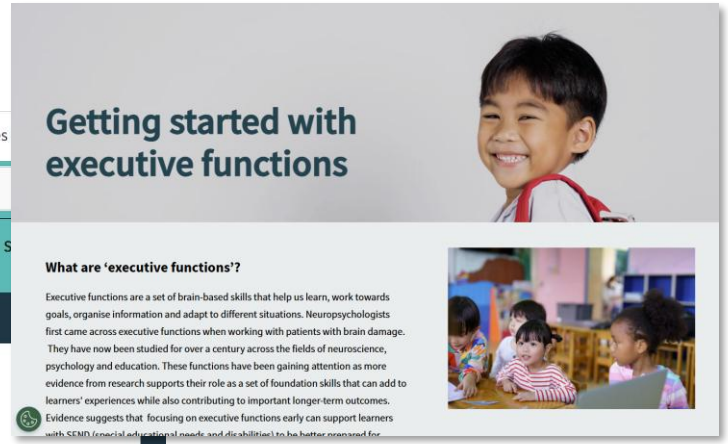


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The foundations have not changed

- Active learning
- Assessment for learning
- Metacognition
- Inclusive education
- Language awareness
- Reflective practice
- Self management

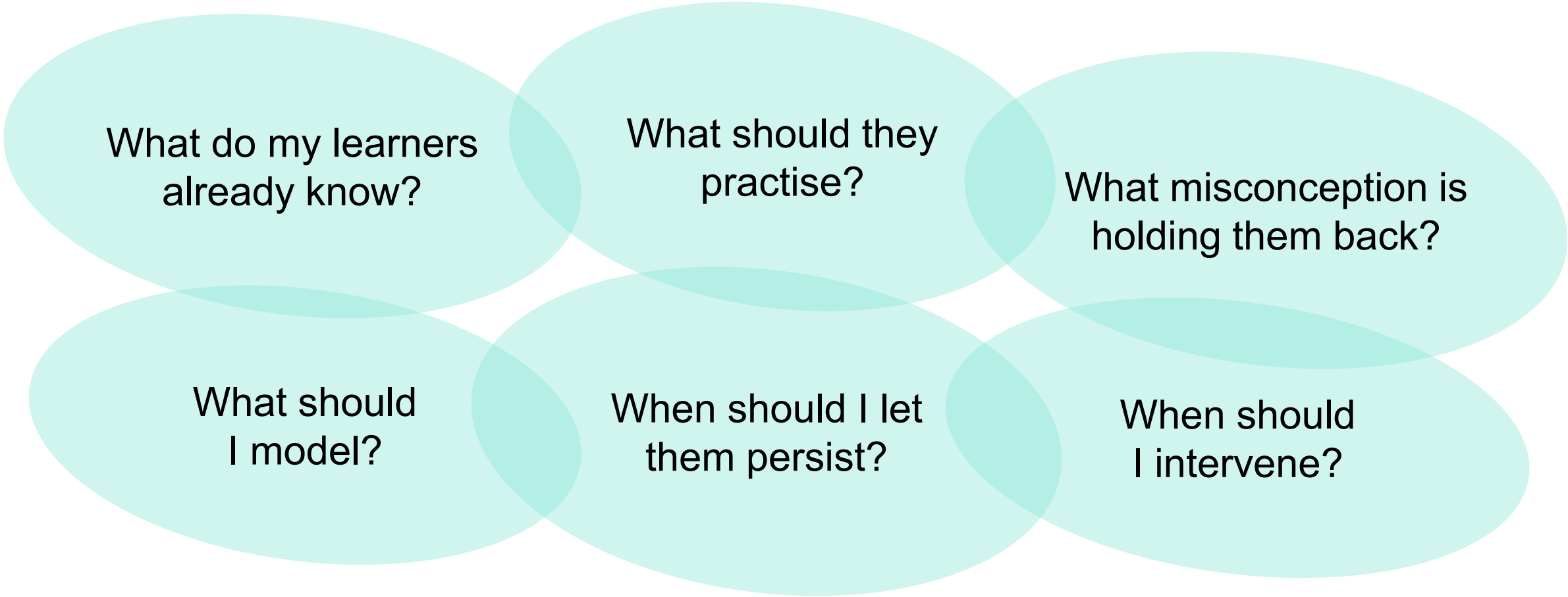






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Teachers already make complex decisions about learning



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Teachers already make complex decisions about learning



AI changes the context



It does not remove the need for educational judgement

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A changing context adds new decisions

- What thinking should remain with the learner?
- Where could AI provide useful support?
- Could AI offer another representation or perspective?
- Is AI extending learning or bypassing it?
- What would count as evidence of understanding?

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Not all friction is a problem to be removed

Friction that obstructs learning

Effort through which learning develops

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Reflection point – what do you think?

In the session we used Menti.com with the following responses

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Knowledge and skills still matter in the age of AI

Summary of responses:

- 79% explicitly described subject knowledge and skills as highly important.
- Subject knowledge helps us ask better questions and check AI's answers.
- AI should support our thinking and creativity. Our own judgement remains essential.
- Teachers remain essential for guidance, empathy and understanding learners' needs.
- Bottom line: participants see expertise as the control system for AI - enabling better questions, reliable judgement and responsible classroom use.

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How important are subject knowledge and skills in the age of AI?

Representative voices from the submissions:

- “AI is a multiplier of capability, not a substitute for competence.”
- “AI is a powerful tool and human judgement is the quality control mechanism.”
- “Gen AI … readily invents plausible but wrong ideas.”
- “Ask better questions. Refine prompts. Spot missing information. Challenge assumptions.”
- “Human skills like critical thinking and empathy drive true career value.”

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How important are subject knowledge and skills in the age of AI?

Innovative

Very important

Extremely most important

Very very important

I want toclesrn. More ho Ai is helpful in education

Very very important we are just facilitator for future generations

very important

Excited

Very important to understand if ai halucinating or not

Very important to be able to figure out the correctness and authenticity of the information/ data

Subject knowledge is essential while skills help transfer beyond to application and synthesis

High

Yes subject knowledge is most important for this time

Subject knowledge is the essential core of education. AI should be used minimal.

Yes it's important

It gives us, educators, an advantage if we are skilful with using AI along with solid subject knowledge.

AI enhances, but does not replace, human knowledge and skills.

It is helpful in the classroom.

The most important edge today is combining subject expertise with AI literacy.

AI enhances, but does not replace, human knowledge and skills.

Very!!!

very much

Still important

Extremely important

Very important

Extremely important

As important as always.

Extremely important !

Extremely important. Otherwise it might be misleading

Very important.

Extremely

As important as ever!

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How important are subject knowledge and skills in the age of AI?

Oh. VERY.	Most important	Very important	Very important in today's world	very important	It is important as AI depends on a device but we need to develop our own understanding	Crucially important	Very very important.
Extremely important as AI doesn't always give the correct answer	Very much important, Without that u can't even command AI correctly	It makes the difference.	It is important to understand their understanding	Very important.	Very Important	very much as its subject knowledge	Very much
Subject knowledge is incredibly important	Key if learners are to be independent	Super important	Very Important	Very important	Extremely important, we won't survive without it.	Very important	Indeed very important
High	Equally important, each one needs the other	Interlinked and cannot be separated	Very important	Innovative	Absolutely	Extremely important	Important

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How important are subject knowledge and skills in the age of AI?

Yes	important	A lot	I think AI helps teacher to provide creative and interactive learning	Very important as this is the basis of teaching and allowing understanding in learners.	Very important	Imperative	its usefull
Very important	Still important	It is fundamental	Very important to make sure there is no misconception	Very important. AI can make mistakes and you need to be able to identify it.	Everything is available on chatgpt to be learnt	There is no substitute for subject knowledge and skills.	Human impact is still more valuable, complex, and important
very important	More crucial	Very important	Essential	Very important to help human	Important to apply critical thinking to AI responses and keep the human in the loop	for context and validation	Quite important and comprehend the real meaning of education
Perhaps more important than ever	Abdolutely important brcsuse students are not parroting animals	Extremely important	Very important	ITs very important	Very important	Very important	Subject knowledge and skills remain essential in the AI era. They enable us to evaluate AI outputs critically, solve problems effectively, and apply technology responsibly and creatively.

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How important are subject knowledge and skills in the age of AI?

Super important but as a supplementary tool

Without subject knowledge, you might not be able to analyse the results of AI.

Very important. It should aid learning.

Extremely important

veryy imprtant

Very important

Extremely important

Knowledge and skills cannot be replaced by Ai

Extremely important

Very important

So much

Very important

Very important

Very important.

Very important

As important as always

AI can help build, subject knowledge... But human skills will always be needed

More crucial than ever

Knowledge and Skills shall only be complemented wnd shaped by the usage of AI rather not a replacement for human thinking and judgement.

very important

Pretty important, basis for prompt

I think its important to understand subject knowledge as an essential learning process which AI tend to bypass it.

Extremely

Equally.. As it is not always reliable

Really helpful to find other point of view quickly

Very decisive

More important than ever. Enables good judgement. Reduces cognitive load.

Very important. It enhances

Very important

Very Important

Vital. These are foundational to the critical thinking needed to critique and apply AI effectively. AI is an enhancement, not a substitute

Can AI teach skills?

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How important are subject knowledge and skills in the age of AI?

very important

verrryyy important!

Very very important

I think its extremely important.

Essential

Increasingly important

Very important, first have knowledge and skills, then use AI

Extremely important

Very important

Somehow more important than before, because the way Gen AI works, it readily invents plausible but wrong ideas (this is also its strength)

It is very important

Very important

Indispensable. Without deep subject knowledge and foundational skills, humans cannot effectively direct AI, verify its accuracy, or solve complex, real-world problems

To make our curriculum/resources more thorough, contextual and relatable, it's essential to have subject knowledge and skills in the age of AI.

Very. It helps them evaluate the quality of the answers they get from AI at the same time enabling them to learn what they need from it

Very important to enter the correct prompts

To improve the precision and accuracy of students' responses which are applicable in their writing, project-based researches and also their mathematical learnings.

Really important to compete with future demand and student learning ways.

Very important to allow the how and what to explain the the skill in explaining phenomenon

Subject knowledge is very important as it streamlines what learners should know in a world of vast information

Both are important

Very important

Absolutely important

I think subject knowledge is important as it gives the useful content that one would need to use AI responsibly.

More than anything

Crucial

Absolutely important to both navigate AI and use AI as a support to knowledge and skills. Can assist in time management.

Extremely important

Still highly essential. Since the teachers are still in the classrooms, you have to have the absolute knowledge.

Extremely important.

It's very important as it will help you discern and soft through information AI provides.

Can't replace

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How important are subject knowledge and skills in the age of AI?

If u do not have the background knowledge, how will u know if AI is generating correctly

A lot

Only if you have the subject knowledge would we be able to get the best of Ai

They are irreplaceable

Important

Students need to hone content knowledge to discern the outputs given by AI. It's extremely important.

Very important

AI will not replace teachers but enhance teaching and learning

Knowledge in a subject is essential to teachers without which AI tools are of no use

For effective prompting, subject knowledge is crucial

Skills are extremely important in an age of AI probably more than subjects!

Very important

Balance is the key

It gives the educators proper idea to deliver the lesson.

Support learning process

Am absolute must have

Very important.

Helpful

Enable us to evaluate AI outputs critically, solve problems, and apply knowledge meaningfully.

Subject knowledge and skills remain essential because they help us think critically, evaluate AI-generated information and use AI effectively.

AI content may nit be authentic

It is a powerful tool but it should be used wisely

very important

I've read an academic article that proposed a liberal arts degree/mentality is actually the one rote way of thinking that AI will not be able to replace in the workforce anytime soon.

Very important

Important but needs balance between human connection

very important

It is important because it determines what a user can generate with it and examine with it generates.

It helps prepare teaching material in a split of seconds knowing when AI hallucinate.

It is very important.

Very important to improve ourself

Extremely

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How important are subject knowledge and skills in the age of AI?

Very important to enable one to cross check and avoid ai hallucinations. You have to be aware of the expected outcomes

Subject knowledge is the foundation. The AI can be used as enhancer or the catalyst.

Extremely important

Important to evaluate quality of information

Very important

It is something that can be transferred as they will learn them firsthand rather than the instant one

VERY important

V. Important

Very important but Ecco on the meet drive me nuts

Important and we have to adapt but ensure to used it as tools

Very important, it definitely enhances learning and understanding

Wry important. With all technology, especially AI, teachers must consider the SAMR model before integrating

Absolutely necessary

It is important for both educators and learners

To notice hallucinated facts from AI

Equally important asking with AI integration

Extremely important

It will improve various skills for all year levels

Very important

Extremely important

extremely

Very important

Essential to verify accuracy, guide students, encourage deeper thinking

It may not always be reliable.

Saves teachers time

Of course it's greatly important

extremely important

You are the expert who can decide what AI produce are appropriate or not so it is incredibly important

To know the difference between between the fact and misinformation

Very important

Subject knowledge is not as important than skills

Absolutely necessary

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How important are subject knowledge and skills in the age of AI?

Very Important

Very important, but also important with a proper balance, knowledge and judgement.

essential

Extremely important

Subject knowledge is for sure important because you won't be able to work with AI

Important to ask more questions and get write decisions

A balance needed as foundation is the knowledge.

Not very. But in the class subject knowledge is important

Yes it is very important in teaching

They complement each other and they both facilitate the understanding of a subject or topic.

Foundation of high rise building

So you know what is actually right

More important than ever - a differentiator

important

Very important

Very important

The strongest professionals will combine deep domain knowledge, practical skills, critical judgement and AI fluency. AI is a multiplier of capability, not a substitute for competence.

Very important

Need of the hour!

Very important

Skills based is more important

It is very important. Having confidence in ones skill and subject knowledge can drive HOW you use AI.

Very important. Ai us a tool, but the person knows what to ask the Ai

Very important

more important than ever

Useful

Very important. Teacher needs to have sufficient knowledge to verify the information shared by AI

They help you to filter what AI generates so that you can verify the information generated before sharing them with learners.

Important escpecially ddigital literacy

Very important

Super important

It is very essential

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How important are subject knowledge and skills in the age of AI?

Extremely. Teachers guide and challenge learners to grow their thinking processes, at a point where they don't realize that it is needed. AI won't do that till it's asked to do it.

imp to be updated

Find información fast

support

very important

It is very exciting and helpful.

Its important to write proper prompt to ask any question to AI so if we are knowledgeable and skillful we could ask appropriate questions.

Gain more idea

Necessary so that it will be fruitful and productive

V important

Important

Very important in today's competitive and busy life, with so many challenges.

Very important because they need to be able to distinguish true/relevant information from fake information

It's the subject knowledge and the skills that can help in professional usage of AI

Promoting knowledge to a higher level

Very important, to give better prompt

Very important

Extremely important

Subject knowledge and skills remain essential in the age of AI. AI supports learning, but we still need critical thinking, creativity, and understanding to use it effectively and responsibly.

It is very important but i would still insist on teaching students the safe way to use it

How important are subject knowledge and skills in this age of AI?

AI can provide information, but subject knowledge helps us understand it, and skills help us apply it. The future belongs to people who combine strong subject knowledge, essential human skills, and th

It's really important because to some extent AI cannot replace human intelligence

Very important

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An impressive output may conceal limited learning

- Information ≠ knowledge
- Performance ≠ learning
- Output ≠ understanding



[Source] AI-generated fictional Cambridge 2300 illustration, created 19 October 2026

Knowledge gives learners something to think with

Subject knowledge helps learners:

- recognise what is plausible
- notice mistakes and omissions
- connect new ideas with existing understanding
- ask more precise questions
- evaluate evidence within a discipline
- apply understanding in a different context

Skills enable learners to use what they know

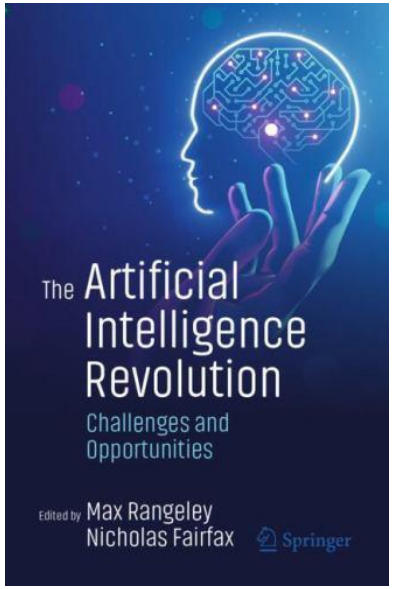
- explaining and reasoning
- analysing and evaluating
- solving unfamiliar problems
- thinking creatively
- communicating effectively
- reflecting and self-regulating
- making responsible decisions

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Cognitive offloading

Weakening:

- Conceptual understanding
- Procedural memory
- Long-term retention





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Cognitive surrender?!

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If AI can do more of the work, what should learners still do for themselves?

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A learner uses AI to produce an excellent answer

What would you need to see before concluding that learning had taken place?

- Can they explain it?
- Can they evaluate it?
- Can they improve or challenge it?
- Can they apply the understanding elsewhere?
- Can they continue without the generated response?

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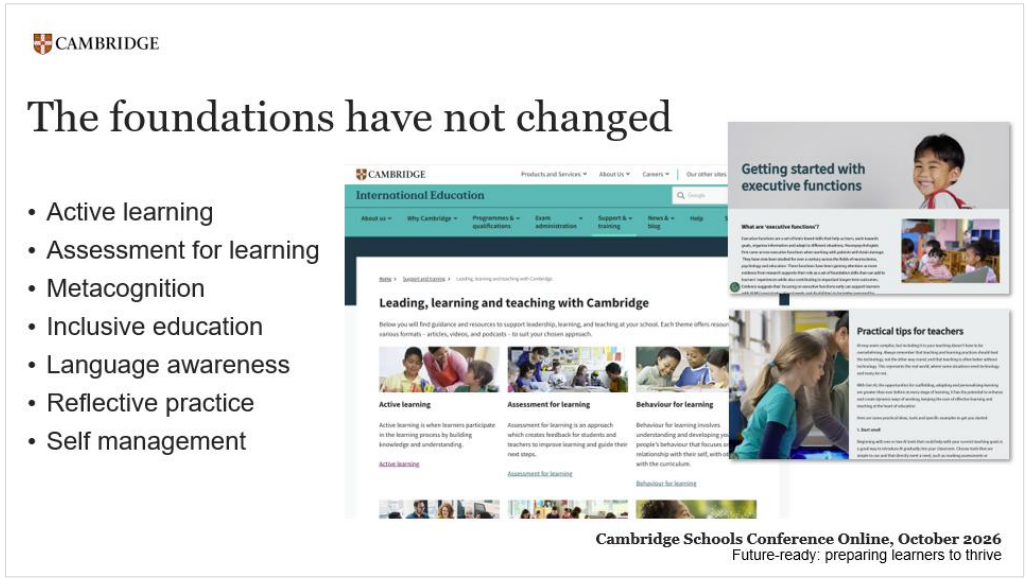
Purpose before possibility

- What is the intended learning?
- What knowledge should learners develop or use?
- What skills should they practise?
- Where must the thinking remain with the learner?
- How could AI meaningfully extend the learning?

The Cambridge approaches help us make those decisions

Active learning:

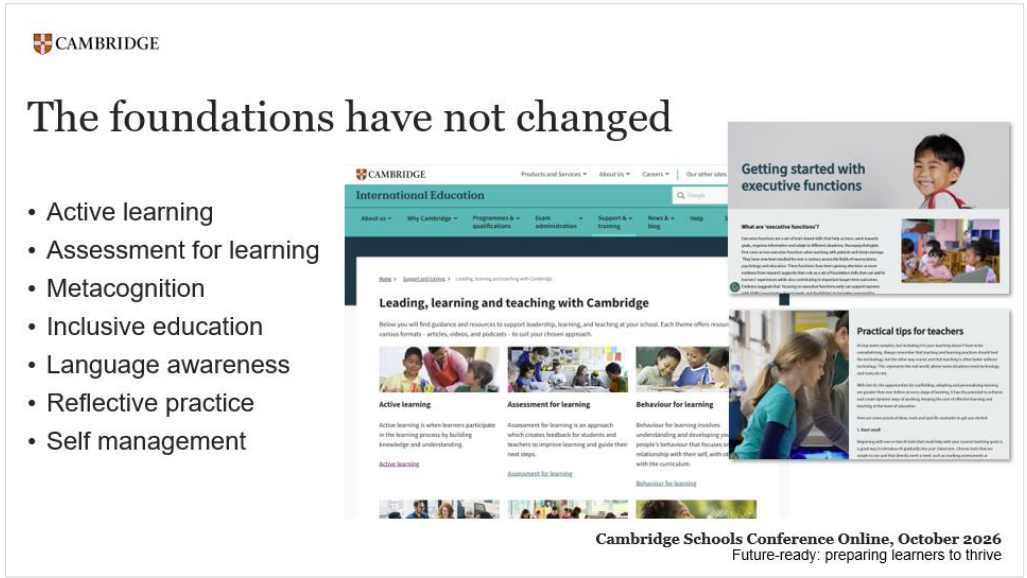
- What is the learner doing and thinking?



The Cambridge approaches help us make those decisions

Assessment for learning:

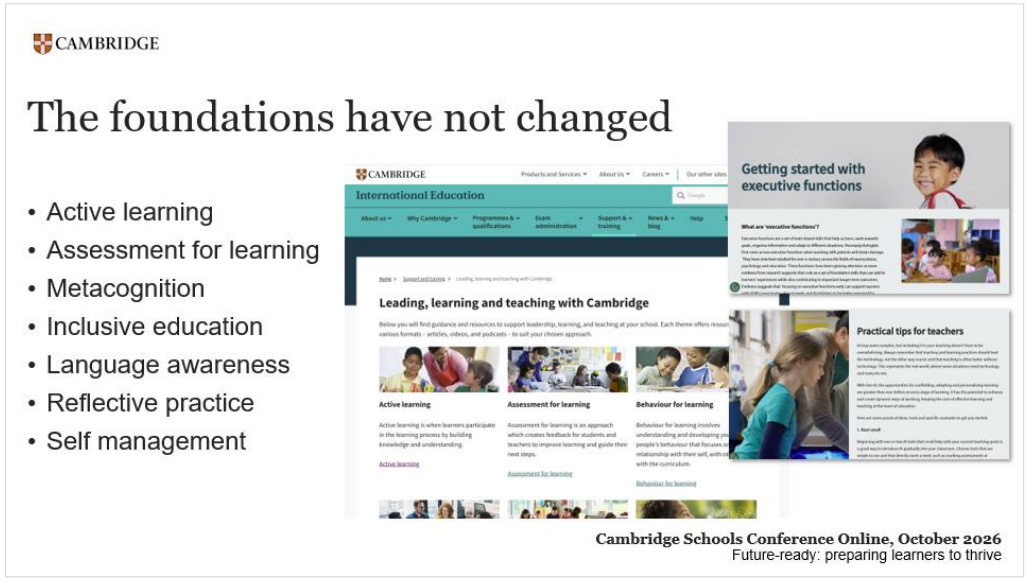
- What evidence shows understanding?



The Cambridge approaches help us make those decisions

Metacognition:

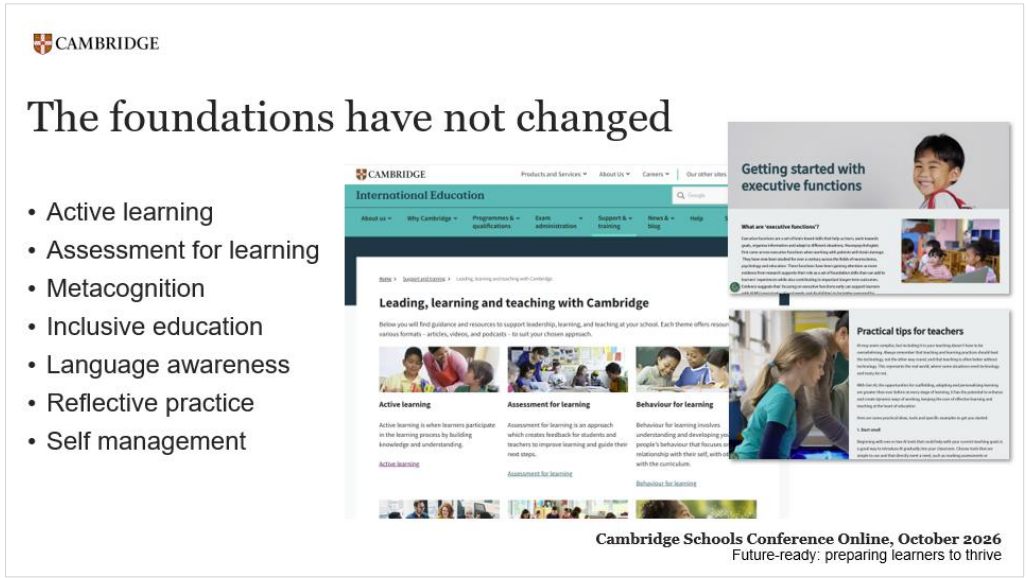
- Can learners explain how AI affected their process?



The Cambridge approaches help us make those decisions

Inclusive education:

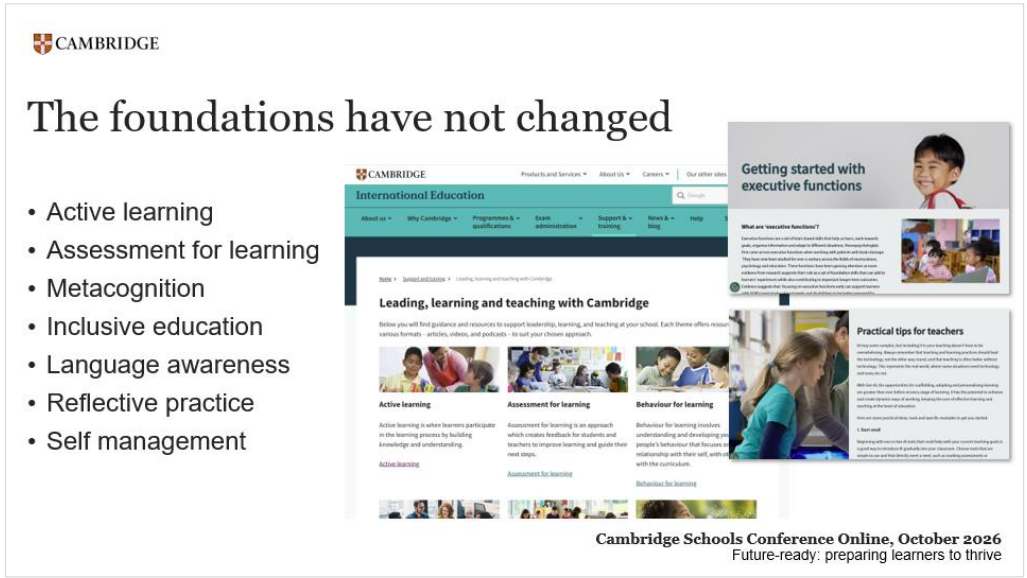
- Does this help remove an irrelevant barrier?



The Cambridge approaches help us make those decisions

Language awareness:

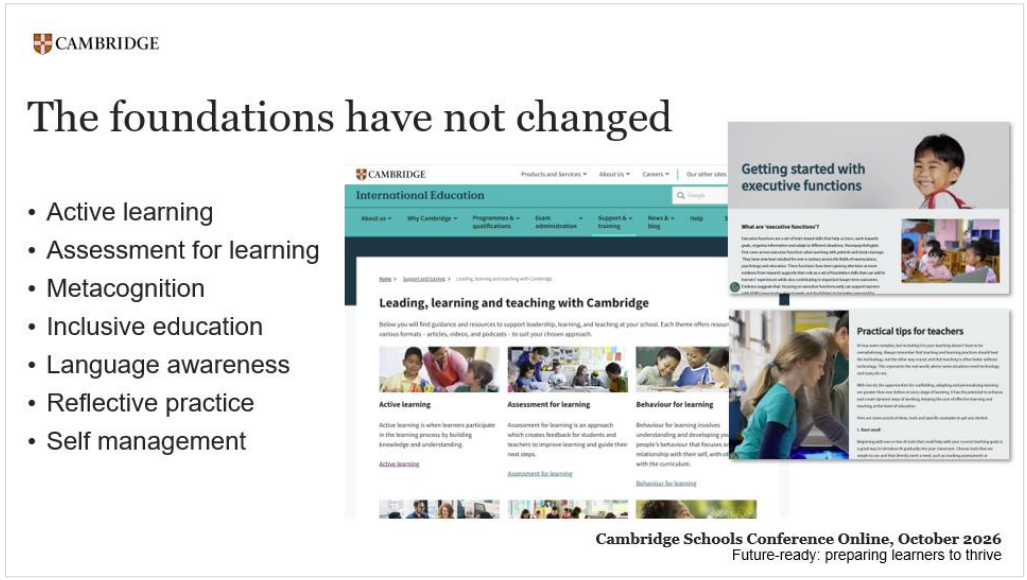
- Is language supporting or concealing understanding?



The Cambridge approaches help us make those decisions

Reflective practice:

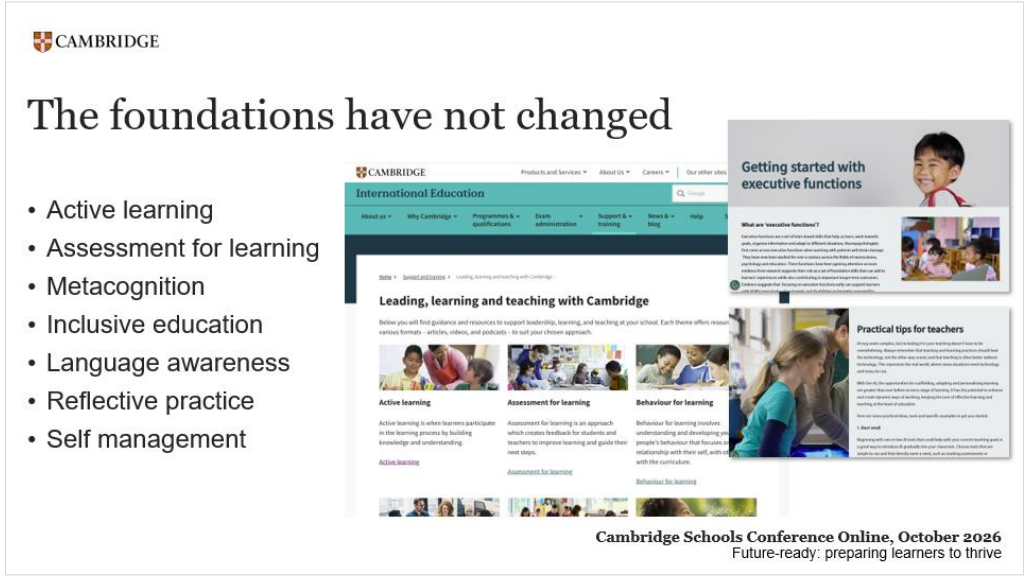
- What should the teacher retain, adapt or stop?



The Cambridge approaches help us make those decisions

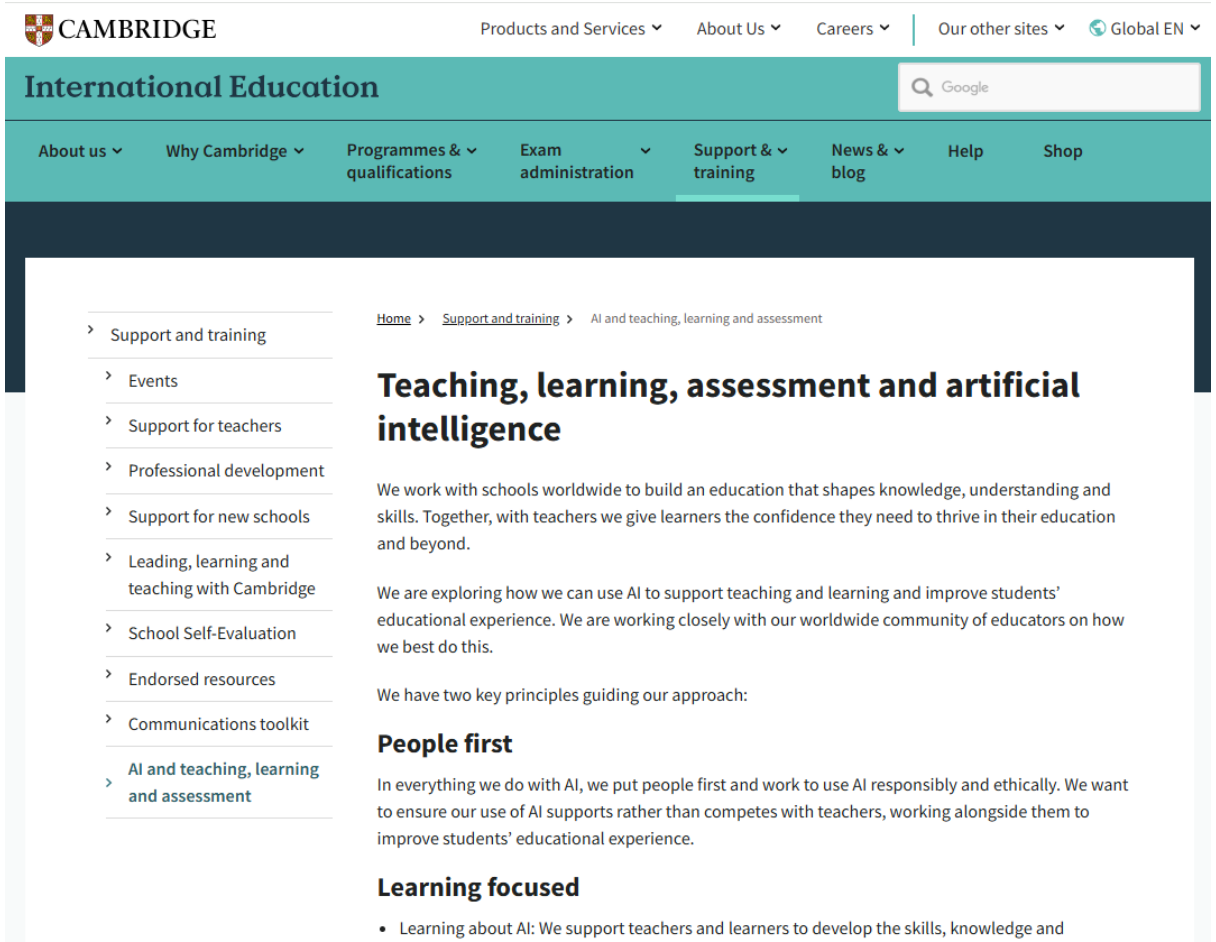
Self management:

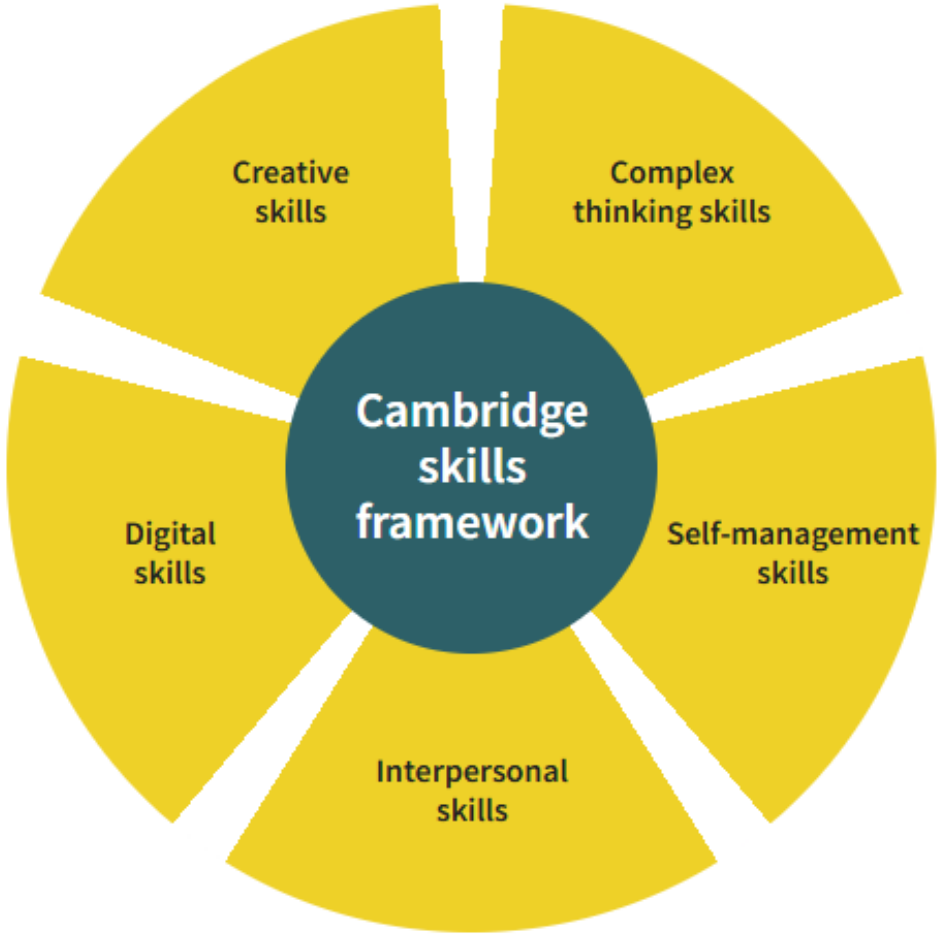
- Does AI help learners plan and make their own decisions?



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Continue the conversation





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Subject knowledge and skills matter more than ever in the age of AI

AI can generate answers

Learners still need to build understanding

Teachers create the conditions to make this happen

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Subject knowledge and skills matter more than ever in the age of AI

Knowledge helps us judge

Skills help us apply

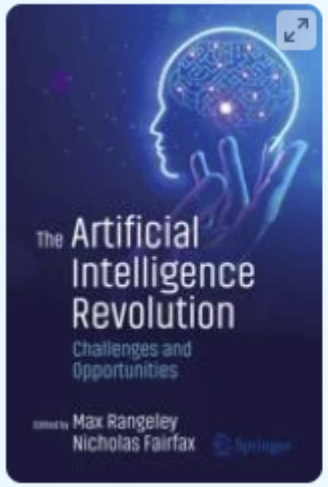
Understanding helps us adapt

Teachers help learners develop all three

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Cognitive offloading

- Accessing information ≠ constructing knowledge



The Artificial Intelligence Revolution

Challenges and Opportunities

Book | May 2026

The Memory Paradox:
Why Our Brains Need Knowledge in an Age of AI

Barbara Oakley,[1] Michael Johnston,[2] Ken-Zen Chen,[3] Eulho Jung,[4] Terrence Sejnowski[5]

Abstract: In an era of generative AI and ubiquitous digital tools, human memory faces a paradox: the more we offload knowledge to external aids, the less we exercise and develop our own cognitive capacities. This chapter offers the first neuroscience-based explanation for the observed reversal of the Flynn Effect—the recent decline in IQ scores in developed countries—linking this downturn to shifts in educational practices and the rise of cognitive offloading via AI and digital tools. Drawing on insights from neuroscience, cognitive psychology, and learning theory, we explain how underuse of the brain's declarative and procedural memory systems undermines reasoning, impedes learning, and diminishes productivity. We critique contemporary pedagogical models that downplay memorization and basic knowledge, showing how these trends erode long-term fluency and mental flexibility. Finally, we outline policy implications for education, workforce development, and the responsible integration of AI, advocating strategies that harness technology as a complement to – rather than a replacement for – robust human knowledge.

Keywords: cognitive offloading, memory, neuroscience of learning, declarative memory, procedural memory, generative AI, Flynn Effect, education reform, schemata, digital tools, cognitive load, cognitive architecture, reinforcement learning, basal ganglia, working memory, retrieval practice, schema theory

1. Introduction

Educators in recent decades have often championed "learning how to learn" and critical thinking skills over rote knowledge, encapsulated in the refrain: "Why memorize it when you can look it up?" Yet this modern mindset carries a paradox. Just as schools and students began relying on calculators and the internet, a significant shift occurred. Decades of steadily rising IQ scores—the famed Flynn Effect—suddenly leveled off and even began to reverse in several high-income countries. Although IQ is undoubtedly influenced by multiple factors, considerable evidence suggests this educational shift away from explicit content instruction and memorization, combined with increased reliance on external memory aids and continuous digital distractions, has actively contributed to declining cognitive performance. This chapter asks a provocative

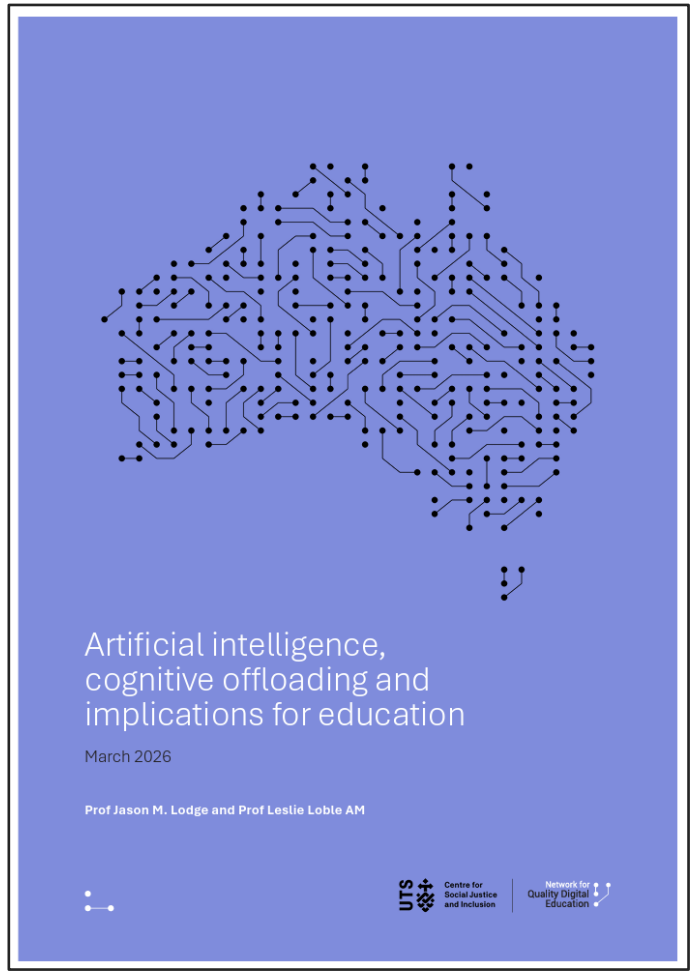
[1] Barbara Oakley, Oakland University, oakley@oakland.edu
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[3] Ken-Zen Chen, National Yang Ming Chiao Tung University, kenzenchen@nycu.edu.tw
[4] Eulho Jung, Uniformed Service University of the Health Sciences, eulho.jung@usuhs.edu
[5] Terrence J. Sejnowski, The Salk Institute for Biological Studies, terry@snl.salk.edu

Oakley, B., Johnston, M., Chen, K.-Z., Jung, E., & Sejnowski, T. (2025). "The Memory Paradox: Why Our Brains Need Knowledge in an Age of AI." In The Artificial Intelligence Revolution: Challenges and Opportunities (Springer Nature, forthcoming).

Cognitive offloading

- Accessing information ≠ constructing knowledge

"There is a growing body of evidence that using AI can short-circuit the cognitive effort required for sustainable, deep learning, creating 'false mastery' with potentially long-term consequences."



Lodge J. M. and Loble L (2026). *Artificial intelligence, cognitive offloading and implications for education*, University of Technology Sydney, doi:10.71741/4pyxmbnjaq.31302475.

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Cognitive offloading

- Accessing information ≠ constructing knowledge

- Learning depends on:
  - Active cognitive effort
  - Practice in recall, explanation, and sense-checking

- Tools that remove effort too early can weaken:
  - Conceptual understanding
  - Procedural memory
  - Long-term retention

