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Unlocking higher-order thinking skills

Exploring systems thinking, analogical problem solving and metacognition in our secondary classrooms

Irenka Suto, Florence Kemsley

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Future-ready: preparing learners to thrive

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Presenters

Irenka Suto

Florence Kemsley

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Today's workshop

This workshop delves into the connections between skills and knowledge in the Cambridge Pathway. You will:

- explore systems thinking, kind and wicked problem-solving, analogical and metacognitive skills
- discuss best teaching practices and share experiences
- examine the relationship between higher order thinking skills and the Cambridge learner attributes
- participate in activities to help learners develop these skills.

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Let's start with a question

What will be more important for today's learners, thinking about equipping them well for the future?

You might want to consider technology change, sustainability issues, the pace of change, wellbeing:

A. Knowledge?

B. Skills?

C. Both knowledge and skills?

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Can’t we access all the information we need instantly?

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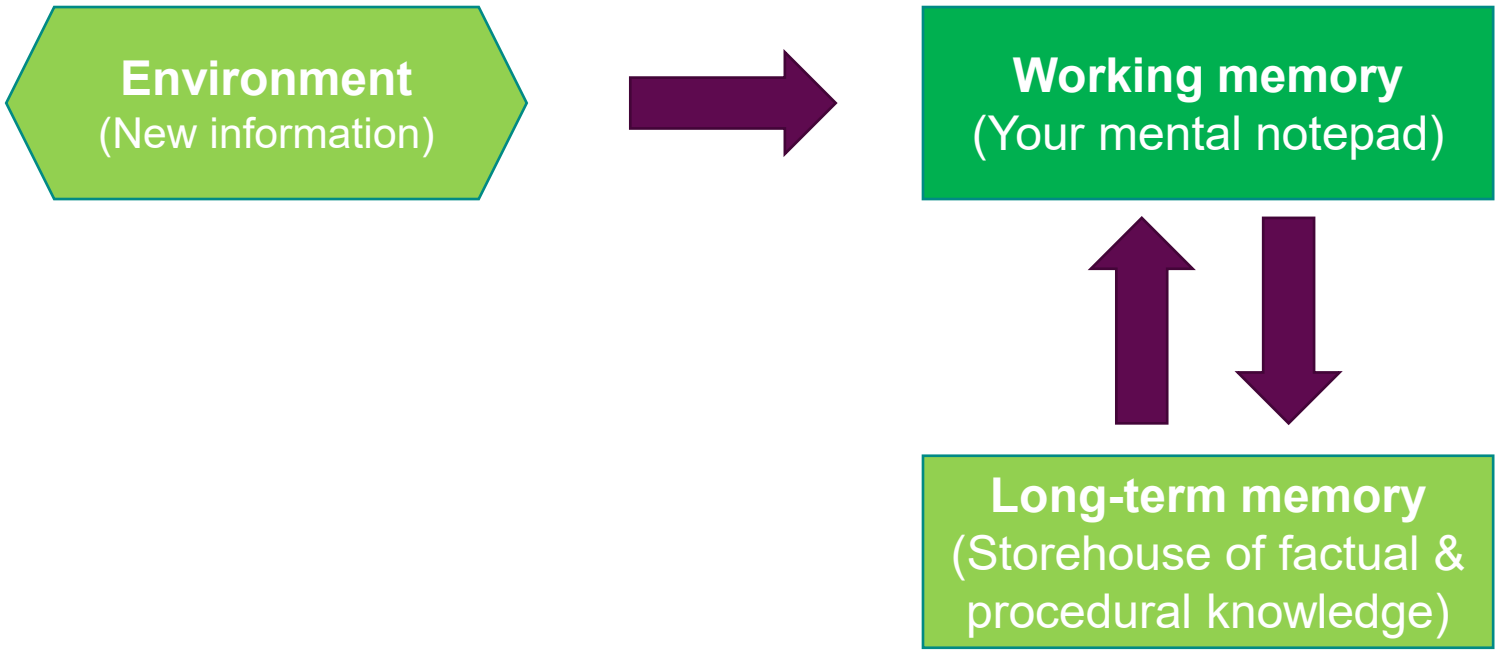
The good news

Curricula can be both knowledge-rich AND skills-rich.

Skills and knowledge are deeply intertwined.

“Deeper thinking skills need content on which to work. You cannot use deeper thinking skills unless you have something to think about.” (John Hattie, 2015)

Just about the simplest model of the mind possible



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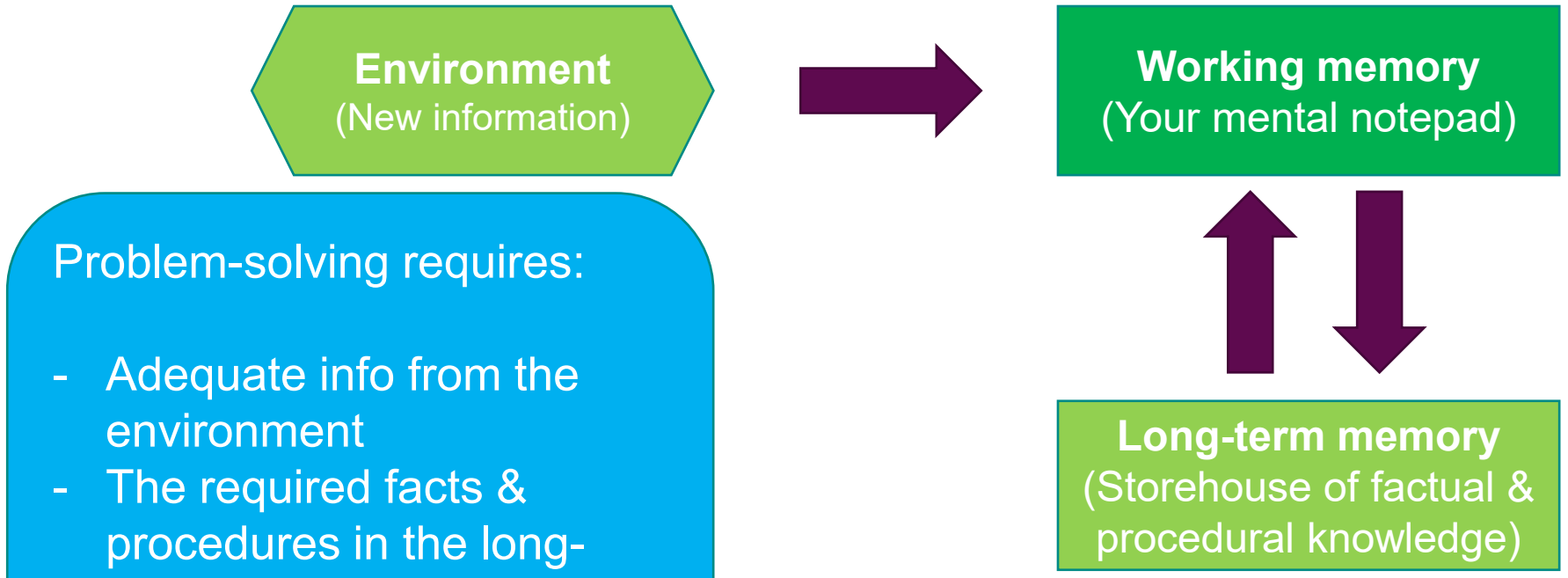

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What are ‘future’ skills

- There are hundreds of skills that could be considered necessary for the future.

- Researchers in the Digital Education Futures Initiative (DEFI) reviewed 99 frameworks. Their analysis generated this figure.

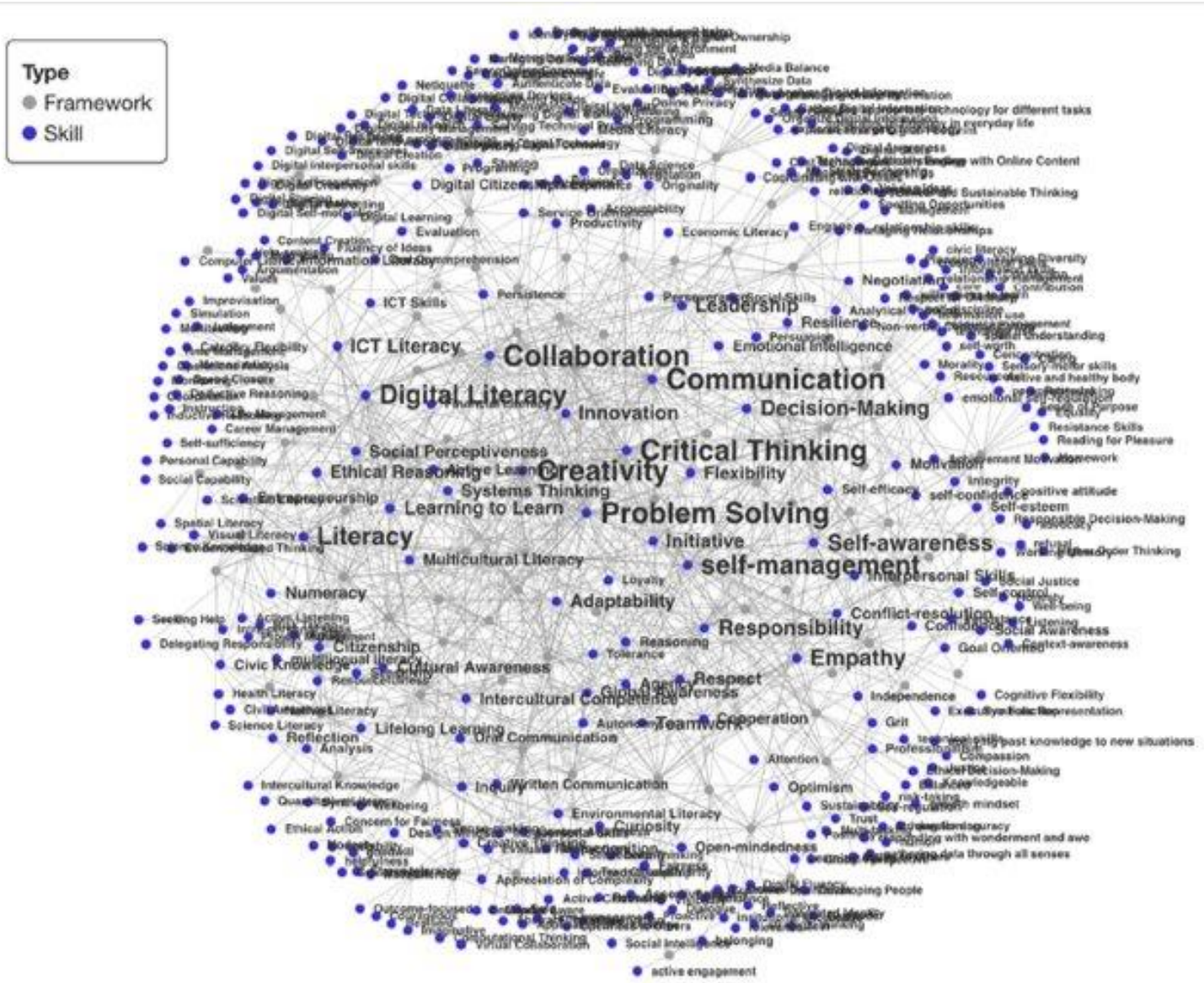

Figure 3. Two Mode Network Diagram of Frameworks and Skills.

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Nine meta-categories of future skills

DEFI researchers recently conducted a scoping review (Kotsiou et al. 2022), analysing 99 frameworks of future skills which cover 341 skills.

These skills were grouped into nine meta-categories.

- Higher order thinking skills
- Dialogue skills
- Digital & STEM literacy
- Values
- Self-management
- Lifelong learning
- Enterprise/ innovation
- Leadership skills
- Flexibility

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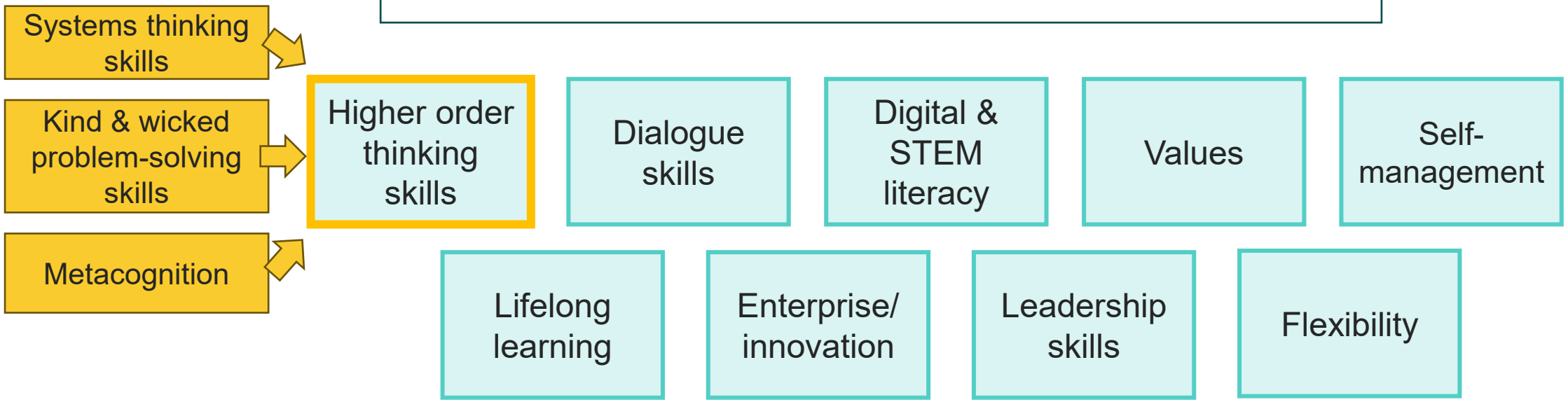

Systems thinking skills

- About examining relationships and dynamics within systems that are often complex, enabling informed decisions that account for broader contexts and long-term consequences of actions.
- Arguably, some of the most pressing global issues, such as war, famine, poverty, and climate change, are fundamentally the result of systemic failures.

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Problem-solving skills

- Often involves overcoming obstacles to achieve goals.
- **Analogical thinking**, which identifies similarities across different contexts, is often critical.
- **Kind** problems are well-defined with clear goals, established rules, reliable feedback, and predictable solutions (e.g. chess problems, computer programming).
- **Wicked** problems are poorly-defined, multifaceted, ever-evolving challenges. Information is often incomplete or contradictory (e.g. deforestation, political problems).

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Metacognitive skills

- Thinking about one's own thinking
- This involves planning, monitoring, evaluating, changing, and reflecting on one's own learning behaviours.

Metacognitive knowledge:

(e.g. I have trouble remembering dates)

Metacognitive regulation:

(e.g. This problem-solving strategy isn't working so I should try something else).

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Where do these skills feature in Cambridge subjects?

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Activity (in pairs)

- We have collated some specimen questions from different AS and A level subjects (English Language, Geography, Physics and Psychology).

- Using the definitions of the future skills we have highlighted, consider whether tackling these questions would help learners to develop these skills.

- Discuss with a partner

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Feedback

- How did you find the task?

- What can we do to help learners understand the skills they are developing through studying subject disciplines?

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Nurturing skills nurtures the Cambridge Learner attributes

Cambridge learners	Cambridge teachers
Confident in working with information and ideas – their own and those of others	**Confident** in teaching their subject and engaging each student in learning
Responsible for themselves, responsive to and respectful of others	**Responsible** for themselves, responsive to and respectful of others
Reflective as learners, developing their ability to learn	**Reflective** as learners themselves, developing their practice
Innovative and equipped for new and future challenges	**Innovative** and equipped for new and future challenges
Engaged intellectually and socially, ready to make a difference	**Engaged** intellectually, professionally, and socially, ready to make a difference

Where can you see links between the skills we've been discussing and our Learner and Teacher Attributes?

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Higher-order thinking skills in published resources

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How can we support students with these skills?

Systems thinking

Cambridge International AS & A Level Global Perspectives – analysis and evaluation of different healthcare systems:

Some other countries, for example the USA, have a healthcare system based on private health insurance. There are no limits on the range of treatments available, no compromises on the standard of care and no significant waiting lists – provided you have the ability to pay or your insurers agree to pay. If your financial resources are more limited, you will receive considerably less or perhaps no medical treatment at all, however ill you are. Yet when former President Obama introduced a system in the USA with more publicly controlled elements and the requirement for everyone to have the option of reasonably priced health insurance, he met fierce political opposition.

DISCUSSION POINT

- What is the fairest system of healthcare? Is this the same as the most effective one?
- Does government healthcare place unacceptable limits on our ability to choose our own medical treatments?
- What about countries where little or no modern healthcare is available – public or private?
- What about healthcare in your own country? How does it compare with these alternatives?

Cambridge International AS & A Level Biology – maintaining the health of astronauts on a mission to Mars with reference to homeostatic systems:

Question for discussion

The weightlessness experienced by astronauts during space travel has significant effects on the normal working of their bodies.

There are plans for astronauts to travel long distances into space. For example, it takes spacecraft about seven months to reach Mars from Earth. Discuss the problems involved in maintaining the health of astronauts on a manned mission to Mars and suggest some solutions to the problems you identify.

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How can we support students with these skills?

Problem solving skills

2 The price of a product falls from $5 to $4. As a result, its supply in a given time period falls from 800 units to 700 units.

What is the PES?

A 0.71
B 0.625
C 1.6
D 0.5

3 A firm supplies 10 units of a product at $48 per unit.

If the PES is 4, how many units will the firm supply at a price of $60 per unit?

A 10
B 20
C 40
D 60

Cambridge International AS & A Level Economics – Kind problem solving. Students must make calculations using the standard PES formula.

Cambridge International AS & A Level Global Perspectives – Wicked problem solving. Students must identify a complex problem and propose solutions.

ACTIVITY 7.6

Consider the problem you have been working on with your team, or another issue that relates to one of the syllabus topics and is also relevant to your local area. Write some short notes that cover:

- why it is a problem
- why it is relevant to your local area and how it relates to other parts of the world
- possible sources of evidence you could use to show this and any specific pieces of evidence you have already found
- some ideas on how these pieces of evidence support one another
- a possible solution to the problem
- the pieces of evidence you have found that would be most effective in justifying that solution.

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How can we support students with these skills?

Metacognitive skills

SELF-ASSESSMENT CHECKLIST

Let's revisit the Knowledge focus and Exam skills focus for this chapter.

Decide how confident you are with each statement.

Now I can:	Show it	Needs more work	Almost there	Confident to move on
define *unified atomic mass unit* as one-twelfth of the mass of a carbon-12 atom	Write a definition for this term in your own words.			
define and use the terms *relative atomic mass*, *isotopic mass* and *formula mass* in terms of unified atomic mass unit	Write definitions for these terms in your own words.			
define and use the term *mole* in terms of the Avogadro constant	Recall the value of the Avogadro constant and use it to calculate numbers of particles.			

Cambridge International AS & A Level Chemistry – Self-assessment checklists at the end of each chapter.

Cambridge International AS & A Level History – Students reflect on and clarify their understanding through discussion.

Reflection

Discuss your response to the Ems Telegram with another student. Did you reach similar conclusions about Bismarck's conduct? Would you change your mind about him in the light of your discussion?

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Resource creation activity

- **Objective**: Create new resources that promote higher-order thinking.

- **Activity**: In groups, create an idea for a new educational resource (e.g., a worksheet, project outline, or assessment) designed to develop higher-order thinking skills.

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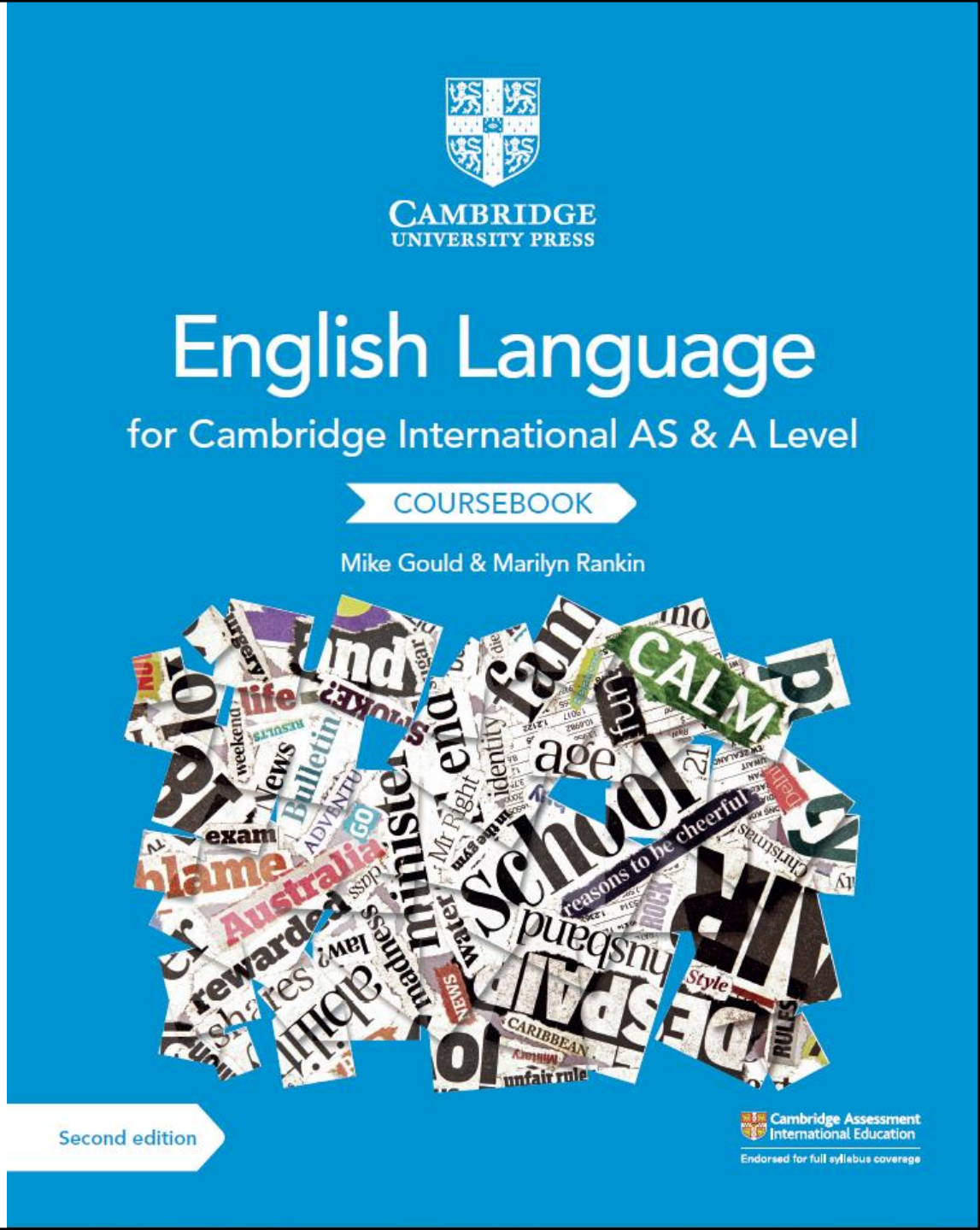
Cambridge International AS & A Level English

Take the following learning objectives to create a resource that develops higher-order thinking skills:

LO1: Understand what voice and viewpoint are.

LO2: Explore how they contribute to the effects of a text.



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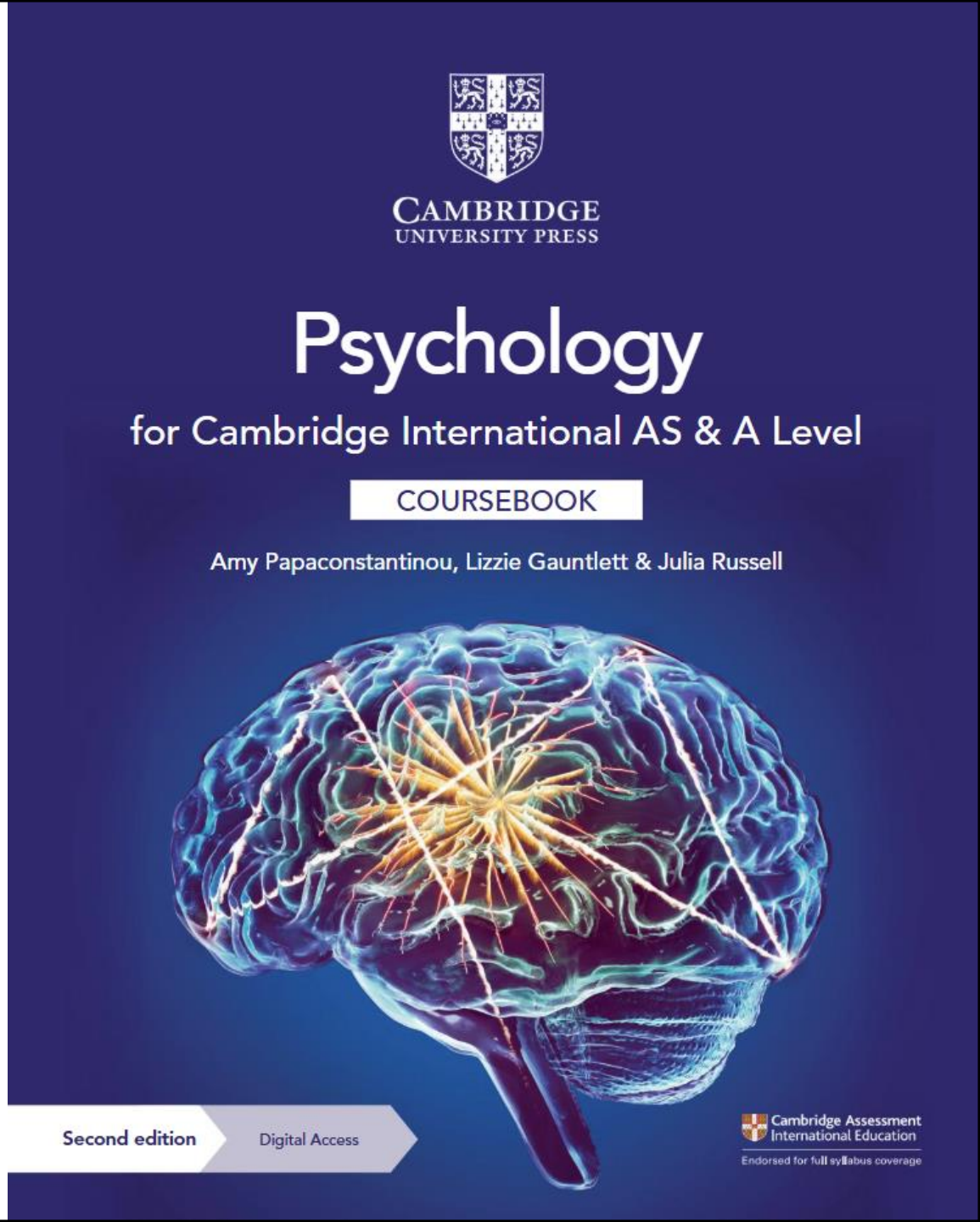
Cambridge International AS & A Level Psychology

Take the following learning objectives to create a resource that develops higher-order thinking skills:

LO1:Evaluate the use of experiments in psychological research including the use of experimental and control groups/ control conditions.

LO2: Apply knowledge of experiments to a given novel research scenario.



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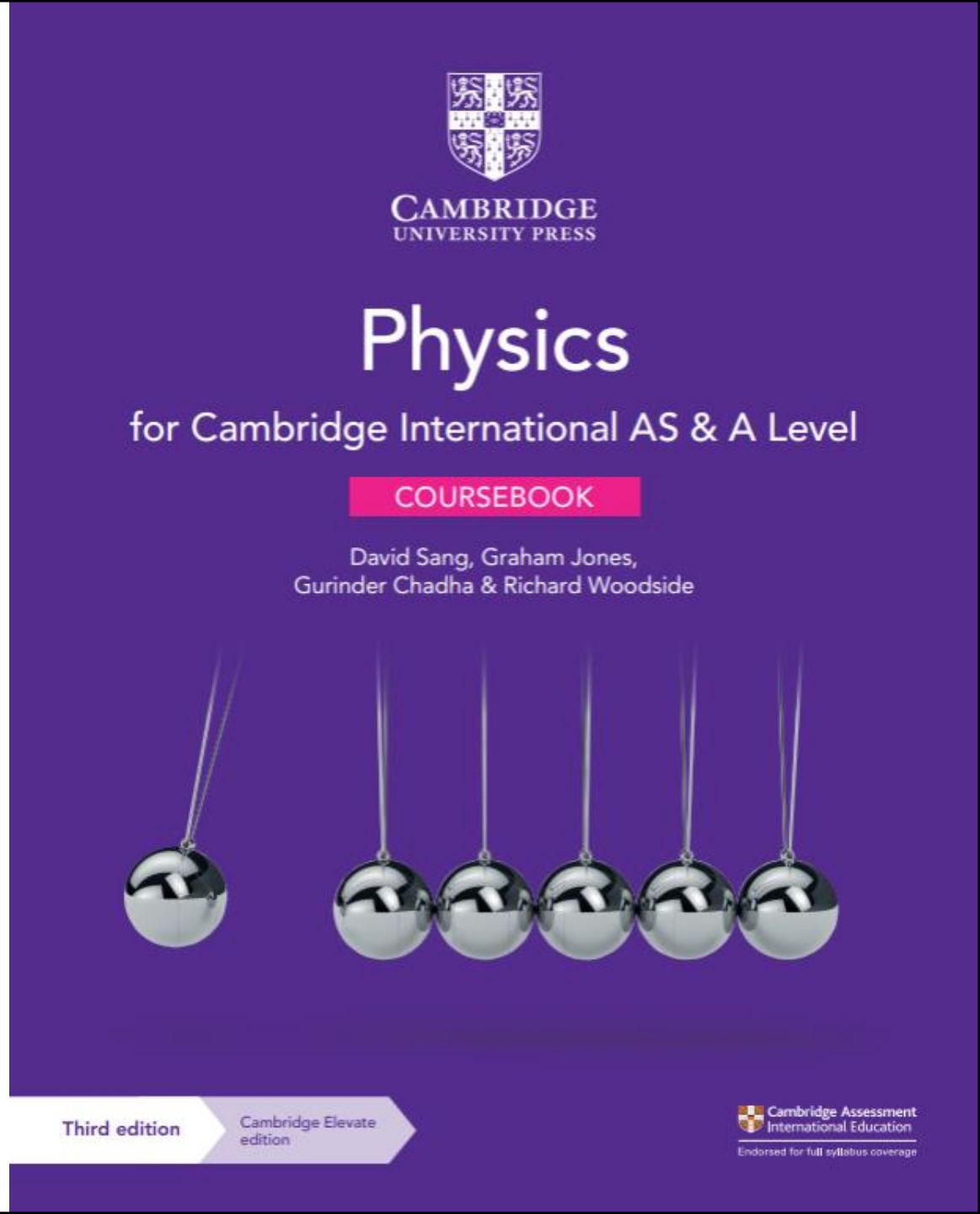
Cambridge International AS & A Level Physics

Take the following learning objectives to create a resource that develops higher-order thinking skills:

LO1: Understand the use of X-rays in imaging internal body structures, including an understanding of the term contrast in X-ray imaging.

LO2: Understand that computed tomography (CT) scanning produces a 3D image of an internal structure by first combining multiple X-ray images taken in the same section from different angles to obtain a 2D image of the section, then repeating this process along an axis and combining 2D images of multiple sections.



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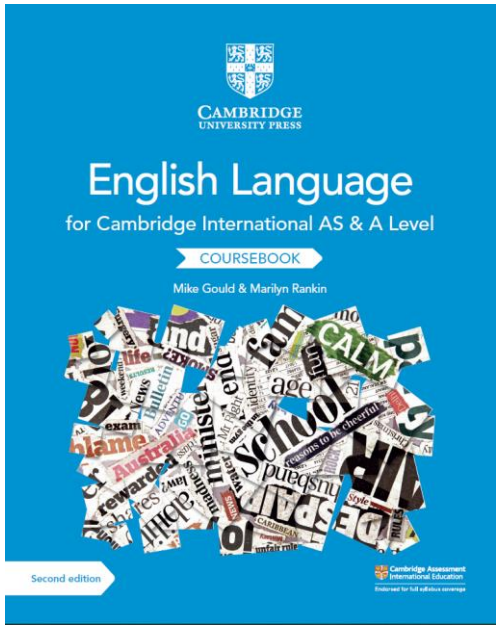
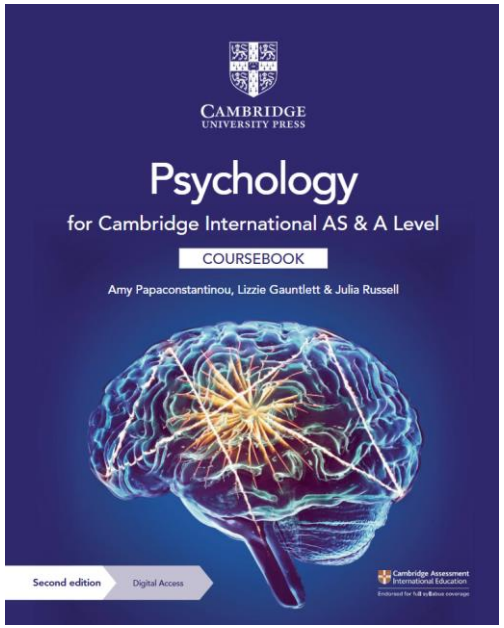
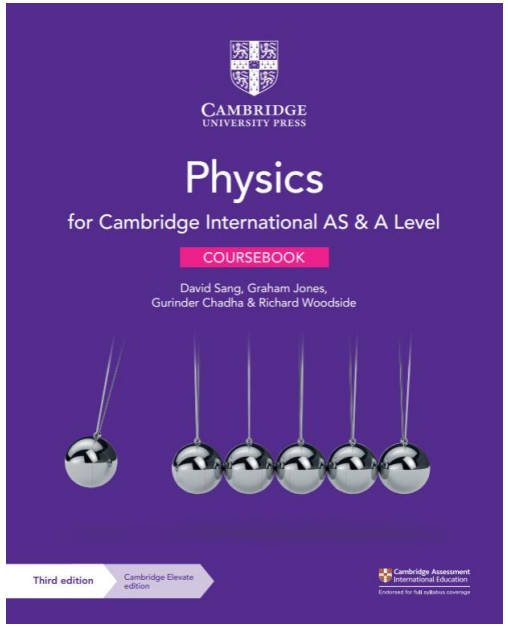
Feedback

- Now report back to the whole group about the activity that you created in your group.

- How can we develop published resources that support these skills?







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Conclusion

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Any questions?

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Get in touch!

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