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Supporting the Professiona Learning of School Leaders and Teachers

LCCS NW2 Session 2

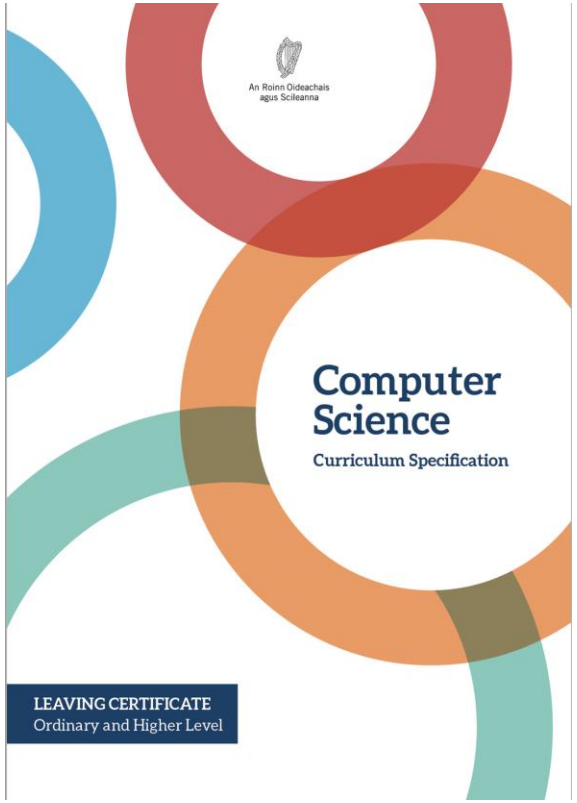
Computational Thinking II

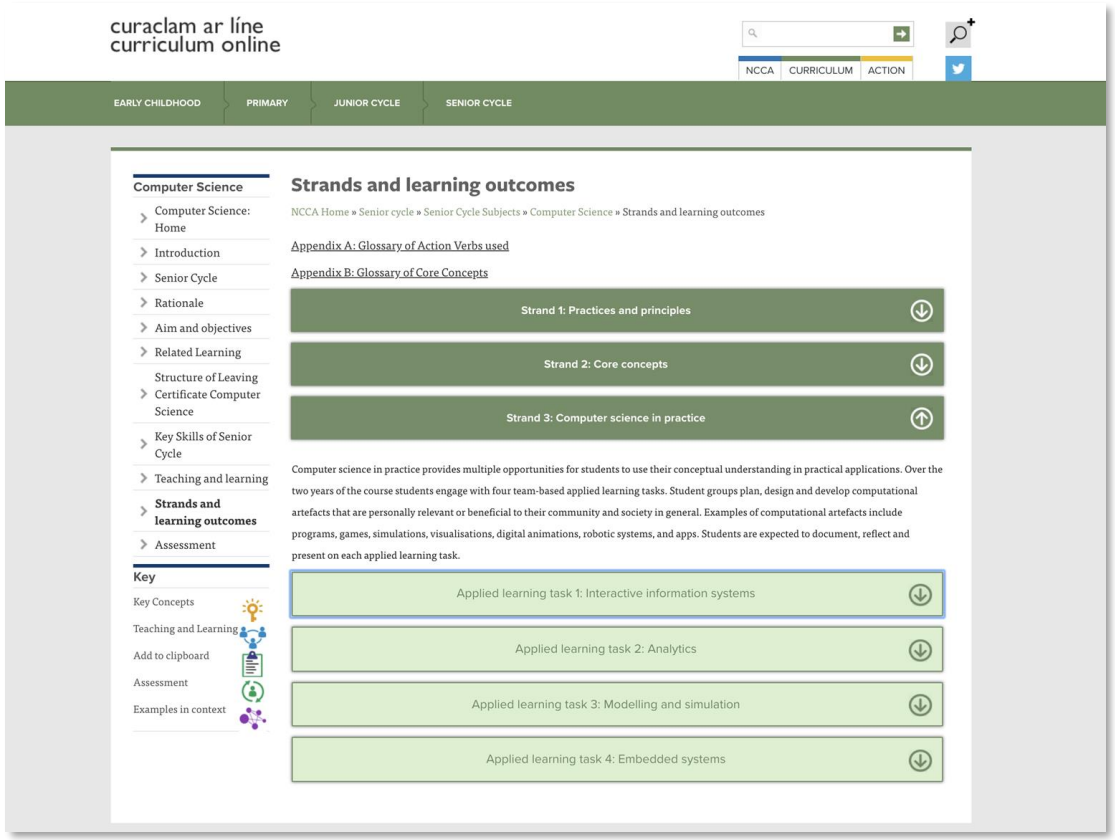
By the end of this session …

Participants will have been enabled to…

- develop their understanding of Computational Thinking (CT) concepts
- consider the questions: What is CT? Why is CT important?
- reflect on successful pedagogies for teaching CT skills
- analyse and develop solutions to problems of various types using CT skills such as abstraction, decomposition, pattern recognition and algorithmic thinking

LCCS Curriculum Specification





https://www.curriculumonline.ie

What does the specification say?

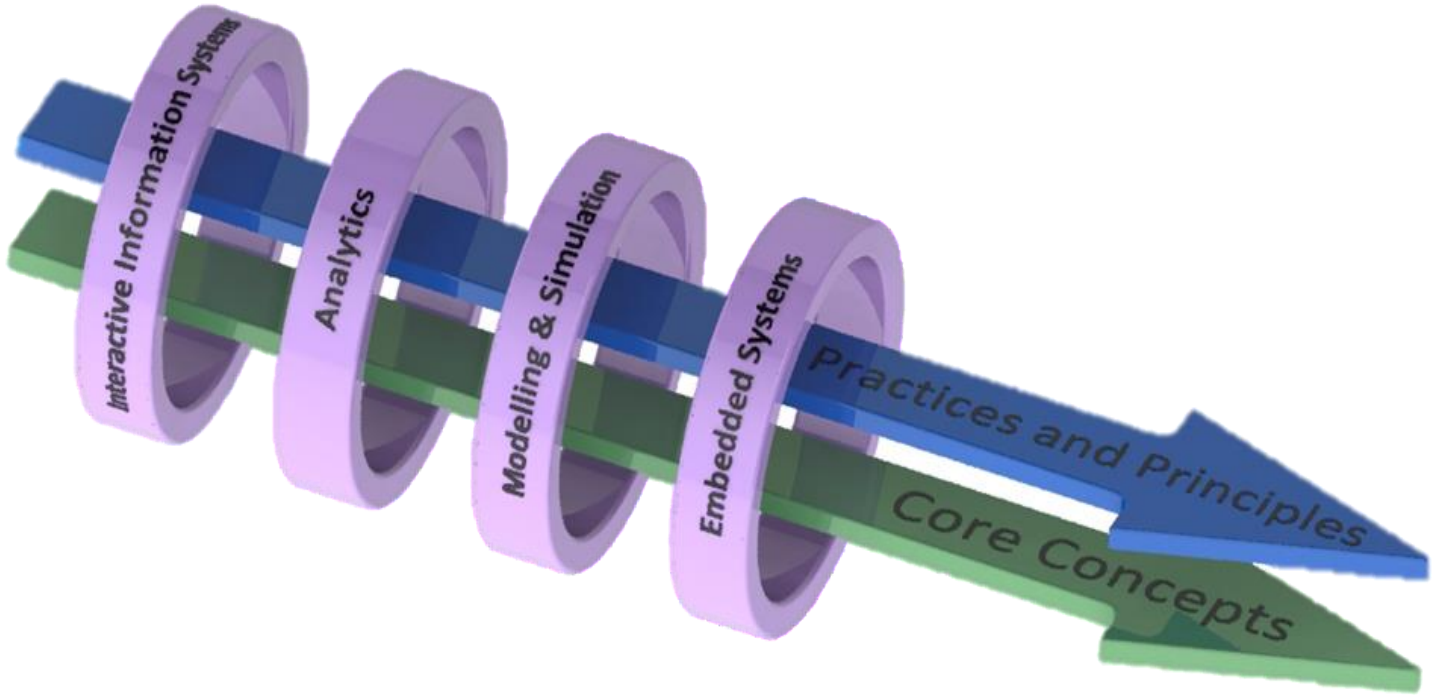
*"Computer science is the study of computers and algorithmic processes. Leaving Certificate Computer Science includes how programming and **computational thinking** can be applied to the solution of problems, and how computing technology impacts the world around us."*

[LCCS Spec. Page 2, paragraph 1]

Strand 1: Practices and principles	Strand 2: Core concepts	Strand 3: Computer science in practice
▸ Computers and society ▸ Computational thinking ▸ Design and development	▸ Abstraction ▸ Algorithms ▸ Computer systems ▸ Data ▸ Evaluation/Testing	▸ Applied learning task 1 - Interactive information systems ▸ Applied learning task 2 - Analytics ▸ Applied learning task 3 - Modelling and simulation ▸ Applied learning task 4 - Embedded systems

What does the specification say?

"The role of programming in computer science is like that of practical work in the other subjects — it provides motivation, and a context within which ideas are brought to life. Students learn programming by solving problems through ***computational thinking*** *processes and through practical applications such as applied learning tasks."* LCCS specification (2017)



What is Computational Thinking?

"Computational Thinking is the thought processes involved in formulating problems and their solutions so that the solutions are represented in a form that can be effectively carried out by an information-processing agent."

Jeannette M. Wing
Carnegie Mellon University (2011)

Computational Thinking Concepts

Source: https://csunplugged.org/en/computational-thinking/

Simple Daily Examples

Looking up a name in an alphabetically sorted list

- Linear: start at the top
- Binary search: start in the middle

Standing in a queue at a bank, supermarket, check in desk, passport control

- Performance analysis of task scheduling

Taking your children to football, music and the swimming pool

- Traveling salesman (with more constraints)

Cooking a gourmet meal

- Multi-tasking, Parallel processing:

Cleaning out your garage

- Keeping only what you need vs. throwing out stuff when you run out of space.

Storing away your child's toys scattered on the floor

- Using hashing (e.g., by shape, by color)

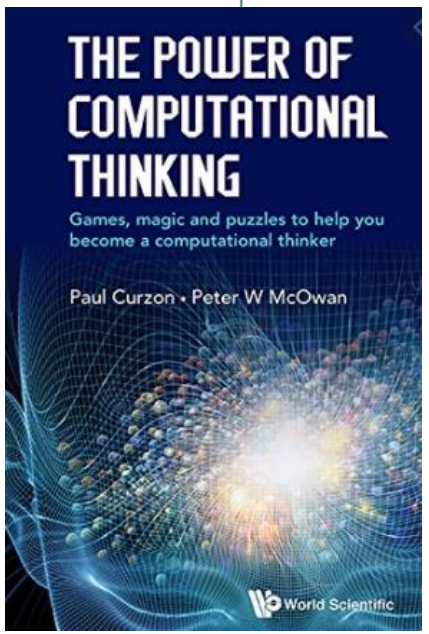
Why is Computational Thinking Important?

- It moves students beyond being technologically literate
- It creates problem solvers instead of software technicians
- It emphasises the creation of knowledge rather than the use of information
- It presents endless possibilities for creative problem solving
- It enhances the problem-solving techniques you already teach

(Source: Pat Phillips, NECC 2007, Atlanta)

“What are effective ways for teaching computational thinking?”

How to Teach Computational Thinking



- ❑ Increase your own CT knowledge
- ❑ Integrate CT concepts into everyday instruction
- ❑ Use CT terms for everyday tasks

e.g. “Let’s create an algorithm for …”

- ❑ Encourage students to formulate and test their own hypotheses

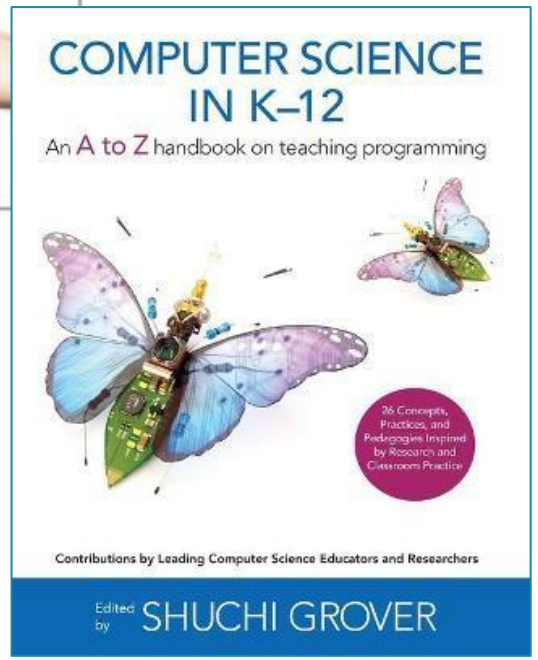
e.g. “Crime rates are on the rise …”

- ❑ Provide opportunities for students to transfer their learning to other situations

Successful CT Pedagogies

- Analogy / Storytelling
- CS Unplugged
  - Kinaesthetic
  - Role Playing
  - Puzzles
  - Art
  - Games
  - Magic
- Enquiry Based Learning (TEMI)

Programming Practice (Python / JavaScript)



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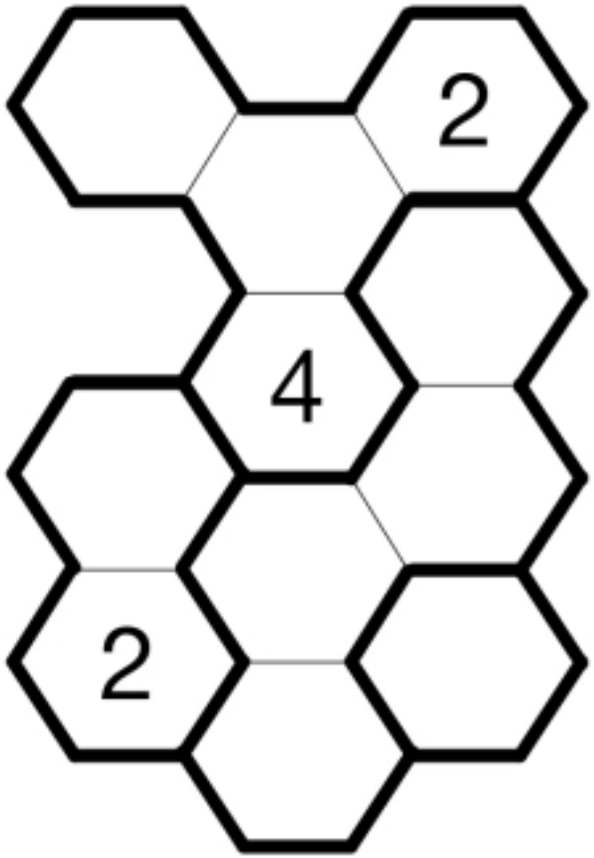
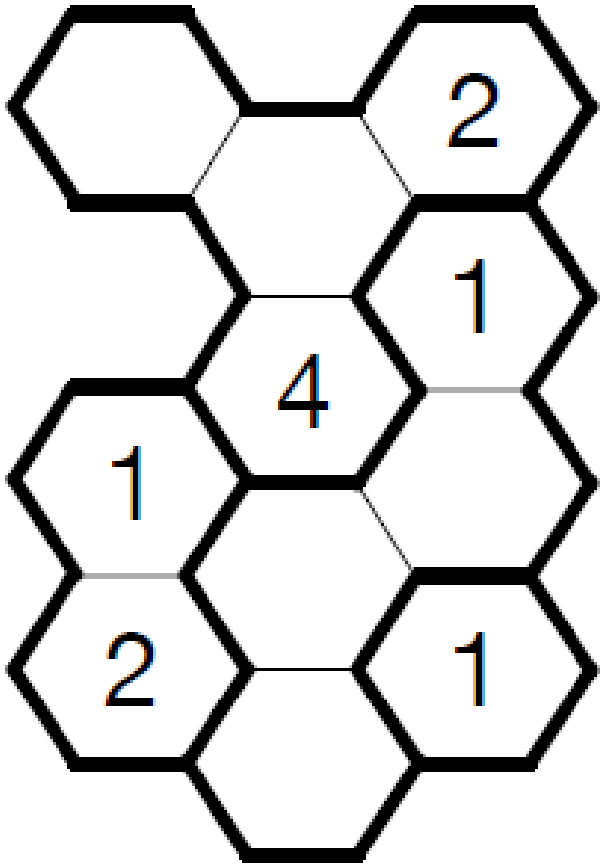
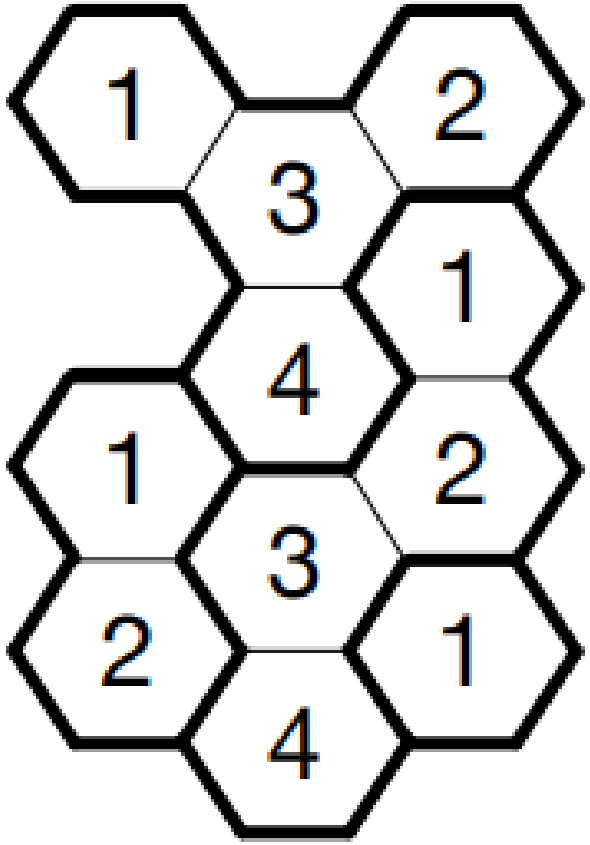
Applying Computational Thinking Skills

Examples

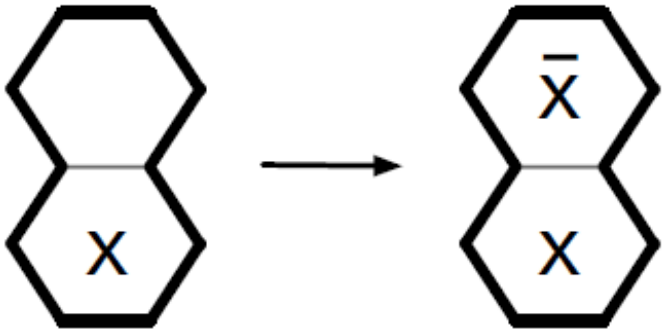
Cut Hive Logic Puzzles



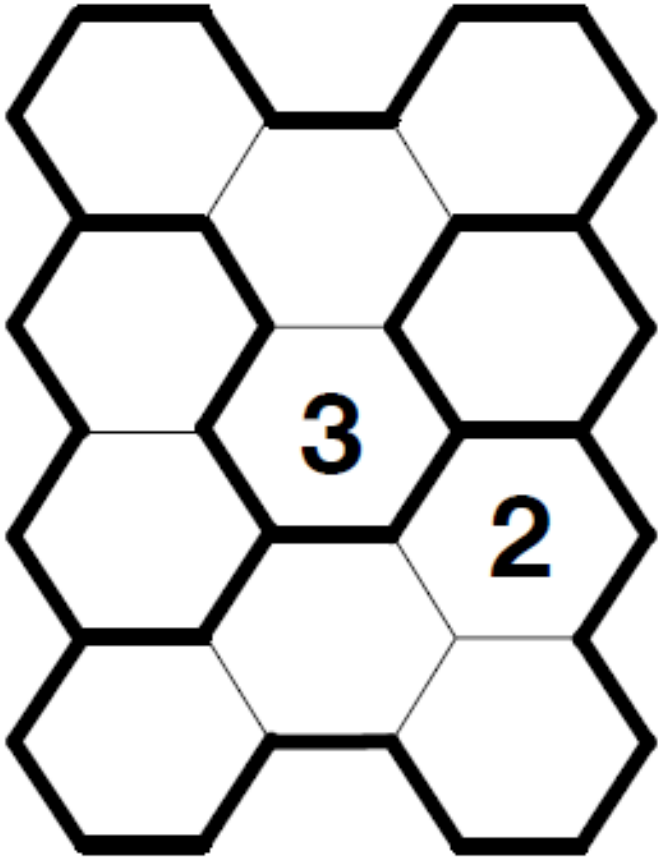


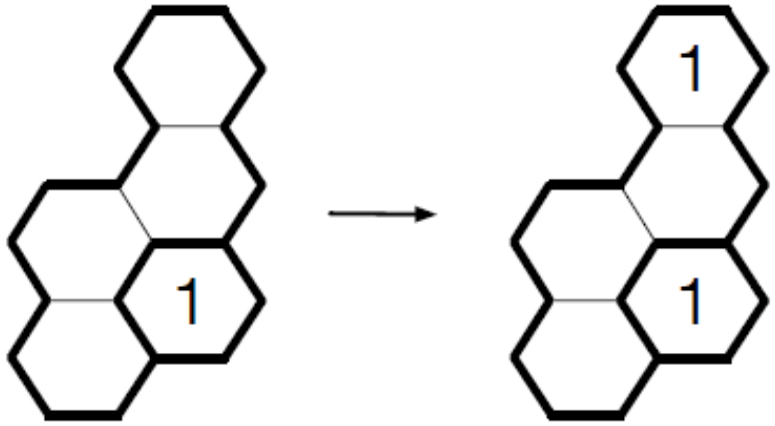


Cut Hive Logic Puzzles



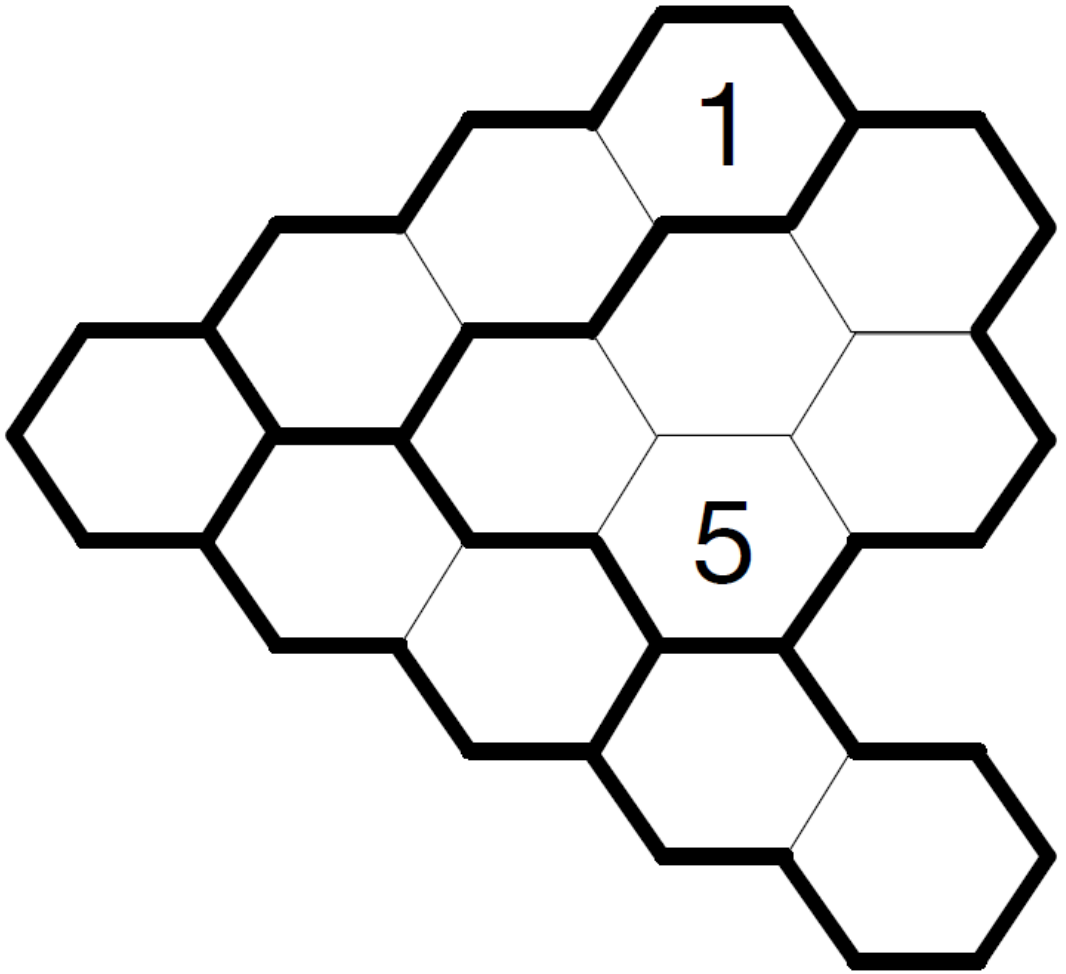
Single Hexagon



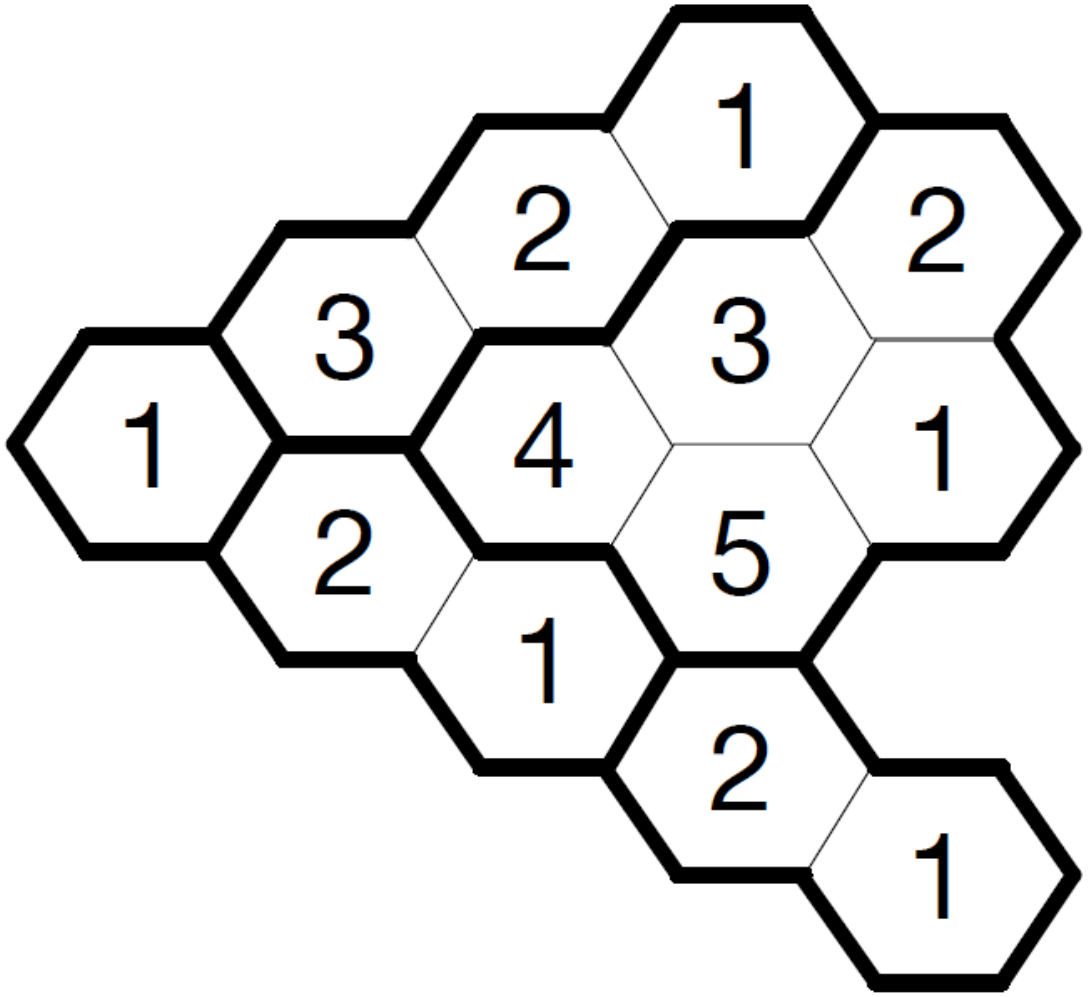


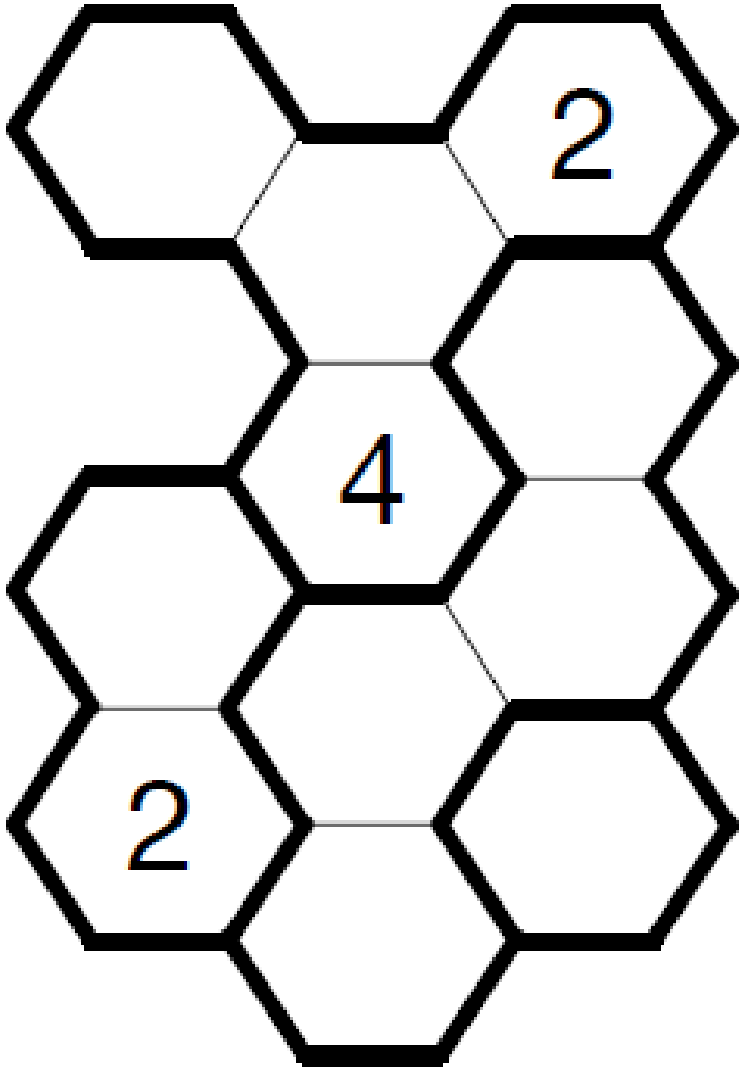
Corners

Challenge



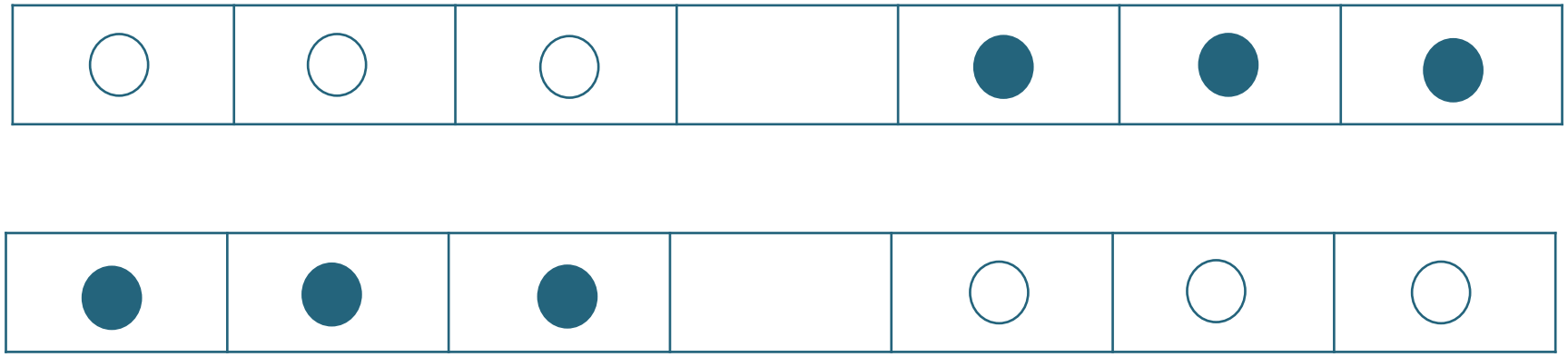
Solution





Algorithmic Thinking

The aim is to swap the positions of the black and white pieces.



Pieces can move either by sliding into an adjacent empty square, or by jumping a single adjacent piece into the empty square immediately beyond.

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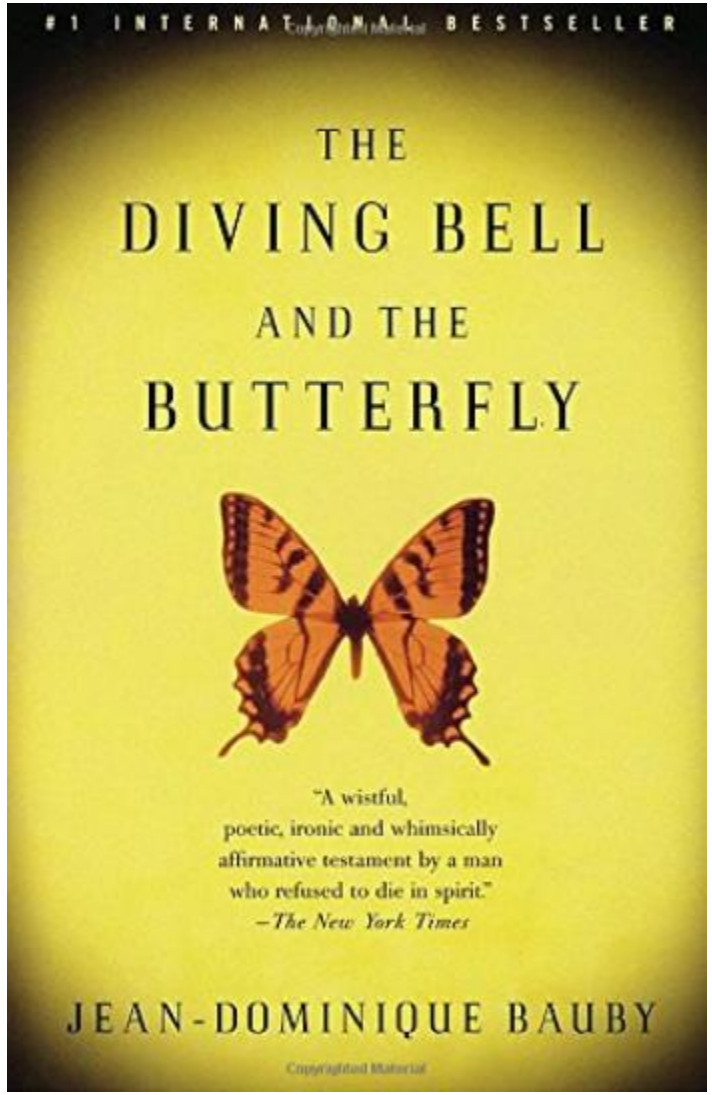
Group Activity

Scenarios

Group Activity

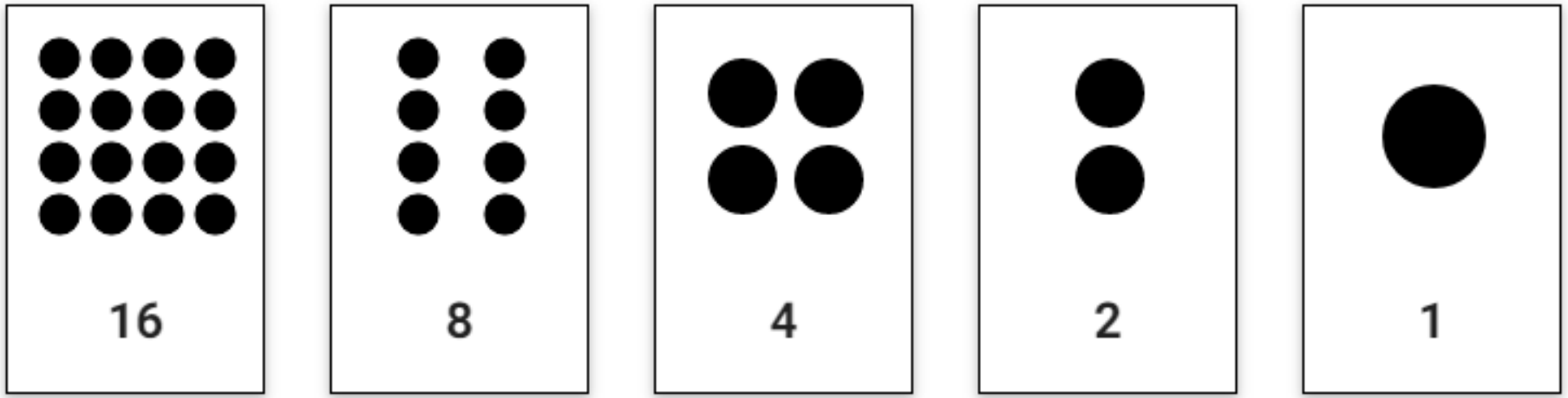
Scenario 1 (Storytelling)



https://www.youtube.com/watch?v=t4Ek4ZBpshs

'The Diving Bell and the Butterfly' is an incredibly uplifting book. It's the autobiography of Jean-Dominique Bauby, written after he woke up in a hospital bed totally paralysed. In the book, he describes life with locked-in syndrome. He did have a way to communicate not only to write the book but also with medics, friends and family. He did it without any technology at all. How?

Scenario 2 (Kinaesthetic)

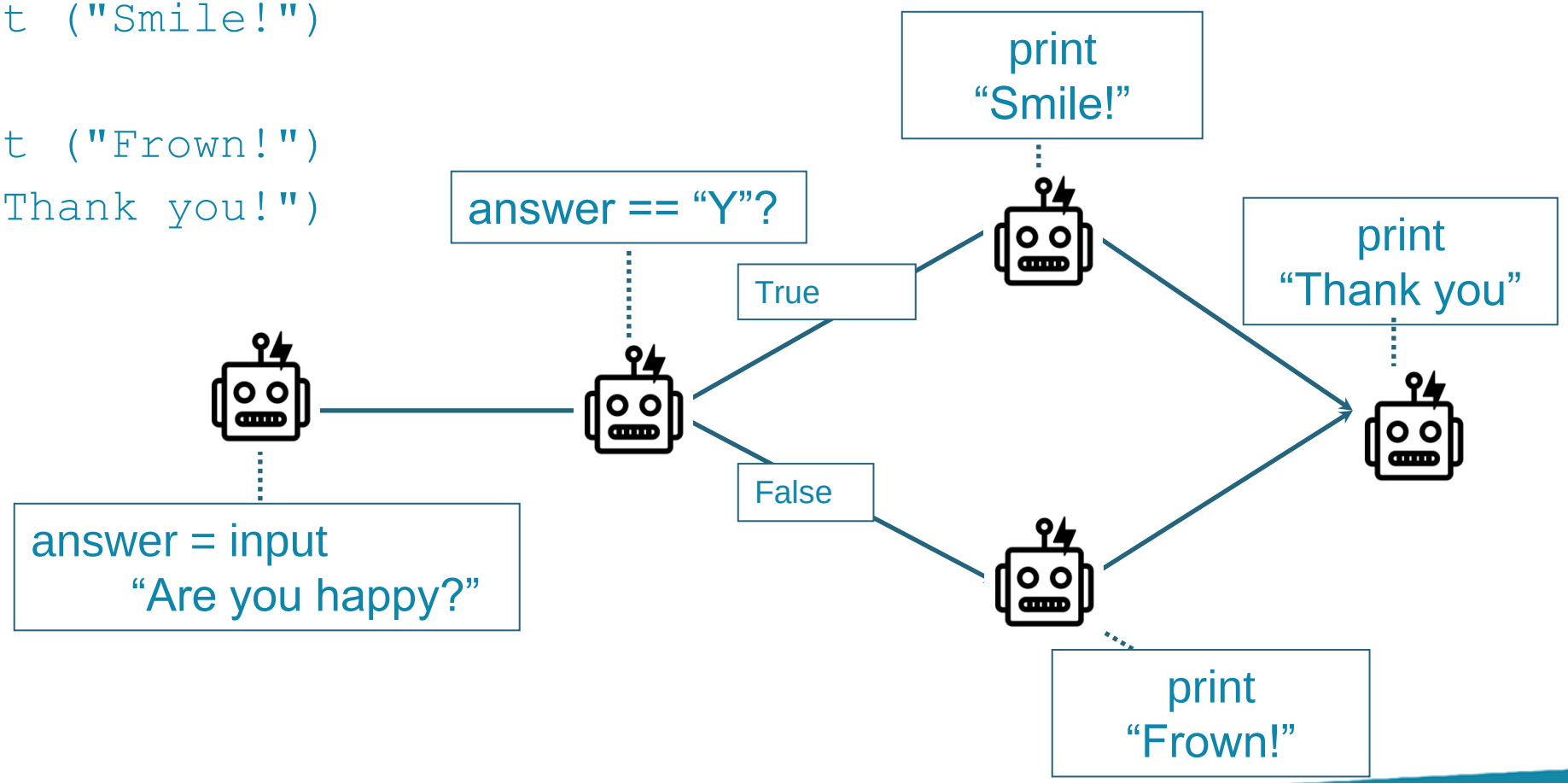


Which cards do we need to turn over to make the number 13?

(The cards are blank on the reverse side.)

Scenario 3 (Role play)

```
answer = input ("Are you happy?")
if answer == "Y":
    print ("Smile!")
else:
    print ("Frown!")
print ("Thank you!")
```



Instructions

In your assigned group go to the breakout area

Read the scenario provided

Design a presentation based on the scenario …

- a description of the scenario provided
- a demonstration of the activity
- an outline of how the pedagogy could be used to teach CT concepts
- suggestions on how the scenario could be used (or extended) to design lesson(s) suitable for LCCS

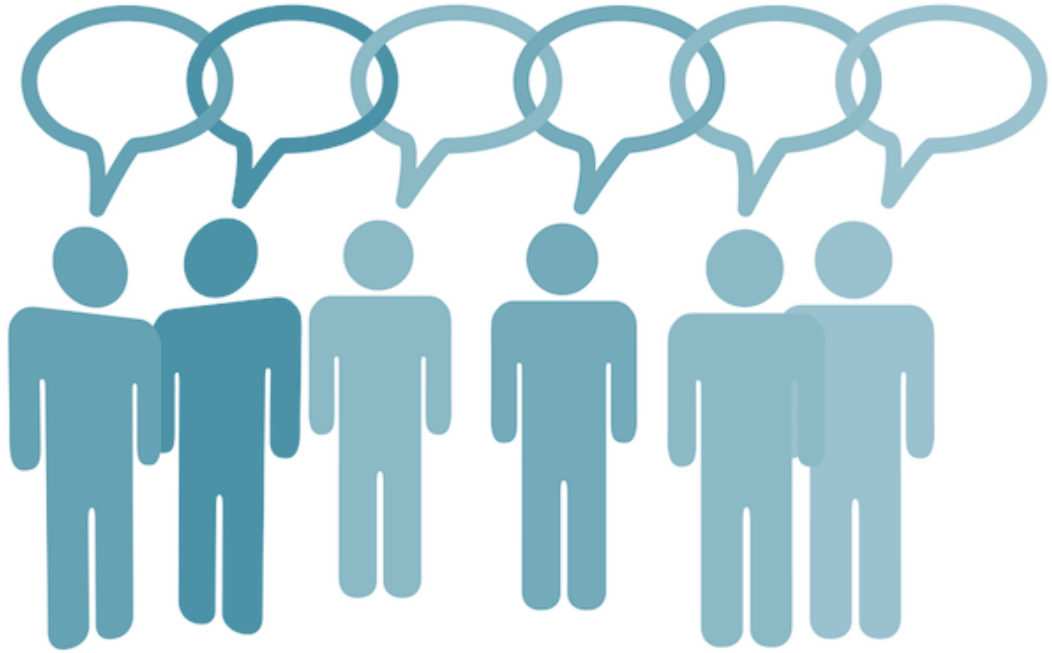
Next Step: Present back to the wider group.

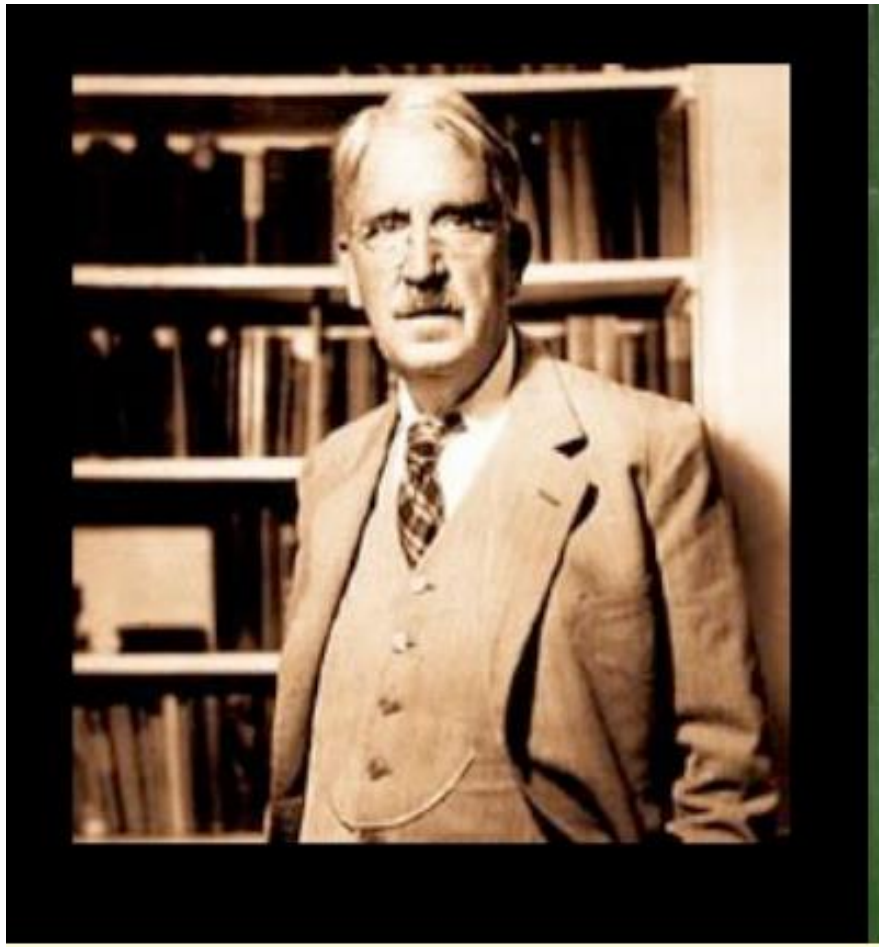
Breakout

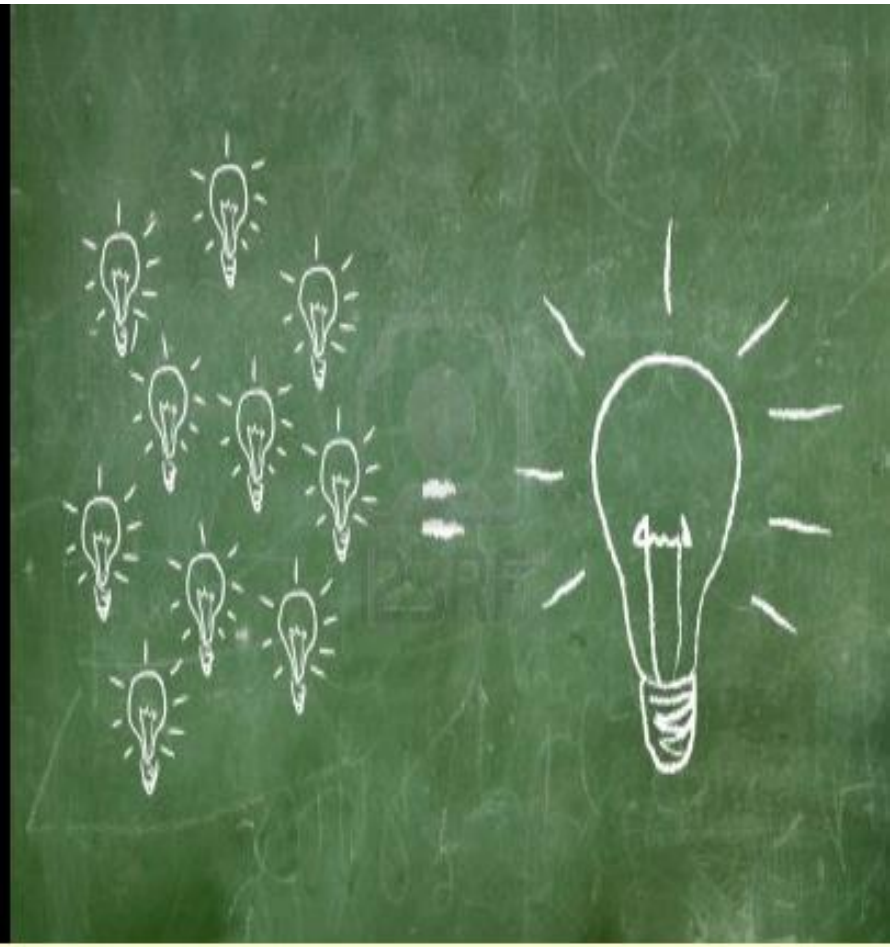
Presentation

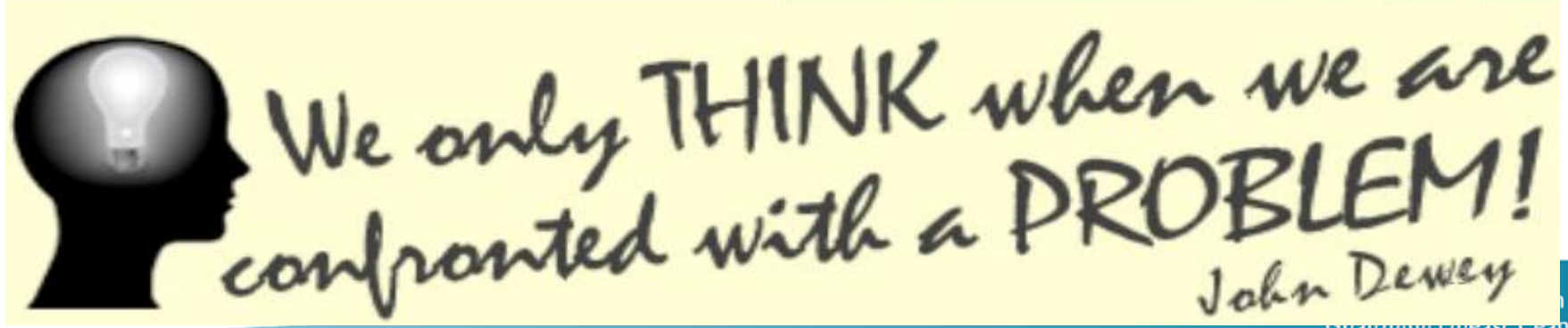
What CT concepts are you explaining?

What pedagogy are you using?








We only THINK when we are confronted with a PROBLEM!
John Dewey

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