PDST

Professional Development Service for Teachers | An tSeirbhís um Fhorbairt Ghairmiúil do Mhúinteoirí

LEAVING CERTIFICATE COMPUTER SCIENCE

National Workshop 1

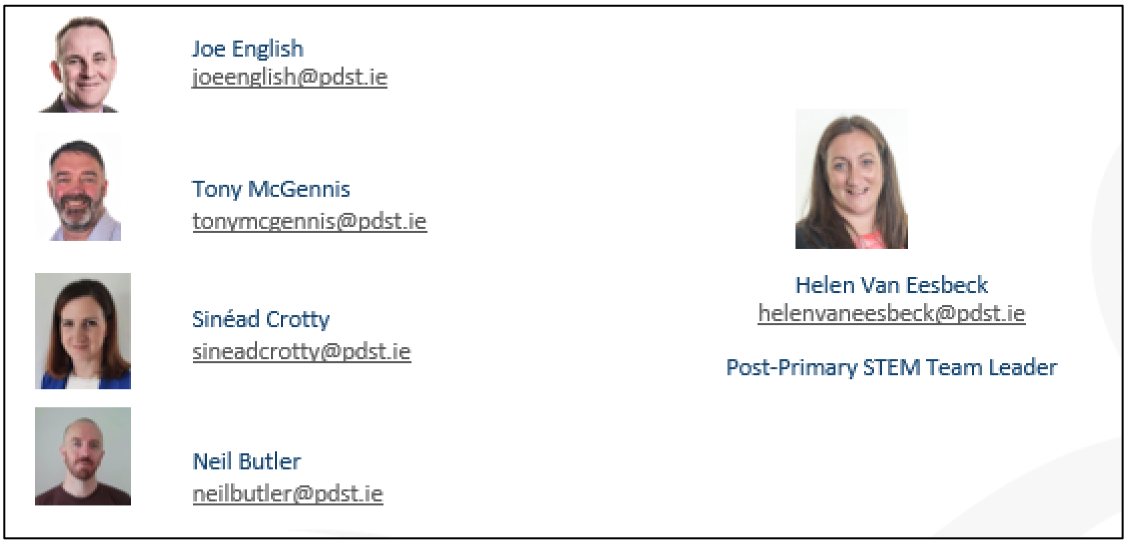
© PDST 2022

This work is made available under the terms of the creative Commons Attribution Share Alike 3.0 License http://creativecommons.org/licences/by-sa/3.0/ie/. You may use and re-use this material (not including images and logos) free of charge in any format or medium, under the terms of the Creative commons Attribution Share Alike Licence. Please cite as: PDST Leaving Certificate Computer Science Participant Booklet, 2022.

Table of Contents

Session 1: Introduction to LCCS

Meet the Team



Joe English
joeenglish@pdst.ie

Tony McGennis
tonymcgennis@pdst.ie

Sinéad Crotty
sineadcrotty@pdst.ie

Neil Butler
neilbutler@pdst.ie

Helen Van Eesbeck
helenvaneesbeck@pdst.ie

Post-Primary STEM Team Leader

Notes

Key Messages

There are many ways to use the LCCS specification	Notes:
The learning outcomes (LOs) are non-linear	Notes:
ALTs The Applied Learning Tasks (ALTs) provide an opportunity to teach theoretical aspects of LCCS.	Notes:
LCCS can be mediated through a constructivist pedagogical approach	Notes:
Digital technologies can be used to enhance collaboration, learning and reflection.	Notes:
LCCS is a subject for ALL	Notes:

Think - Pair - Share

Question	What I thought	What my partner thought	What we will share
What is Computer Science?			
Who is Computer Science for?			

Think-Pair-Share Square Strategy

This strategy allows you to quickly engage the whole class without losing any time moving furniture or formulating groups. Think-Pair-Square-Share is a series of steps that enables the students move through the stages of individual work, paired work and group work before feeding back to the whole class very simply.

Think: The students spend time in silence writing or thinking about their own ideas.

Pair: Students turn to the person next to them to discuss their ideas with a partner.

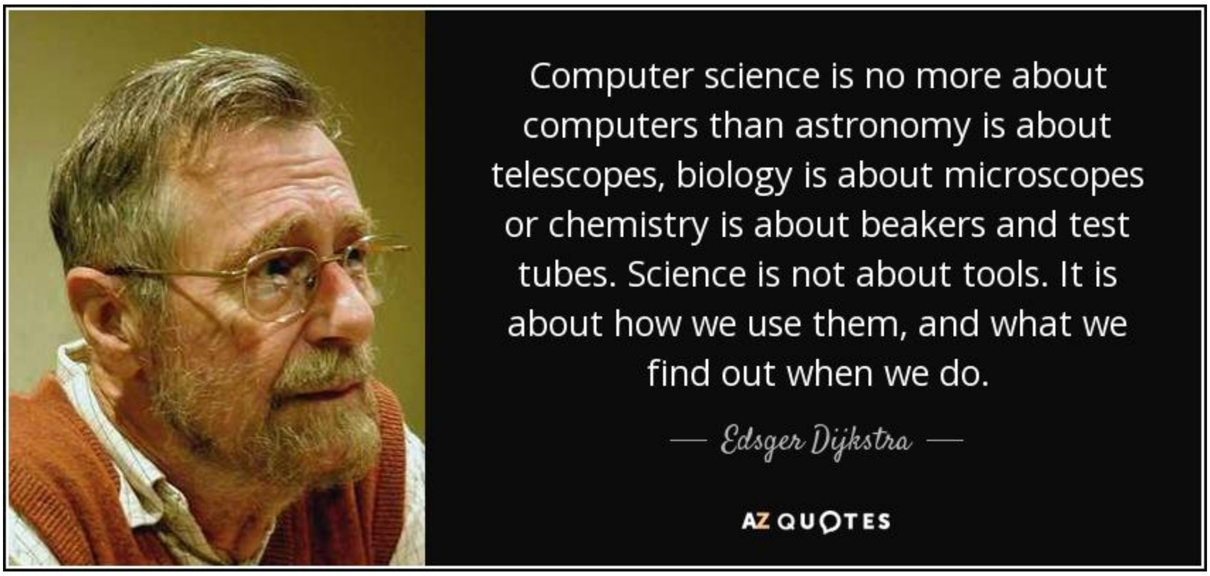
Share: Students share their answers with another group

Square: Two pairs work together as a new group to complete the task of agreeing on a response from the first two answers that the pairs have come up with. They also elect who will be speaking. This stage is crucial for extracting the high level explanation behind why an answer was chosen. This reduces the amount of answers that a teacher has to elicit from a class. It helps promote student learning as students discuss and teach each other.

Notes

CSforALL

- Computer Science is suitable for all.
- Computer Science can be a fun and engaging way to learn about the world we live in
- Computer Science is both innovative and collaborative – people work together to come up with solutions that can make a real difference to society
- Computer Science involves design thinking and creativity
- Computer Science is especially suitable for people who are curious and logical and want to learn more about the world around them and develop ways to shape society
- Computer Science is equally suitable to girls and boys
- Computer Science is equally suitable to people who are particularly strong at maths and those with an average ability in maths
- Computer Science needs diversity, not stereotypes!
- Computer Science opens up opportunities in almost every profession imaginable
- Computer Science is relevant to all careers/in all walks of life

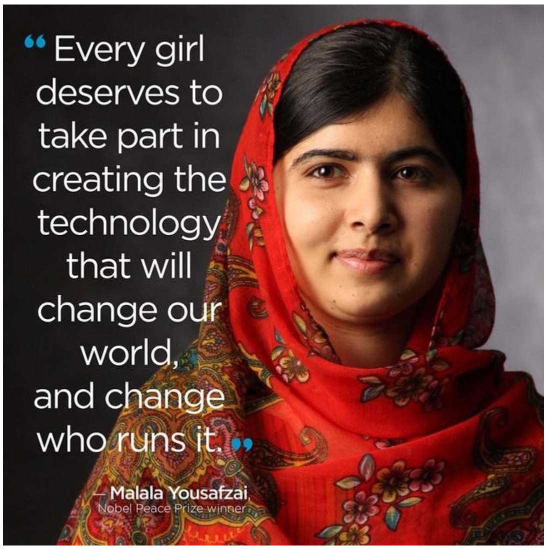


Computer science is no more about computers than astronomy is about telescopes, biology is about microscopes or chemistry is about beakers and test tubes. Science is not about tools. It is about how we use them, and what we find out when we do.

— Edsger Dijkstra —

AZ QUOTES

Despite having made significant inroads into many traditionally male-dominated fields (e.g., biology, chemistry), women continue to be underrepresented in computer science. students' stereotypes about the culture of these fields - including the kind of people, the work involved, and the values of the field - steer girls away from choosing to enter them.


"Every girl deserves to take part in creating the technology that will change our world, and change who runs it."
– Malala Yousafzai,
Nobel Peace Prize winner

Students have stereotypes about the culture of computer science and engineering and girls face negative stereotypes about their abilities. Both types of stereotypes signal to girls that computer science and engineering are not appropriate fields for them.

Source: Cheryan S, Master A, Meltzoff A. Cultural stereotypes as gatekeepers: increasing girls' interest in computer science and engineering by diversifying stereotypes. Frontiers in Psychology. 2015;6(49):1–8.

Notes

Ice Breaker

My Favourite	Your Favourite (Write your favourite in this column)	Names (Who else’s favourite?)
Film		
Food		
Team		
Song		
Book		

Growth Mindset

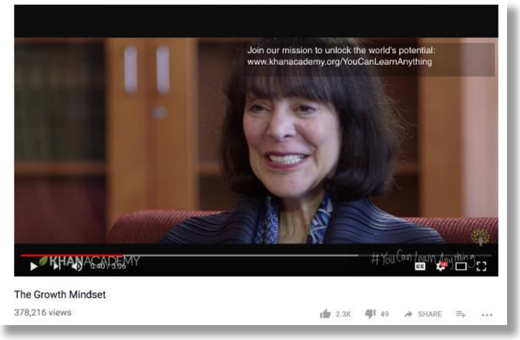
Should you tell your kids they are smart or talented?

Professor Carol Dweck answers this question and more, as she talks about her ground-breaking work on developing mindsets. Watch these two videos to find out more.

CAROL DWECK

FOR DECADES I'VE BEEN STUDYING WHY SOME PEOPLE SUCCEED WHILE PEOPLE, WHO ARE EQUALLY TALENTED, DO NOT. AND OVER THE YEARS I'VE DISCOVERED THAT PEOPLE'S MINDSETS PLAY

play a crucial role in this process.



Join our mission to unlock the world's potential:
www.khanacademy.org/YouCanLearnAnything

The Growth Mindset

378,216 views

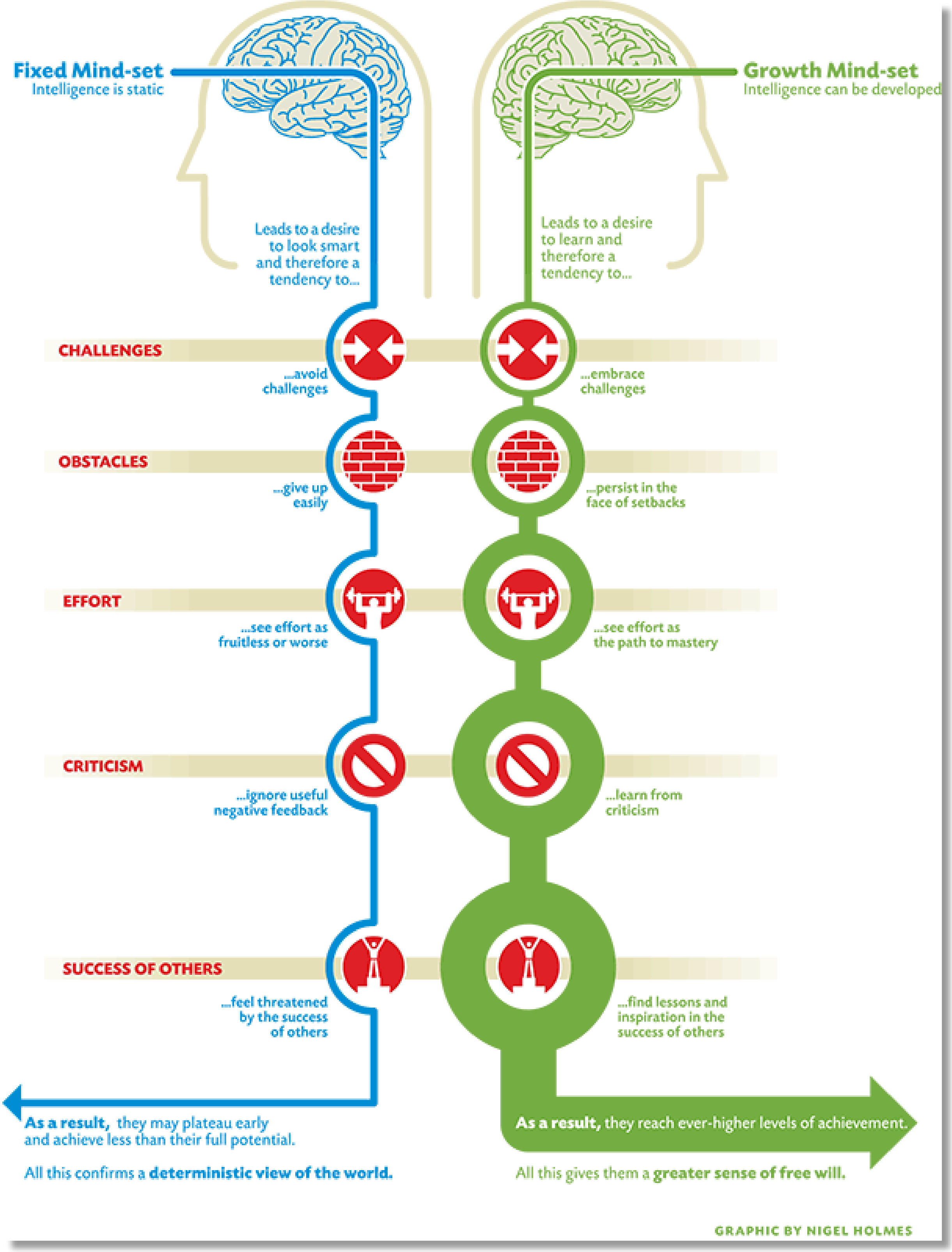
https://youtu.be/hiiEeMN7vbQ

Learn more about the power of "yet" in helping students succeed in and out of the classroom.

https://youtu.be/wh0OS4MrN3E

Sal Khan from the Khan Academy talks with Stanford Professor Carol Dweck about her research on Growth Mind-set.

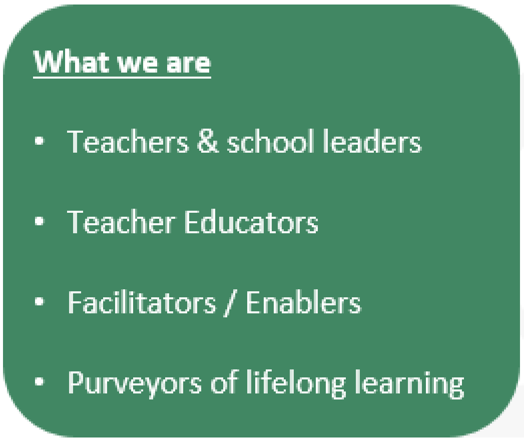
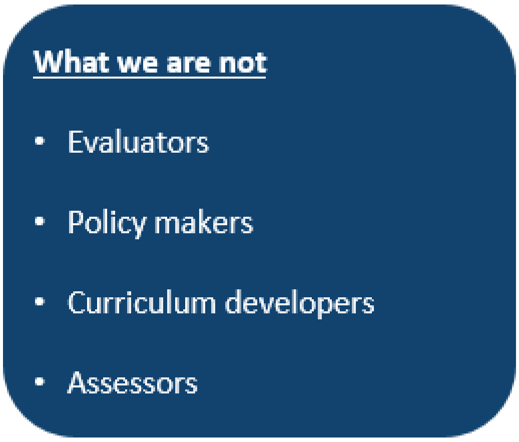
Notes


Fixed Mind-set
Intelligence is static
Growth Mind-set
Intelligence can be developed
Leads to a desire to look smart and therefore a tendency to...
Leads to a desire to learn and therefore a tendency to...
CHALLENGES
...avoid challenges
...embrace challenges
OBSTACLES
...give up easily
...persist in the face of setbacks
EFFORT
...see effort as fruitless or worse
...see effort as the path to mastery
CRITICISM
...ignore useful negative feedback
...learn from criticism
SUCCESS OF OTHERS
...feel threatened by the success of others
...find lessons and inspiration in the success of others
As a result, they may plateau early and achieve less than their full potential.
As a result, they reach ever-higher levels of achievement.
All this confirms a deterministic view of the world.
All this gives them a greater sense of free will.
GRAPHIC BY NIGEL HOLMES

Culture and Expectations

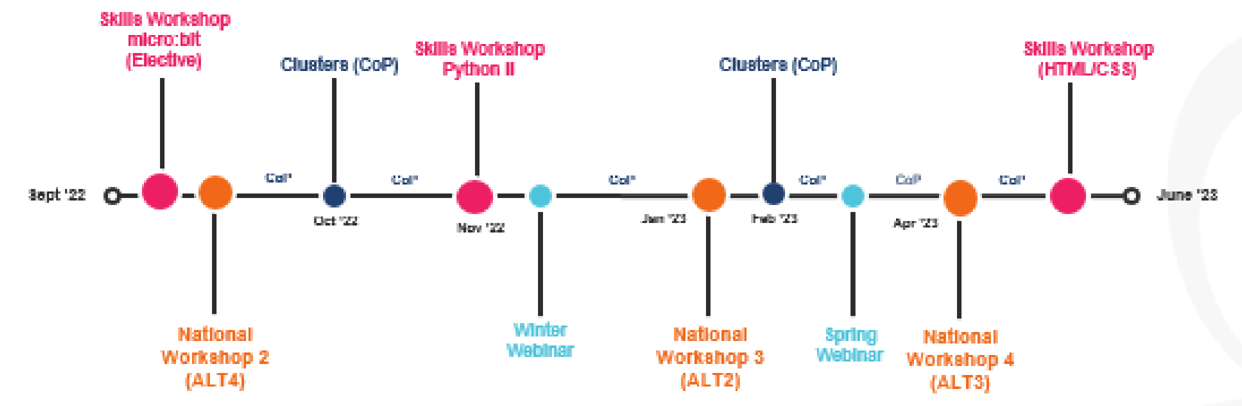
What should the culture be in the group?
What expectations do you have from each other?

The Role of the PDST

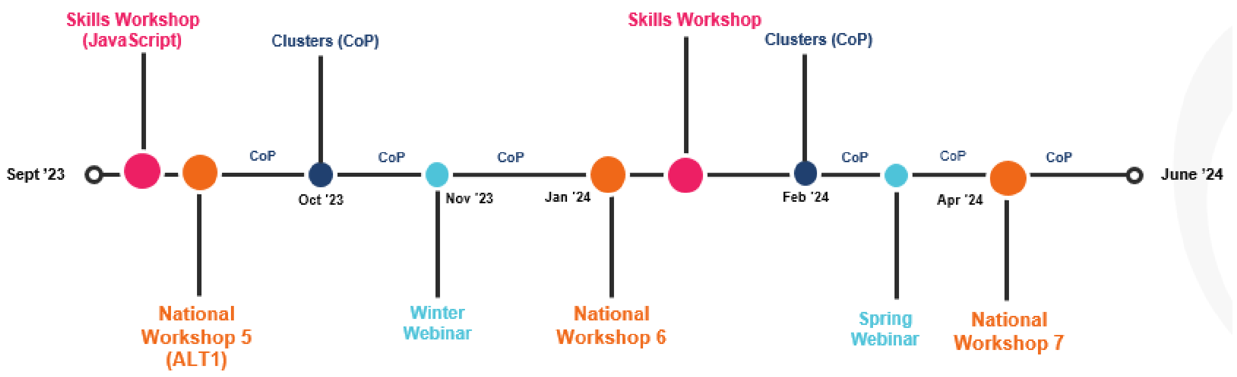
What we are	What we are not
 **What we are** - Teachers & school leaders - Teacher Educators - Facilitators / Enablers - Purveyors of lifelong learning	 **What we are not** - Evaluators - Policy makers - Curriculum developers - Assessors

LCCS CPD Timeline

LCCS CPD Timeline (2022-23)

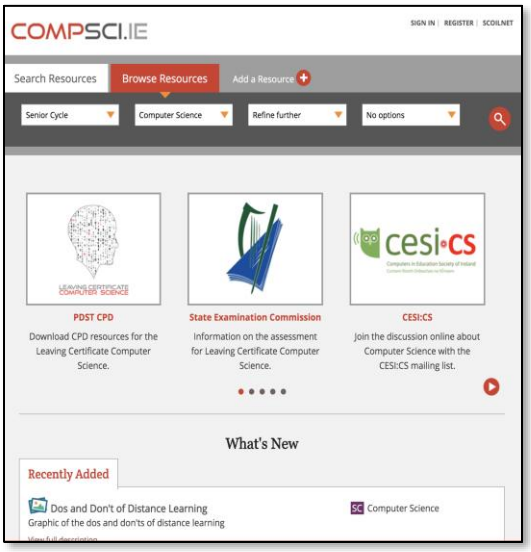

Skills Workshop micro:bit (Elective)
Clusters (CoP)
Skills Workshop Python II
Clusters (CoP)
Skills Workshop (HTML/CSS)
Sept '22
CoP
CoP
CoP
CoP
CoP
CoP
June '23
Oct '22
Nov '22
Jan '23
Feb '23
Apr '23
National Workshop 2 (ALT4)
Winter Webinar
National Workshop 3 (ALT2)
Spring Webinar
National Workshop 4 (ALT3)

LCCS CPD Timeline (2023-24)



Notes

COMPSCI.IE



COMPSCI.IE

SIGN IN | REGISTER | SCOILNET

Search Resources | Browse Resources | Add a Resource

Senior Cycle ▾ | Computer Science ▾ | Refine further ▾ | No options ▾

PDST CPD

Download CPD resources for the Leaving Certificate Computer Science.

State Examination Commission

Information on the assessment for Leaving Certificate Computer Science.

CESI:CS

Join the discussion online about Computer Science with the CESI:CS mailing list.

What's New

Recently Added

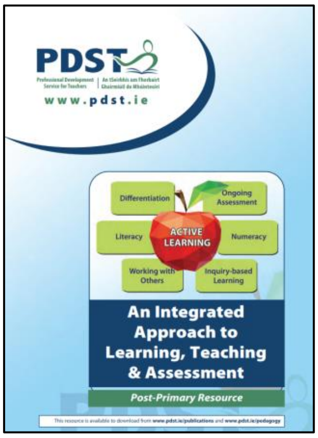
Dos and Don't of Distance Learning

Graphic of the dos and don'ts of distance learning

Computer Science

https://www.compsci.ie/

An Integrated Approach to Learning Teaching and Assessment



PDST

www.pdst.ie

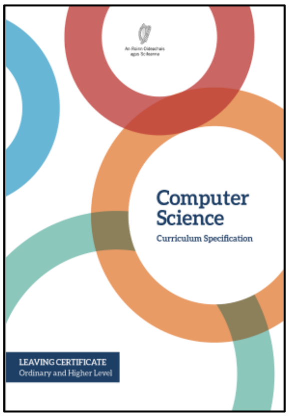
An Integrated Approach to Learning, Teaching & Assessment

Post-Primary Resource

https://pdst.ie/sites/default/files/Integrated%20Approach_0.pdf

Notes

LCCS Curriculum Specification



An Roinn Oideachais agus Scileanna

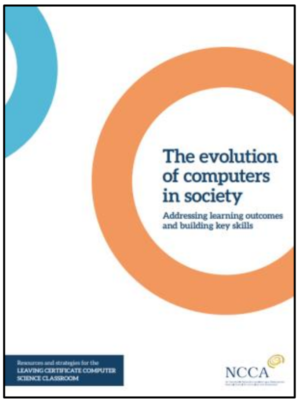
Computer Science

Curriculum Specification

LEAVING CERTIFICATE
Ordinary and Higher Level

https://ncca.ie/media/3369/computer-science-final-specification.pdf

The Evolution of Computers and Society



The evolution of computers in society

Addressing learning outcomes and building key skills

Resources and strategies for the LEAVING CERTIFICATE COMPUTER SCIENCE CLASSROOM

NCCA

https://curriculumonline.ie/getmedia/a5e0d88d-e0f1-43bc-ab68-349b5660fbce/NCCA-The-Evolution-of-Computers-in-Society-LC-SC.pdf

Notes

LCCS Curriculum Specification

Introduction
Senior Cycle
Computer Science (Rationale/Aim/Objectives)

Related Learning
Structure of Leaving Certificate Computer Science
Key Skills of Senior Cycle

Teaching and Learning (ALTs)
Teaching and Learning (Differentiation)
Assessment

Final Reflection (3-2-1)

Complete the 3-2-1 reflection with regard to the LCCS specification.

List three things you learned

1.

2.

3.

List two things you'd like to learn more about

1.

2.

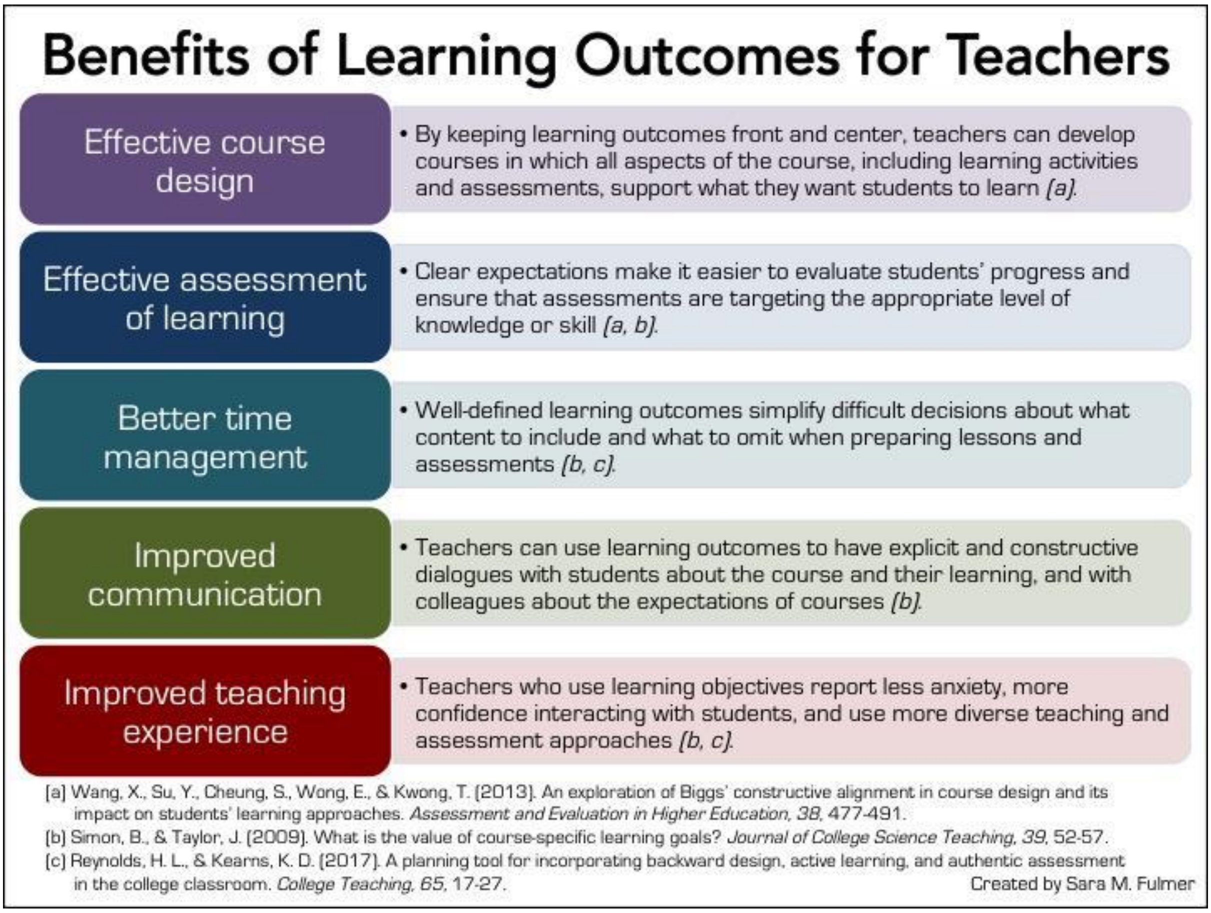
One question you still have

1.

Session 2: Learning Outcomes and the ALTs

Learning outcomes have become ubiquitous within worldwide curriculum policy in recent years. This move comes with many potential benefits, as it shifts the focus from providers to users of education, and it introduces a common language, addressing issues of progression, transparency and equity (CEDEFOP, 2009).

(Mark Priestly, University of Stirling)



Benefits of Learning Outcomes for Teachers

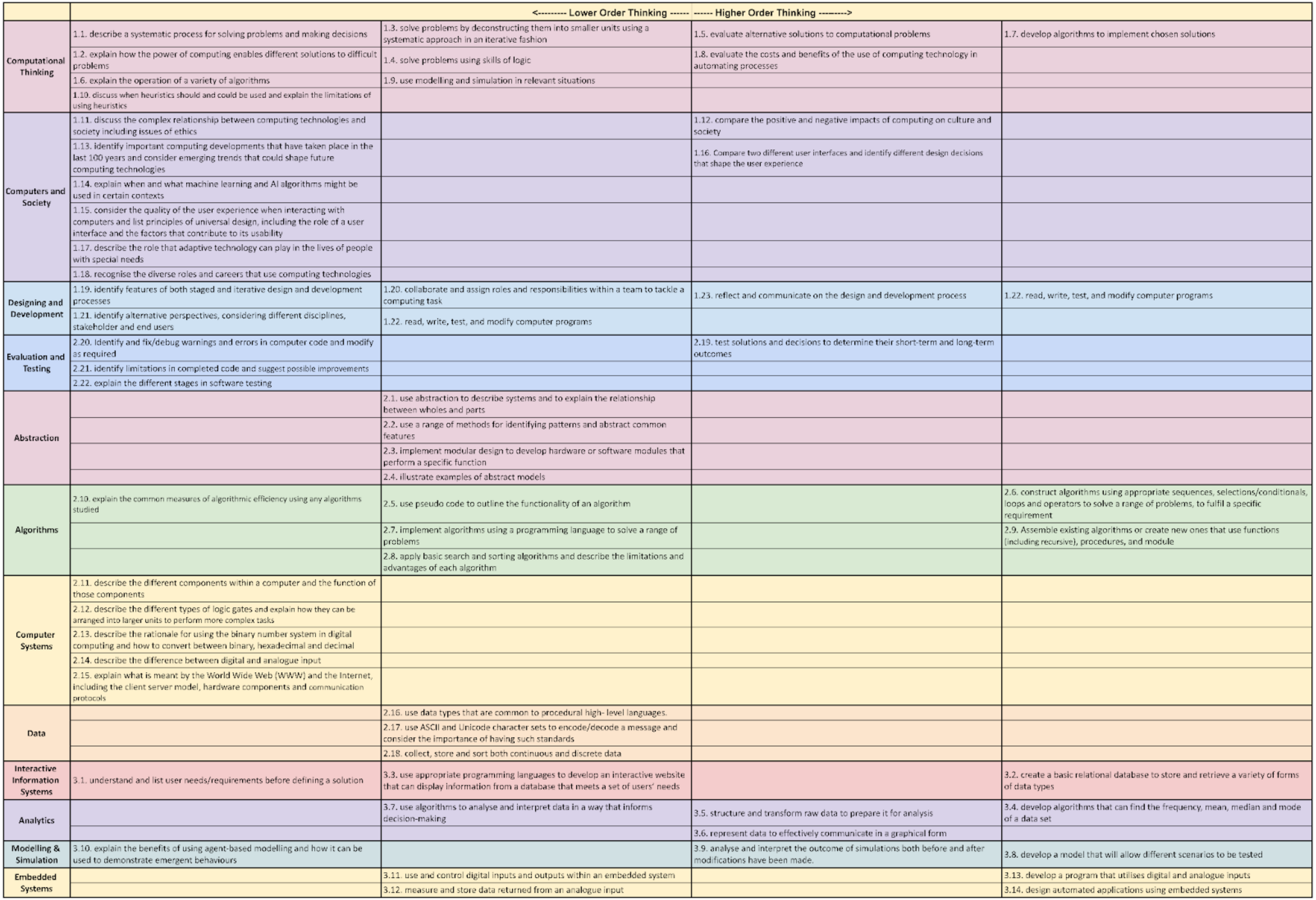
Effective course design	• By keeping learning outcomes front and center, teachers can develop courses in which all aspects of the course, including learning activities and assessments, support what they want students to learn *[a]*.
Effective assessment of learning	• Clear expectations make it easier to evaluate students' progress and ensure that assessments are targeting the appropriate level of knowledge or skill *[a, b]*.
Better time management	• Well-defined learning outcomes simplify difficult decisions about what content to include and what to omit when preparing lessons and assessments *[b, c]*.
Improved communication	• Teachers can use learning outcomes to have explicit and constructive dialogues with students about the course and their learning, and with colleagues about the expectations of courses *[b]*.
Improved teaching experience	• Teachers who use learning objectives report less anxiety, more confidence interacting with students, and use more diverse teaching and assessment approaches *[b, c]*.

[a] Wang, X., Su, Y., Cheung, S., Wong, E., & Kwong, T. (2013). An exploration of Biggs' constructive alignment in course design and its impact on students' learning approaches. *Assessment and Evaluation in Higher Education, 38*, 477-491.

[b] Simon, B., & Taylor, J. (2009). What is the value of course-specific learning goals? *Journal of College Science Teaching, 39*, 52-57.

[c] Reynolds, H. L., & Kearns, K. D. (2017). A planning tool for incorporating backward design, active learning, and authentic assessment in the college classroom. *College Teaching, 65*, 17-27.

Created by Sara M. Fulmer



	<--------- Lower Order Thinking ------ ------ Higher Order Thinking --------->			
Computational Thinking	1.1. describe a systematic process for solving problems and making decisions	1.3. solve problems by deconstructing them into smaller units using a systematic approach in an iterative fashion	1.5. evaluate alternative solutions to computational problems	1.7. develop algorithms to implement chosen solutions
	1.2. explain how the power of computing enables different solutions to difficult problems	1.4. solve problems using skills of logic	1.8. evaluate the costs and benefits of the use of computing technology in automating processes	
	1.6. explain the operation of a variety of algorithms	1.9. use modelling and simulation in relevant situations		
	1.10. discuss when heuristics should and could be used and explain the limitations of using heuristics			
Computers and Society	1.11. discuss the complex relationship between computing technologies and society including issues of ethics		1.12. compare the positive and negative impacts of computing on culture and society	
	1.13. identify important computing developments that have taken place in the last 100 years and consider emerging trends that could shape future computing technologies		1.16. Compare two different user interfaces and identify different design decisions that shape the user experience	
	1.14. explain when and what machine learning and AI algorithms might be used in certain contexts			
	1.15. consider the quality of the user experience when interacting with computers and list principles of universal design, including the role of a user interface and the factors that contribute to its usability			
	1.17. describe the role that adaptive technology can play in the lives of people with special needs			
	1.18. recognise the diverse roles and careers that use computing technologies			
Designing and Development	1.19. identify features of both staged and iterative design and development processes	1.20. collaborate and assign roles and responsibilities within a team to tackle a computing task	1.23. reflect and communicate on the design and development process	1.22. read, write, test, and modify computer programs
	1.21. identify alternative perspectives, considering different disciplines, stakeholder and end users	1.22. read, write, test, and modify computer programs		
Evaluation and Testing	2.20. Identify and fix/debug warnings and errors in computer code and modify as required		2.19. test solutions and decisions to determine their short-term and long-term outcomes	
	2.21. identify limitations in completed code and suggest possible improvements			
	2.22. explain the different stages in software testing			
Abstraction		2.1. use abstraction to describe systems and to explain the relationship between wholes and parts		
		2.2. use a range of methods for identifying patterns and abstract common features		
		2.3. implement modular design to develop hardware or software modules that perform a specific function		
		2.4. illustrate examples of abstract models		
Algorithms	2.10. explain the common measures of algorithmic efficiency using any algorithms studied	2.5. use pseudo code to outline the functionality of an algorithm		2.6. construct algorithms using appropriate sequences, selections/conditionals, loops and operators to solve a range of problems, to fulfil a specific requirement
		2.7. implement algorithms using a programming language to solve a range of problems		2.9. Assemble existing algorithms or create new ones that use functions (including recursive), procedures, and module
		2.8. apply basic search and sorting algorithms and describe the limitations and advantages of each algorithm		
Computer Systems	2.11. describe the different components within a computer and the function of those components			
	2.12. describe the different types of logic gates and explain how they can be arranged into larger units to perform more complex tasks			
	2.13. describe the rationale for using the binary number system in digital computing and how to convert between binary, hexadecimal and decimal			
	2.14. describe the difference between digital and analogue input			
	2.15. explain what is meant by the World Wide Web (WWW) and the Internet, including the client server model, hardware components and communication protocols			
Data		2.16. use data types that are common to procedural high- level languages.		
		2.17. use ASCII and Unicode character sets to encode/decode a message and consider the importance of having such standards		
		2.18. collect, store and sort both continuous and discrete data		
Interactive Information Systems	3.1. understand and list user needs/requirements before defining a solution	3.3. use appropriate programming languages to develop an interactive website that can display information from a database that meets a set of users' needs		3.2. create a basic relational database to store and retrieve a variety of forms of data types
Analytics		3.7. use algorithms to analyse and interpret data in a way that informs decision-making	3.5. structure and transform raw data to prepare it for analysis	3.4. develop algorithms that can find the frequency, mean, median and mode of a data set
			3.6. represent data to effectively communicate in a graphical form	
Modelling & Simulation	3.10. explain the benefits of using agent-based modelling and how it can be used to demonstrate emergent behaviours		3.9. analyse and interpret the outcome of simulations both before and after modifications have been made.	3.8. develop a model that will allow different scenarios to be tested
Embedded Systems		3.11. use and control digital inputs and outputs within an embedded system		3.13. develop a program that utilises digital and analogue inputs
		3.12. measure and store data returned from an analogue input		3.14. design automated applications using embedded systems

Group Activity 1: Linking the Learning Outcomes

Examine the learning outcomes (LOs) and pick 2 or 3 from different strands that could be experienced together.

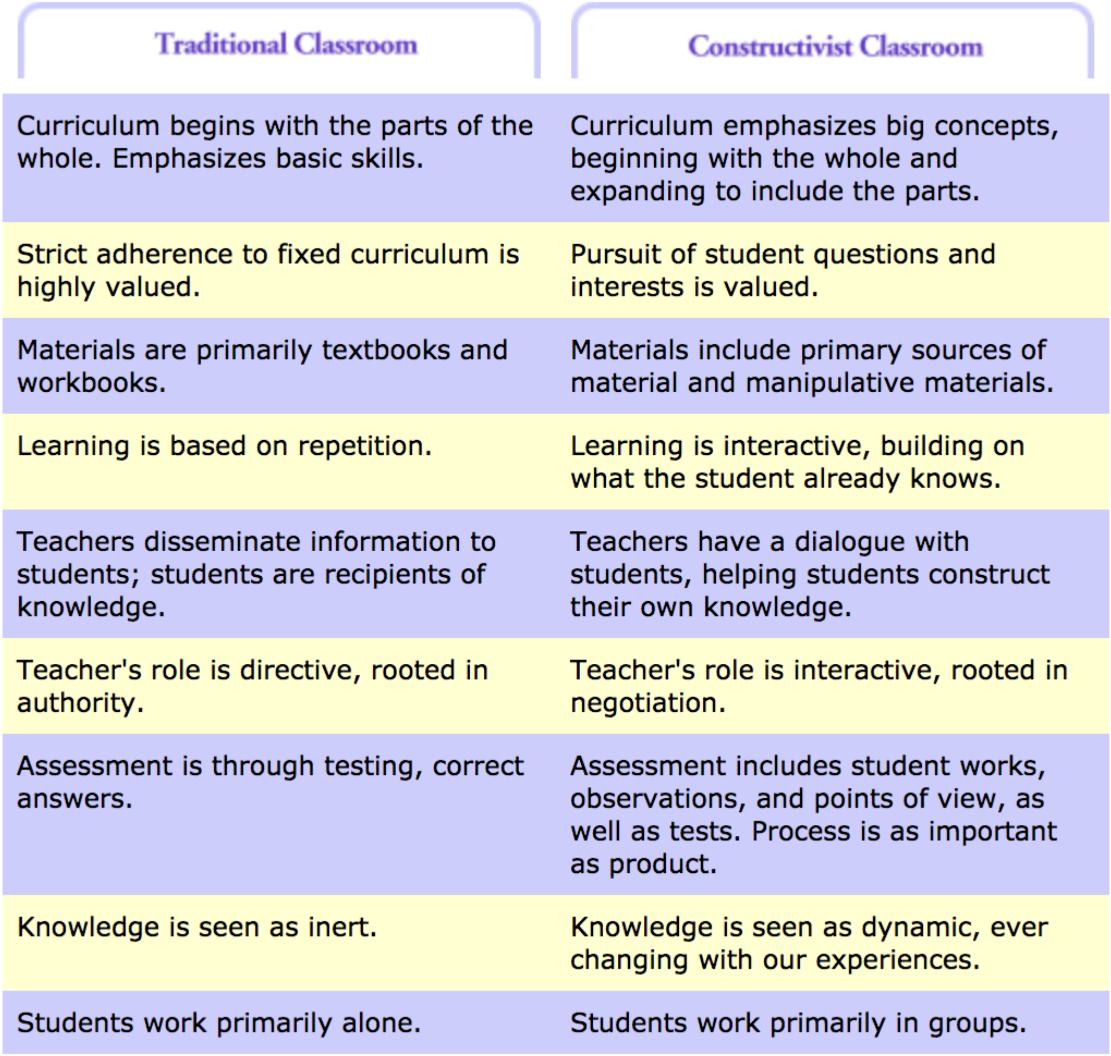
Which LOs did you choose?

What learning experience(s) would you use to engage your students with these LOs?

Which other LOs could your students experience during this learning?

How would you know if these LOs have been achieved?

Constructivist Pedagogy



Traditional Classroom	Constructivist Classroom
Curriculum begins with the parts of the whole. Emphasizes basic skills.	Curriculum emphasizes big concepts, beginning with the whole and expanding to include the parts.
Strict adherence to fixed curriculum is highly valued.	Pursuit of student questions and interests is valued.
Materials are primarily textbooks and workbooks.	Materials include primary sources of material and manipulative materials.
Learning is based on repetition.	Learning is interactive, building on what the student already knows.
Teachers disseminate information to students; students are recipients of knowledge.	Teachers have a dialogue with students, helping students construct their own knowledge.
Teacher's role is directive, rooted in authority.	Teacher's role is interactive, rooted in negotiation.
Assessment is through testing, correct answers.	Assessment includes student works, observations, and points of view, as well as tests. Process is as important as product.
Knowledge is seen as inert.	Knowledge is seen as dynamic, ever changing with our experiences.
Students work primarily alone.	Students work primarily in groups.

https://www.thirteen.org/edonline/concept2class/constructivism/index_sub1.html

Applied Learning Tasks

Group Activity 2: Investigating the ALTs

1. Each group is assigned a particular ALT.
2. In your assigned groups, discuss and share potential ideas (possible project ideas for students) for your assigned ALT.
3. Aim for as many ideas as you can.
4. Record your ideas in the shared document under your Group Number – can be text/images etc.
5. Present ideas to the wider group.

Ideas for your ALT

Group Activity 3: Expanding Your Idea

1. Pick one or two of your ideas from earlier
2. Look at your idea again – this time you will be given some prompt questions to consider
3. Record your thoughts in the shared document
4. Present your ideas to the wider group

What teaching & learning strategies could you use?

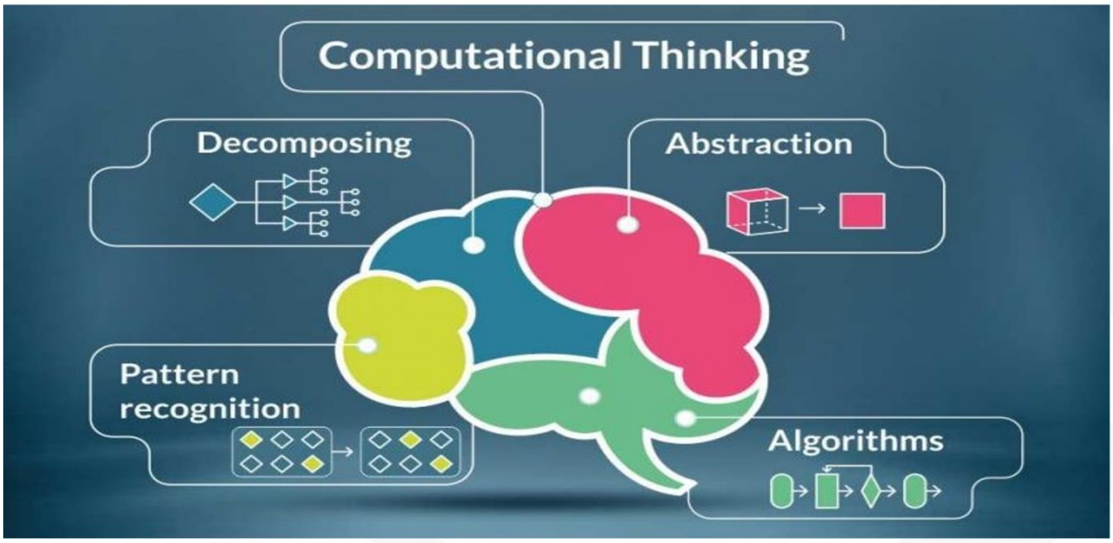
How would you assess?

Can it be linked to other parts of the course?

What theory could be taught at the same time?

In terms of planning where in the course do you see this ALT fitting in?

Session 3: Computational Thinking Activities



Activity 1: Write your own short note on the aspects of Computational Thinking

Abstraction:

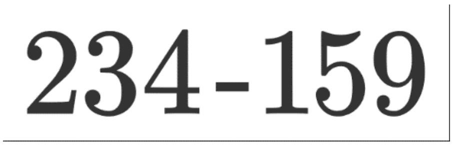
Decomposition:

Pattern Recognition:

Algorithm Formation:

Activity 2: Consider how you carry out a familiar task. How did you do it? What computational aspects are used? Are there other ways of doing this? Do these have advantages / disadvantages?

Subtraction:



234-159

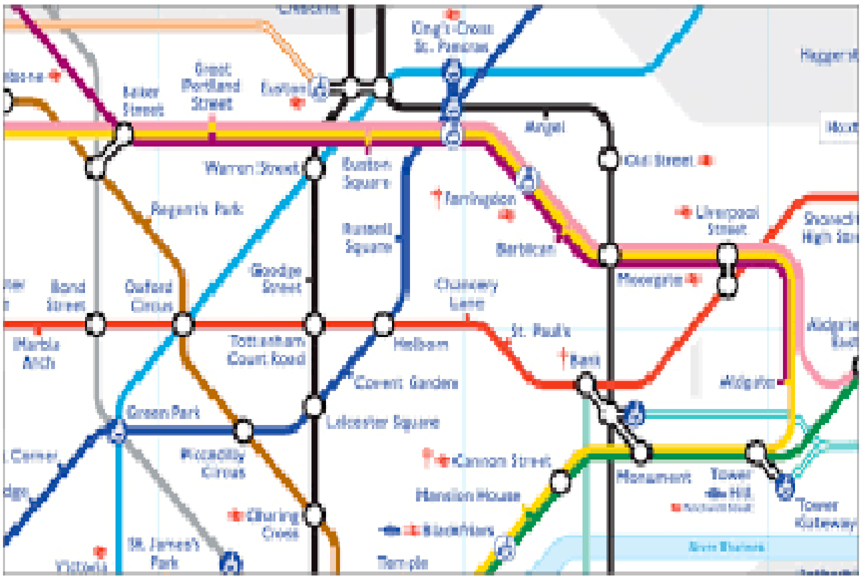
Description / Analysis of Method:

Subtraction:

$$234-159$$

Describe other methods / give advantages and disadvantages.

Activity 3: Name and describe some ways in which Abstraction is used in the design of the London Tube Map.



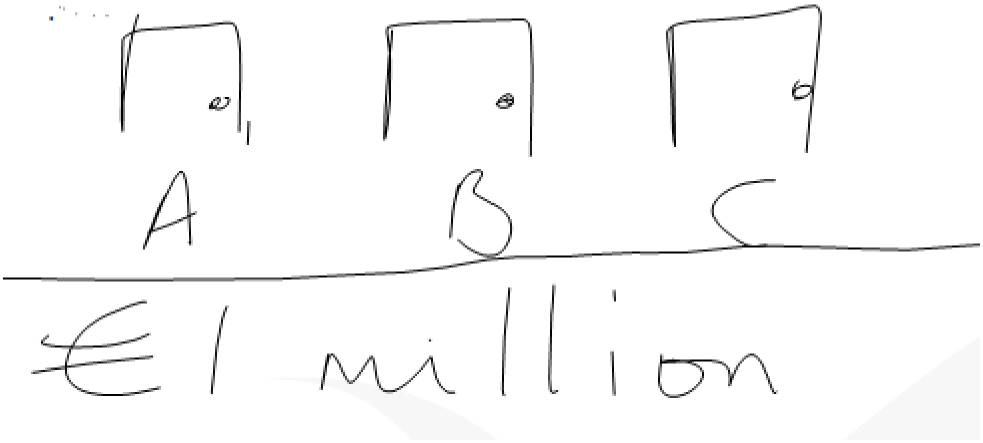
Examples of Abstraction:

Activity 4: Adapting the Monty Hall Problem

Think about a quiz show where the first prize is €1 million and final contestant has to choose one of the doors, behind one of which is the big prize.

The contestant chooses, say Door A, but, before the door is opened, the quiz show host reveals that there is nothing behind one of the other doors (B or C).

The contestant is then invited to change their choice.



What should they do - stick with their original choice? Change their choice? Or does it not matter what they do? Write down your first thoughts and then try experiments in threes to see what pattern emerges.

Your original thoughts: Stick? Change? Or Doesn't Matter?

Results and Conclusions of experiments (using Paper cups and a coin): (1 person plays the role of contestant, one as host and the 3rd person records)

Activity 5: Use Computational Thinking methods to answer the question: "Who has more sisters – boys or girls?"

Thoughts, Results and Analysis

Session 4: Teaching & Learning Programming

Learning Challenges faced by Novice Programmers

Your personal account of learning how to program.

Notes

Use the space provided on the next page to answer the two questions shown.

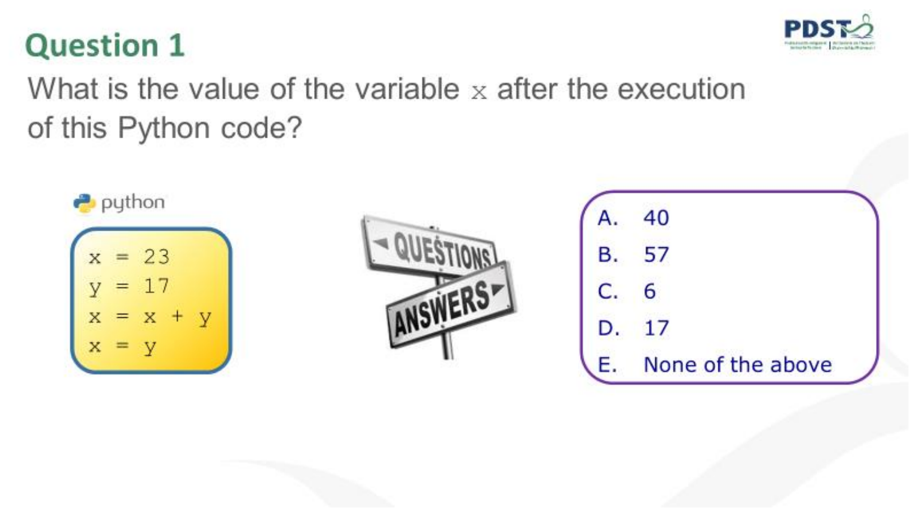
You may find the following questions useful to guide you:

- What was the first programming language you learned?
- If you ever learned a second programming language, how did the learning experience differ the second time around?
- Did you ever have that Aaahhh!! moment?
- Were there any programming constructs you found particularly difficult/easy to grasp?
- What was the balance between theory and practical?
- What were the practicals like?
- What approach was taken by your teachers?
- What was the nature of your learning?
- In what ways might Computer Science differ from other subjects in terms of learning (later we can ask the same question in terms of teaching)

How did you learn how to program?

What were the main challenges for you?

Programming Pedagogies: Warmup Activity



Question 1

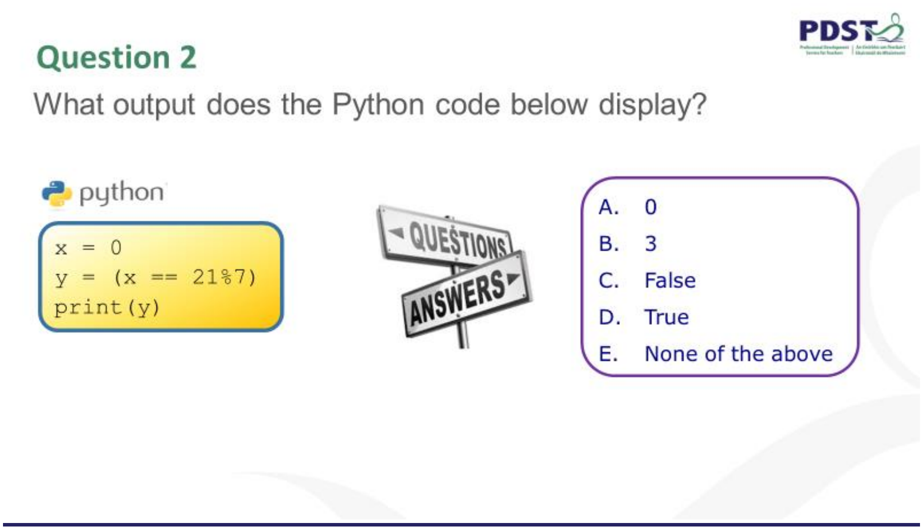
What is the value of the variable x after the execution of this Python code?

```
x = 23
y = 17
x = x + y
x = y
```

A. 40
B. 57
C. 6
D. 17
E. None of the above

- This is question 1 of 4
- Possible answers to all questions are A, B, C, D or E
- No conferring please!

Notes



Question 2

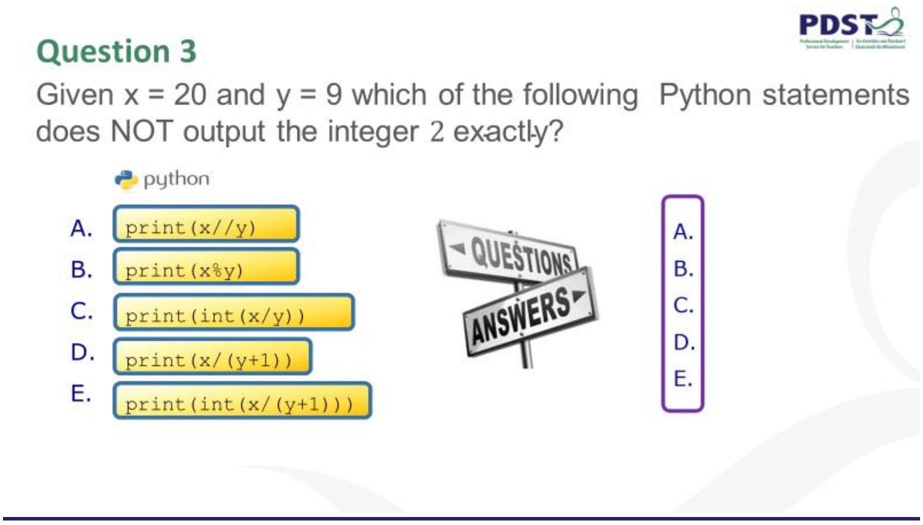
What output does the Python code below display?

```
x = 0
y = (x == 21%7)
print(y)
```

A. 0
B. 3
C. False
D. True
E. None of the above

- Keep going – this is question 2 of 4
- Don't worry about being incorrect
- All results are anonymous!

Notes



Question 3

Given x = 20 and y = 9 which of the following Python statements does NOT output the integer 2 exactly?

python

A. `print(x//y)`

B. `print(x%y)`

C. `print(int(x/y))`

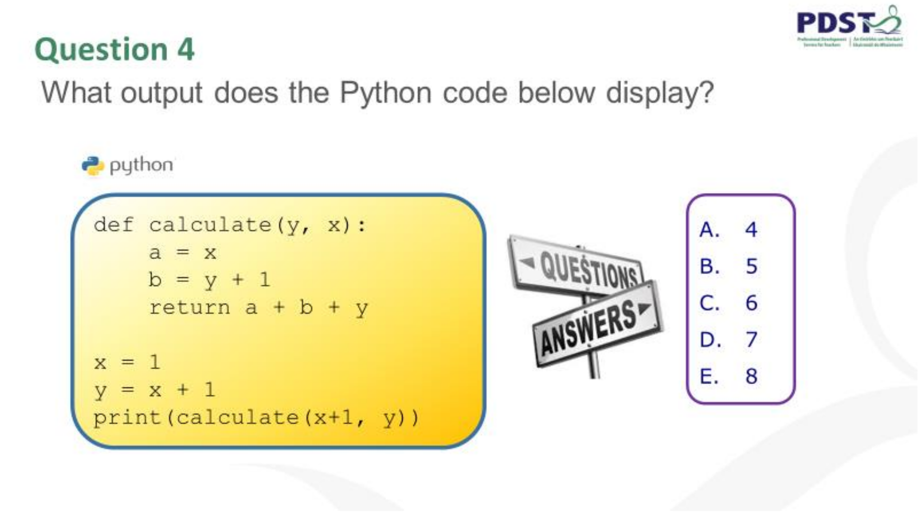
D. `print(x/(y+1))`

E. `print(int(x/(y+1)))`

A.
B.
C.
D.
E.

- Almost there – this is question 3 of 4
- You will have an opportunity to discuss with others later

Notes



Question 4

What output does the Python code below display?

python

```
def calculate(y, x):
    a = x
    b = y + 1
    return a + b + y

x = 1
y = x + 1
print(calculate(x+1, y))
```

A.	4
B.	5
C.	6
D.	7
E.	8

- Well done – this is the final question!

Notes

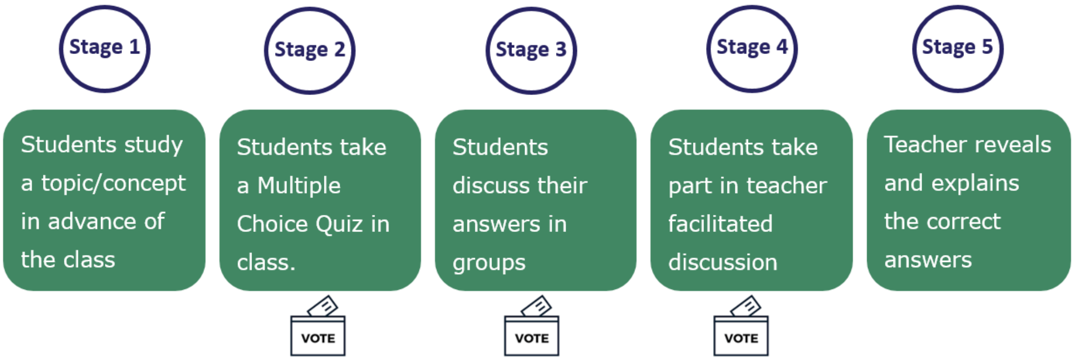
Programming Pedagogies: Peer Instruction

The warmup activity is an example of a slightly modified version of a programming pedagogy called *peer instruction*.

Peer instruction is a well-evidenced pedagogical strategy developed by Eric Mazur at Harvard University and has been used successfully in Physics, Mathematics and Computer Science. It involves a combination of flipped learning and collaborative working - based on carefully designed Multiple Choice Questions (MCQs) with structured discussion and voting.

Peer instruction offers a way of assessing whether novices really understand concepts that require a precise understanding. It is especially useful for testing *faulty mental models*.

The five key stages of peer instruction are illustrated in the diagram below


Stage 1
Students study a topic/concept in advance of the class
Stage 2
Students take a Multiple Choice Quiz in class.
VOTE
Stage 3
Students discuss their answers in groups
VOTE
Stage 4
Students take part in teacher facilitated discussion
VOTE
Stage 5
Teacher reveals and explains the correct answers

Research findings show that when used as an alternative to teacher explanation peer instruction[1]

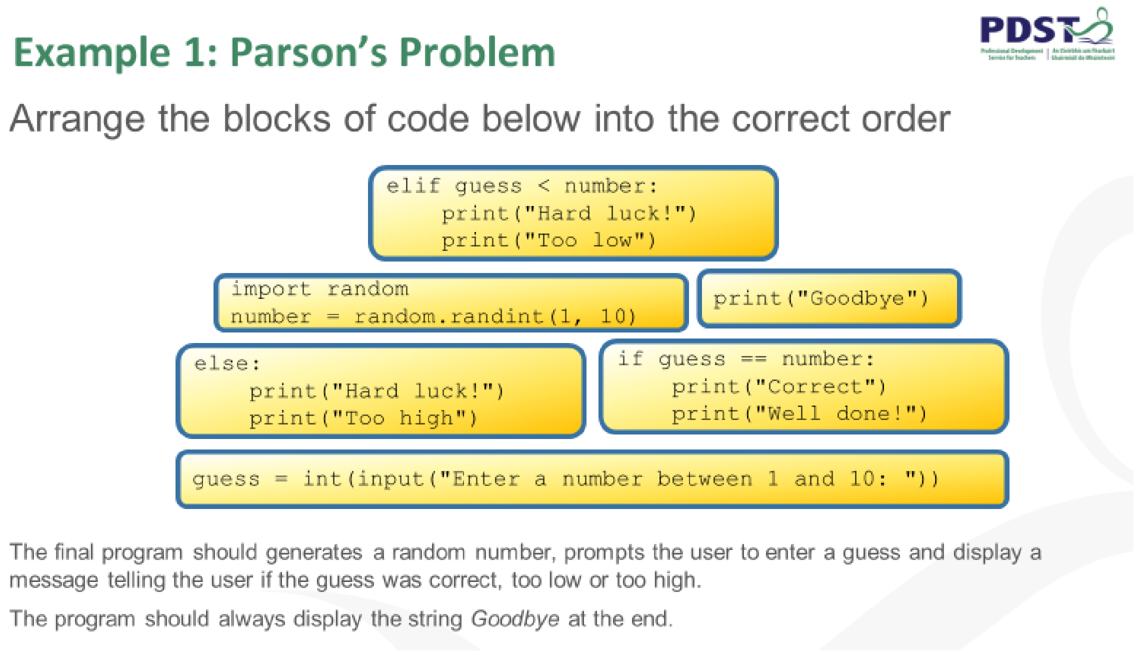
- has a statistically significant effect on learning
- is twice as effective as a good teacher explanation
- develops a better sense of self efficacy *especially among girls*

For more information on peer instruction see http://peerinstruction4cs.org

[1] Source: Strategies for teaching programming (Sue Sentence, CAS South East Conference, July 2017)

Programming Pedagogies: Parson's Problem

Example 1: Students are asked to arrange blocks of code to perform a specified task.



Example 1: Parson's Problem

Arrange the blocks of code below into the correct order

```
elif guess < number:
    print("Hard luck!")
    print("Too low")
```

```
import random
number = random.randint(1, 10)
```

```
print("Goodbye")
```

```
else:
    print("Hard luck!")
    print("Too high")
```

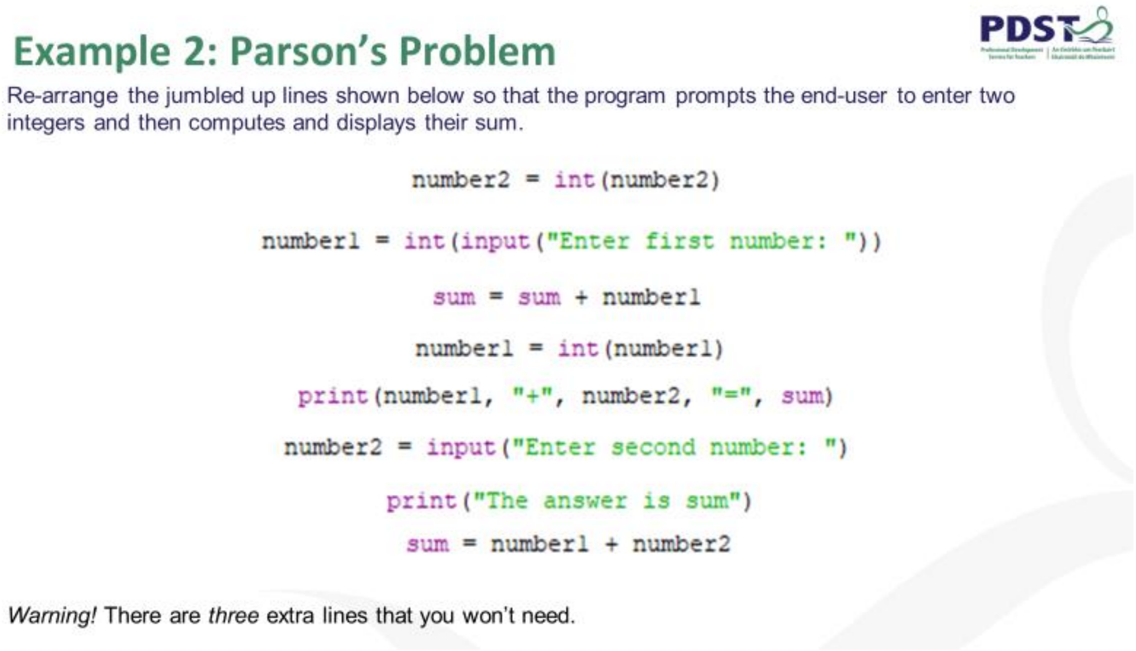
```
if guess == number:
    print("Correct")
    print("Well done!")
```

```
guess = int(input("Enter a number between 1 and 10: "))
```

The final program should generates a random number, prompts the user to enter a guess and display a message telling the user if the guess was correct, too low or too high.

The program should always display the string *Goodbye* at the end.

Example 2: Students are asked to arrange blocks of code to perform a specified task but this time with extra lines of code which are not needed (called *distractors* or red herrings).



Example 2: Parson's Problem

Re-arrange the jumbled up lines shown below so that the program prompts the end-user to enter two integers and then computes and displays their sum.

```
number2 = int(number2)
number1 = int(input("Enter first number: "))
sum = sum + number1
number1 = int(number1)
print(number1, "+", number2, "=", sum)
number2 = input("Enter second number: ")
print("The answer is sum")
sum = number1 + number2
```

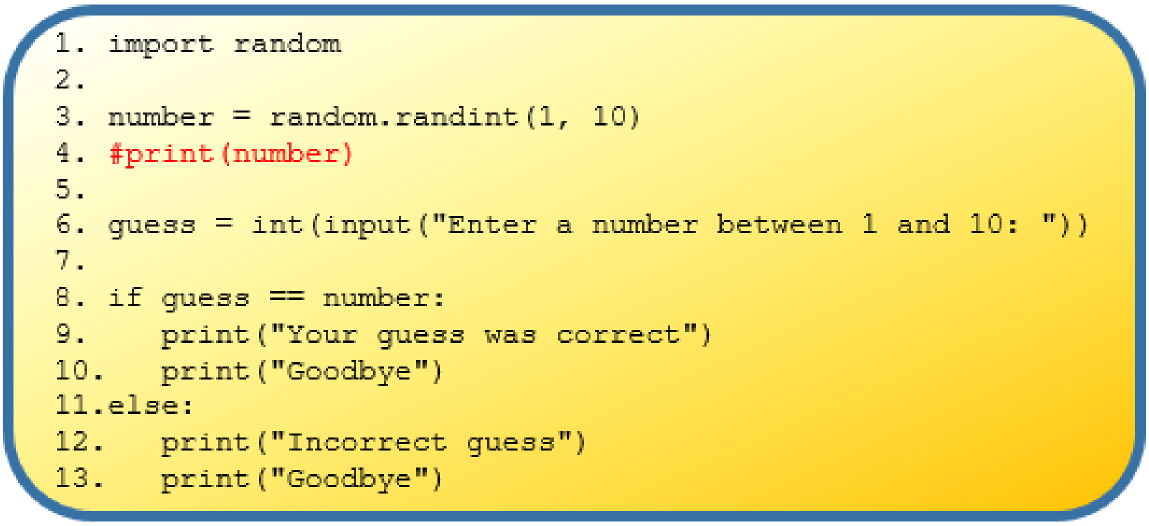
Warning! There are *three* extra lines that you won't need.

Programming Pedagogies: PRIMM

Students are …

- asked to **Predict** what code will do
- **Run** it and see if their prediction was correct
- given some tasks to help them to **Investigate** the code
- asked to **Modify** the code to do make it do different things
- asked to **Make** a new program

PRIMM Example



```python
import random

number = random.randint(1, 10)
#print(number)

guess = int(input("Enter a number between 1 and 10: "))

if guess == number:
    print("Your guess was correct")
    print("Goodbye")
else:
    print("Incorrect guess")
    print("Goodbye")
```

Predict: Discuss in pairs. What do you think the above program will do?

Be precise.

Run: Download the program / key it in. Execute the program. Test your prediction.

Were you correct?

Notes

Investigate:

1. Uncomment line 4. What happens?
2. What is the purpose of line 4?
3. What would happen if you removed int from line 6?
4. Try changing == to != on line 8. What happens?
5. What if == was changed to = ?
6. What would happen if you don't enter an integer?
7. Try removing a bracket (anywhere). What happens?
8. Annotate each line of the program

Modify:

1. Change the program so that it generates a number between 1 and 100
2. Change the program so that there is only one print ("Goodbye") statement (without altering the logic)
3. Extend the program so that it tells the user if the number entered was too high or too low
4. Design an algorithm based on the program that would give the user 3 guesses
5. Get the computer to generate 4 numbers (lotto) OR ask the user how many numbers to generate

Make: Write a program that generates two numbers and prompts the user to enter their product

Notes

Notes:

Notes:

Notes:

Professional Development Service for Teachers | An tSeirbhís um Fhorbairt Ghairmiúil do Mhúinteoirí

info@pdst.ie | pdst.ie

An Roinn Oideachais agus Scileanna
Department of Education and Skills

Dublin West Education Centre

The PDST is funded by the Teacher Education Section (TES) of the Department of Education and Skills (DES) and is managed by Dublin West Education Centre