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

An Roinn Oideachais agus Scileanna
Department of Education and Skills

National Workshop 1

LEAVING CERTIFICATE
COMPUTER SCIENCE

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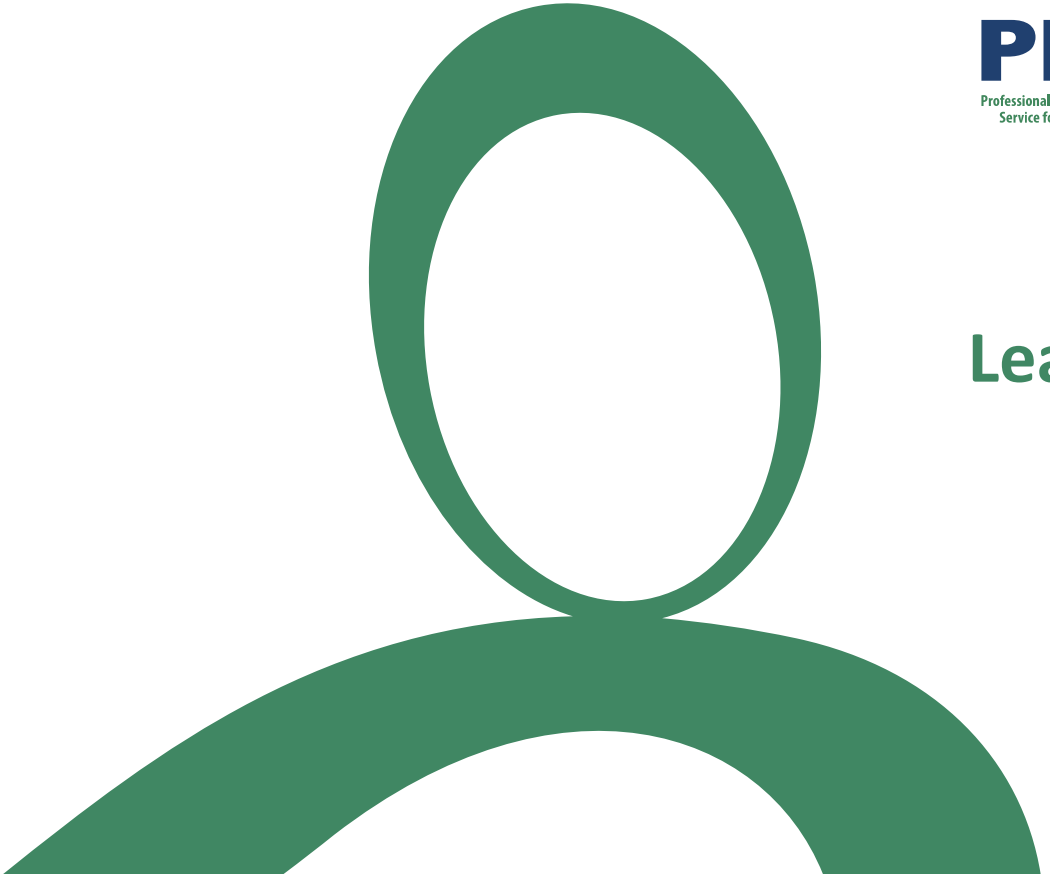
Professional Development Service for Teachers | An tSeirbhís um Fhorbairt Ghairmiúil do Mhúinteoirí

Session 2 – Learning Outcomes & Applied Learning Tasks



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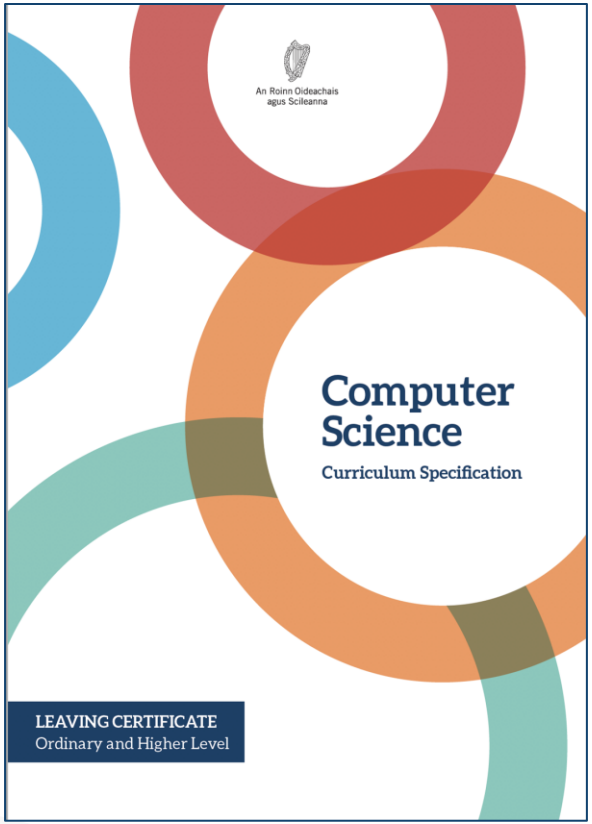
Learning Outcomes

Leaving Certificate Computer Science Curriculum Specification

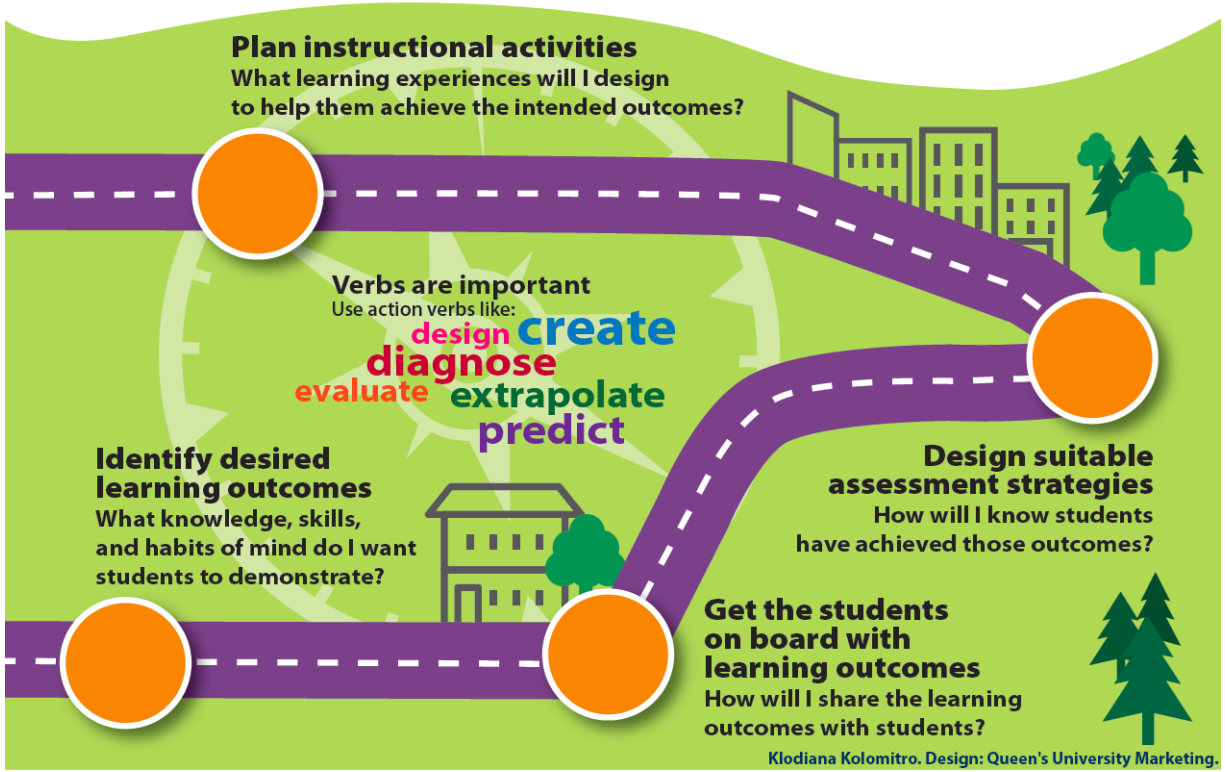


‘Learning outcomes can best be defined as statements of what a learner knows, understands and is able to do after completion of learning.’

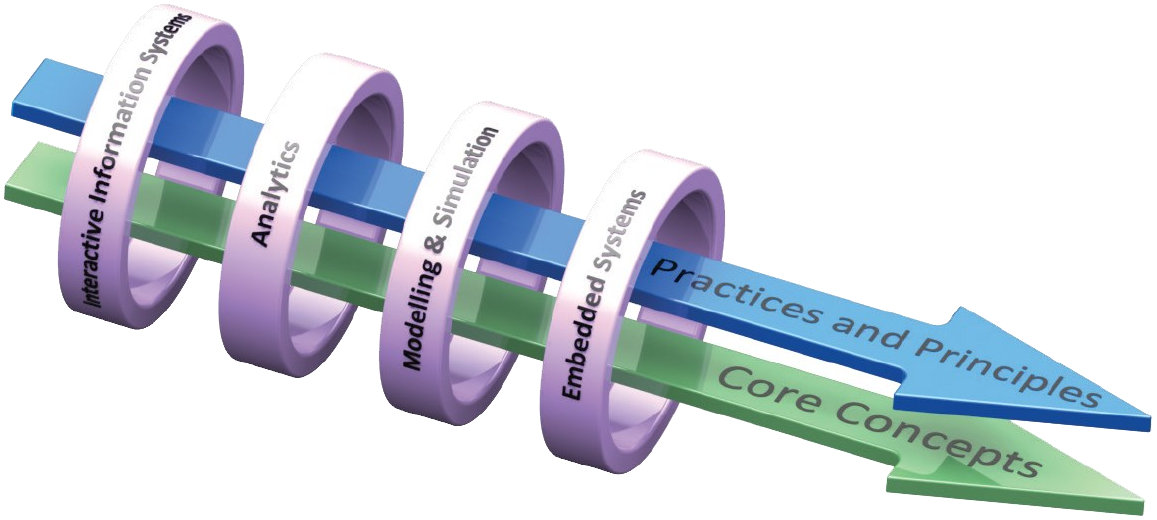
CEDEFOP (2009)

Learning Outcomes

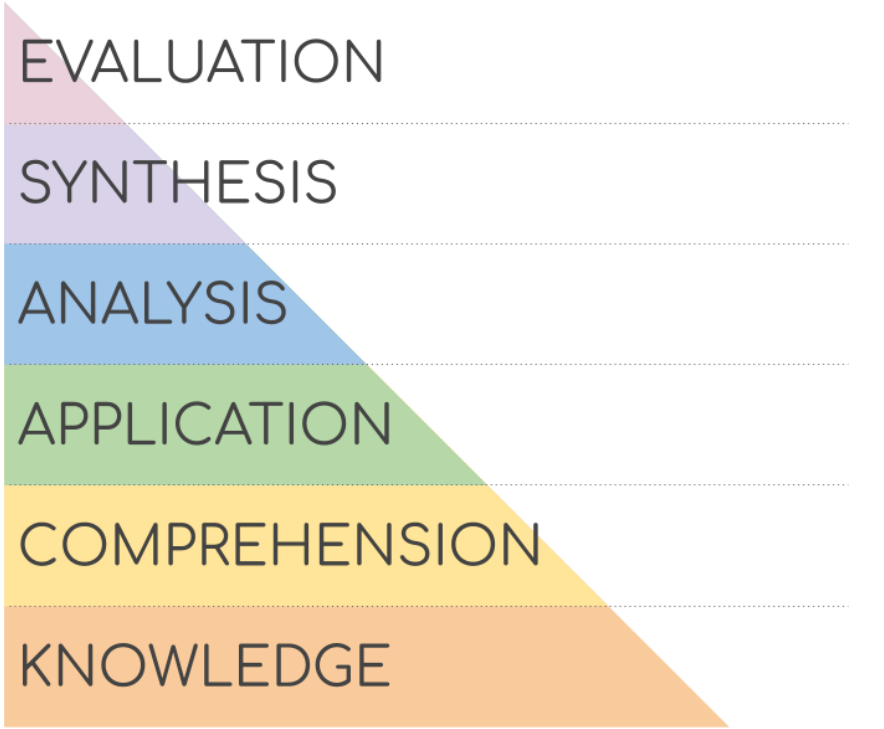
Learning outcomes are direct statements that describe the knowledge, skills, and habits of mind that students are expected to reliably demonstrate after a learning experience.



LCCS Interwoven



Bloom's Taxonomy



LCCS Learning Outcomes

	<——— 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

Instructions

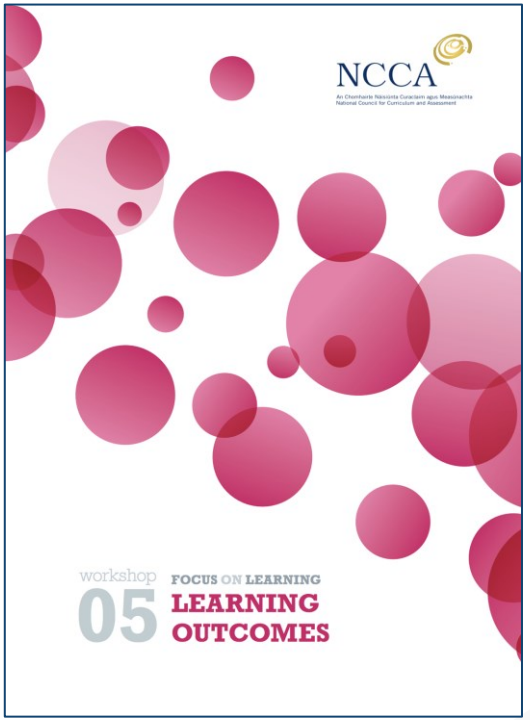
Examine the learning outcomes (LOs) and pick 2 or 3 from different strands that could be experienced together.

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?

Please record your ideas/discussion on the shared document.

15 minutes

More on Learning Outcomes



Learning Outcomes to Success Criteria

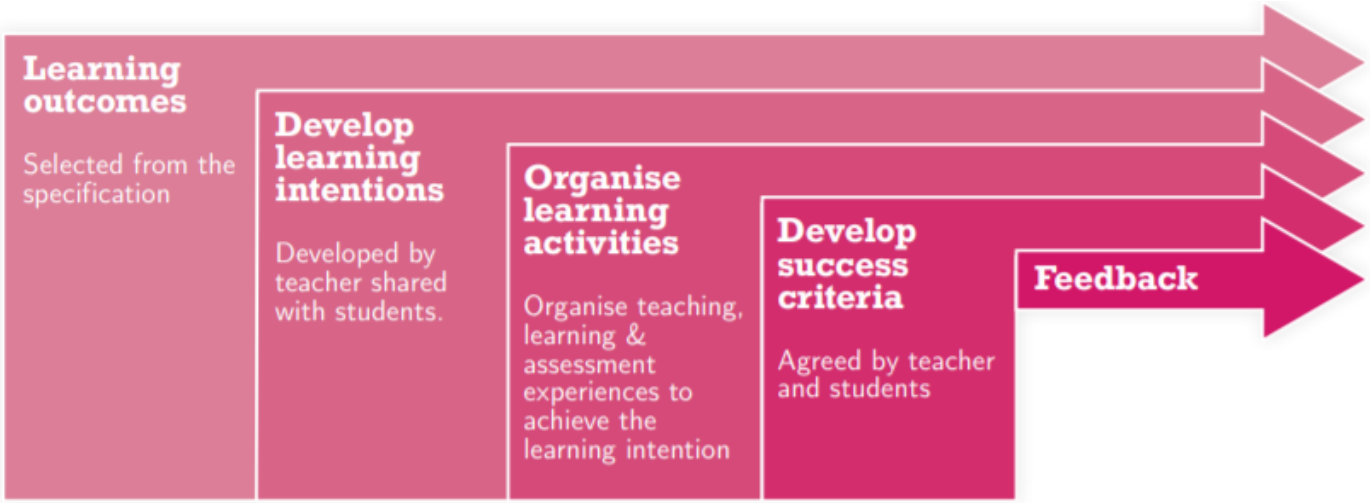


Figure 1: Planning teaching learning and assessment

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)*.

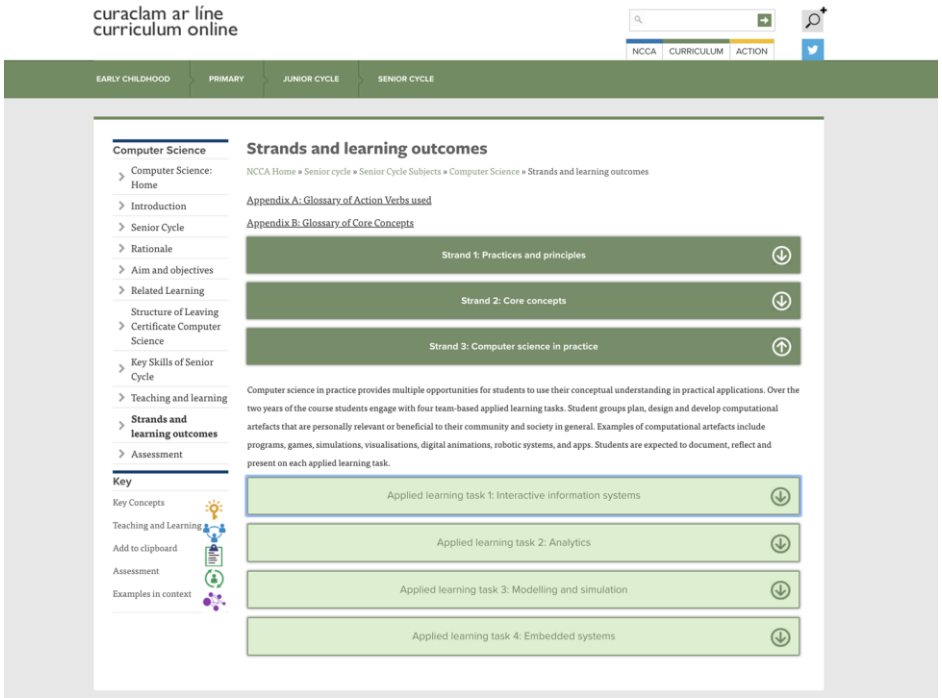
(a) Wang, X., Su, Y., Cheung, S., Wong, E., & Kwong, T. (2013). An exploration of Biggs' constructive alignment in course design and its impact on students' learning approaches. *Assessment and Evaluation in Higher Education, 38*, 477-491.

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

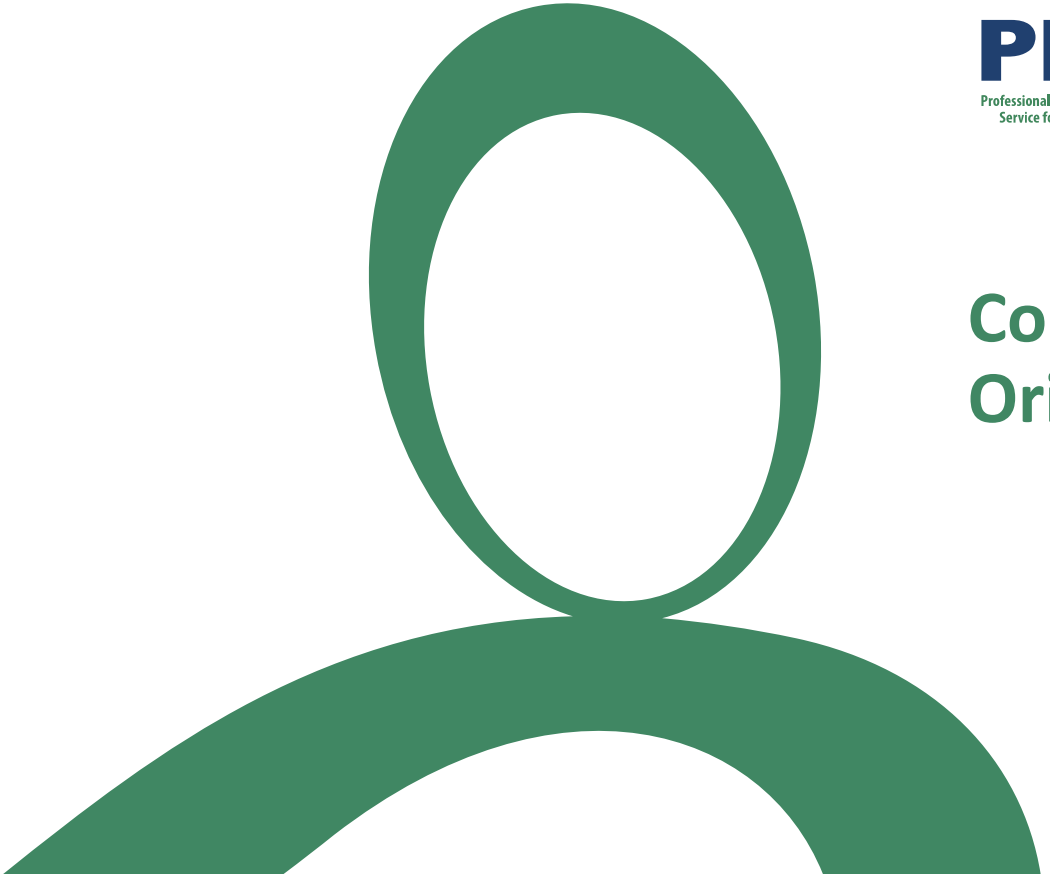
(c) Reynolds, H. L., & Kearns, K. D. (2017). A planning tool for incorporating backward design, active learning, and authentic assessment in the college classroom. *College Teaching, 65*, 17-27.

Created by Sara M. Fulmer

NCCA Supports for LCCS



https://www.curriculumonline.ie



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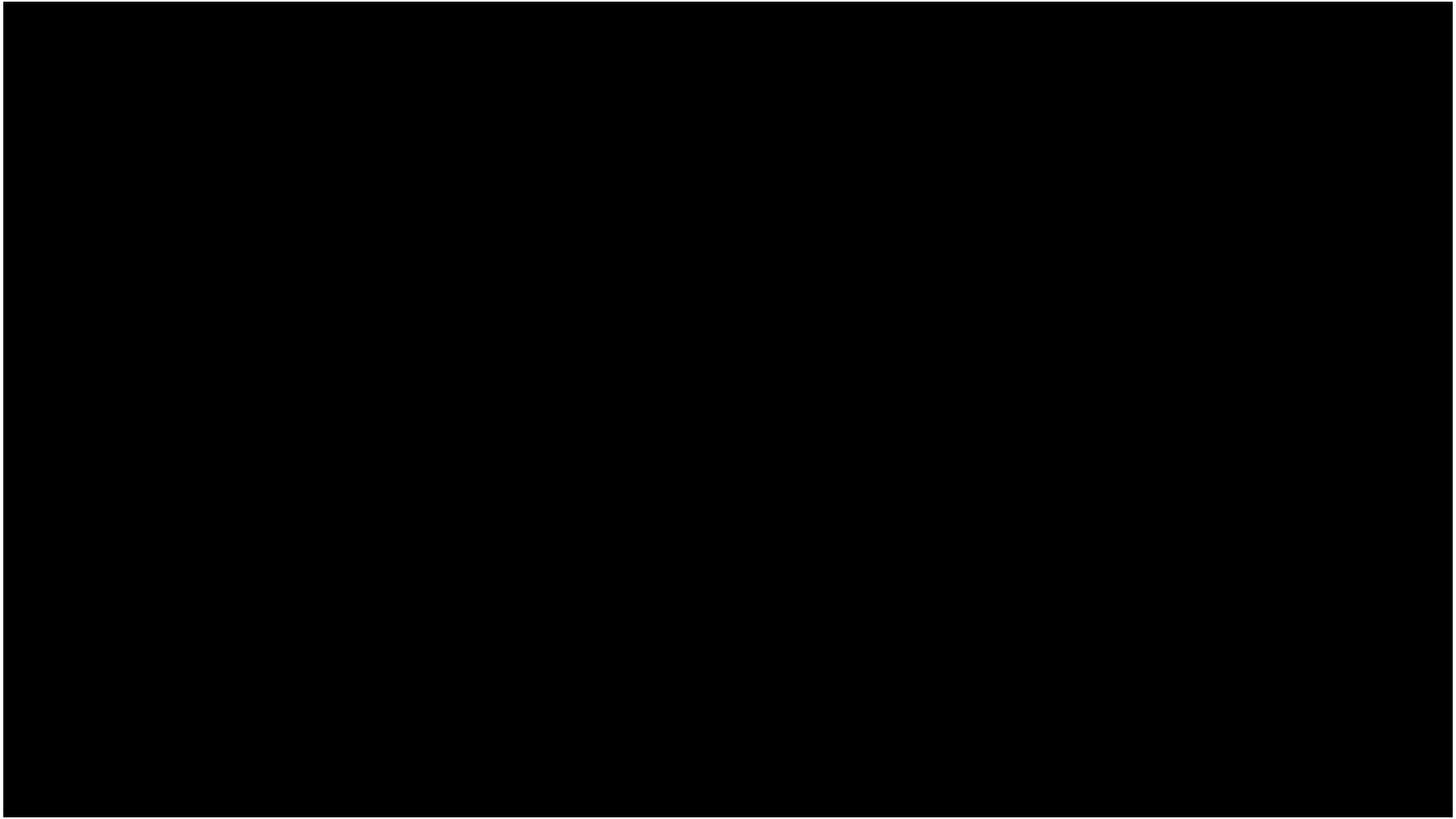
Constructivist Pedagogical Orientation



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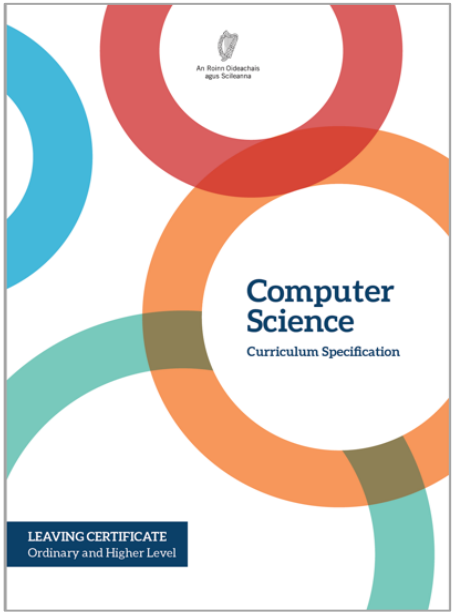
Applied Learning Tasks

'Students work in teams to carry out four applied learning tasks over the duration of the course.'

'Each of which results in the creation of a real or virtual computational artefact.'

'Where possible, the artefacts should be beneficial to the community and society in general.'



'These artefacts should relate to the students' lives and interests.'

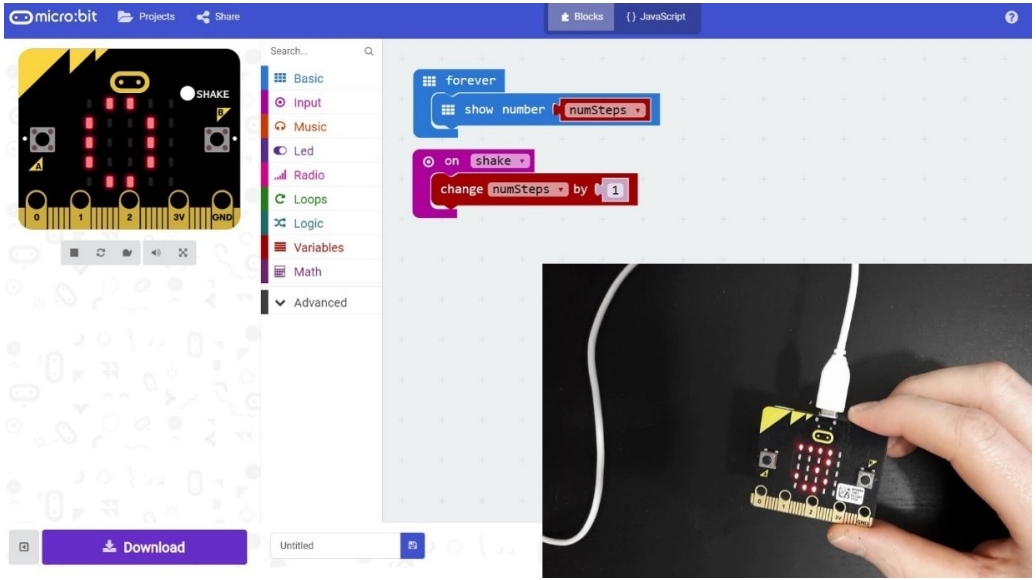
'Examples of computational artefacts include programs, games, web pages, simulations, visualisations, digital animations, robotic systems, and apps.'

LCCS Specification: p10

The four applied learning tasks (ALTs) explore the following four contexts:

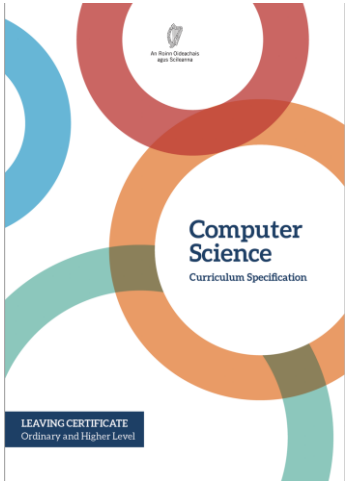
ALT 1: Interactive information systems
ALT 2: Analytics
ALT 3: Modelling and simulation
ALT 4: Embedded systems.

What is an Applied Learning Task?



The 4 Applied Learning Tasks (ALT's) (such as an embedded system) give students opportunities to apply their skills and learn to create digital artefacts.

LCCS Interwoven



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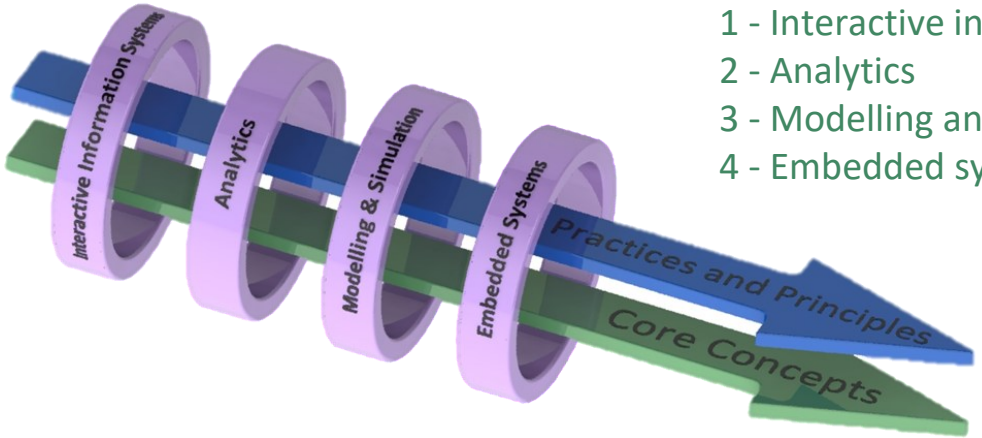
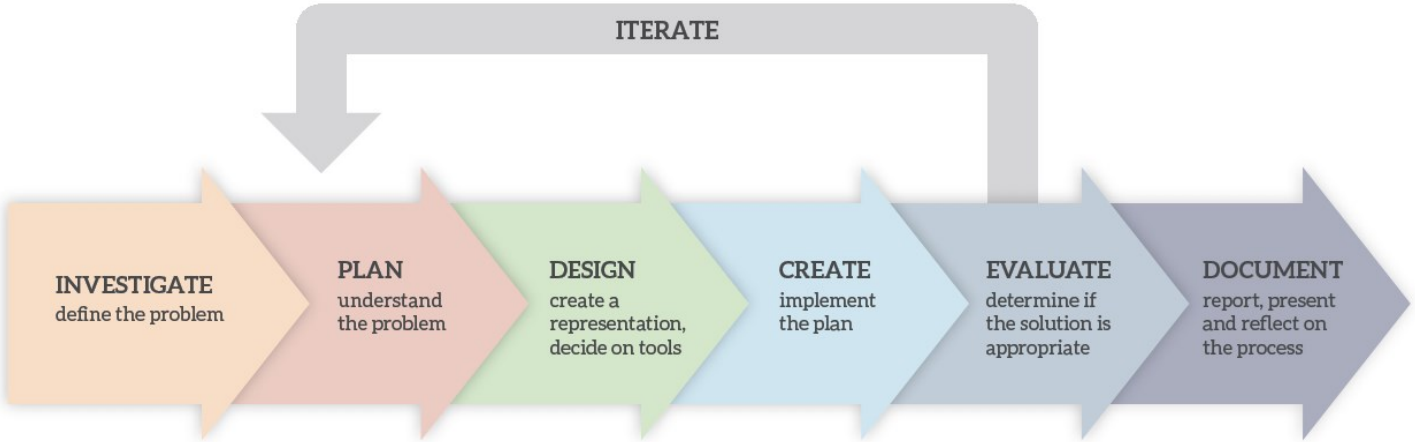


1 - Interactive information systems
2 - Analytics
3 - Modelling and simulation
4 - Embedded systems.

Key to remember:

The Learning Outcomes are explored through the lens of ALTs.

Design process



LCCS Specification: p11

Group Activity / Breakout

Group Activity #1: 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 (Google slide) under your Group Number – can be text / images etc.
5. Present ideas to the wider group.

15 minutes

2 minute stretch break

Group Activity #2: Expanding your idea

In your assigned groups:

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

Group Activity #2: continued

- *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?*

10 minutes

An Roinn Oideachais
agus Scileanna
Department of
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