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Inclusive Science Pedagogies through Universal Design for Learning

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#ASETDConf26

ASSOCIATION FOR SCIENCE EDUCATION

Intended Learning Outcomes

By the end of the session, participants will:

- Understand the 3 core UDL principles in a science context
- Identify barriers to participation in science learning
- Apply UDL to adapt an existing science activity
- Leave with ready-to-use inclusive strategies

Signposting

Time	Activity
5m	Introduction/provocation & poll
5-15	UDL principles in science
15-40	Choice block: learning station or challenge cards (primary/secondary options)
40-50	feedback from groups, debrief difference between tasks
50-60	Reflection & next steps

Who is excluded?

Primary: investigate how the surface area of a parachute affects its drop time

Secondary: outline the data handling for the Specific Heat Capacity required practical

Who might struggle here?

Is this is science problem or a task design problem?

In UDL, we design flexible learning environments, not ‘fix’ learners

UDL principles applied to science 1

1. Multiple Means of Representation (the *what*)

How content is presented

- Diagrams + models + simulations
- Practical demos + videos + annotated images
- Word banks, symbols, dual coding

  Example:

Instead of only text on electrical circuits → use circuit kits, simulations, labelled visuals

UDL principles applied to science 2

2. Multiple Means of Action & Expression (the *how*)

How students show understanding

- Written explanations *or* verbal *or* diagrams *or* models
- Poster, presentation, practical demonstration
- Scaffolded templates for reports

  Example:
- Students explain particle theory by:
  - Drawing
  - Building with objects
  - Recording a short explanation

UDL principles applied to science 3

3. Multiple Means of Engagement (the *why*)

Motivation and relevance

- Choice of context (sports, environment, space)
- Enquiry-based questions
- ‘Real-world’ problems

  Example:

Climate change data vs local pollution vs biodiversity investigation

A 'typical' task

Complete the worksheet about food chains

Identify barriers under:

- Representation
- Expression
- Engagement

Principle: What could you add/change?
Representation, e.g., images, models, video
Action/Expression, e.g., draw, build, explain verbally
Engagement, e.g., choice, real-life link

Example transformation

Original:
Complete worksheet

UDL version:
- Watch short clip + food chain cards
- Build a food web physically
- Explain using diagram or voice recording
- Choose your context (ocean / woodland / local park)

Encourage:
- Low-prep adaptations
- Small achievable changes (not full rewrites)

Choose your path - breakouts

A. Learning station – Primary

B. Challenge Cards – Primary

C. Learning station – Secondary

D. Challenge Cards – Secondary

Learning stations = choice + movement + exploration

Challenge cards = constraint + focus + depth

Chatterfall [what is this?]

1. Engagement (The Why of Learning)

- What is one new way you can offer your learners more choice or autonomy based on the challenge cards?
- How can you make your learning topics more personally relevant and authentic to your specific students?
- What is a specific strategy you can use to minimize threats and distractions in your redesign?

2. Representation (The What of Learning)

- What flexible ways can you present your content so it is not reliant on just one medium or format (e.g., text only)?
- Which accessibility tools or customisable materials did you find most useful at the learning stations

3. Action & Expression (The How of Learning)

- How can you provide students with options to show what they know in a way that aligns with their unique strengths?
- What executive function supports (like graphic organizers or planning templates) can you embed into your redesign?

Unistructural to Multistructural

Quantitative. Gives one piece of information in response moving to giving several pieces of information. No reasons or linkage given. May recall facts without understanding or find information from the text.

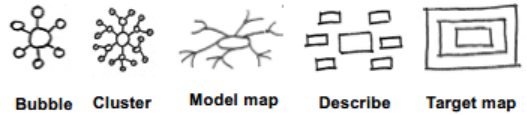
Key command verbs

Ask	Generalise	Measure Name	Rephrase
Choose	Give examples	Observe	Report
Cite Copy	Identify	Outline Quote	Reproduce
Define	Illustrate	Read	Retell
Demonstrate	Indicate	Recall	Restate
Discuss	Infer Interpret	Recite	Review
Duplicate	Label	Recognise	Select
Estimate	List	Record	Show Spell
Express Extend	Locate	Remember	State
Find	Match	Repeat	Summarise
			Tell Write

Outcomes and Products

Cartoon	Examples	Photograph	Story
Chart Collage	Explanation	Poster Quiz	Summary
Collection	Fact	Recording	Table
Definition	Glossary	Reproduction	Test
Diagram	Label List	Show and tell	Workbook
Dictionary	Outline	Speech	Worksheet

Graphic Organiser



Questions/Stems [What, When, Where, Which, Who]

What is ...? What happened...?	Define/ describe ...
When did ...? When was...?	Which facts or ideas show that...?
Where did...? Where is...?	How would you summarise ...?
Which one ...? List three ...	What examples can you find to ..?
Can you recall ...?	Identify the characteristics of...
Can you choose/select ...?	What can you say about ...?
Who was ...? Who were...?	Demonstrate when/where...
Label the main parts of...	Who/What were the key...?
Estimate/Outline which...	What is the main idea of ...?

SOLO Taxonomy Pedagogy Planning Toolkit

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Relational

Quantitative and Qualitative. Shows how several pieces of information link together, seems purposeful or strategic. Can demonstrate integration of facts and ideas. Application to new and unfamiliar situations.

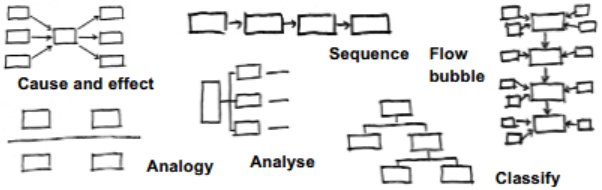
Key command verbs

Analyse Apply	Dissect Divide	Manipulate	Select
Appraise Arrange	Dramatise	Order	Separate
Associate	Employ Establish	Organise	Sequence
Breakdown	Examine Execute	Perform	Show Simplify
Calculate	Experiment Find	Plan Practice	Simulate Solve
Carry out	Focus Group	Prioritize	Summarise
Categorise Choose	Illustrate	Question Rank	Survey
Classify Connect	Implement Infer	Reason Relate	Tabulate Teach
Construct Correlate	Interpret	Reorganise	Transfer
Demonstrate	Interview	Represent	Translate
Develop Discover	Investigate Link	Research	Use

Outcomes and Products

Analogy	Diary	Journal	Questionnaire
Analysis	Draft	Model	Report
Argument	Drama Filmstrip	Performance	Sculpture
Cartoon Conclusion	Forecast Graph	Poster	Simulation
Demonstration	Illustration	Presentation	Survey
Diagram	Interview	Project Puzzle	Syllogism

Graphic Organiser



Questions/Stems [Previous, plus How, Why]

Explain what is happening when...	Prioritize/ Rank/Sequence....?
How is .....analogous to....?	What is the relationship between...?
How would you use/ apply....?	What contributions do.....make to..?
How would you organise ..... to show ...?	Is this a correlation or a causation?
What is meant by. . .?	What is the theme of...?
Use your findings to develop ....?	Why does the character...?
What conclusions can you draw ...?	What motive is shown by ...?
How would you explain ...?	Using what we have practised, how would you solve...?
Why did ...? What would result if ...?	Why do you think ...?
What facts or ideas would you select to prove ...?	What inference can you make ...?
Identify the different parts of...?	How would you categorise/ classify ...?
Illustrate which parts/ features of ...?	What evidence can you find ...?
What is the function of ...?	Give reasons why ...?
How does.....occur?	

Extended Abstract

Quantitative and Qualitative. Goes beyond relational to make links to other concepts/generalises to a different domain or context. Justifying; presenting & defending opinions; weighing validity/ quality with respect to established criteria. Aspects of creation & originality.

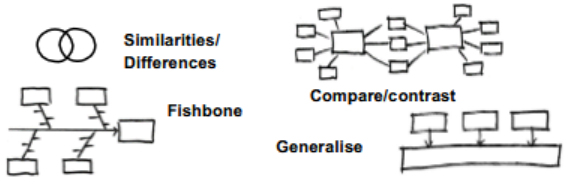
Key command verbs

Adapt	Decide Deduct	Explain Extend	Produce
Appraise	Defend Design	Formulate	Propose Prove
Argue Assess	Determine	Hypothesise	Rate
Build Change	Develop Devise	Imagine Improve	Recommend
Combine	Disprove	Infer Influence	Revise Solve
Compare	Discover Dispute	Innovate Integrate	Speculate
Compose	Distinguish	Invent Interpret	Substitute
Conclude	Elaborate	Judge Justify	Test Theorise
Construct	Estimate	Model Modify	Transform
Convert Create	Evaluate	Perceive Persuade	Validate
Criticise Debate	Experiment	Predict Prioritise	Visualise

Outcomes and Products

Abstract Article	Database	Plan Play Poem	Set of rules or
Advertisement	Experiment Film	Project	principles Song
Book	Game	Recommendation	Story
Chart Checklist	Graph Invention	Report	Spreadsheet
Comic Strip	Media Product	Role play	Storyboard
Court trial	Painting	Self-evaluation	Survey

Graphic Organiser



Questions/Stems [Previous, plus How, Why, *could*, *might*]

How would you evaluate/ adapt/improve...?	What data supports the conclusion and why...?
How could you determine...?	How would you adapt ..... to create a different...?
Assess the value/importance of...?	What could be done to minimise (or maximise)...?
What is your opinion of...?	How would you create/design a new ...? What ideas can you add to ...?
Do you support the outcomes/ actions of...? What would you recommend...?	What would you predict/infer from ...? What changes would you make to solve ...?
What would you select/how would you justify...?	Can you propose an alternative...?
How would you prove/disprove...?	Can you formulate a theory for/ hypothesise why...?
Why did they (person/character) choose...?	What solutions would you suggest for ...?
How would you rank/prioritise the...?	
Which is the best answer/model ...?	
What might happen if you combined ...?	
What would happen if...?	

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Reflection and take-home

What is the biggest barrier in your current curriculum that this UDL redesign activity will help you remove?

In one word or a short phrase, what is your key takeaway from the learning stations today?