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Bloom, Katy (2026) Inclusive Science Pedagogies through Universal Design for Learning. In: ASE Teacher Developers National Conference, 26 June 2026, Online. (Unpublished)

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Inclusive Science Pedagogies through Universal Design for Learning

Dr Katy Bloom

York St John University

#ASETDConf26

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)









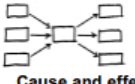
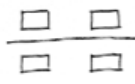
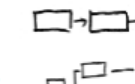
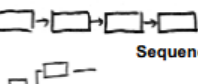
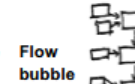
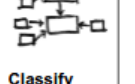
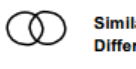

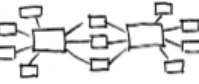
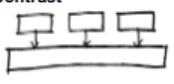



- What is one new way you can offer your learners more choice or autonomy based on the challenge cards?
- How can you make your learning topics more personally relevant and authentic to your specific students?
- What is a specific strategy you can use to minimize threats and distractions in your redesign?

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?

 Unistuctural to Multistuctural	 Relational	 Extended Abstract
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.	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.	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 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	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 Infr Reason Relate Tabulate Teach Construct Correlate Interpret Reorganise Transfer Demonstrate Interview Represent Translate Develop Discover Investigate Link Research Use	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 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	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	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  Bubble  Cluster  Model map  Describe  Target map	Graphic Organiser  Cause and effect  Analogy  Analyse  Sequence  Flow bubble  Classify	Graphic Organiser  Similarities/ Differences  Fishbone  Compare/contrast  Generalise
Questions/Stems [What, When, Where, Which, Who] What is ...? What happened...? When did ...? When was...? Where did...? Where is...? Which one ...? List three ... Can you recall ...? Can you choose/select ...? Who was ...? Who were...? Label the main parts of... Estimate/Outline which...	Questions/Stems [Previous, plus How, Why] Explain what is happening when... How isanalogous to...? How would you use/ apply...? How would you organise to show ...? What is meant by ...? Use your findings to develop ...? What conclusions can you draw ...? How would you explain ...? Why did ...? What would result if...? What facts or ideas would you select to prove ...? Identify the different parts of...? Illustrate which parts/ features of ...? What is the function of ...? How does.....occur?	Questions/Stems [Previous, plus How, Why, could, might] How would you evaluate/ adapt/improve...? How would you determine...? Assess the value/importance of...? What is your opinion of...? Do you support the outcomes/ actions of...? What would you recommend...? What would you select/how would you justify...? How would you prove/disprove...? Why did they (person/character) choose...? How would you rank/prioritise the...? Which is the best answer/model ...? What might happen if you combined ...? What would happen if...?
SOLO Taxonomy Pedagogy Planning Toolkit  Dr Katy Bloom York St John University @bloom_growhow	 	What data supports the conclusion and why...? How would you adapt to create a different...? What could be done to minimise (or maximise)...? How would you create/design a new ...? What ideas can you add to ...? What would you predict/infer from ...? What changes would you make to solve ...? Can you propose an alternative...? Can you formulate a theory for/ hypothesise why...? What solutions would you suggest for ...?

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?