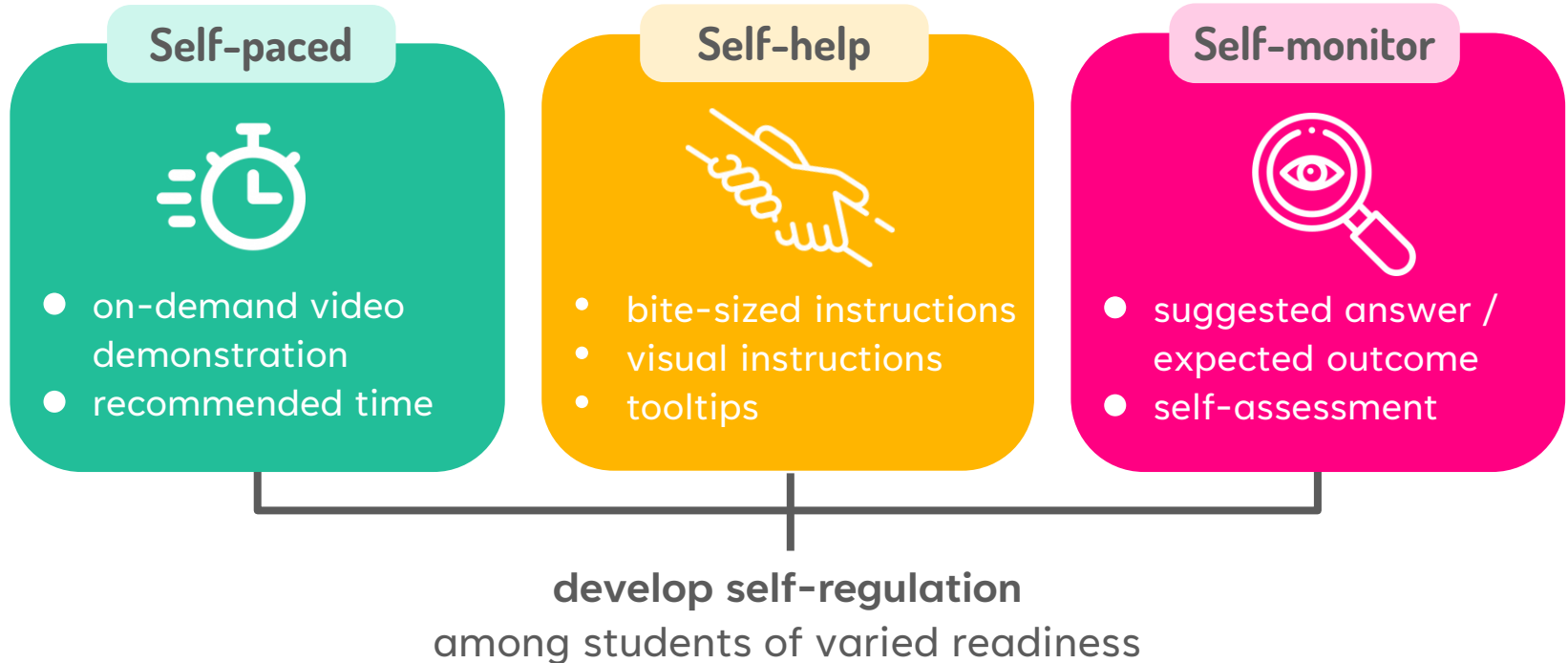




# Supporting Self-Regulated Learning in Practical Lessons

# Key Elements of Lesson Design



# How to use the SLS modules?

## Pre-lesson



To familiarise students with the practical tasks prior to the lesson

## During lesson



To promote students' autonomy during the practical lesson

## Post-Lesson



To revisit practical tasks with visual information for revision

### Subjects:

(Upper Secondary) Biology, Chemistry, Physics, Nutrition and Food Science  
(Lower Secondary) Food and Consumer Education, Science

# Spotlight of SLS Features

# Encourage the 'thinking behind the doing' with pre-practical activities

Prerequisite activities such as reordering a set of jumbled procedures or completion of partial procedures could encourage students to **actively think** about steps in the experimental procedures.

**INSTRUCTIONS**  
Match the empty boxes in the image with the options by selecting the empty box and the correct option

Place the steps in the proper order for preparing a pure and dry sample of copper(II) sulfate salt.

- 1 Add excess copper(II) oxide to dilute sulfuric acid.
- 2 Filter the mixture to obtain the filtrate.
- 3 Heat the filtrate until it is saturated.
- 4 Allow the saturated solution to cool for the salt to crystallise.
- 5 Filter the mixture to collect copper(II) sulfate crystals.
- 6 Rinse the crystals with a small amount of cold distilled water.
- 7 Dry the crystals between sheets of filter paper.

Reorder jumbled procedures using click-and-drop questions

1) Measure 50 cm<sup>3</sup> of liquid L using a \_\_\_\_\_ and pour it into the plastic cup.

2) Measure and record the initial temperature of the plastic cup using a \_\_\_\_\_.

answer

- beaker
- burette
- measuring cylinder
- pipette

Complete procedures using fill-in-the-blanks questions

# Enhancing learning with accessible bite-sized multi-modal instructions

Replayable videos and/or animation enable students to **self-pace** and **revisit demonstration to self-help** as necessary, providing **greater clarity**. It also enables the teacher to focus on more complex guidance.

The screenshot shows a digital recipe interface. At the top, it says '2 Preparation and Cooking'. Below this is a horizontal row of 12 numbered steps, with step 2 highlighted in a pink box. Below the steps is a blue-bordered box containing the recipe details. On the left, the title 'Shortcrust pastry' is followed by five numbered steps. Step 2 is highlighted in red text. On the right, there is a video player showing hands kneading dough in a bowl. The video player has a search icon, a refresh icon, and a download icon.

2 Preparation and Cooking

1 2 3 4 5 6 7 8 9 10 11 12

**Shortcrust pastry**

1. Sift the plain flour and salt in a mixing bowl.
2. **Add cold butter into the sifted flour. Cut into smaller cubes using a palette knife and rub them into the flour with fingertips until the mixture resembles breadcrumbs and is pale yellow in colour.**
3. Add cold water slowly into the breadcrumb mixture and mix to form a soft dough.
4. Knead the dough on a lightly floured surface with fingertips until smooth.
5. Wrap the dough in a cling wrap and rest it in the chiller for 10 minutes.

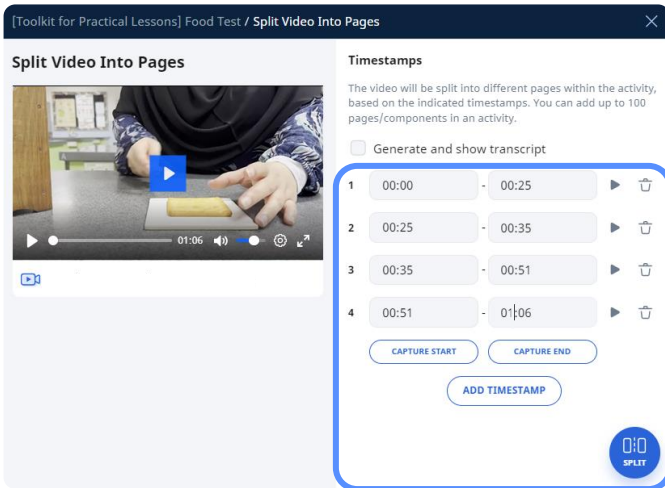
Search Refresh Download

Chunking step-by-step instructions using paginated activity

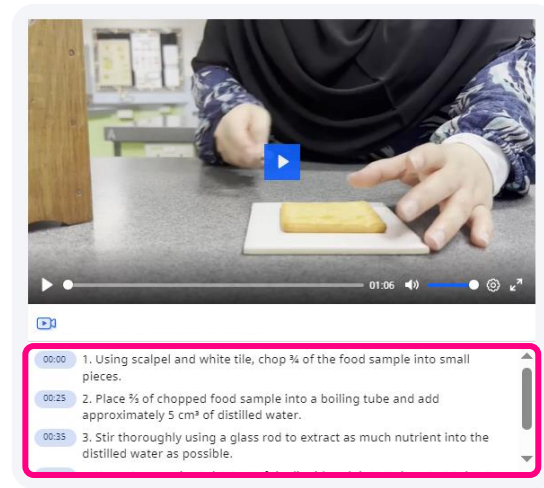
Present multi-modal instructions (textual and visual) using 2-column display

# Enhancing learning with accessible bite-size multi-modal instructions

Bite-sized videos help students to **follow instructions better** and be **more engaged** as they **receive instructions in a timely manner** while performing the task.



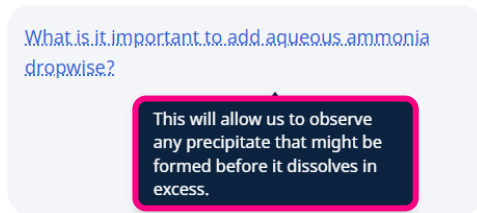
Split video into step-by-step lengths across paginated activity



Split video into step-by-step lengths anchored to a timestamp using transcript

# Encourage the 'thinking behind the doing' with just-in-time questions

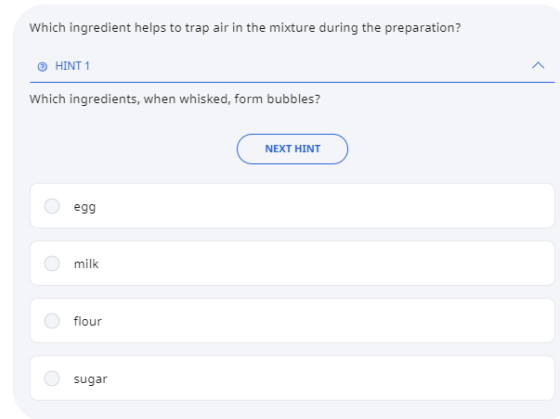
Questions about the purpose behind the steps could be displayed alongside the experimental procedure to **cultivate active thinking** with explanation provided on hover to support students.



.What is it important to add aqueous ammonia dropwise?

This will allow us to observe any precipitate that might be formed before it dissolves in excess.

Encourage thinking within procedure using [tooltips](#)



Which ingredient helps to trap air in the mixture during the preparation?

HINT 1

Which ingredients, when whisked, form bubbles?

NEXT HINT

- egg
- milk
- flour
- sugar

Check for understanding using [multiple-choice questions](#)



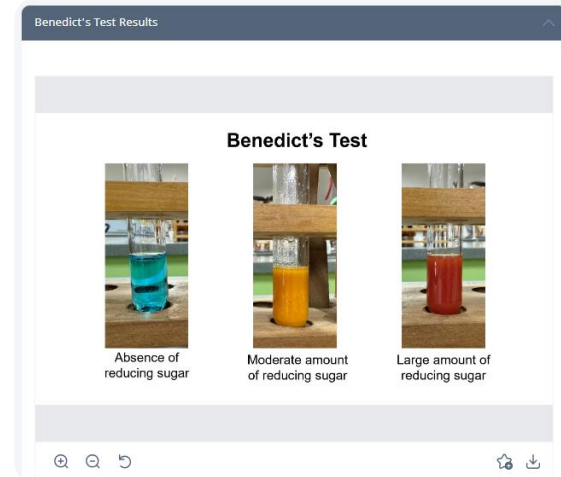
# Empowering students to monitor their progress with scaffolds

Provision of checklists and additional hints to **facilitate self-help** and **familiarise students with the experimental task**.

**INSTRUCTIONS**  
You may select more than one option

- Have you rinsed your pipette with the original solution?
- Have you removed any residual liquid at the tip?
- Have you removed the bubble in the pipette during extraction?
- Have you handled the pipette safely when fitting the pipette filler?
- Have you adjusted the liquid level in the pipette with the tip of the pipette above the liquid surface?

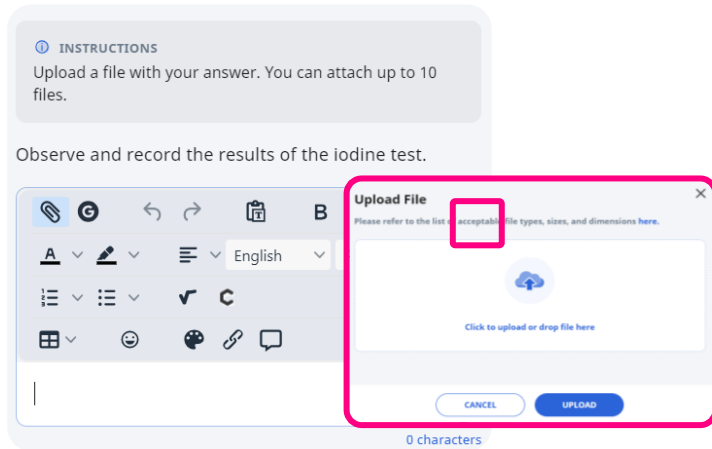
Provide procedural checklists using multiple choices questions



Provide optional references using accordion view

# Empowering students to monitor their progress with visual references

Images of visual observations support students in their **reviewing their experimental tasks and results** during and after the practical lesson.



Keep a record of **key** experimental observations by uploading media



Provide images of expected observation via suggested answer

# Supporting students to monitor their progress with specific and timely feedback

Feedback that students could receive upon submission provides them with assurance and opportunities to take corrective action during the lesson.

The screenshot shows a digital interface for a 'FEEDBACK ASSISTANT'. At the top, it says 'Feedback Assistant - Mathematics will provide marks and feedback for this question'. Below this, a student's answer is shown as  $h = 0.75 \text{ m}$ , with a red 'x' indicating it is incorrect. A 'Submit' button is visible to the right. Below the answer, a feedback panel is shown with a green dot and the score '0.70'. The panel is titled 'Accuracy' and contains the following text: 'Answer must be between 0.66 and 0.74.' Below this, there are four radio button options: 'Student answer must be exact', 'Student answer must be rounded to 2 decimals', 'Student answer must have 2 significant figures', and 'Answer must be in the range ( 0.66 , 0.74 )'. The last option is selected.

Check accuracy of quantitative measurements using [FA-Math](#)

# Facilitate students' reflection of learning with self-assessment

Success criteria help students to be aware of their learning goals while allowing teachers to gain awareness of students' level of confidence.

**Success Criteria**  
I am able to extract nutrients from solid food sample to be used in food tests.

Yes

No

*Self-Assessment*

**Green** I **can do** this step on my own.

**Yellow** I am **a little unsure** but I still manage to do this step.

**Red** I **need help** for this step.

Self-assessment using multiple-choice questions

# Sample SLS Modules

Find out how more about the features in the Sample SLS modules  
co-designed with teachers from our partner schools

# Biology – Food Test

## Food Test - Experiment

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8

self-paced guidance

### Benedict's Test

1. Prepare a water bath by heating a beaker  $\frac{2}{3}$  filled with tap water over the Bunsen burner.
2. Add  $2\text{ cm}^3$  of Benedict's solution to  $2\text{ cm}^3$  of food sample in a test tube. Shake thoroughly.
3. Place the test tube in the boiling water bath for 2-3 minutes. *\*Note: the water level in the water bath must be higher than the mixture level in the boiling tube.*
4. Turn off the Bunsen burner after 2-3 minutes.
5. Use the test tube holder to remove the test tube from the boiling water bath and place it in the testtube rack.

[Read Less](#)

accessible bite-sized video instruction



- 00:00 1. Prepare a water bath by heating a beaker  $\frac{2}{3}$  filled with tap water over the Bunsen burner.
- 00:04 2. Add  $2\text{ cm}^3$  of Benedict's solution to  $2\text{ cm}^3$  of food sample in a test tube. Shake thoroughly.
- 00:21 3. Place the test tube in the boiling water bath for 2-3 minutes.

recommended time 2 min

Observe and record the results of the iodine test.

### INSTRUCTIONS

Upload a file with your answer. You can attach up to 10 files.

upload media

Prepopulated Answer here...

### Suggested Answer

The iodine solution turns from brown to blue-black.



multi-modal suggested answer

# Chemistry – Qualitative Analysis

## Test 5

Add about 1 cm<sup>3</sup> of solution **X** in a test-tube.

To this test-tube, add an equal volume of dilute nitric acid, followed by a few drops of aqueous barium nitrate.

Record your observations

What is the purpose of adding dilute nitric acid?

Read L

It is to remove the presence of interfering ions (if any).

tooltips questions

Type answer here

## Suggested Answer

The solution changes from [colourless to brown].

A colourless and odourless gas evolved. Gas evolved relights glowing splint.



multi-modal suggested answer

## Qualitative Analysis Notes

### Notes for anions

anion	test	test result
carbonate ( $\text{CO}_3^{2-}$ )	add dilute acid	effervescence, carbon dioxide produced
chloride ( $\text{Cl}^-$ ) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
iodide ( $\text{I}^-$ ) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	yellow ppt.
nitrate ( $\text{NO}_3^-$ ) [in solution]	add aqueous sodium hydroxide, then aluminium foil; warm carefully	ammonia produced
sulfate ( $\text{SO}_4^{2-}$ ) [in solution]	acidify with dilute nitric acid, then add aqueous barium nitrate	white ppt.

reference notes using accordion view

# Nutrition and Food Science - Quiche

## 2 Preparation and Cooking

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12

self-paced guidance

### Shortcrust pastry

1. **Sift the plain flour and salt in a mixing bowl.**
2. Add cold butter into the sifted flour. Cut into smaller cubes using a palette knife and rub them into the flour with fingertips until the mixture resembles breadcrumbs and is pale yellow in colour.
3. Add cold water slowly into the breadcrumb mixture and mix to form a soft dough.
4. Knead the dough on a lightly floured surface with fingertips until smooth.
5. Wrap the dough in a cling wrap and rest it in the chiller for 10 minutes.
6. Preheat oven to 190 °C.
7. Roll the dough with a rolling pin using short, light strokes in one direction, until the required size is reached. Do not overstretch the dough.
8. Grease a fluted baking tin with vegetable oil.
9. Transfer the rolled pastry onto the greased baking tin.
10. Prick the base all over with a fork.
11. Bake blind in the oven on the middle shelf for 15 minutes or until pastry is firm.
12. Place the pastry on a cooling rack to cool slightly before adding the filling



accessible bite-sized animations / videos

[Read Less](#)

[What is the purpose of sifting flour?](#)

[Read Less](#)

It helps to incorporate air and remove lumps and impurities that may be present in the flour.

tooltips questions

### Self-assessment

- I can do this step on my own.
- I am a little unsure but I still manage to do this step.
- I need help for this step.

self-assessment



**Thank you!**