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## **TEACHING IDEAS SHARED FROM SAILS TEACHER EDUCATION PROGRAMME**

Cooking food - Irish version



*This resource has been developed through the SAILS Teacher Education Programmes (2012-2015) but was not developed as a finalized SAILS Inquiry and Assessment Unit. These materials are shared to inspire further use of inquiry and assessment of inquiry skills in the science classroom.*



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## TEACHER SHEET: What happens when you cook spaghetti?

This activity is designed for 1<sup>st</sup> Year students. Its main purpose is to encourage students to consider the science behind an everyday experience that they may be familiar with and to recast that experience in a scientific setting.

By doing this it is hoped that students will begin to exercise and develop skills specifically in the following four skill areas:

- Measurement and proficient use of measurement devices;
- Recording and analysis of results/observations in formats appropriate to the context;
- Planning skills;
- Teamwork.

[WRITTEN IN TERMS OF JCSA IN LESSON PLAN TEMPLATE]

An assessment rubric for these skills is overleaf.

You may want to replace or augment some of the skills listed if this is to be used as an activity with older students, or if you wish to focus on alternative skills with your particular teaching group.

### PRIOR KNOWLEDGE/PRE-REQUIRE SKILLS:

Prior knowledge and pre-requisite skills which you may need to consider before this activity are:

Correct use of:

- A callipers;
- A top-pan balance;
- Thermometer/probe;
- Hot-plate/Bunsen burner;
- Calculation of mean from multiple measurements;
- Units;
- Hot to cook spaghetti (at home);
- Graphs
  - Axes
  - Scaling
  - Units
  - Titles

### VARIABLES:

While not exhaustive variables listed below are worth considering or using as prompts with students during the activity:

- total mass of spaghetti
- mean mass of a spaghetti strand
- mean length of spaghetti strands used
- mean diameter of a spaghetti strand
- type of spaghetti
- broken/whole spaghetti strands
- volume of water used
- temperature of the water
- time allowed for cooking
- addition of salt/oil
- lid/no lid on cooking vessel
- cooking vessel: lab glassware or kitchenware?
- dimensions of the cooking vessel – base diameter/thickness?
- difficulty in measuring spaghetti accurately after cooking

## **SUGGESTED EQUIPMENT:**

While not exhaustive equipment per group listed below is easily available/standard:

- 2l pyrex beaker/kitchen pots
- spaghetti
- tongs
- salt
- cooking oil
- water
- Vernier/bow callipers
- 30cm rule
- kettle
- graduated cylinder OR measuring jug
- thermometer OR temp. probe
- top pan balance
- paper plates OR large weigh boats
- hotplate

## **EXPERIMENT ENDPOINT:**

The description of the endpoint of the experiment is something that each group has to agree upon before starting the practical activity and list it as one of the points of their procedure.

Students may follow the practice in their home e.g. 8 minutes boiling, the instructions on the packet of spaghetti, al dente, or some may suggest throwing it at the wall to see if it sticks!

## **ASSESSMENT:**

The student sheet and groupwork sheet are intended to elicit written responses under the four intended skill categories, but could be enhanced by requiring students to produce a formal report under specified headings and collating this with the two worksheets.

This is in addition to any assessment that could be carried out by the circulating teacher during the assessment – making notes about individuals/groups that could be added into written/verbal feedback to students.

If it is intended that students would use assessment rubrics/criteria for success as benchmarks for on-going peer assessment of experimental work then a suggestion to initiate that process would be the production of model experimental reports (or extracts from) for each skill level i.e. emerging, developing, consolidating, extending.

Each exemplar would be laid out on a lab bench (enlarged/laminated) and students would indicate whether the exemplar was emerging, developing, consolidating or extending by noting this on a post-it and placing it beside the exemplar. Groups of student would rotate through each exemplar using the assessment rubric as a guide to making their judgement. This would then be followed by a whole class discussion on each exemplar.

This exercise would give students more confidence in participating in peer assessment, and help them develop a critical ability based on a clear benchmark. Importantly guided peer assessment may encourage more effective reflection on learning by students.

## **TEACHING SEQUENCE:**

Working through the student sheet and group sheet may take the entire of a 40 minute class period. It would be important to factor in suitable whole class discussion time between some of the items in the student sheet. Time limits on each stage/step may vary depending on student engagement.

The carrying out of the experiment will take another 40 minute period (possibly 2 x 40 minutes depending on the group). Any down-time in this session might be used for student to begin their formal report.

|                                     |              |                              |
|-------------------------------------|--------------|------------------------------|
| <b>Class:</b><br>First Year Science | <b>Date:</b> | <b>Topic:</b><br>Measurement |
|-------------------------------------|--------------|------------------------------|

|                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Learning Outcome(s):</b></p> <p>To measure length, mass, diameter and temperature accurately</p> | <p><b>JCSA Key skills:</b></p> <p>Managing myself: Using digital technology – use of data logger to measure temperature/ use of socrative</p> <p>Communication - using language – keywords associated with topic/discussion with peers</p> <p>Being Creative _ Learning creatively – considering options for experiment</p> <p>Working with others – Learning with others - roles in experimental work</p> <p>Managing information and thinking – Being curious - investigating the effect of boiling spaghetti, gathering data.</p> |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Opportunities for Assessment:</b></p> <p>Brainstorming for planning investigations</p> <p>Think pair share for student discussion</p> <p>Placemat for student discussion [SUPPLIED]</p> <p>Students create own questions</p> <p>Observation</p> <p>Graphic Organiser for developing hypothesis and diagnosing problems</p> <p>Student worksheet [SUPPLIED]</p> <p>Observation of data tables</p> <p>Correction of student report</p> <p>Learning log for reflection</p> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

| Must                                                                                                                                                                                                                                                                                        | Should                                                                                                                                                                                                                                                                                                                                                                                                                        | Could                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Students will be able to:</p> <p>Identify the appropriate instrument to measure temperature, mass, length and diameter</p> <p>Identify one method for measuring temperature, mass, length and diameter</p> <p>Perform simple tasks to measure temperature, mass, length and diameter</p> | <p>Be able to offer a variety of solutions for their predictions</p> <p>Identify the most appropriate solution for a given measurement problem in relation to temperature, mass, length and diameter</p> <p>Should know all the key terms, and units.</p> <p>Be able to offer scientific explanations for what they observe in their experiments</p> <p>Know how to calculate mean temperature, mass, length and diameter</p> | <p>Be able to offer plausible alternatives for each of the measurements</p> <p>Be able to discuss probable sources of error and discuss how these may be overcome.</p> <p>Relate these measurement skills to other areas.</p> <p>Consider further refinements for this experiments</p> <p>Could use formula to calculate percentage error or percentage expansion.</p> |

CRITERIA FOR SUCCESS THAT CAN BE SHARED WITH STUDENTS – SHOULD OR COULD CARDS COULD BE SUPPLIED AND LEFT TO STUDENT INITIATIVE AROUND CLASSROOM

#### Resources:

- Measuring Equipment
- Resources for experiment
- Skills sheets
- graphic Organiser
- 2l pyrex beaker/kitchen pots
- spaghetti
- tongs
- salt
- cooking oil
- water
- Vernier callipers/bow callipers
- 30cm rule
- kettle
- graduated cylinder OR measuring jug
- thermometer OR temp. probe
- top pan balance
- paper plates OR large weigh boats
- hotplate

## Outline of Lesson

### **Introduction**

Question to groups:

What happens when you cook spaghetti?

Strategy: Think pair share square then fill in Q1 & 2 on student sheet

Assessment (reasoning & critical thinking):

- Class regroup for conclusion (Teacher checks all anticipated safety issues are addressed)

Question to groups:

What is the best way to cook spaghetti?

Strategy: Q3 – 7 on student sheet followed by placemat

**Assessment (diagnosing problems & distinguishing alternatives):**

- Teacher check on placemat
- Student predictions written on board

### **Body of lesson: Experiment**

Strategy: Group Work (3)

Students clearly identify measurements that must be taken based on predictions. (Complete following on graphic organizer)

Students clearly identify variables.

Students develop experiment based on predictions.

Students request skills sheets/demonstrations if they are unsure as to how equipment is used.

Students check with teacher for that they have covered all safety issues.

Students create table to record all data.

Students complete experiment and record data and observations

Students discuss data and explain results within their group.

They consider if any more experiments need to be completed to validate their data.

Assessment (planning investigations, researching conjectures & developing hypotheses):

- Graphic organizer
- Observation of discussion of students critiquing experiments
- Observation of teamwork
- Correction of data table

**Sharing of data:**

All groups present their data to class on shared table

Students working in groups identify anomalies and patterns and through group discussion try to explain these anomalies and patterns.

Assessment (forming coherent arguments):

- Use graphic organiser

Students individually record their experiment (for homework if teacher feels necessary).

Assessment (scientific literacy, reasoning, forming coherent argument, critiquing experiments/critical thinking)

- Assessment of experimental report
- Completion of learning log





## ASSESSMENT RUBRIC: What happens when you cook spaghetti?

| ASSESSMENT ITEM                                                     | EMERGING                                                                                                                                                                                                                           | DEVELOPING                                                                                                                                                                                                                                                      | CONSOLIDATING                                                                                                                                                                                                                                                                                                                                                                                                                                      | EXTENDING                                                                                                                                                                                                                                                                                              |
|---------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PLANNING                                                            | Little/no discussion<br>OR<br>Carries out initial idea                                                                                                                                                                             | Discussion of several ideas & decision on preferred method/approach                                                                                                                                                                                             | Discuss and develop several methods before deciding justified on scientific process of elimination basis (possible procurement of extra equipment)                                                                                                                                                                                                                                                                                                 | Discussion and trial of several methods with reflection & refinement before carrying out preferred method (possible procurement of extra equipment)                                                                                                                                                    |
| TEAMWORK                                                            | Takes part passively in group activity/not all of group taking part or assigned roles/little (or no) discussion of respective roles                                                                                                | All of group taking part in activities following discussion but roles are unclear/confused                                                                                                                                                                      | Negotiation of specific tasks, all of group actively take part, with on-going feedback to group                                                                                                                                                                                                                                                                                                                                                    | Negotiation of specific tasks, all of group actively take part, with on-going feedback to group and challenging of each other in positive/supportive manner                                                                                                                                            |
| RECORDING OF RESULTS                                                | Results/measurements recorded with/without units<br>No selecting of correct initial measurement i.e. mass, length, diameter, temperature                                                                                           | Results/measurements tabulated with units & also represented graphically (repeated measurements without mean values)<br>Selecting correct initial measurement i.e. start point as well as end point                                                             | Results/measurements tabulated with units & mean values (or sample calculations shown) & also represented graphically – appropriate to context i.e. bar chart <u>not</u> pie-chart or trend graph.<br>Must include at least two of the measureable variables.                                                                                                                                                                                      | Results/measurements tabulated with units & mean values (or sample calculations shown) & also represented graphically – appropriate to context with                                                                                                                                                    |
| ANALYSIS & INTERPRETATION OF RESULTS                                | No analysis                                                                                                                                                                                                                        | Analysis incomplete missing some factors with conclusion not following logical progression                                                                                                                                                                      | Logical conclusion based on data but not linked to initial prediction                                                                                                                                                                                                                                                                                                                                                                              | Explicit connections/conclusions drawn from both table & graph across all factors investigated.                                                                                                                                                                                                        |
| USE OF MEASUREMENT, MEASUREMENT EQUIPMENT, OR ESTIMATION TECHNIQUES | No useful measurements made due to incorrect measurement, measurement of irrelevant factors, or misidentification of factors<br>e.g. Boiling point assessed visually (steam/bubbling) or time not accurately measured/not measured | Some factors were identified and measured correctly e.g. mass/volume of H <sub>2</sub> O, number & mass of spaghetti strands, mean length of spaghetti strands, temp of H <sub>2</sub> O measured by thermometer or data logger probe, time measured accurately | All identified measurable factors are measured accurately and mean values calculated (in appropriate units) e.g. mass/volume of H <sub>2</sub> O, number & mass of spaghetti strands, mean mass per strand, mean length of spaghetti strands, temp of H <sub>2</sub> O measured by thermometer/data logger probe, time measured accurately<br>Callipers used to measure diameter of spaghetti strands before & after e.g. Vernier or bow callipers | All identified measurable factors are measured accurately and mean values calculated (in appropriate units, symbols & measuring equipment)<br>Effect of cooking vessel dimensions considered i.e. base area/thickness<br>Identifying possible sources of error (qualitative rather than quantitative). |



## STUDENT SHEET:

What happens when you cook spaghetti?

Student Name:

- ① What do you see (observe) happening to spaghetti when it is cooked? Write down two things you have observed when you last saw spaghetti being cooked.

- ② You have now listened to the observations that the whole class have given. If there are other observations that you think are important in the cooking of spaghetti write them below.

- ③ List 5 steps you would give to another person as instructions on how to cook spaghetti.

- ④ Now that you have listened to the other students in the class, do you need to add or change anything in your instructions? If you do write them below.

- ⑤ What changes to the spaghetti are you going to record or measure & how?

- ⑥ What factors do you think could affect the spaghetti during cooking? Give three or more.

- ⑦ Draw below how you would set up this experiment. Make sure you add labels.



**GROUPWORK SHEET:**

- Each member of the group should write down 2 or 3 steps that they think the group needs to do in this experiment.
- On the back of this sheet the group should agree on the steps for the method/procedure
- The group should also show how it will record results

**GRAPHIC ORGANISER:**

MY PREDICTIONS:



POSSIBLE METHOD 1:



POSSIBLE METHOD 2:



I CHOSE METHOD....

...BECAUSE