


In2steam Lesson Example – Inquiry Based Learning

1. Unit title	Science Buffet
2. Target group	9 – 12-year olds (3 rd to 5 th grade)
3. Duration	No. of lessons (approx. 40 minutes each):
4. STEAM Skills/ 21st Century Skills??	<input checked="" type="checkbox"/> Critical Thinking <input type="checkbox"/> Entrepreneurship <input checked="" type="checkbox"/> Communication <input checked="" type="checkbox"/> Collaboration <input type="checkbox"/> Tech Literacy <input type="checkbox"/> Creative Thinking <input type="checkbox"/> Media Literacy <input checked="" type="checkbox"/> Social skills <input checked="" type="checkbox"/> Problem Solving 
5. Expected learning outcomes	<p>By the end of this unit, learners will be able to:</p> <ul style="list-style-type: none"> ● describe relatively complex process such as science experiments ● understand and describe the importance of following instructions ● carry out real-life science experiments, under appropriate supervision ● understand and describe the specific topics covered (air pressure, water absorption, magnetic fields, carbon dioxide, kindling temperature), and relate them to real-life situations <p>By completing the stretch activities, learners will also be able to:</p> <ul style="list-style-type: none"> ● understand and describe the role and importance of variables in scientific experiments; ● compare and contrast results from similar experiments
6. Subjects and topics covered	Science; Arts; Native Language (writing reports, formal vs informal ways of narrating a story)
7. Methodologies	<input type="checkbox"/> Design Thinking <input checked="" type="checkbox"/> Inquiry Based Learning <input type="checkbox"/> Problem Based Learning
8. Integration of the Arts	Story-telling as drama, poetry, comic strips; Arts (illustrations)
9. Learning Environment	Classroom
10. Required resources	List resources required for a successful lesson; if specific learning spaces are required (e.g. IT room, outdoor spaces, etc.) ensure they are available on the date required and that alternative solutions are put in place (e.g. outdoor space not available due to bad weather)
11. Prior knowledge a. teacher b. students	<p>Teachers will need to brush up their knowledge on Inquiry Based Learning. A good understanding of how emotional intelligence influences the learning experience would also be beneficial.</p> <p>Pupils do not need a great deal of prior knowledge to complete this activity. In fact, this can be a good introductory unit for sciences at the start of the academic year, thus setting the tone for an open, interactive and hands-on learning process.</p>

**12. Detailed description
of the step-by-step
sequences of the
unit, incl. specific
activities to support
the learning
experience**

Introduction

Start the lesson with an ice breaker which will last no more than 10 minutes. This will help to set the scene and get pupils thinking about their emotions and how to recognise them. This particular activity is a [Didactics of Emotions technique \(DoE\)](#), called “Guess what I am feeling?”.

Choose 3 volunteers who will have to briefly step out of the room; one of the 3 will be designated as the group leader. The other pupils will then agree on an emotion they can act out well (e.g. being in love, happy, scared, bored, sad...). Once the volunteers are back in the room, the teacher chooses an everyday situation for the players to act out their chosen emotion (e.g. brushing teeth, frying an egg or going to school ...). Each volunteer is allowed to pick 2-3 players to guess their emotion. While the volunteer is guessing the emotion, the teacher records the time it takes. The winner is the player who is quickest in guessing the emotion.

Step 1 - Surprise, curiosity, questioning

Explain to the class that they are going to carry out five different real live experiments, involving flames and liquids and special equipment. Do not tell them what the experiments are going to be: in fact, they will have to guess based on the instructions they will receive. Introduce the experiments in a way that spurs their curiosity, e.g. “We are going to work with all sorts of tools, there will be flames and bangs and it might get a bit messy”. At the centre of the room, set up a table with all ‘ingredients’ necessary to carry out all five experiments: this is the ‘Science Buffet’ table.



Do not organise the ingredients by experiments, but distribute them randomly across the table, so that each group will have to search for their ingredients (see also picture above).

To be successful with their experiments, pupils will have to collaborate within the group, each taking a different role for each experiment. Emphasise that they will have to capture what they have down in the Experiment Report (Annex 1)

Split the class into 5 equal groups; as far as possible, ensure an equal distribution of girls and boys. Each group will receive a set of instructions, containing a list of ‘ingredients’ they need to pick up from the ‘Science Buffet’, as well as the sequential instructions to complete the experiment. This means that each group will complete one experiment, and that each group will complete a different experiment. At the end of the actual experimentation, the groups will present their protocols and outcomes to

each other, thus allowing all pupils will learn about the 5 experiments through teamwork and observation. Each group will capture their learning experience in the form of an experiment report (see Annex 1). The report consists of five parts. To start with, they will choose a group name, which can contribute to their sense of ownership and excitement. They will have to guess the name of the experiment they are analysing, based on the input they have had so far (Part 1). They will then have to annotate what they think is going to happen if the experiment is successful (Part 2). Part 3 is the actual protocol of the experiment, here pupils will list all the steps they have taken. The outcome is then recorded in Part 4. Finally, inspired by the experiment, the groups are asked to create a life motto which they will have to re-use later (Part 5).

Step 2 - Problem statement

Make sure pupils read the instructions before starting the activity. They can do this either individually or within their groups. Review the instructions with them and answer any questions. Ask a few probing questions, e.g. "Which part of this experiment do you think is the most exciting?", "Where do you have to pay most attention?", etc.

Each group will designate a 'buyer' – this is the pupil who will go to the Science Buffet table and pick up all the ingredients listed on their instructions, and only those ingredients.

Step 3 - Hypothesis statement

Within their groups, pupils will have to complete part 1 of the Experiment Report: based on the information they have been given, as well as on the ingredients they were allocated, what do they think the experiment will be about? They will have to capture their opinions in the form of a title for the experiment. In part 2 of the Experiment Report, they are going to guess what the outcome of the experiment is going to be. Ask them to give reasons to explain their guess (you can use this to introduce the word 'justification'). Within their groups, pupils are going to discuss the likely outcomes of each experiment. Listen in to their conversations and moderate only if required, to make sure everybody contributes equally. Promote a positive environment where no hypothesis is discarded at this stage. Remember that any error during the experiment should simply be noted once it has been spotted, so that later it can be used as an additional learning opportunity.

Step 4 - Possible explanations, answers and solutions

The groups will now follow the instructions and carry out the experiment. One group member will act as the scribe and will note the procedure followed (part 3 of the Experiment Report): what actions did they take, in which order, etc. At the end of the experiment, the group will then discuss what and how the scribe should report in part 4 (scientific results). Part 5 of the Experiment Report requires the pupils to create a motto inspired by their experience during the experiment.

Step 5 - Design experimental protocols

At this stage, the procedure of the experiment completed will have been written down (part 3 of the Experiment Report, see Step 4 above). Pupils will

	<p>now be asked to review this part to make sure it is understandable; they will be asked to provide further details. Once they have a formalised procedure, i.e. the experiment protocol, ask them to choose a medium to represent the protocol: a poem, a song, a play, a comic strip. They will have to use the motto they have chosen as the title of their deliverable.</p> <p>Step 6 - Confirm or reject hypotheses, compare with established facts Once Step 5 is completed, the groups will be ready to present the experiments to each other. Taking it in turns, each group will introduce themselves and their chosen motto. They will then present or recite their experimental protocol, to explain what they are going to do. They will ask their peers what they think is going to happen, then they will proceed to carry out the experiment. This step is very important as it represents the idea of continuous testing in science. Peers will need to observe, ask questions and express opinions. Furthermore, they will be able to learn about all 5 experiments.</p> <p>Step 7 - Re-use in lesson or in everyday situations Pupils will create a record of their learning experience, both in written and not written format. Future science lessons covering the topics of the experiment should make use of the records, which the pupils will be able to use as a reference point (e.g. air, air pressure vacuum; carbon dioxide; etc.). The creative representation of their protocol can be re-used in their respective arts lessons.</p>
<p>13. Gender-inclusive strategies and activities planned</p>	<p>This activity is gender neutral. Avoid using gender biased narratives when presenting the experiments (e.g. do not make jokes about ‘burning money’ connected to a specific gender). Ensure that boys and girls are evenly distributed across the groups, so that the final results are not categorised into ‘boys’ and ‘girls’ work. When observing the group work, make sure every group member contributes equally (this is also a personality aspect, gender may or may not play a role).</p>
<p>14. Assessment & Evaluation</p>	<p>For Steps 1 and 2 above, ask probing questions to check for understanding. Use Step 3 to observe the group dynamics and listen in to their conversations. This will provide further information about knowledge gaps, as well as language and communication skills. At the end of Step 3, each group will have provided a written justification which can be formally assessed against a variety of standards (e.g. language skills, understanding of topic, etc.). If each group completes more than one experiment, you will have multiple written examples to assess, written by different pupils. For Step 4, observation will be key as it will provide tangible results about the actual experiments (skills to follow instructions, collaborate and share, observe, describe; dexterity; etc.). The stretch activity mentioned under Step 5 will also provide tangible results in the form of an illustrated set of instructions. The stretch activity mentioned under Step 6 will provide further opportunities to assess the learning against curricular standards in science subjects.</p> <p>An important aspect of evaluation will be observation throughout the unit. In particular, it will be important to ensure pupils remain on task and are engaged; offer support whenever you feel they are stuck. If there are specific problematic aspects of a topic that keep arising, make a note to review them in a follow-up lesson.</p>

15. Intellectual property rights (IPR) / Origin of the activity



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ANNEXES

ANNEX 1: Experiment Report

Experiment Report-1

Group Name: _____

Group Members: _____

1 Write the name of the experiment.

2 Guess the Result.

3 Write the procedure of the experiment.

4 Report the Scientific Results.

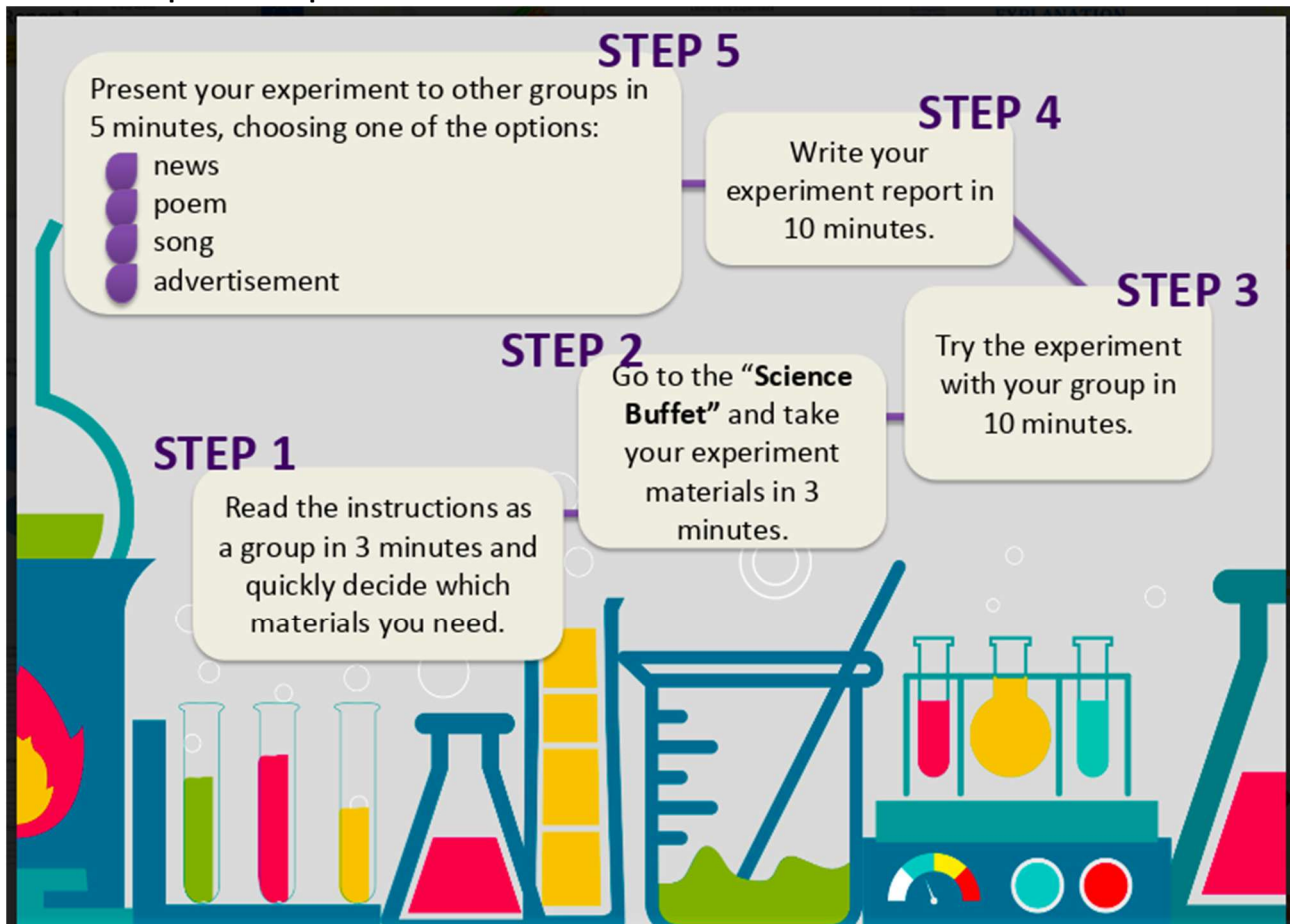
5 What's your life motto?

I believe that ...

INSTRUCTIONS FOR PUPILS

1. Give your group a name; write down the names of the group members
2. Look at the instructions and list of ingredients you were given; based on that information, what will the experiment be about? Give the experiment a name based on the information gathered.
3. While carrying out the experiment, make sure every step is carefully written down in step 3.
4. Once the experiment has been concluded, describe the outcome and the scientific success you may have experienced.
5. Finally, use your creativity to come up with a life motto, based on your experience with the experiment.

ANNEX 2: Steps of the Experiment



Pupils will be given a flexibility to try different approaches to the experiment, as long as they record their procedure and they reach they correct result.

Annex 3: List of the ingredients for the 5 experiments

Experiment no.	Ingredients
1	A flask, a box of matches, a hard-boiled egg
2	A funnel, a balloon to inflate, a candle, a beaker with some water
3	Plastic covered thin copper wire, some sticky tape, metallic paper clips, a nail, one 9V battery
4	A flask, a cork with a hole (to fit into the flask), a measuring cylinder, a plastic spoon, 5g of baking powder, 50ml of vinegar, a candle, a box of matches, a holder to securely and safely hold the flask
5	A beaker, tongs, safety goggles, a plastic stirrer, a graduated cylinder

Randomly distribute and display the above ingredients on the Science Buffet table, do not display them separately by experiment; see also picture below for an example. Remember that at this stage, the pupils are still trying to guess what their experiment will be; this will also require them to negotiate their way through the buffet.



Annex 4: List of the five experiments

