Atelier Labs toolkit
Exploring the world through chemistry and art

"Learning is not the result of teaching actions, but the result of subjective constructions"
Reggio Children

Produced by Attenborough Arts Centre in collaboration with Nether Hall School, Rachel Scanlon and Asmaa Abdalla.
Context:

Atelier Labs formed part of the SENsory Atelier programme funded by Paul Hamlyn Foundation and managed by Attenborough Arts Centre at The University of Leicester. Artist Rachel Scanlon and Chemist Asmaa Abdalla worked with staff and students at Nether Hall school to explore chemistry through art, inspired by the pedagogy of Reggio Emilia. The wider programme sees collaboration between 9 special schools, artists, teachers, young people and the wider community to develop learning and exploration through art.

Rachel Scanlon:

Rachel is a visual artist who mixes 2D, 3D and immersive installation exploring architectural spaces and how people relate to those. She is an artist educator working with Early Years upwards, including school groups, SEN and 121 creative mentoring, and with adults, including women in refuges and those living with dementia. Her focus is on child led art activities using Reggio Emilia principles to co-create projects together, ensuring children’s voices are heard.

Rachel has an interest in merging Art and Science having worked on a number of cross-curricular projects in the past. She believes both subjects encourage children to ask questions and notice the world around them more; inspiring curiosity and igniting a spark of creative thinking. Chemistry invites children to experiment, hypothesise and use their hands to create something practical - much like art.

Asmaa Abdalla:

Asmaa is a chemist, currently in the third year of a Chemistry with a year in MChem degree, and a UK Student recruitment and Outreach assistant working for the University of Leicester. Asmaa brought real world chemistry knowledge to the project, helping to adapt complex chemical reactions into simple concepts that can be explored in a classroom, or non-laboratory space.

Bob Christer:

Bob is the Programme Manager for SENsory Atelier, a theatre maker, educator and project manager with an interest in developing others through creative practice. Bob is constantly curious about the synergies between different methodologies in arts, education and beyond, and has authored this toolkit as part of the wider sharing of learning from the SENsory Atelier programme.
Top Tips for making science accessible through art:

- Make room for practical explorations as soon as possible
- Give everyone lots of opportunities to find their own way into the activity
- Create opportunities to ask questions (verbally or not!) and test out ideas.
- Make space for peer learning and solo explorations, and flexibility to move between the two.
- Start simple, what can you do with as few materials as possible? How can this then be expanded/built upon?
- Don’t be afraid to repeat and revisit an activity, this can reinforce learning, as well as find new explorations and possibilities.
- Never assume something is too complex for your learners. Include the complex scientific language as well as simplified instructions.
- Hypothesise and have fun!

What is hypothesising?
We’ve used the word hypothesise a lot throughout this document, so what do we mean by this? The dictionary definition is to give a possible, but not yet proven explanation for something. Many of the activities we conduct may well have proven explanations, but for our context we are interested in the world of the young people we are collaborating with. What concepts do they not have a firm understanding of yet, and how can we present opportunities for them to form ideas and opinions, possible explanations, for what might happen next. This can include what might happen if I mix two chemicals together (e.g. vinegar and bicarbonate of soda) as much as it can include what might happen if I draw a line here, if I use the colour red, if I sculpt clay in this way, or scrunch paper in cooking oil etc... The key question is always ‘What happens if...?’

Non-verbal questions
For many of the young people we work with, verbal communication can be limited. As such, we don’t limit our communication to just verbal cues, often using non-verbal communication as the core ‘language’ spoken in a session. This can include modelling behaviours (or hypotheses as above...), or responding to the actions of a young person by mirroring (akin to the intensive interaction model of communication - https://www.intensiveinteraction.org/). This might look like offering materials directly to join with the young person’s enquiries, placing materials within a young person’s area of focus to suggest additional enquiries, noticing their area of interest and mirroring, or building on their actions. Most importantly, although we may offer suggestions, we never lead a young person’s enquiries, or attempt to persuade them to work to our own interests.
Starter sessions:
Here’s a handful of sessions to get you started, some simple explorations, extension investigations, and the hard science.

Lava Lamps

Materials:
Glass Jar (or plastic bottle if you prefer/need something safer); water; oil; food colouring; fizzy vitamin tablets.

Set up and starter exploration:
1. Pour water into a jar to about a third full
2. Pour oil into the jar the rest of the way, leaving a gap at the top to allow bubbles out
3. Put a few drops of food colouring into the jar, watch as they sink through the oil and mix with the water. You could use a pipette if you have one to feel more like a scientist conducting your experiment...
4. Finally drop a fizzy vitamin tablet into the mix and observe what happens.

Extension investigation prompts:
What happens if?... You introduce torches, coloured gels/cellophane, pipettes, video on screen of the reaction (helping to enable visually impaired students to see a larger version), replace water with tonic water and use a UV torch to see it glow, sensory bottles (filled with rice, bells/other sensory materials.)
The science:

This experiment explores the density of different compounds, water, oil, food colouring and a chemical reaction that produces carbon dioxide gas.

Fizzy vitamin tablets contain sodium bicarbonate and citric acid. When a tablet is mixed with water the bicarbonate of soda in the tablets reacts with the citric acid, leading to the production of sodium citrate, water and carbon dioxide.

Formula

<table>
<thead>
<tr>
<th>Reactants</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium Bicarbonate + Citric Acid + Water</td>
<td>Sodium Citrate + Water + Carbon Dioxide</td>
</tr>
<tr>
<td>NaHCO₃ + C₆H₈O₇ + H₂O</td>
<td>Na₃C₆H₅O₇ + H₂O + CO₂</td>
</tr>
</tbody>
</table>

Questions:

What might happen if you use more/ less of the water/ oil?
What happens if you break up the fizzy vitamin tablet first?
What happens if you mix food colouring colours?
Self-inflating balloons

Materials:
Plastic bottle; Bicarbonate of Soda; Vinegar; Balloon; funnels if available

Set up and starter exploration:
1. Put around two spoonfuls of Bicarbonate of Soda into the plastic bottle (you may need a funnel to get the powder into the bottle, and feel more like a scientist)

2. Stretch a balloon a few times before use, then with help, put about a spoonful of vinegar into the balloon - a different funnel can be useful here.

3. Still with help, keep the vinegar in the large end of the balloon, and carefully stretch the open end of the balloon over the bottle top, keeping the vinegar and Bicarb separate.

4. On the count of 3 lift the balloon so its contents go into the bottle

5. Watch as the liquid and powder mix and fizz, and the balloon inflates on the top of the bottle.

Extension investigation prompts:
What happens if?... The same ingredients are used to create volcanoes where the frothy reaction can spill over the top of a container and run down the sides like lava. Can food colouring be added to the vinegar to change the colour of the frothy mixture produced? Can we use different shaped, or sized balloons? What happens if we change the amount of bicarb or vinegar used?
The science:
This experiment explores a chemical reaction that produces carbon dioxide gas.

The vinegar (acetic acid) mixes with the sodium bicarbonate and creates a reaction that produces sodium acetate, water and carbon dioxide. We can see the invisible carbon dioxide being produced by watching the balloon inflate.

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Questions:
What gas is produced?
Can you squeeze the gas out of the balloon while it’s still attached to the bottle?
What combinations of materials make the most gas?
What happens if you use a bigger/ smaller bottle?
What happens if you use more bicarb powder/ vinegar?
Try putting vinegar into the bottle and powder into the balloon - which way is better?
Stress balls

Materials: Balloons; thin sandwich bags; home-made play dough or home-made cloud dough (recipes for both below)

Set up and starter exploration:

1. If appropriate give the children a choice of which type of stress ball they want to make. Have one of each prepared and let them feel both to decide which they prefer. The play dough can be squashed and the dent is visible, the cloud dough springs back when squashed. Both similar but a little bit different in their resistance and allows children a voice in their activity.

2. Mix your ingredients together to make the dough:

   **Play dough recipe:** 1 cup flour, ½ cup salt, 1 tsp oil, 1 cup boiling water (add a dash of cold water to the cup first so the mixture isn’t too hot for children)

   Give each pupil a mixing bowl and let them mix first with a spoon until the hot water has cooled down, then with their hands. If it is too sticky add extra flour, if too dry add extra water.

   **Cloud dough recipe:** 1 cup cornflour, ½ cup hair conditioner

   Again begin mixing with a spoon, then use your hands to smooth it all together. If too sticky add extra flour, if too dry add extra conditioner.

3. Make a small fist sized ball by rolling the dough of choice between your hands

4. Put into a sandwich bag and wrap tightly, tying a small knot to keep it compact.

5. Cut the straight end off a balloon. With help, squeeze the bag of dough into the balloon. One person holds open the balloon, one person pushes the dough in.

6. Repeat with another balloon, this time put the hole of the first balloon down into the second ballon so their holes are at opposite ends.

7. Now you can squeeze away and explore the elasticity of the material you have produced.

Extension investigation prompts:

**What happens if?...** we add a face/picture to the stress ball with a ballpoint pen or permanent marker, what happens when we stretch or squish the images? What if we put different materials inside balloons such as rice, bells, a squeaker or other sensory materials? What uses can we find for any left over dough? What happens if we add food colouring to the dough mixture.
The science:
The mixing of different chemical compounds in making both Play Dough and Cloud Dough create new chemical compounds as chemical reactions take place during the mixing, or kneading phase. In the case of the playdough mixture, the reaction is aided by the heat of the water, as heat increases the kinetic energy of the molecules in the mixture.

In each case the new compounds created have different properties to their original ingredients, essentially mixing solids and liquids to form a viscoelastic solid which can be stretched, squished and changed with relatively little force.

Questions:
What happens if you have too much conditioner/water?
What happens if you have too much flour?
What is the best way of getting the dough into the balloon?
Additional activities to consider:

Cyanotypes

Bicarb and vinegar volcano

Mentos and coke explosion

More information on the wider SENsory Atelier programme can be found at www.unlockingtheworldblog.com