STEM-Talking Matters Monster Mash-Up

Six activities for science play, to encourage STEM language use

1. Baking soda/vinegar volcanoes
2. Water polymer balls
3. Seed planting
4. Oobleck
5. Spaghetti-marshmallow construction challenge
6. M&Ms colour dissolving

Are kids in ECE too young for this?

Nope! These science activities are great for all ages, you can just go deeper on the follow-up and extension questions.

Can we try these at home?

Yes, absolutely. Most of them are using kitchen ingredients. Water polymer beads can be found in some toy shops called “Orbeez” or on Aliexpress (etc) using the search terms listed in the activity.

What’s the benefit for kids from playing and talking about cool things?

Language development! Developing a curious, enquiring mind! Preparing for school, and a lifetime of knowledge acquisition!

Shopping list for full set

Item
Cleaning cloths
Towels for clean-up (cloth or paper)
Rubbish bags
Oven/roasting pan
Small bucket for waste
Water jugs
Water polymer balls/beads
Narrow necked bottle (eg small milk bottles)
Vinegar, white
Baking soda
Teaspoons
Plastic cups
Plain white paper towels
Permanent markers
Seeds (sugarsnap or snow peas, or broadbeans)
Cornflour
Food colouring
Small marshmallows
Spaghetti
Ruler
Plastic side plates
M&Ms or Skittles or Pebbles

Instructions & equipment by activity

1. Baking soda/vinegar volcanoes

Instructions

In a spot that can be easily cleaned, and overflow contained, add either baking soda or vinegar into a container, add the other one and see what happens!

Equipment

- Tray to contain spills/overflow
- Narrow-necked bottle or container for doing the reaction in
- Container to hold vinegar (or just use the vinegar bottle if small hands can safely/easily lift it)
- Container to hold smaller measures of baking soda (eg paper muffin cups)
- Spatula or small teaspoon

Health & Safety

Baking soda and vinegar react together to produce carbon dioxide. This won't be in an amount that is harmful, unless you have many, many litres of vinegar and a small enclosed room. However, the mess can be surprising, so we recommend using a roasting pan or similar to do the experiment within, for easy cleaning.

Questions to Ask

What is the clear liquid? How could we find out? What about the white powder? If the teacher didn't know what it was, would it be safe to mix these two unknown things together?

How much of each should we add together? What happens if we have only a small amount of vinegar but heaps of soda? Or the other way around? Does it matter if you add vinegar to soda or soda to vinegar?

How would you describe the liquid? What does it look like? (clear, colourless, see through, transparent, like water, liquid, solution, viscous, cool, cold, smelly, acidic, chemical…) What about the powder – what are all the words you can use to describe that? (white, small grains, fine powder, soft, smooth, dust, even, fine).

Describe what you see happening when we add the two ingredients together! (bubbles, foam, explosion, reaction, chemistry, fizzing, getting bigger, creating, changing, stuff is happening)

What does the foam feel like? Smell like? Taste like? (NB make it clear that we can only smell and taste this because teacher knows it is safe to do so). Does the foam last forever?

What happens when the reaction is finished? Is it the soda or the vinegar that has run out? What could we do to test this? (add more of each separately and see if bubbles form again).

Extension Suggestions

What would happen if we added a drop of dishwashing detergent? What about food colouring? What if we added dirt or sand?

Do any other ingredients in the kitchen do this? Does baking powder work the same way as baking soda?

What is vinegar made of? What in it is causing the reaction? (acetic acid). What is in baking soda? (sodium bicarbonate). Why do we use baking soda in baking? (pro tip – the same reaction occurs in your cake, causing the bubbles that make a cake light and fluffy).

2. Water polymer balls

Instructions

Add water polymer balls to clean tap water, leave over night (2 nights if they're the super big ones) to absorb & expand. Play!

Equipment

- Water polymer balls
- Water
- Container
- Tray to contain spills while playing

Health & Safety

'Orbeez' is the common brand name for these, but you can also order them from places like AliExpress where they are called "water polymer beads/water crystal beads/water crystal gel/water gel" or similar. They are made from a super absorbent polymer (word cheat: poly=many, mer=molecule) which is just a molecule that can absorb up to 300x its weight in water. While you should never eat anything that isn't food, and *especially* nothing from a science experiment, if you *do so accidentally*, they pass through the digestive tract and are expelled naturally without causing harm. They (water polymers) are non-toxic, do not bind together and do not break down in the digestive process. If you're finished playing with them, chuck them in your garden to help your plants & soil retain water (they'll break down and disappear into their non-toxic component parts quick enough).

Questions to Ask

Before you touch the water, talk about what you think it will feel like, what do you think is in there – do your senses say the water is just water, before you use touch?

Encourage touch and feel. What does it feel like? (slimy, smooth, bubbles, balls, spheres, rubbery, elastic, compressible, squeeze, bouncy, cold) What do they look like when you hold them? (clear, transparent, see-through, coloured, crystal, shiny, reflective) compared to when they're back in the water (invisible, translucent, undefined edges, blurry, blobs of colour, coloured water spots).

Super common question is "what happens if I keep squeezing" or "whats inside?" – encourage everyone to crush up a small one and find out! (the bigger ones are more expensive and take longer to expand but if you want to ruin everyone elses fun you can crush these ones too 😉).

Extension Suggestions

What happens if you add food colouring to the water? Do the clear ones absorb the colour?

What if you put some of the water beads in a small cup and add salt?

Do they bounce? Do they shrink down to small hard plastic-feeling balls again if you leave them out of water? How many times can you expand and shrink them?

Can we use them to grow plants? /will they sustain plant life?

Will they absorb milk? Juice? Just the water out of the milk and juice or the whole lot? (do they turn white or yellow/orange).

3. Seed planting

Instructions

Scrunch paper towels into the bottom half of a clear plastic cup, wet them as you go. You want them wet enough that they glisten/shine, but not so wet as to have water pooling in the bottom on the cup.

Poke a seed down one side, against the wall – so you can see the roots grow down and the leaves shoot up.

On the side without a seed, write your name, the date planted and what type of seed it was.

Pop it on a sunny windowsill, keep the paper towels at the glistening stage of wetness, and watch it grow!

Equipment

- Clear plastic (or just use drinking glasses! Sustainable!) cups
- Plain white paper towels
- Permanent marker pens
- Seeds (recommend peas or beans for visibility, but you can use any seed)
- Water

Health & Safety

Nice warm, wet paper towels are the perfect environment to grow mould! Don't worry if you see some black-ish spots, its just normal mould like you'd find in the bathroom or on old food in the fridge. If you see anything that is bright orange or yellow, consider throwing that one out, transferring the seed into a new cup.

When your seedlings are big enough to transfer into a soil pot, consider disposing of the paper towels in your compost bin and the plastic cups in the recycling. If you've used drinking glasses or similar, give them a good wash and put them back where you found them (with a warm glow of knowing you haven't contributed to the global plastic problem 😉).

Questions to Ask

Why are we using paper towels? What function do they have? (holding the seeds up/support/structure).

How can the seed grow without dirt? What does dirt do for a seed? (holds it up, provides water, some minerals useful for the plant more than the seed, which has everything it needs in its little food parcel).

Why are we adding water? What does the water do?

Why a clear container? (So we can see what the seed does).

What does the seed feel like? What colour is it? What is the powder coating for? (bird deterrent, anti mould agent etc).

Extension Suggestions

Draw lines on the cup to track growth progress, consider drawing a graph with the data.

Why do the roots grow downwards? What happens if we take a seed that's just sprouted, and turn it upside down?

If we add food colouring to the paper towels, will the roots or shoots change colour?

Have a plan for transferring the plants when sprouted into seedings, into dirt in a pot or bucket, or into a garden. Let your students follow its growth through to fruit production (peas! Beans!) and then death – where it becomes compost.

What happens if we never transplant the seeding?

4. Oobleck

Instructions

Mix your cornflour and water together in your chosen container. Add food colouring if desired. Play!

Equipment

- Container to contain the slime (roasting pan, big bowl etc – something big enough to let several pairs of hands in to play at the same time).
- Cornflour (Ratio of 2:1 cornflour to water. Eg 2 cups cornflour to 1 cup water)
- Water (Ratio of 2:1 cornflour to water. Eg 2 cups cornflour to 1 cup water)
- Food colouring

Health & Safety

Non-toxic (it counts a food, technically) but can be messy – easily cleans away with water. Be wary of strength of colouring/dye, as it has the potential to dye skin or clothing if too much.

Questions to Ask

Before you start: What does it look like? What do you think it is going to feel like?

What *does* it feel like? How would you describe it? (solid, liquid, cold, cool, slimy, sludge, weird, strange)

Will it hold up items? What if they are light or heavy? (sink, submerge, disappear, eats it, envelops)

Can you make a ball of it in your hand? What happens to it? (breaks, melts, drips, slimy, cool)

Extension Suggestions

Oobleck is called a non-Newtonian fluid because its viscosity changes depending on pressure – if you hit it, it acts like a solid, if you hold it gently, it acts like a liquid. Viscosity is just a fancy word for how *thick* a liquid is.

Use different toys and tools with it – what works and what doesn't – cookie cutters?

What if you add more or less water when you're making it? What if you add sand – is it still oobleck only gritty? Or does the sand change in into a normal fluid? What does it look or feel like if you leave it to dry out?

What happens if you add dishwashing detergent? (you get stretchy oobleck).

5. Spaghetti-marshmallow construction challenge

Instructions

Give groups some marshmallows and spaghetti, the challenge is to construct a tower in anyway you like, using only those two materials, as tall as you can get it. You can frame this as a competition, or you can encourage collaboration and idea sharing (stealing ideas is a fallacy – get new ideas any way you can!). Measure heights, record the numbers and compare.

Equipment

- Small marshmallows
- Spaghetti
- Ruler

Health & Safety

Technically food, so no problem. Keep an eye out for where you are working, as kids will sneaky-eat the materials, so choose a reasonably clean table/floor to work on.

Have a dustpan and broom handy for easy clean up.

Questions to Ask

What is your plan? Have you tried different ways of connecting pieces? Do you have to use only one piece of spaghetti at a time? Would it be stronger if you added more in between each marshmallow? Do you have to use full length pieces of spaghetti?

How would you describe the spaghetti as a building resource? (brittle, breaks, weak)

What kind of building shapes and structures have you seen in the city or in photos from around the world? (towers, pyramids, square or round towers, several pillars, flat tops, needle shapes…).

What different design elements did they use? What about with bridges? (eg support struts, reinforcing, wide bases, tapering tops).

Have you had a look at what other people are doing to get some ideas?

Extension Suggestions

Do it again! Learn from your mistakes/fast failures and improve upon them!

What if you did something to the spaghetti to stop it breaking so easily?

Would it work with bigger ‘mallows? What about tiny ones? Gummy lollies instead of marshmallows?

Have you tried it with extremely short pieces of spaghetti? What about using the mallows like bricks, with the spaghetti acting like steel reinforcing?

If its not forbidden in the rules, its fair game!

You can do this with lego or duplo too.

6. M&Ms colour dissolving

Instructions

Add the lollies in a colour pattern around the edge of your plate or bowl. Carefully pour water into the middle until the lollies are half submerged. Leave it alone but wait and keep watching. Take some photos of the interesting stuff to come back to later.

Equipment

- Plates/bowls
- M&Ms, Pebbles or Skittles
- Water

Health & Safety

Food! No worries here. Watch out for mess with the colouring coming off.

Questions to Ask

What do you think is going to happen? Have you ever held an M&M in your hand for too long before? What happened then?

What do you think the water is going to do to the lollies?

Describe what you see happening! Is it what you expected or is it surprising?

What do the colour patterns look like? Are any new colours being made? What if you mix it a wee bit?

Extension Suggestions

What happens if you use warm water? What about hot? What if you use oil instead of water? Or milk? Why are they different?

What happens if you jiggle the plate? Or swirl the water in the middle?

Do the lollies taste the same without their colour on? What does that mean for where in the treat the flavour is held?

We are considering converting this booklet into a formal resource, we'd love your thoughts and feedback! Email us at STEM@cometauckland.org.nz

If you're keen to try other science experiments at home or in your ECE, check out some of the websites and books below!

- The Kitchen Science Cookbook by Michelle Dickinson: https://nz.kitchensciencecookbook.com/
- Mr Shaha's Recipes for Wonder: Adventures in Science Round the Kitchen Table: https://www.bookdepository.com/Mr-Shahas-Recipes-for-Wonder-Adventures-Science-Round-Kitchen-Table-Alom-Shaha/9781925321890
- https://sciencebob.com/category/experiments/
- https://mommypoppins.com/kids/50-easy-science-experiments-for-kids-fun-educational-activities-using-household-stuff