PRIMARY + STEM

The INVERGOWRIE Foundation

SWINBURNE UNIVERSITY OF TECHNOLOGY

Transcript: Turn Milk into Plastic

Primary and STEM, it's a show where we try out STEM-related activities that have been designed by STEM experts and report back to you about how they worked in real life. If you want to check out the activities, they're all available on the Primary and STEM website, which I'll leave a link to in the show notes.

Oh, and one other thing, I don't have kids. So, thanks to my fabulous group of friends who have primary school aged children and who I might add were very quick to agree to drop them at my house when I suggested a STEM-related play date, I've got some little helpers to test out the STEM activities with me.

Because the kids are obviously under 18 I won't be using their real names or voices. Instead, I'll be asking them to provide a made up name of their choice.

In this episode, 'Charlie', which she is not her real name, and I are going to attempt to turn milk into plastic

'Milk into plastic' is an activity that was created by Science Buddies. They're an organization with, to quote their website, more than 1,100 scientist authored students science projects. From what I can tell, most of the activities on their website appear to be tailored towards teachers for use in the classroom, but the activities look equally as good for use in the home if you just scale them back a bit.

To get a copy of the lesson plan activity sheet I needed to create a free account on the Science Buddies website. It was pretty standard. And all free. Just choose a username, enter a valid email address and create a password.

The activity is pitched at the grade six to eight range, which, with a bit of a buffer could be for kids anywhere from around 10 to 15.

The instructions say that it takes about one hour to complete the activity. Charlie and I knocked it over in about 20 minutes, but we could have extended it if we just kept repeating the process and creating more material.

Here's what Science Buddies recommends to have on hand before starting.

A measuring cup milk – have at least one cup. But, as I found out later, one cup doesn't really create much material in the end. So you might want to consider having a full cotton just in case.

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You need access to a stove top oven and a saucepan, or you can use a microwave and a microwaveable container.

The instructions suggest having a thermos or an insulated container that's big enough to hold all the hot milk. But if you're just doing this at home, you don't actually need these pieces of equipment unless you're planning on warming up the milk an hour or so beforehand, just so you can use the line 'Look, here's what I prepared earlier'.

You'll also needs some white vinegar. You'll need four tablespoons worth for each cup of milk you end up using.

Paper towel: the instructions say six, but didn't actually specify a unit of measure. So, I wasn't sure if this meant six rolls or six paper squares.

And you also need a spoon. I went with just an ordinary metal spoon that was in my cutlery drawer.

Optional materials are food colouring, glitter and markers.

Absolutely yes to the food colouring and the glitter. But realistically it will be quite a few days before you can consider using markers to decorate your milk-based creations. So probably don't worry about these.

If you want to upskill on your plastics knowledge before you get down to business, there's a tab on the lesson plan page that's essentially a cheat shee so you can sound like you know what you're talking about when the kids ask 'what's happening to the milk?' But if you just want to get to the bit where we make some cool glittery objects, then by all means, skip ahead.

To be honest, by the time I got to the third line of the theoretical explanation that underpins the process, I was starting to feel a little bit out of my depth. After reading it four times, maybe it was five, I think I got the gist of what the activity is communicating from a STEM perspective. To save you some time.... From what I can gather here are eight highlights.

One plastic is everywhere.
Two plastic is made up of molecules.
Molecules repeat in a chain, which has caught a polymer in a polymer.
A single repetition of a pattern of molecules is called a monomer.
Making a polymer is called polymerization.
Synthetic polymers are man (or woman) made.
Natural polymers occur in nature.

And... number eight: when milk is heated and combined with an acid, say vinegar, the molecules in the milk undergo polymerization and reveal long chains, AKA 'curd', and... Plastic.

When reading all the theory, the bit I was most interested in was a statement: 'All plastics can be moulded into many shapes'. Which opens up the possibility of creating my own milk-based range of fashion accessories, and or fridge magnets. But I might be getting a little bit ahead of myself.

At this stage I was still pretty sceptical that I could turn milk into anything other than a cafe latte.

So back to the making, turning that milk into plastic, which at its core, we now know is actually an activity that teaches kids about polymerization.

So, here's what happened.

We started by heating the milk. I went with a stove option because it felt kind of more 'science-y and authentic', but no judgment if you take the microwave shortcut.

I say 'we' heated up the milk, but in this instance, I took charge of this step because I was a little bit nervous about, you know, incredibly hot surfaces in the same room as a child that didn't belong to me.

Then I poured the hot milk into a measuring cup until it reached the one cup line. And put it into a heat safe container, which is a fancy description for 'coffee cup'.

Charlie then measured out four tablespoons of white vinegar pouring one tablespoon of it at a time into the coffee cup containing the hot milk.

After the milk and the vinegar were in the cup, Charlie began staring them together with a metal spoon.

Charlie then began spooning out the lumps while draining off the liquid by holding the spoon on an angle against the side of the cup, and then putting each drain spoonful of sludge onto a few stacked sheets of paper towel, which immediately started absorbing the liquid.

It turns out the instructions were referring to squares of paper towel, not rolls. But, in my opinion, six is a gross under-representation of how many you'll need – at least how many I needed. We ended up using around 24 sheets.

Once she'd scooped as much of the mixture as she could out of the coffee cup, she patted down the lump of material she'd created to try to get more of the liquid out of it.

'Color', she said. I'd forgotten the step where you were supposed to add the food dye.

So, we emptied out the remnants and clumps of liquids still in the coffee cup. Somehow, I managed to get the sludge like substance back into the cup, added a few drops of food dye and mixed it together.

And… Nothing happened.

It was still whitish colour more.

'More!', she said.

Perhaps a little heavy handedly, I tipped what turned out to be half a bottle of unicorn dream food dye into the cup.

And Charlie got a stirring.

It took quite a bit of folding and mashing to get the colour to take. And I'm not sure if it was the nature of the material or the strength of the food dye that I'd chosen, but at best we achieved a mild purple hue.

By this stage, my kitchen smelled as if a group of teenage unicorns, who'd recently run a marathon and not washed for days afterwards, had taken up residence in my home.

Because I I'd thrown in so much additional liquid, we now needed another bunch of paper towel squares to try to get as much liquid out of the mixture as possible so it could be shaped into something. Options were a bit limited. Any sculptors out there should lower their expectations about what can be achieved. It was like trying to sculpt lumpy, mashed potato.

Charlie went with a flattish donut shape and we pushed a stick through the centre to create a hole so she could turn it into a pendent.

I'd suggest adding a skewer or a stick to your materials list in case you want to create something similar.

The instructions say to wait 48 hours for the material to harden.

I think I threw out this prediction because it's now day three and I'm still feeling like it needs a little bit more time, but I'm not you to see Charlie again for a few more days so everything will be fine.

Questions that might cross your mind when attempting to replicate the activity.

'How hot is the milk supposed to be?' Well, I heated up the milk to be about the same temperature as if I was making hot chocolate.

'Which milk did you use?' The instructions don't specify which type of milk to use, or if they do, I completely missed this piece of information. When I went to the store to purchase supplies, I felt completely overwhelmed by the choices and had no idea which milk would work best. I ended up going with the full cream option. It seemed to work fine. If you try another type, let me know.

'What would you do differently?' Next time I would buy the strongest coloured food dyel could find! And I would turn on the extractor fan immediately before starting.

Thank you for listening to Primary and STEM. The STEM activity we tried out in this episode was Turn Milk into Plastic! from Science Buddies.

If you'd like to test it out for yourself or discover other activities from the huge range of activities on the Primary and STEM database, check out our website. The address is primaryandstem.online

If you've got some joy out of listening, we'd love you to tell a friend.

We'd also love to hear from you. Did you try this at home? What did you make? How did it go?

Write a review of one of the STEM activities you've tried out at home and send it through to primaryandstem@gmail.com

Primary in STEM is part of a larger project, full of short stories about how women turn their childhood passions into STEM careers, and a database full of STEM activity resources. Support for the project is provided by the Invergowrie Foundation and the Primary and STEM research team.

Thanks for listening and see you next time.

This Transcript is part of the PRIMARY + STEM suite of resources
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