

What makes children think STEM4Me? Ways to help primary school children into STEM without an expensive lab

Dr Josephine Chen-Wilson @DrJoUK1 #STEM4Me C@N-Do project (2019/20)

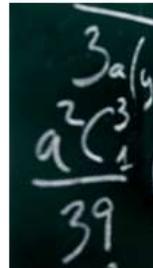
Associate Professors Kimberley Hill and Rachel Mauder (psychology)

Dr Scott Turner (Computing)



Australia dealing with the STEM crisis

and mathematics subjects by school students and tertiary courses, the federal and state governments are encouraging science, technology, engineering and mathematics (STEM) participation in New South Wales schools, summarise STEM and look at some of the initiatives in place in the



of Sydney shows a noticeable decline in the number of students studying Higher School Certificate (HSC). The following shifts were observed:



Chairman of the National Stem Movement, Datuk Prof Dr Noraini Idris, is not surprised by Education Minister Dr Maszlee Malik's statement that the number of students

STEM Crisis and skill shortage

Skills shortage costing STEM sector £1.5bn

17TH MAY 2018 07:00

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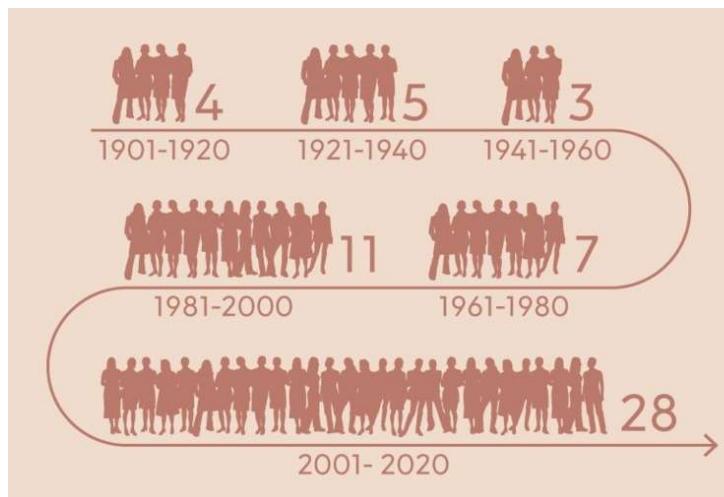
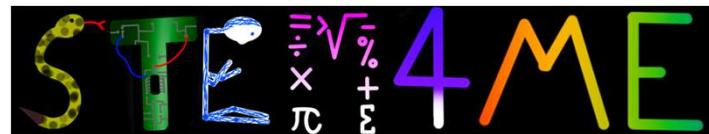
- current shortfall of 173,000 skilled workers as 89% of STEM businesses struggle to recruit
- new STEM roles expected to double in next 10 years: businesses warn of economic impact if skills shortage continues
- STEM Learning calls for businesses to join its efforts to grow the future STEM workforce

New Research Shows Declining Interest in STEM

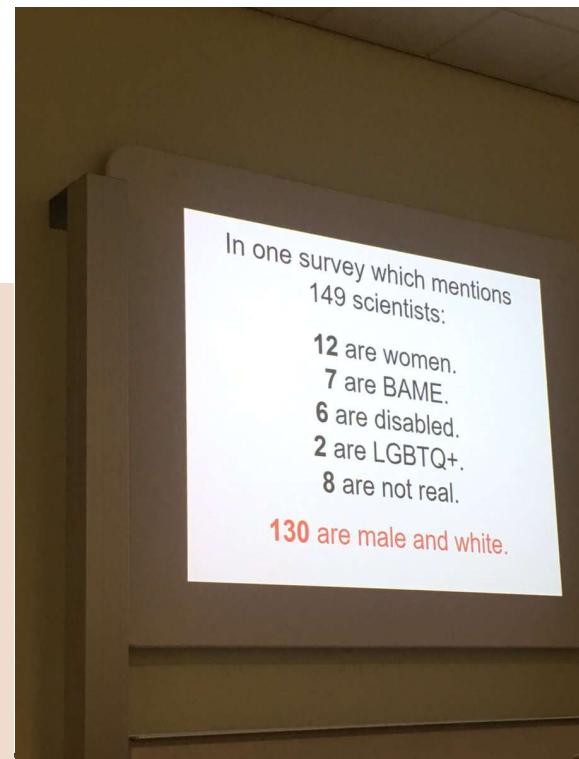
Junior Achievement found a 12 percent drop in interest in STEM careers from teenaged boys, and a low level of interest among teenaged girls remains at 11 percent.

BY STEPHANIE KIM, THE HOUR | JUNE 11, 2018





UoN
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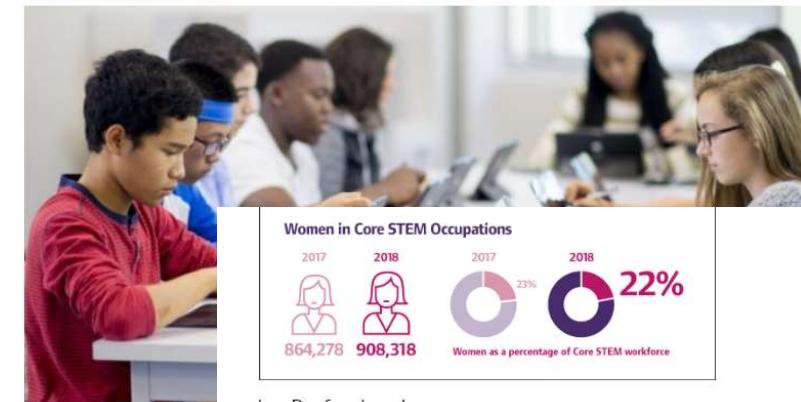
Gender and Attainment Gap

Computer 'geek' stereotype puts girls off subject

By Robbie Meredith
BBC News NI Education Correspondent

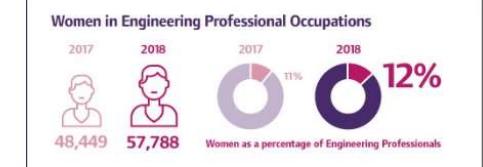
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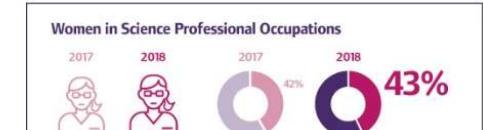
Engineering Professionals

via a 25% increase in the number of professional women engineers in a sector that grew 8.5%. Over the past 5 years, nearly 58,000 women are working as professional engineers, more than double the number there were in 2013, 5 years ago.



Science Professionals

Women now make up 43.2% of the total science professional workforce, but there are important differences between chemical, biological and physical sciences.





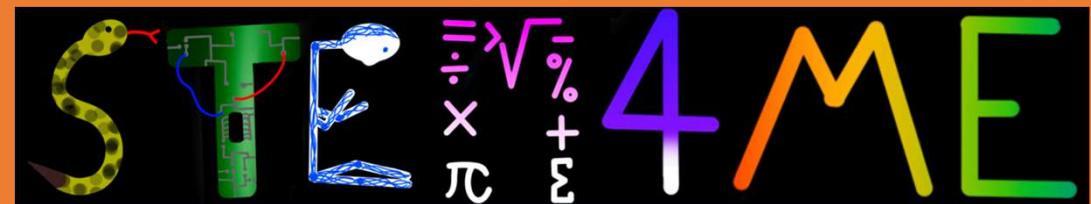
What primary children think of STEM/science

Science capital and science affinity

Do schools matter?

Resources, support and Outreach opportunities

What make children think STEM4Me?



- Draw a scientist doing some work
- https://uon1.padlet.org/josephine_chen_wilson/oe6oq3eb0tje6k9e



padlet

Dr Josephine Chen-Wilson • 10

STEM4Me Workshop for primary schools

Draw-a-Scientist

Dr Josephine Chen-Wilson 1m

Title

Write something ...

Upload Link Search Camera More

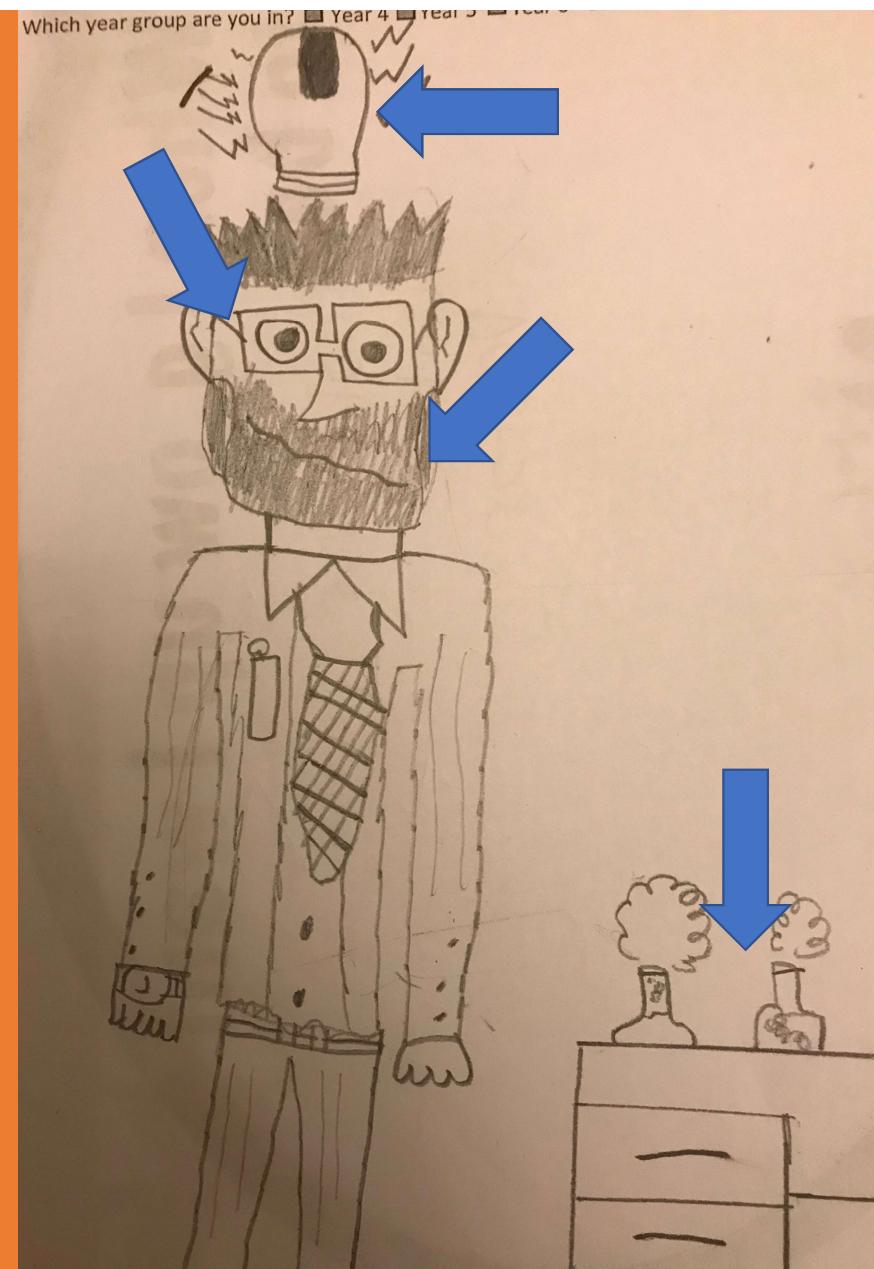


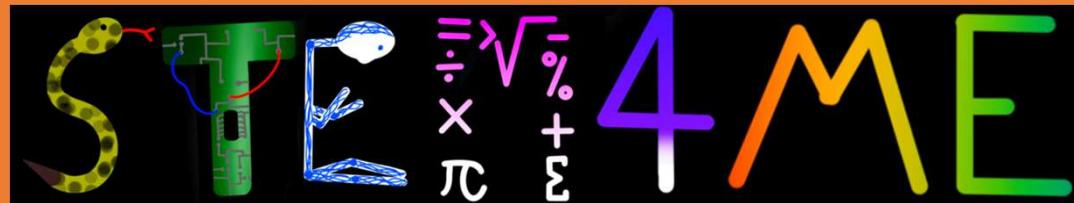
What do primary children think of science?

Draw-A-Scientist-Test (Chambers, 1983)

7 indicators of stereotypical depictions of science/scientist

- Eye glasses/Goggles
 - Lab coat
 - Facial hair
 - Symbols of research (instruments or equipment)
 - Symbols of knowledge (books, filing cabinets!?)
 - Product of science
 - Relevant caption
-
- Higher DAST score in older children's drawing
 - Gender bias in the gender of the scientist drawn
 - Very few drawings of natural science
 - Children from lower SES had lower DAST scores and less detailed drawings





- Decreasing gendered stereotypes in recent meta analysis of DAST across 50 years (Miller et al., 2018)

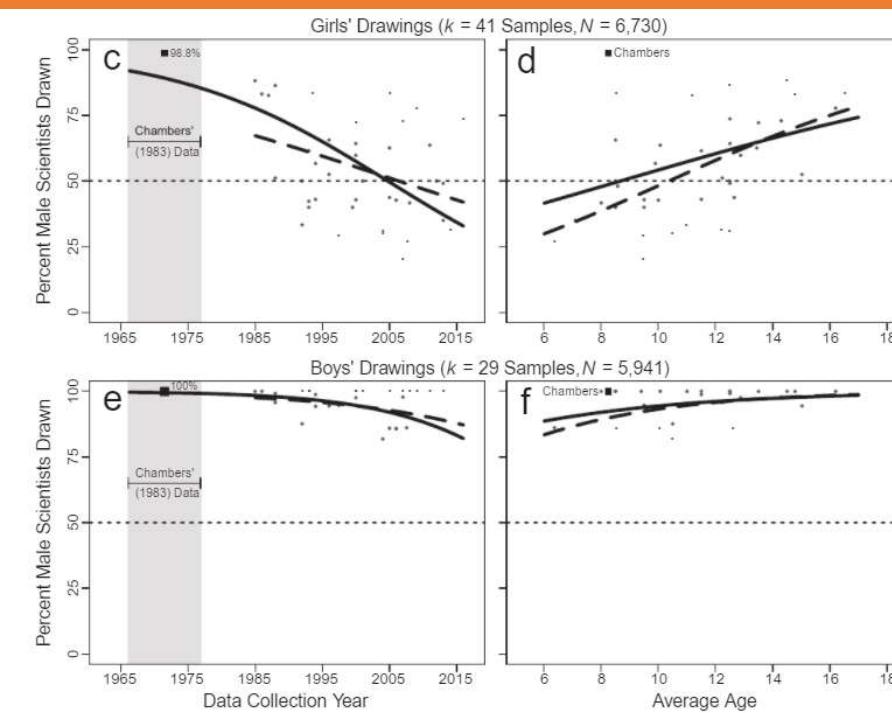


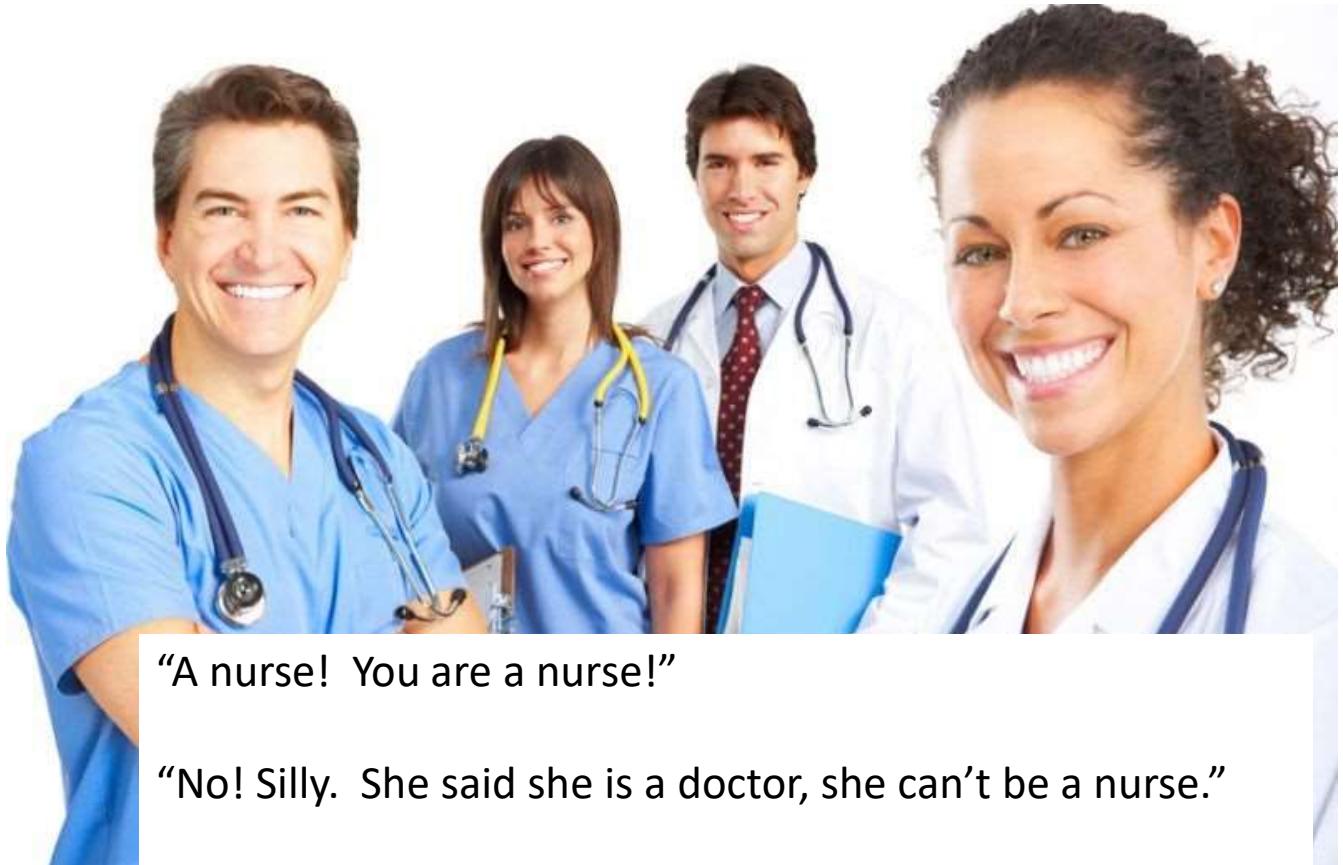
Figure 1. Change over historical time (panels a, c, e) and age (panels b, d, f) in the percentage of scientists drawn as male. The lines represent model predictions converted from log odds to percentages based on including Chambers' (1983) study (solid lines) or excluding it (dashed lines).



"Draw-a-Scientist" picture courtesy of Leon Walls

Careers curiosity panel at Women into STEAM

@STEMLearningU
K



“A nurse! You are a nurse!”

“No! Silly. She said she is a doctor, she can’t be a nurse.”

You can be a doctor and a nurse and a woman/man and you can be a doctor in psychology, history or English

er CC BY

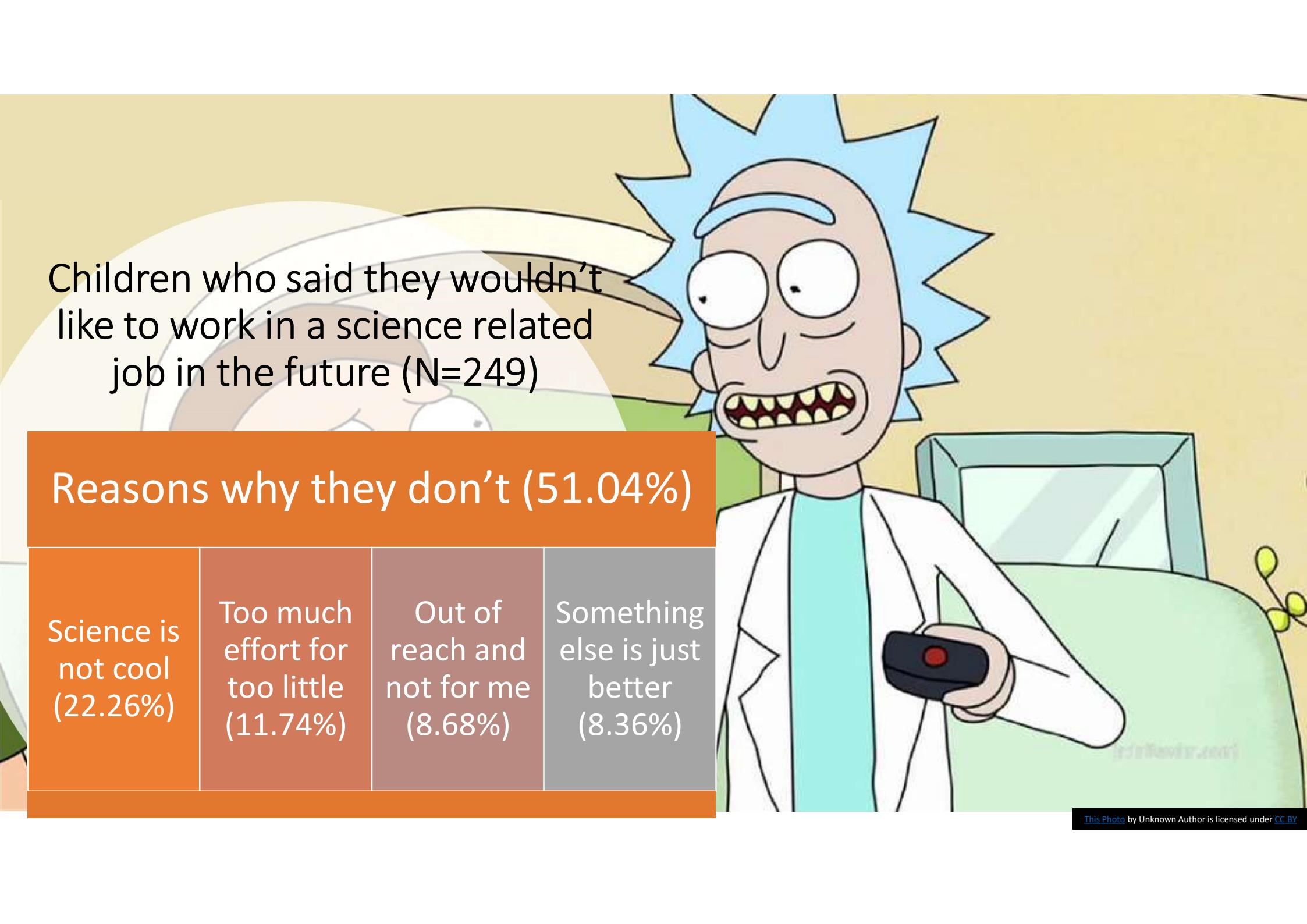
Children who said they'd like to work in a science related job in the future (N=238)

Reasons why they do (53.74%)

External
incentives
(29.03%)

Intrinsic
motivations
(13.59%)

Job security
and own
reasons
(11.12%)

A cartoon illustration of Rick Sanchez from the TV show Rick and Morty. He has his signature spiky blue hair and is wearing a white lab coat over a teal shirt. He is looking towards the left with a wide-eyed, shocked expression. In the background, there's a yellow wall and a circular object on the left.

Children who said they wouldn't like to work in a science related job in the future (N=249)

Reasons why they don't (51.04%)

Science is not cool (22.26%)

Too much effort for too little (11.74%)

Out of reach and not for me (8.68%)

Something else is just better (8.36%)



In a nutshell

Children's idea of what science is can still be limited to the traditional lab-based science of biology, chemistry and physics

A more stereotyped view of science still increased with age when children receive more specialist teaching in secondary school

All these despite the increased accessibility to technologies and resources

Representation of science still biased towards male for boys while girls showing more balanced representation in recent years

For children who didn't want to pursue science past GCSE, the main reasons they put forwards need to be further investigated and addressed



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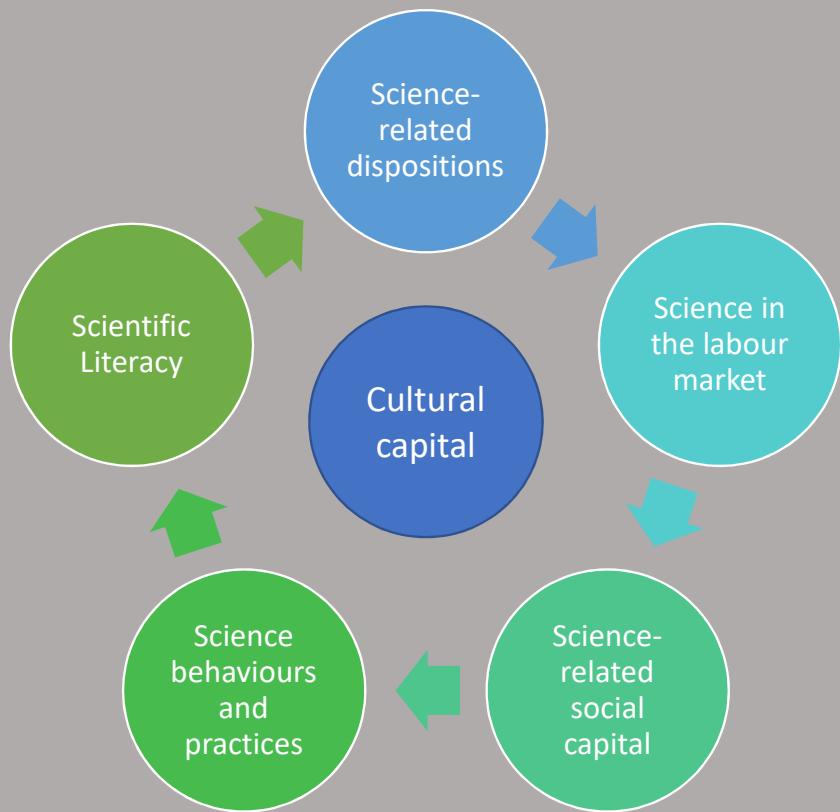
What are the barriers to children's STEM affinity?



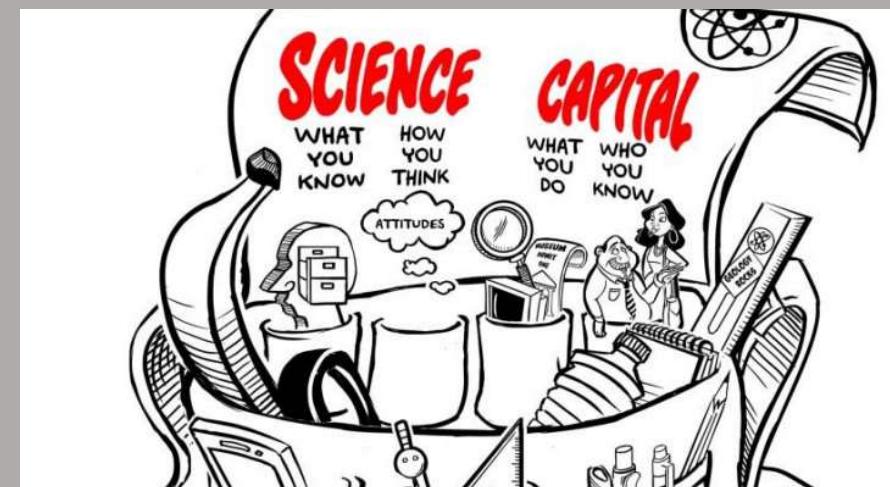
Science capital and science
affinity

Science Capital (Archer et al., 2015)

Secondary age pupils (N=3,431) in Years 7-10



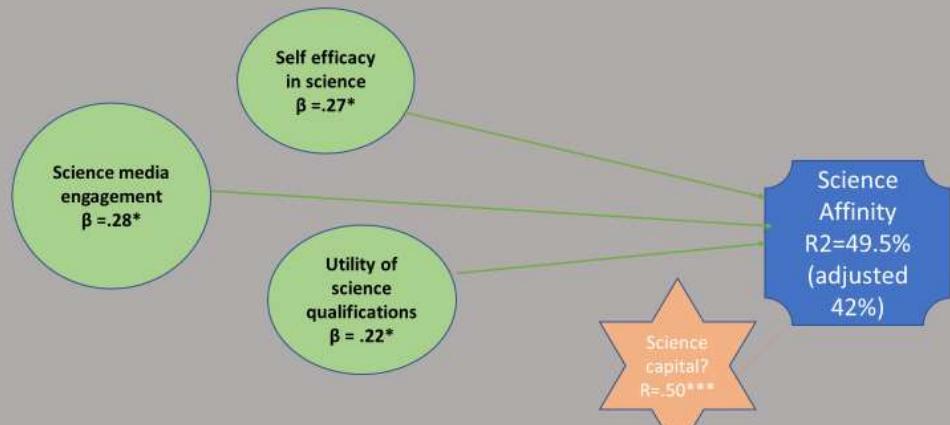
Science capital relates to higher science identity (i.e. other people think of me as a science person) and self efficacy in science as well as future science affinity



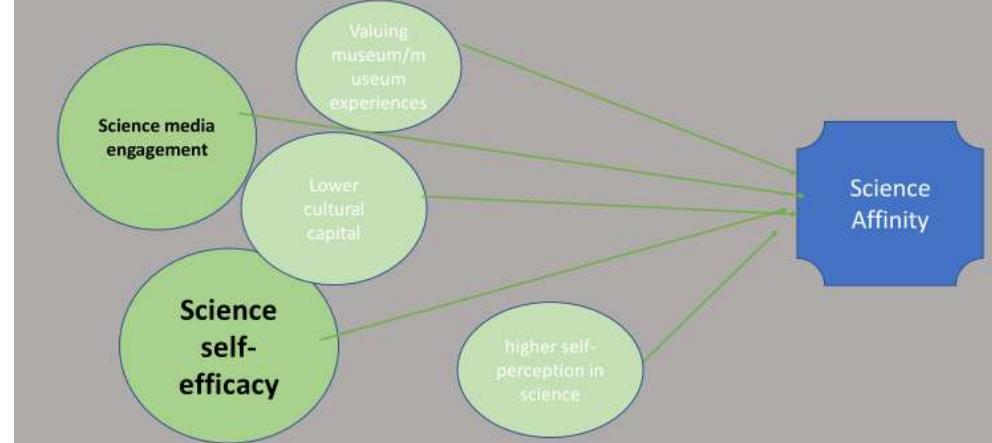
Different predication factors for children from lower vs. higher SES

In addition to science media engagement and self efficacy, *the utility of science qualification* also predicted future affinity in children with lower SES, whereas valuing museum, cultural capital and self perception in science predicted affinity in children with higher SES

What predicted children's future science affinity? (lower SES)



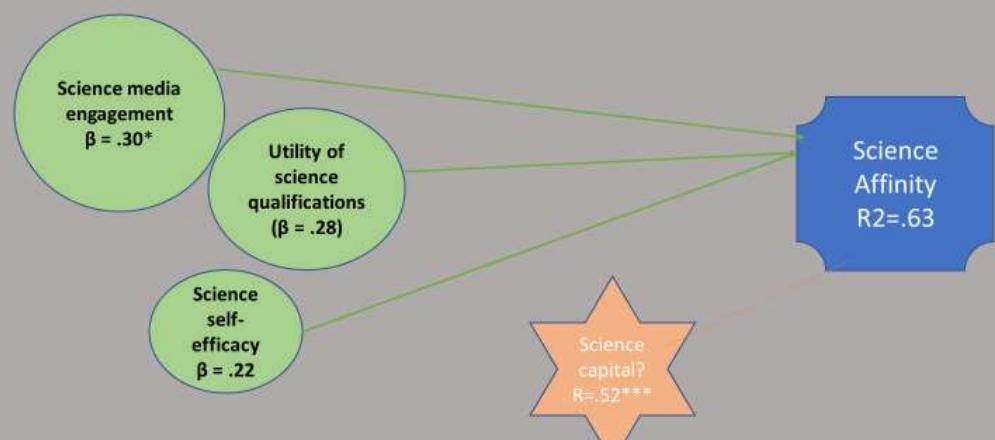
What predicted children's future science affinity? (higher SES)



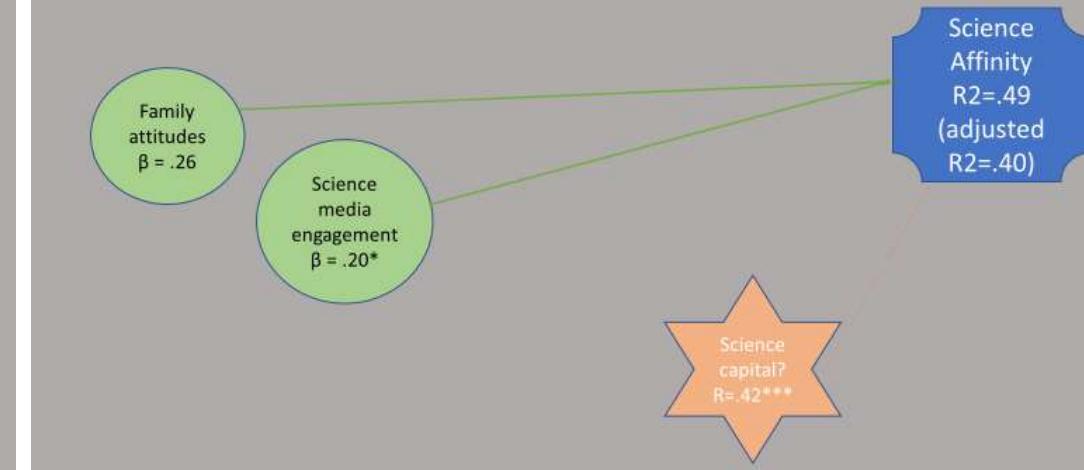
Different predicting factors for children with positive vs. negative outlook

- Science media engagement important to future science affinity.
Different pictures for children with positive vs. negative outlook

What predicted children's future science affinity? Children with positive outlook



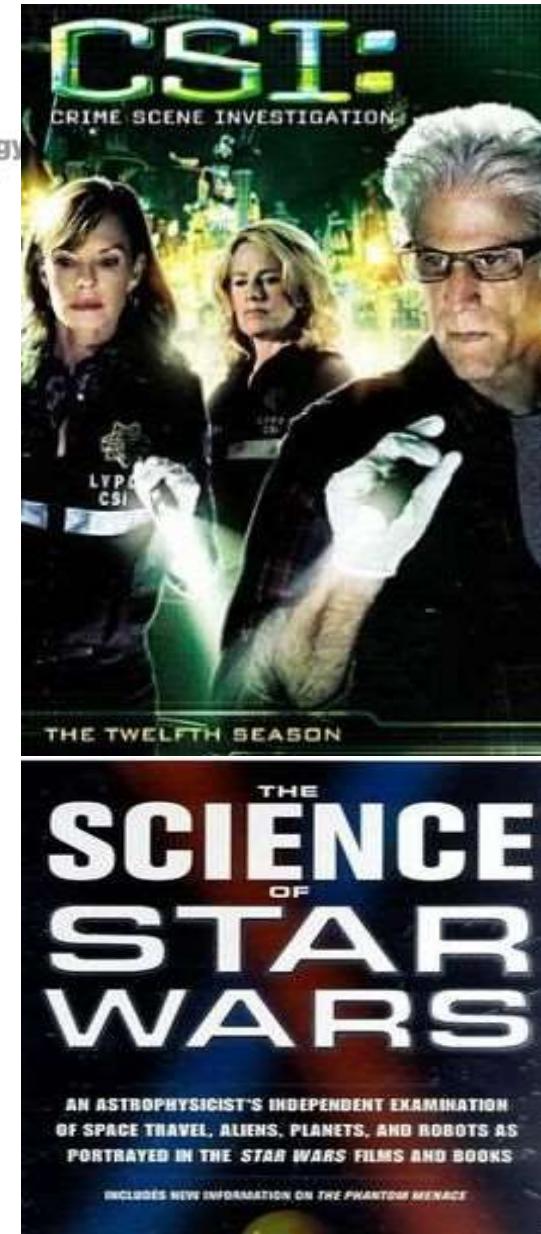
What predicted children's future science affinity? Children with negative outlook





In a nutshell

- Different components of science capital seem to influence children's future science affinity in different ways, depending on a cluster of interacting factors
- In a recent study, science media engagement is a consistent factor for a more positive affinity
- The other components play varying and interesting roles in predicting children's affinity depending on their level of science capital
- Self efficacy in science learning also needs attention

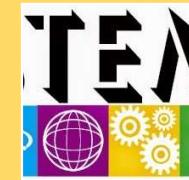


Do schools matter?





- Areas in the science capital survey showed significant differences amongst schools (West Midlands data)

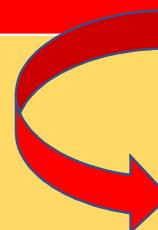


Future Science Job Affinity

Science capital score



Science teachers and lessons



Self-efficacy in science



Valuing science and scientists

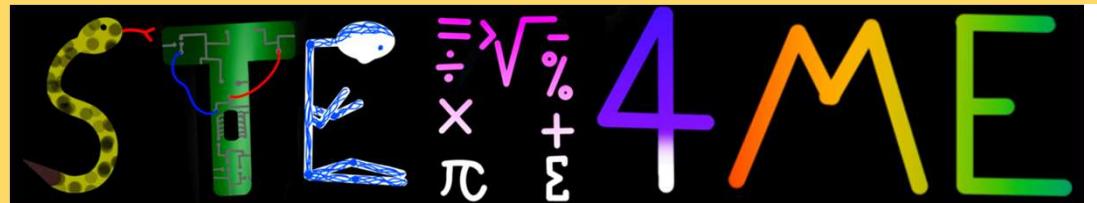


What has worked well for you?



Whole school/Year group activity

- What can you STEM competition



$$\begin{matrix} \equiv & \sqrt{-} & \% \\ \times & + & \Sigma \\ \pi & & \end{matrix}$$

4ME



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Suitable for Years 4-6

What STEM (STEAM) stand for

Pupils search for STEM related jobs independently and collate them into a list

They submit their search result to the class teacher (or head of the year)

Their outcome can be judged in different ways:

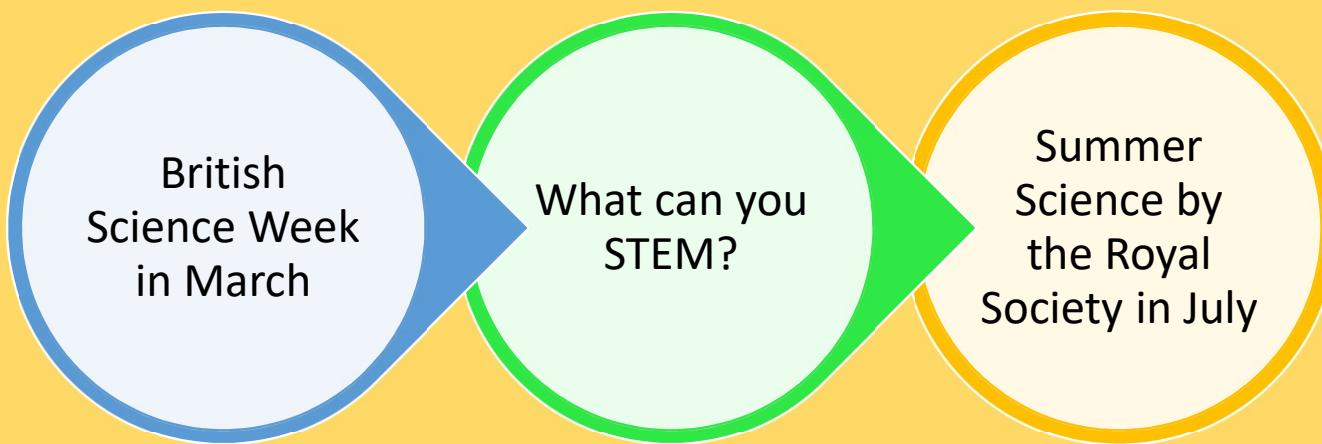
the most STEM jobs found

the most varied STEM jobs

Winner awarded with a box of chocolate

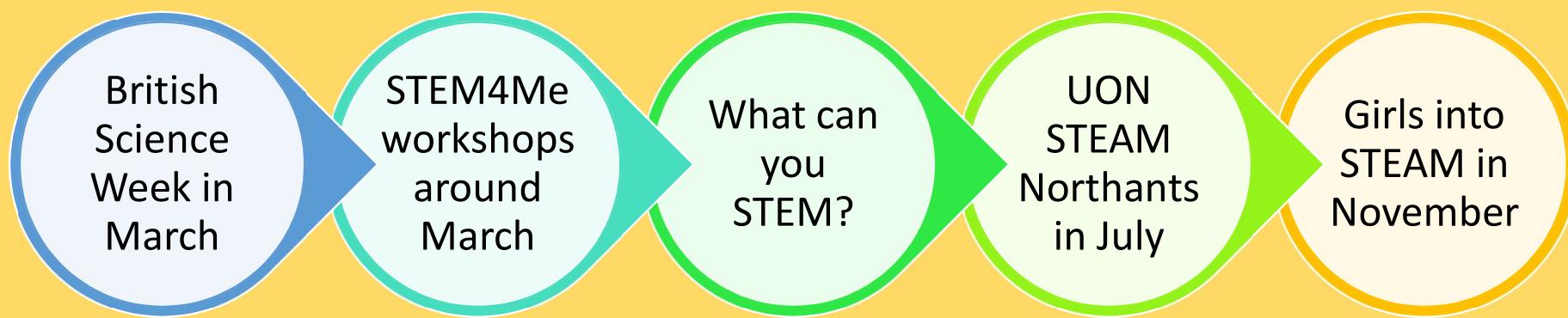
If the house system is running, the house with most jobs found gets points

5th Block Scoreboard	
Out of this World	76
Swaggerifics	69
Rangers	69
"A" Billionaires	59
Young BE swag	52



- Launch the idea of STEM (STEAM) in school
- STEM workshop

- Follow up outreach activities e.g. UON STEAM Northants
- STEM learning also have outreach events around June and July



- Launch the idea of STEM (STEAM) in school



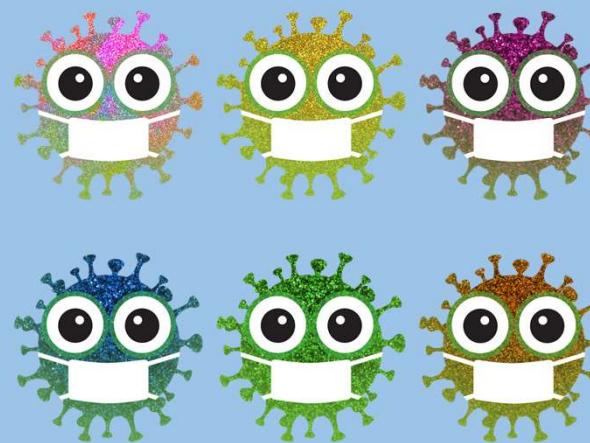
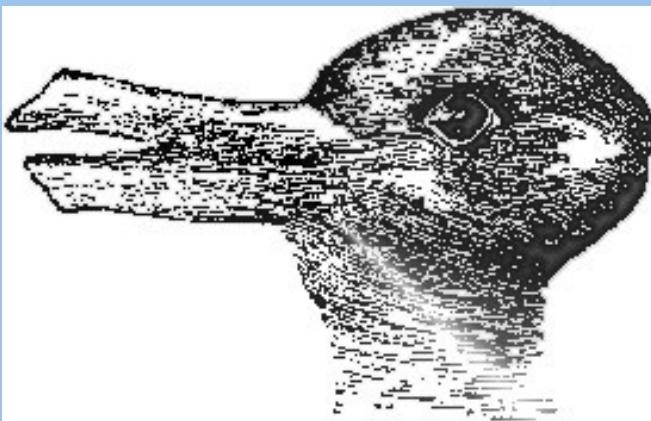


- Launch the idea of STEM (STEAM) in school

- Day workshops at a university
- Where can you STEM winner from each school to receive the award
- Winning entry from each school published on University website



Resources, Support and Outreach





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Daily Demos * Techniquest
Every day this week, we will be uplo...
techniquest

Virtual Sessions
We have a new offer of live streaming...
birminghummuseums

we the curious

nhm

Dr Josephine Chen-Wilson 31m

British Science Museum Virtual Tour

Dr Josephine Chen-Wilson 1h

5-14 March

British Science Week 2021

Dr Josephine Chen-Wilson 1h

EARLY YEARS

Make time for play

Teachwire Teaching Resource

Dr Josephine Chen-Wilson 1h

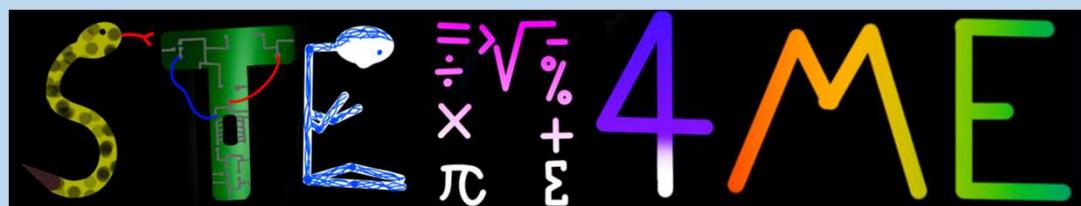
Homepage - British Science Week



- Padlet
https://uon1.padlet.org/josephine_chen_wilson/4h5n0uwarhgr7ik0



Any thought on using some of the resources?

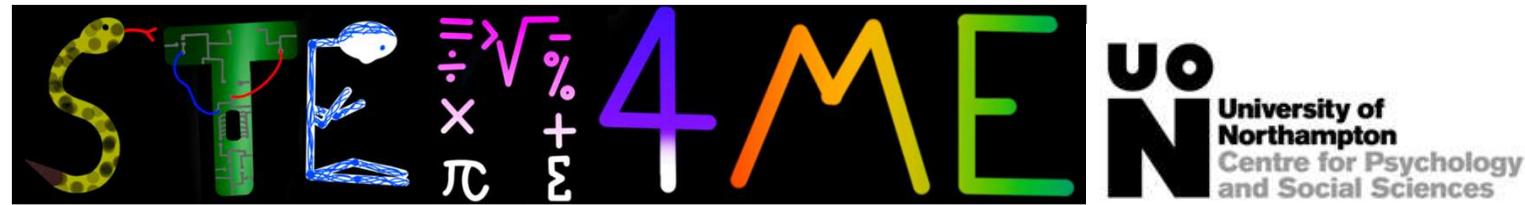




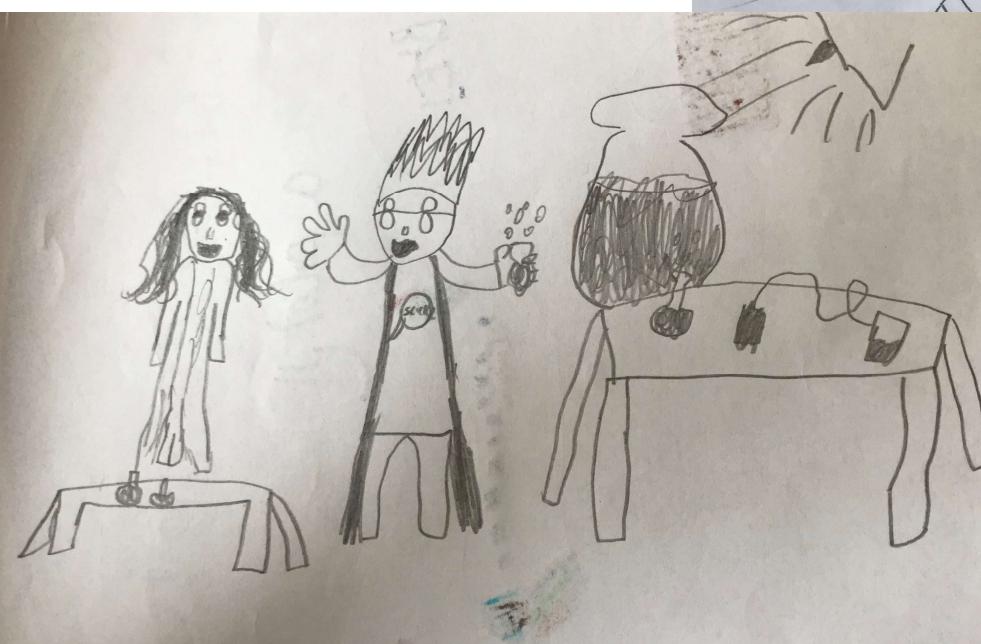
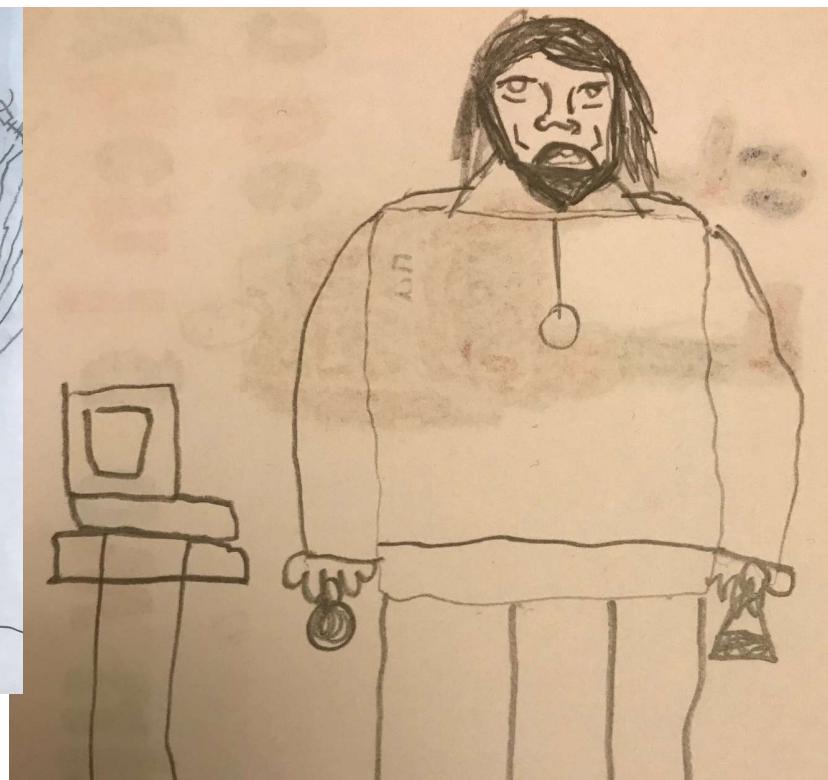
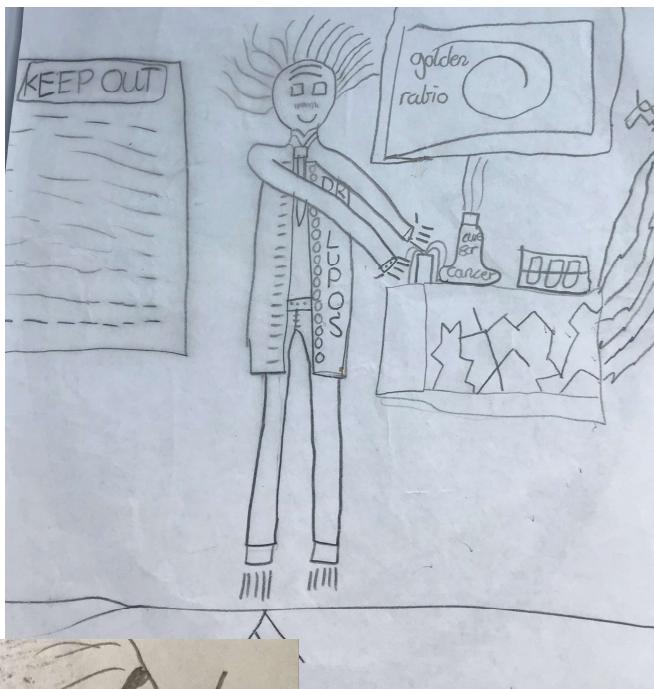
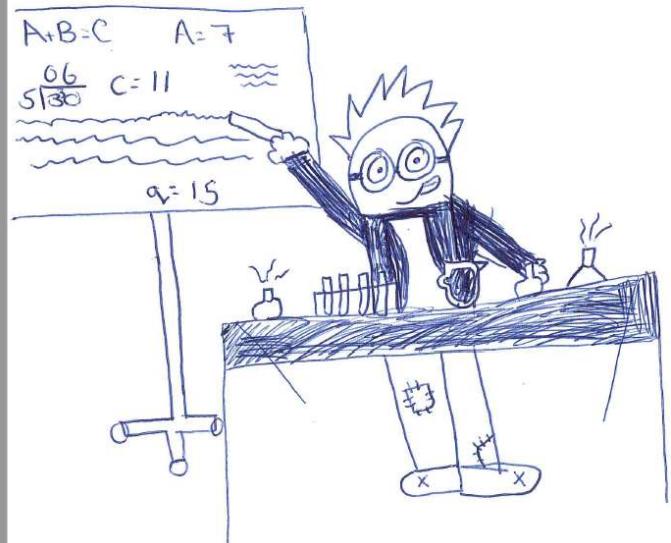
So you want to be a YouTuber?



- Group review activity
 - Each group review 2-3 STEM virtual activities or podcasts
 - Based on a suitable book review template, the children write up their reviews
 - Using the written work, each group record their reviews on camera (or a fake TV recording studio is great fun too)



- <https://i0.wp.com/www.bbdnutrition.com/wp-content/uploads/2018/05/Dont-try-this-at-home.jpg?w=250&ssl=1>



Some very interesting drawings
of a scientist

Children are getting mixed messages about science

Remember most of the children already have limited and biased ideas about science

If they also have limited science capital

They also see more negative portrayals of science or people doing science in the media (their main source of 'role model')





Let's repackage the message for our children

Science is about asking questions and finding answers to them

Science is everywhere

There are lots cool sciency things you can do

<https://twitter.com/i/status/1239506498671333376>

<https://www.youtube.com/watch?v=xoTcR7M4PyE>



Spot the scientist
Was it fair Dame Jocelyn didn't get the Nobel
prize?
How many new words can you get?

People like me
Science is about finding stuff out



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Influencer/Role model



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"It was the most awesome experience I've ever had."
"Once in a lifetime trip exploring and learning new things."

"It was amazing, I would definitely study here when I am older."

"I would say ***it inspired me to study science and enjoy it more.***"

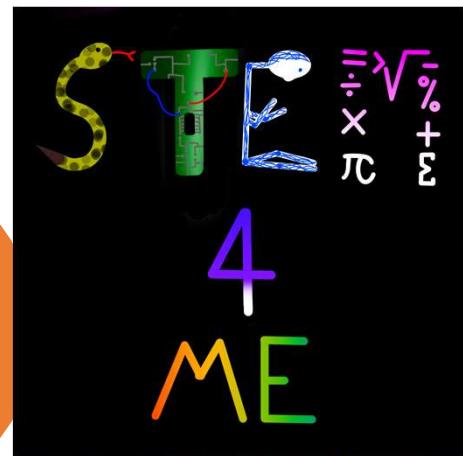
"I would describe Girls4Science as an inspirational and amazing day. I have learnt lots of thing that I never knew before."

The University has some cool students! ***I didn't know that you could do all of those things*** while studying there. Thanks. (Year 5)

I want to be like you when I grow up (Year 4 girl)



STEM workshops



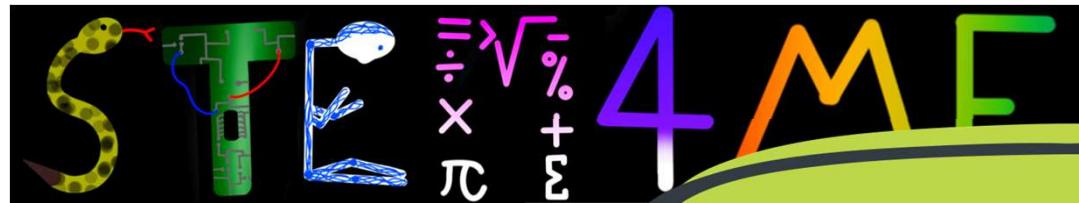
STEM Buddies

Be a part of the children's Science Capital



Dr Scott Turner @scottturner0n · Jul 13, 2020
"We need to show girls that engineering is exciting": how role models can light a spark buff.ly/32ehJvw





I did STEM4Me because I believe that primary school children should be able to experience psychology as much as any other science, as it's so important in everyday lives to understand how the mind works and how behaviours appear in certain situations. (Kimberly)

I loved this project and felt the meaning of the project on a personal level. For example, I didn't know what Psychology (my degree) was until I was 17 From then to now, I have realised there is many misconceptions around Psychology, Which is why this project is so great as we are targeting children and young people to give them the correct information.

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Faculty of Education Health and Wellbeing

Student Volunteer



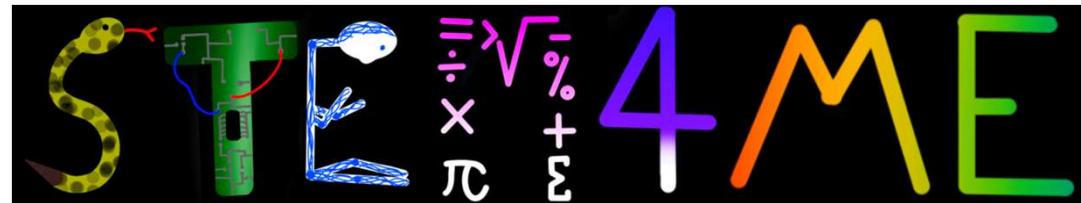
This is to certify that

Sally

Demonstrated excellent leadership, communication
and team-working skills whilst supporting

'Girls 4 Science'

I signed up for STEM4Me because i love to work with children and share my knowledge on computer with them to boast their interest in pursuing a career in Computing. (Dapel Mercy)



From a teacher

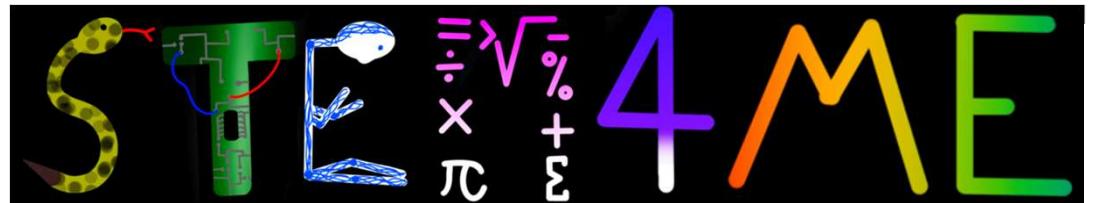
“...The students from UoN were outstanding role models, presented exciting examples of science in real life. The children had the chance to experience these skills first hand When else can you be an astronaut and a psychologist in the same afternoon?!”

“We would love to continue being part of your project moving forward. It was fabulous for children to be exposed the many different careers and how they can reach their aspirations through study”

“The ... who did the psychology session about emotions were really engaging and had good interaction with the pupils. Their activities were age appropriate and made the children think carefully”



There were also suggestions on further improving the design and delivery of the sessions



If possible, I think this project would work in secondary schools, as encouraging STEM in years 7-9 could be beneficial, and allow more advanced content in the sessions?

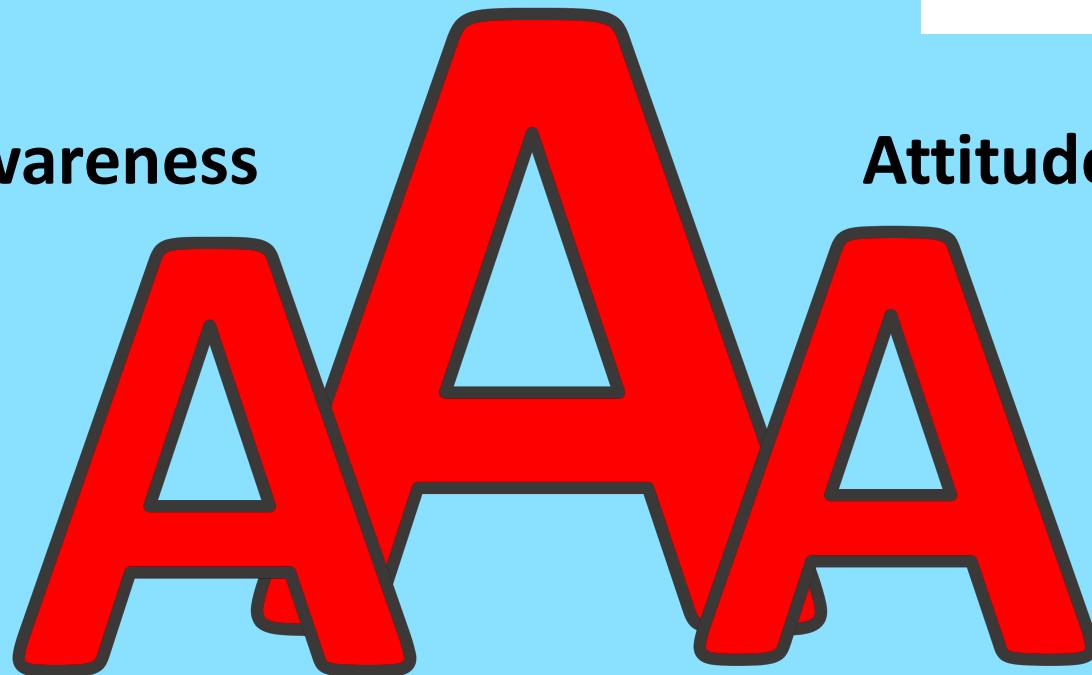
More accessible information around STEM, for instance when we cannot go into schools even now or future, maybe the teachers can lead the session of the message we are getting across and point the children in the right direction for access to STEM or how to get into STEM / next steps.



Agency

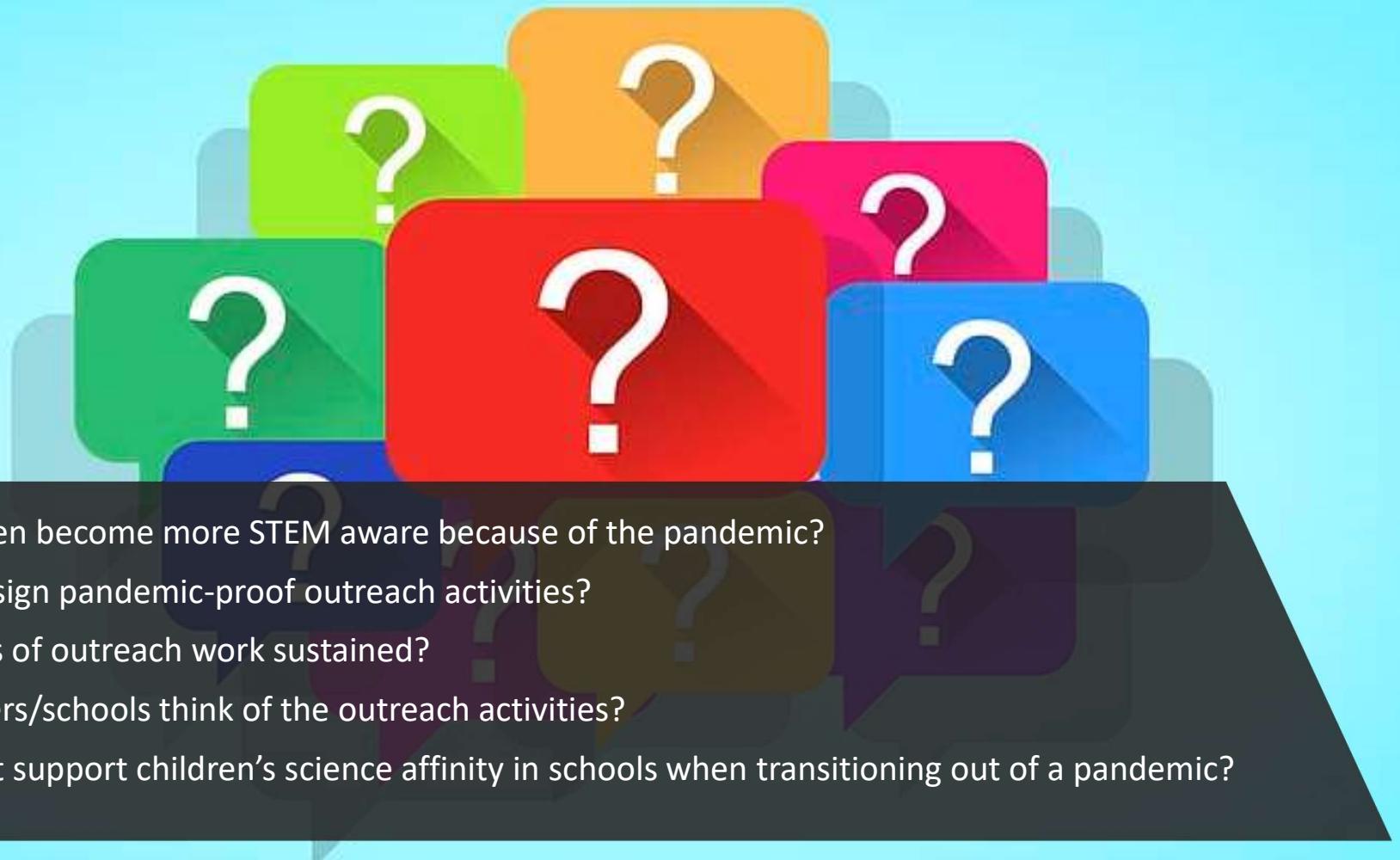
Awareness

Attitude



Making children
think STEM4Me

I have many questions



- Have our children become more STEM aware because of the pandemic?
- How can we design pandemic-proof outreach activities?
- Are the benefits of outreach work sustained?
- What do teachers/schools think of the outreach activities?
- How do we best support children's science affinity in schools when transitioning out of a pandemic?



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Making
children
think
STEM4Me





What can we do to support you and your school?

Get in touch!

Josephine.chen-Wilson@Northampton.ac.uk

@DrJoUK1 #STEM4Me



Girls4Science team at UoW
STEM4Me team at UON,
Pupils and staff in primary schools