

Why don't children all like science?

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Why should we worry about children's science learning and affinity?

- Notion of STEM crisis may still open to debate
- STEM skills shortage is real and persisting
- Gender gaps and issues with diversity also real and persisting (Wise Campaign)

The UK's STEM skills shortage

Michael Shannon Smith | June 2020

Solutions to the UK's shortage of STEM skills must be based on regional and industry-specific needs rather than a one-size-fits-all national approach

Skills shortage costing STEM sector £1.5bn

17TH MAY 2018 07:00

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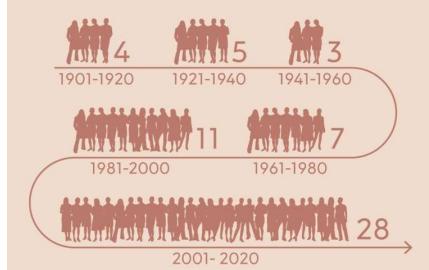
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t: Chairman of the National Stem Movement, Datuk Prof Dr Noraini Idris, is



STEVE 4 ME



The infographic shows the number of women scientists mentioned in surveys across different time periods:

- 1901-1920: 4
- 1921-1940: 5
- 1941-1960: 3
- 1981-2000: 11
- 1961-1980: 7
- 2001-2020: 28



In one survey which mentions 149 scientists:

- 12 are women.
- 7 are BAME.
- 6 are disabled.
- 2 are LGBTQ+.
- 8 are not real.

130 are male and white.

Computer 'geek' stereotype puts girls off subject

By Robbie Meredith
BBC News NI Education Correspondent

19 June 2019 | 101

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Engineering Professionals

Women in Core STEM Occupations

Year	2017	2018
Women as a percentage of Core STEM workforce	23%	22%
664,378	908,318	

Engineering Professionals

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 in Engineering Professional Occupations

Year	2017	2018
Women as a percentage of Engineering Professionals	11%	12%
48,449	57,788	

Science Professionals

Now make up 12% of the total science professional workforce, but there are important differences between chemical, biological and physical sciences.

Science Professional Occupations

Year	2017	2018
Women as a percentage of Science Professional Occupations	42%	43%
1,000,000	1,040,000	



STEVE 4 MEN

University of Northampton
Centre for Psychology and Social Sciences

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

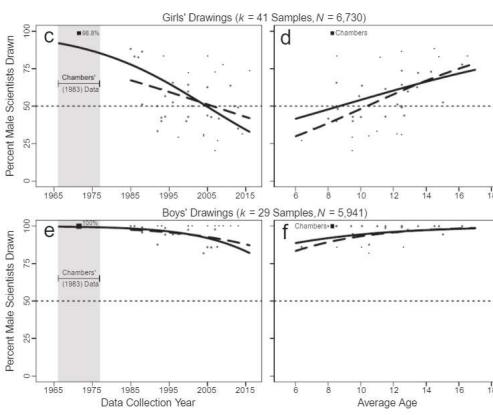


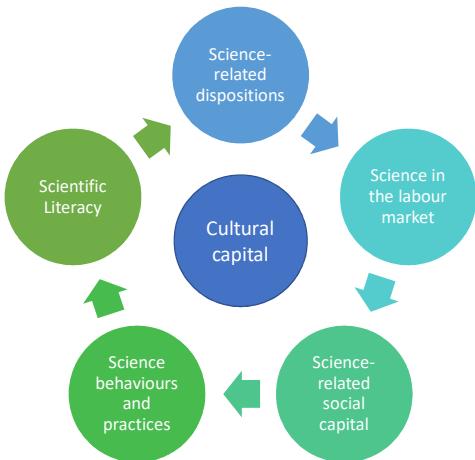
Figure 1 consists of six panels (c-f) showing the percentage of male scientists drawn as male over historical time and age. Panels c and e show data for girls' drawings (k = 41 samples, N = 6,730), while panels d and f show data for boys' drawings (k = 29 samples, N = 5,941). Panels c and d include Chambers' (1983) data. Solid lines represent model predictions including Chambers' (1983) study, while dashed lines exclude it. Panels e and f also include Chambers' (1983) data. The y-axis for all panels is 'Percent Male Scientists Drawn' (0-100) and the x-axis is 'Data Collection Year' (1965-2015) or 'Average Age' (6-18).



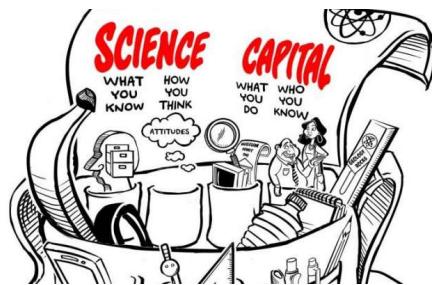
"Draw-a-Scientist" picture courtesy of Leon Walls

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



Method

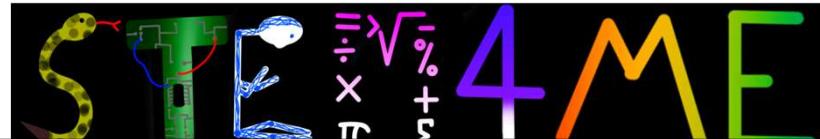
- Participants

- 504 pupils (51.8% female)
- Years 4-6 across 5 primary schools
- Children's level of Science capital

	Low	Medium	High
Current study	34.9%	62.7%	2.4%
Archer et al (2015)	5%	68%	27%

- Measures

- Modified paper version of questionnaire by Archer et al (2015)



Student science capital survey - for BP Aug 2014

This survey asks questions about you and your views about science. This is NOT a test and we want to know what you think. There are no right or wrong answers. We will not share your answers with your teachers.

Please click 'next' at the bottom of each page to continue.

Your consent for taking part in this survey...

*1. Thank you for considering taking part in this research. If you agree to take part, we want you to know that you can stop at any time. You do not need to give a reason.

Please confirm that you understand what the research study involves by ticking each of the statements below:

- I consent to taking part in this questionnaire.
- I understand that confidentiality and anonymity will be maintained and it will not be possible to identify me in any publications.

Once you have ticked all the boxes above, please click 'next' below to begin this survey.

About you...

*2. Please enter your school name below

*3. Which year group are you in?

- Year 7
- Year 8
- Year 9
- Year 10

About you...

*4. Are you a girl or a boy?

Analytical strategy

Developmental differences

Predicting science affinity

How science is understood

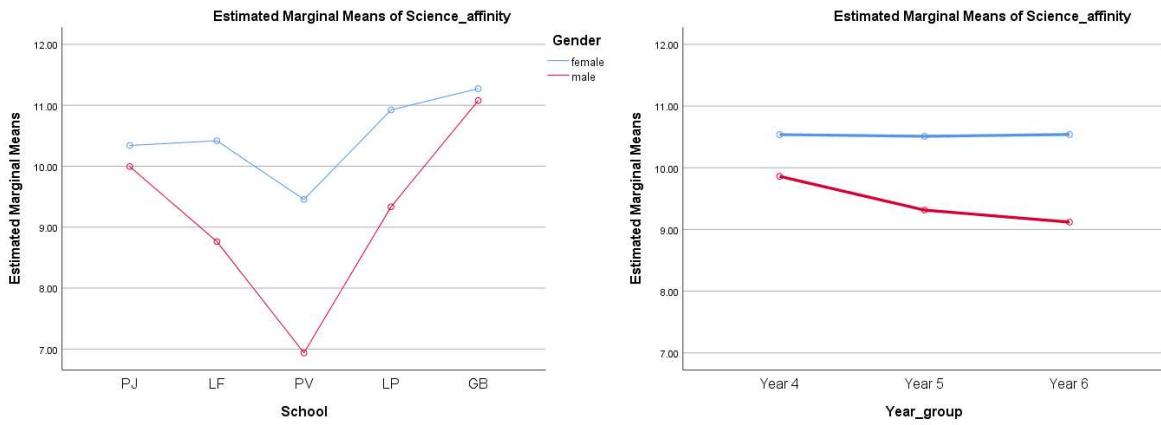


Science Capital and measured sub-scales

- Future Job Science Affinity (.71)
- Utility of science qualifications (.77)
- Science media engagement (.72)
- Valuing museum/museum experiences (.83) Self-efficacy in science (.78)
- Science self-perception* (.74)
- Parental education and Cultural capital
- Family attitudes (.81)
- Informal science activities (.80)
- Science teachers and lessons (.89)
- Valuing science and scientists (.82)

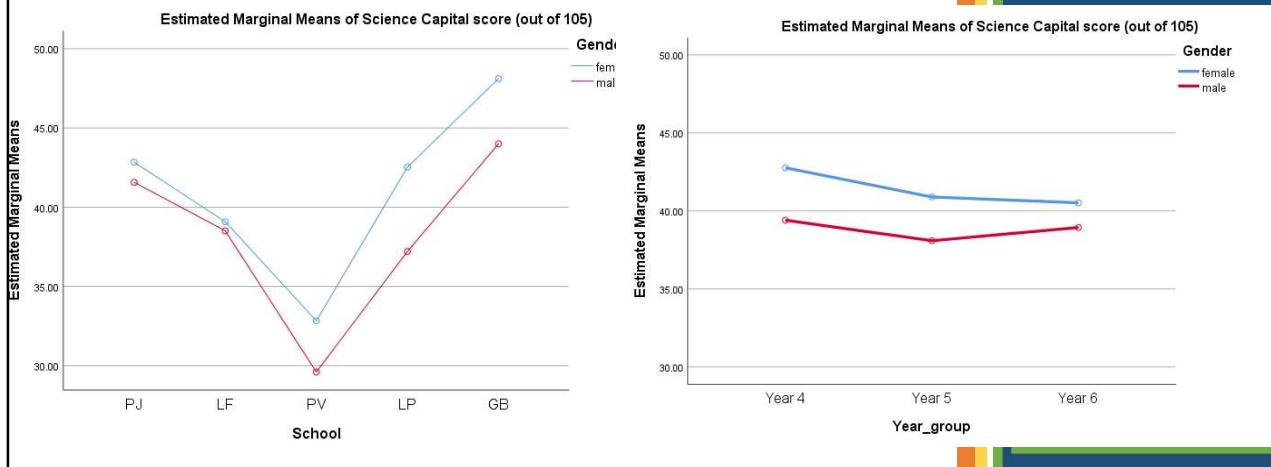
Developmental Differences: Science affinity

Highly significant gender effect (female > male) and significant school effect (PV < the rest)



Developmental differences: Science capital

Highly significant school effect ($PV \ll$ the rest).



Future Science Job Affinity

Do schools matter?

- subscales in the science capital survey showed significant differences amongst school

Science capital score



Science teachers and lessons*



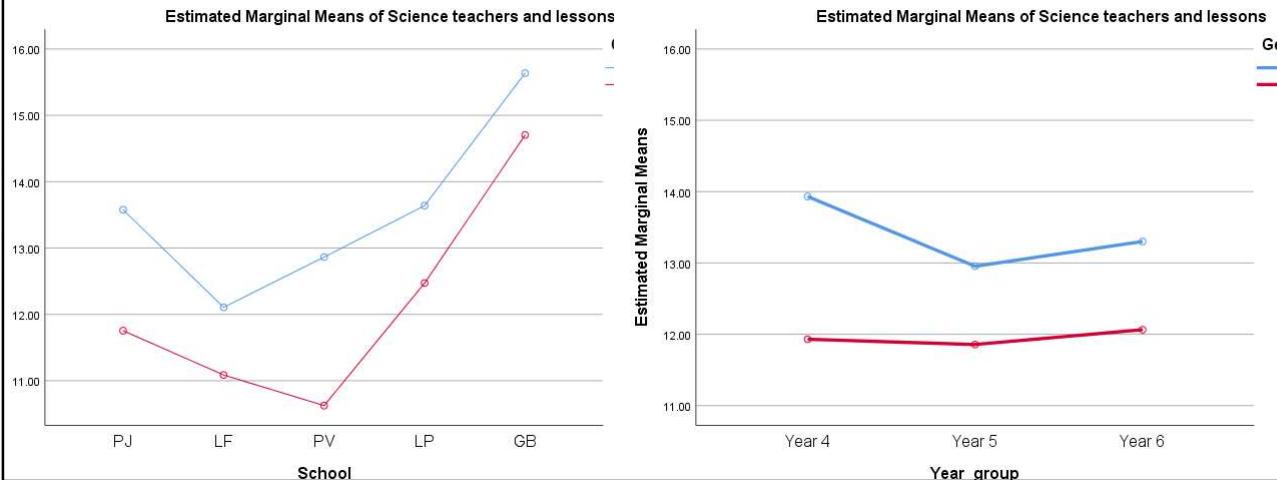
Self-efficacy in science



Valuing science and scientists**

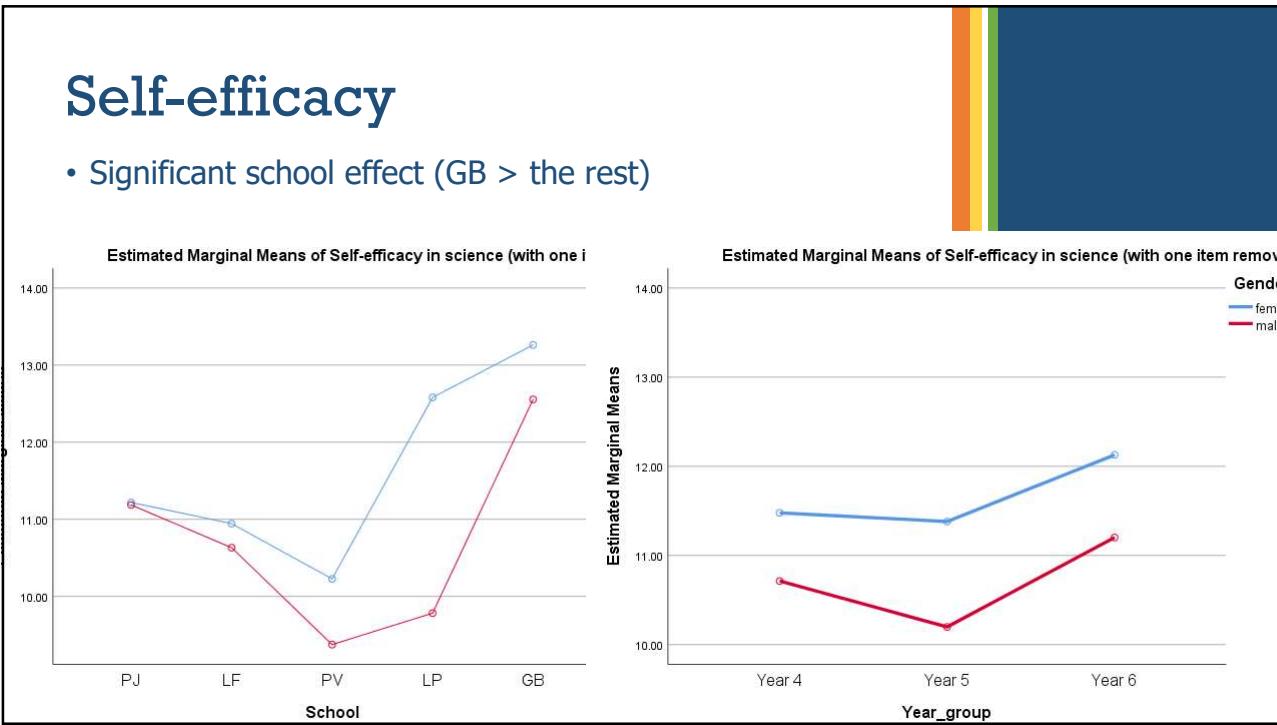
Science teachers and lessons

- Highly significant school effect (GB > the rest) and significant gender effect (female > male)



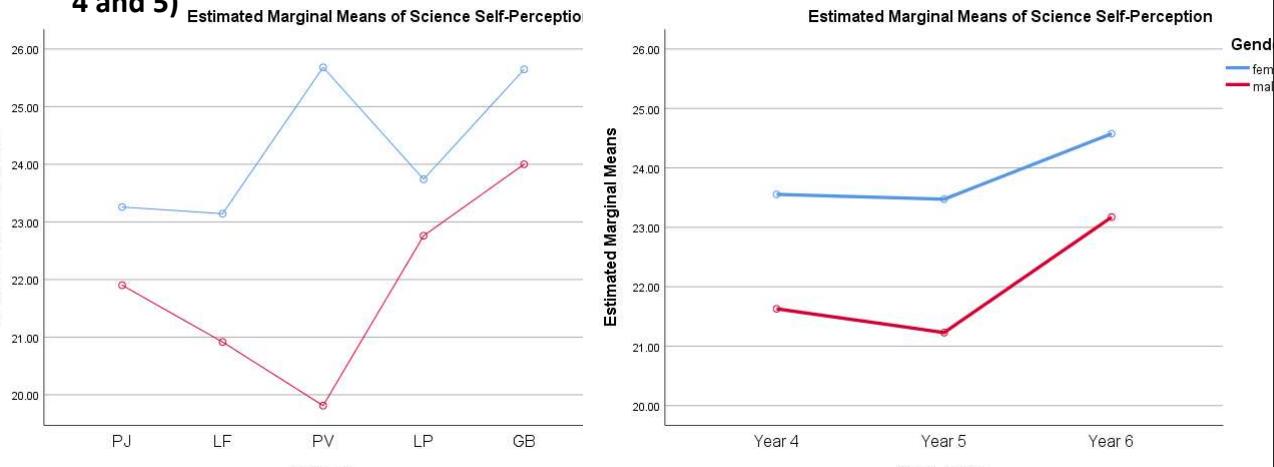
Self-efficacy

- Significant school effect (GB > the rest)



Self-perception

Highly significant gender effect (Female > male, especially at PV) and significant age effect (year 6 > Years 4 and 5)



In a nutshell

- The school effect
 - Direction of school effect on varies (PV vs. GB) in terms of future science affinity, science capital vs. school lessons and efficacy
 - Rating of school teachers and lessons had the highest alpha and significant across schools
 - Given the low science capital in the sample, school plays an important role in fostering children's interest in science
- The age effect is not consistent
- Interesting gender differences at this age range, especially the science self perception
 - How does this early advance in girls lead to the eventual gender gaps in adults before specialism teaching starts in secondary schools?
 - Are boys affected by the way science is taught in primary schools more? Esp there was little difference in terms of their science capital

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

Reasons why they do (53.74%)

External incentives
(29.03%)

Intrinsic motivations
(13.59%)

Job security and own reasons
(11.12%)

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

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%)


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Children's view of science

- 3 factors identified (48.82% of the variance explained, N=479)

Conventional (27.83%)



utilitarian and future oriented (9.21%)

What is science



Inventions and discoveries (9.77%)



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

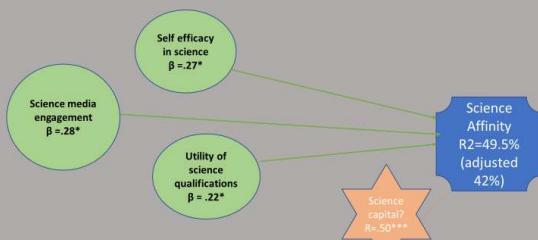
Representation of science still biased towards male for boys while girls showing more balanced representation in recent years

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

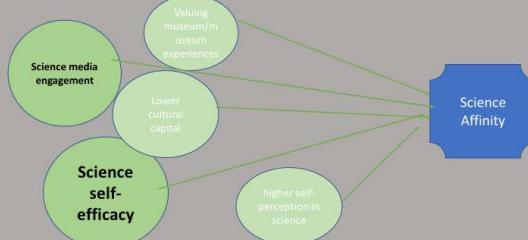
Different predicting factors for children from lower vs. higher SES

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)



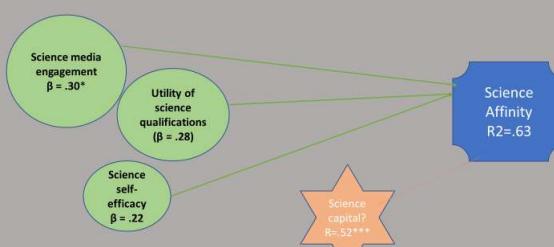
What predicted children's future science affinity? (higher SES)



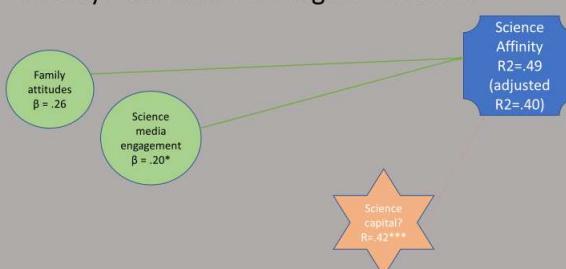
Different predicting factors for children with positive vs. negative outlook

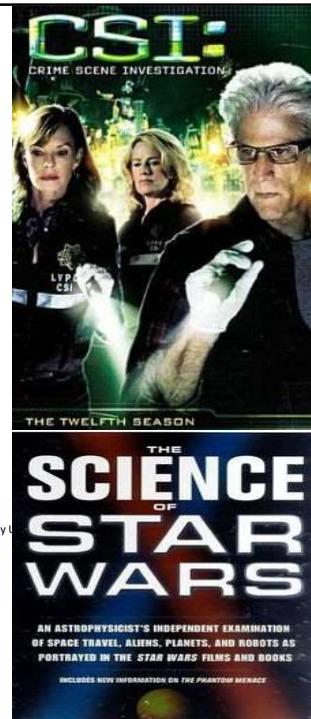
- Science media engagement important to future science affinity.
Different pictures for children with positive vs. negative outlook

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



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

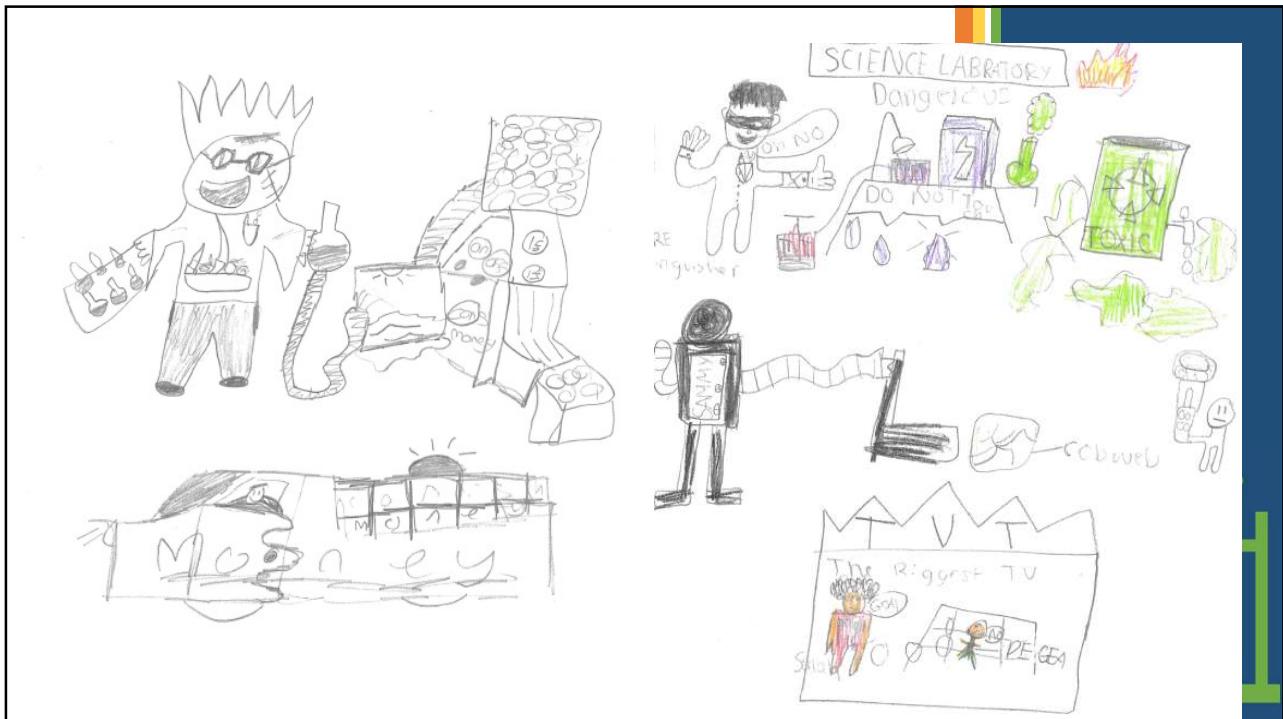




In a nutshell

- Different components of science capital seem to influence children's future science affinity in different ways, depending on a cluster of interacting factors (Archer & DeWitt, 2016)
- 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



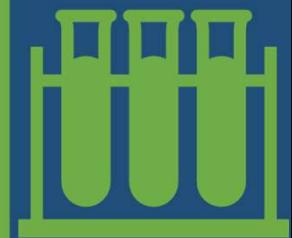


Are we going about it the wrong way?



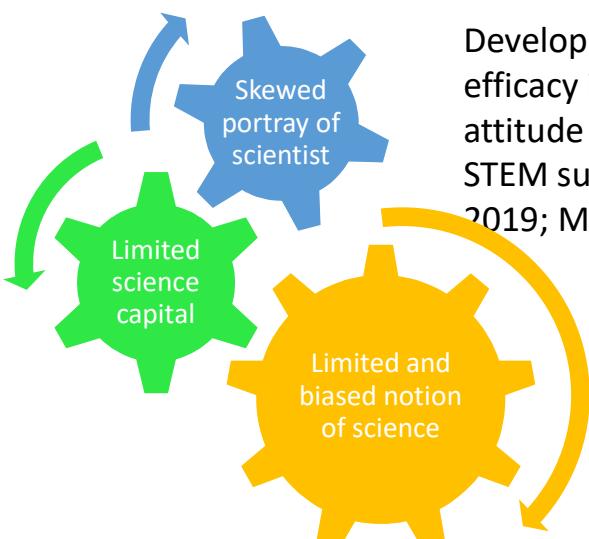
To children, there is a difference between being a scientist and 'doing science'
(Lei et al., 2019)

Consider the reasons given about not wanting to carry on with science, what led to the negative views?





Children are getting mixed messages when developing their science perception and efficacy



Developing identity and efficacy impact on their attitude towards learning STEM subjects (Lei et al., 2019; Muenks et al., 2018)





Let's repackage the message for our children

Science is about asking questions and finding answers to them

Science is everywhere

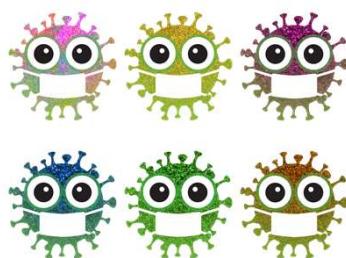
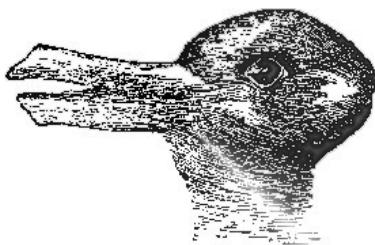
There are lots cool sciency things you can do

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

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



The double edged sword of COVID



Sarah Gilbert Effect



Influencer/Role model



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

"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."

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

A new study is on its way

What is the current level of science affinity and how the children's experiences during the pandemic may shape their science affinity

Help us find out!!

WATCH THIS SPACE

@DrJoUK1 #STEM4Me

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Be a part of the children's Science Capital
#STEM4Me

