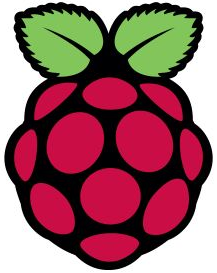

RPF seminar series

Diversity and Inclusion

Why the ‘digital divide’ does not stop at access: understanding the complex interactions between socioeconomic disadvantage and computing education

Hayley Leonard

Thom Kunkeler

Outline

- The ‘digital divide’
- Effects of SES on engagement with computing
- The ‘Learn at Home’ campaign
- Discussion

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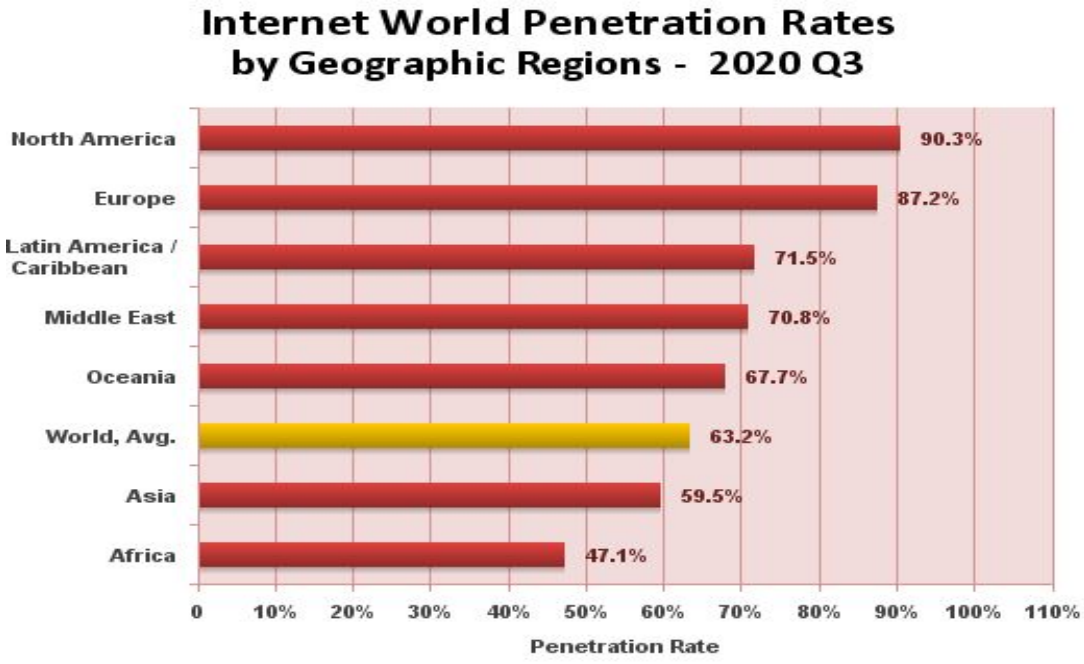
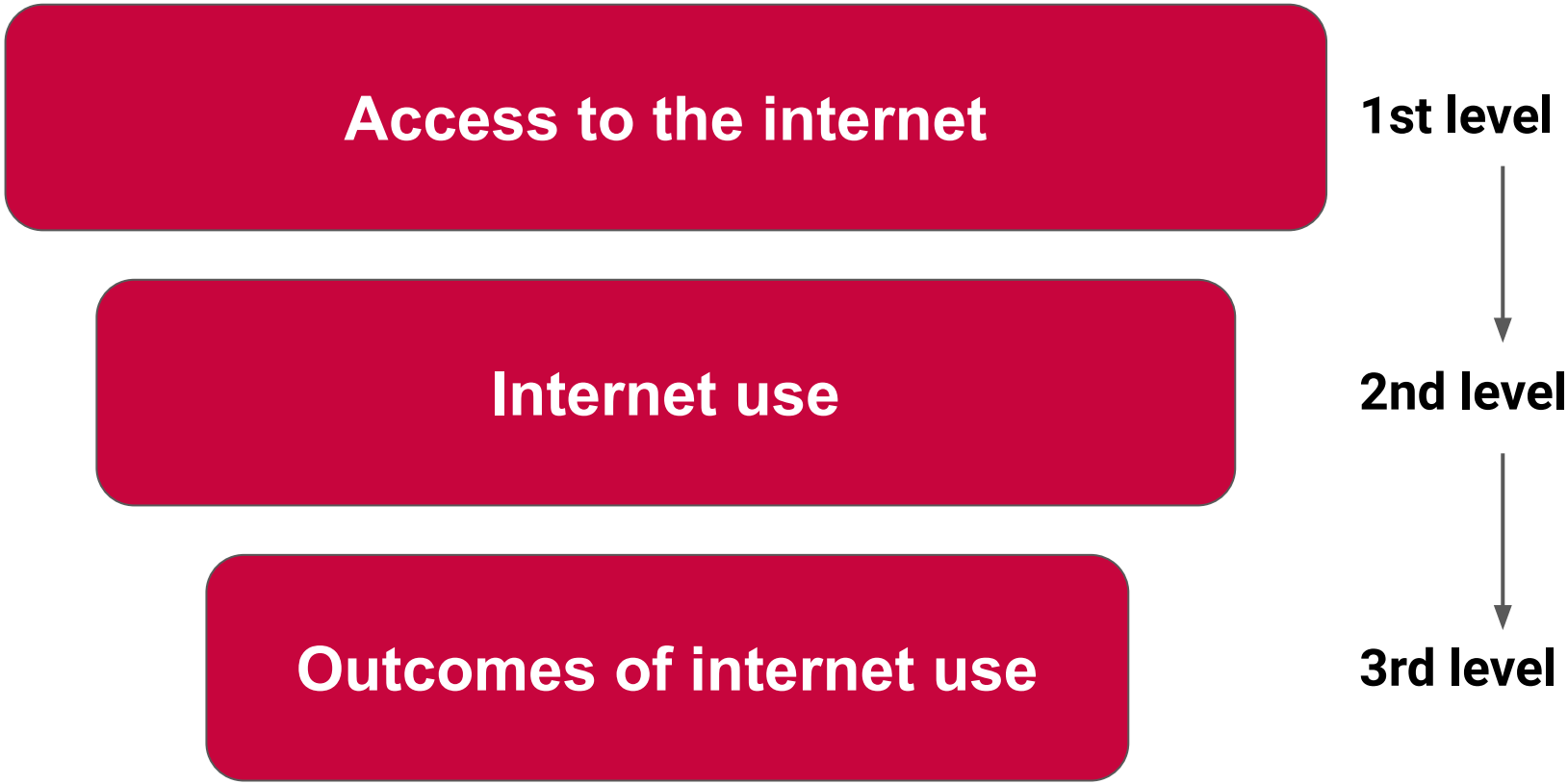
The ‘digital divide’



Source: Internet World Stats - www.internetworldstats.com/stats.htm
Penetration Rates are based on a world population of 7,796,615,710 and 4,929,926,187 estimated Internet users in October 27, 2020.

The ‘digital divide’



Ragnedda & Ruiu (2017). *Social capital and the three levels of digital divide.*

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Effects of SES on engagement with computing

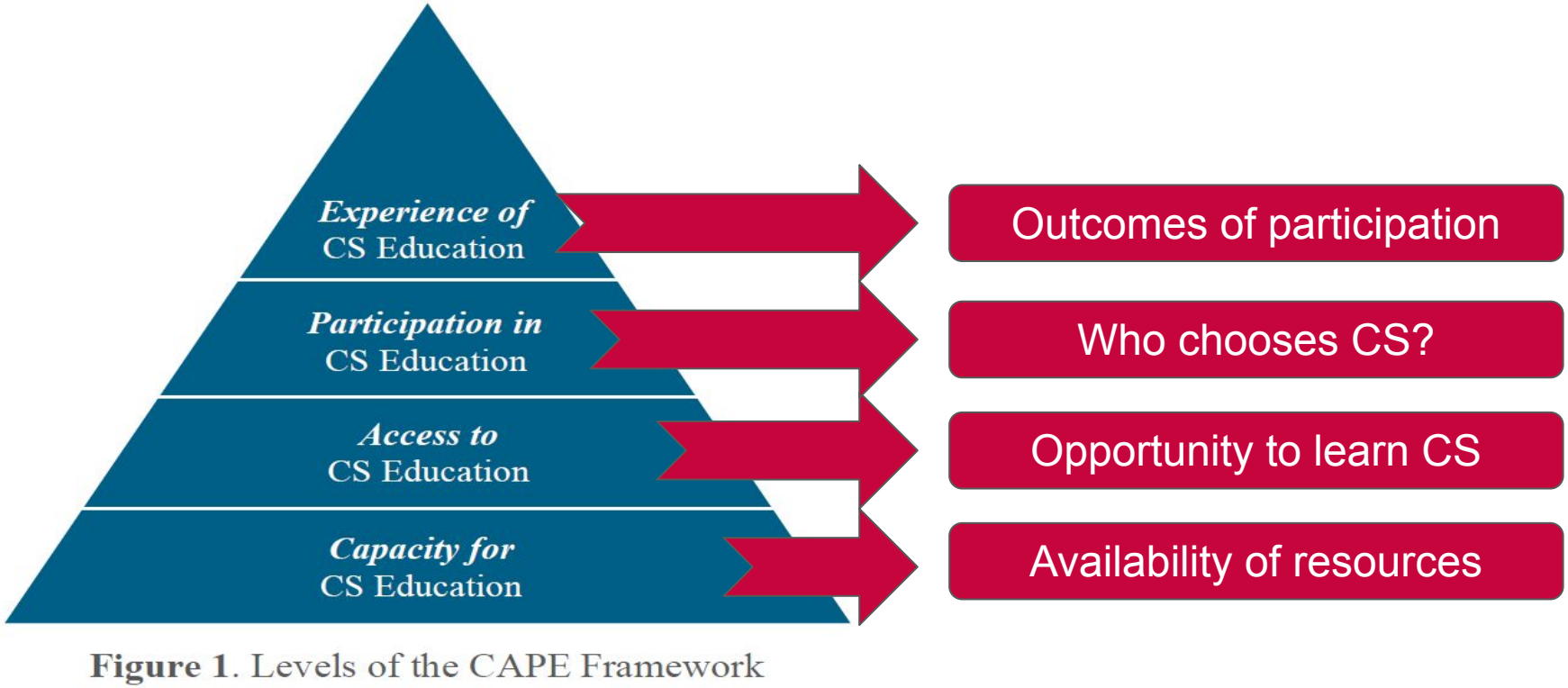


Figure 1. Levels of the CAPE Framework

Source: Fletcher & Warner (2020). Summary of the CAPE framework for assessing equity in Computer Science Education. https://www.tacc.utexas.edu/epic/research

Effects of SES on engagement with computing: England

Teach Computing

National Centre for Computing Education

- Courses and training for primary and secondary teachers, including bursaries
- Free resources including the full Teach Computing Curriculum
- Community support, including local Computing Hubs

Effects of SES on engagement with computing: England

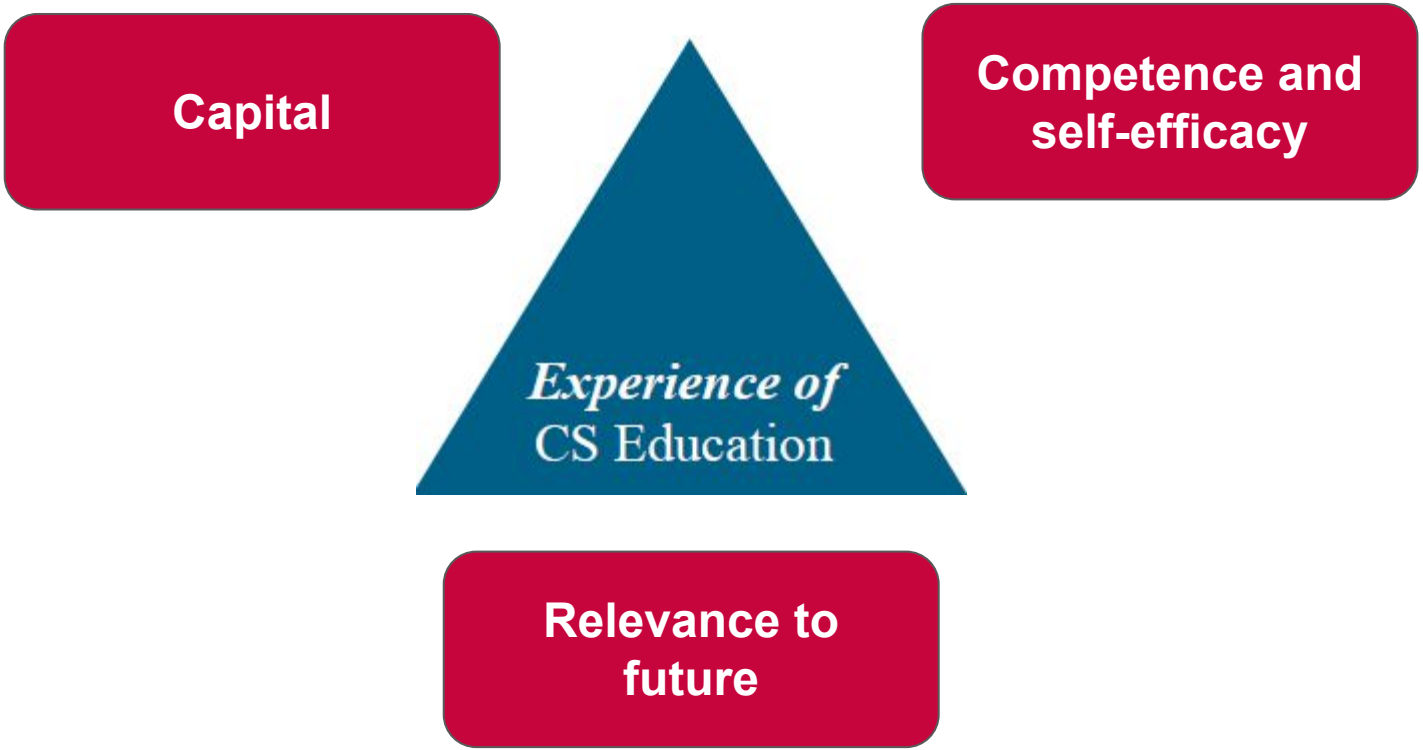
- Access to curriculum
  - Disrupted by COVID-19
  - Highlighted existing problem

Effects of SES on engagement with computing: England

- Underrepresentation of females, some ethnic groups, and those from low-income communities (Kemp et al., 2018)

- Greater complexity when an intersectional approach is taken (Kemp et al., 2020)
  - Low-income < Higher-income: males
  - Low-income > Higher-income White females (not Black/Asian females)

Effects of SES on engagement with computing: England



Effects of SES on engagement with computing: England

Technological capital

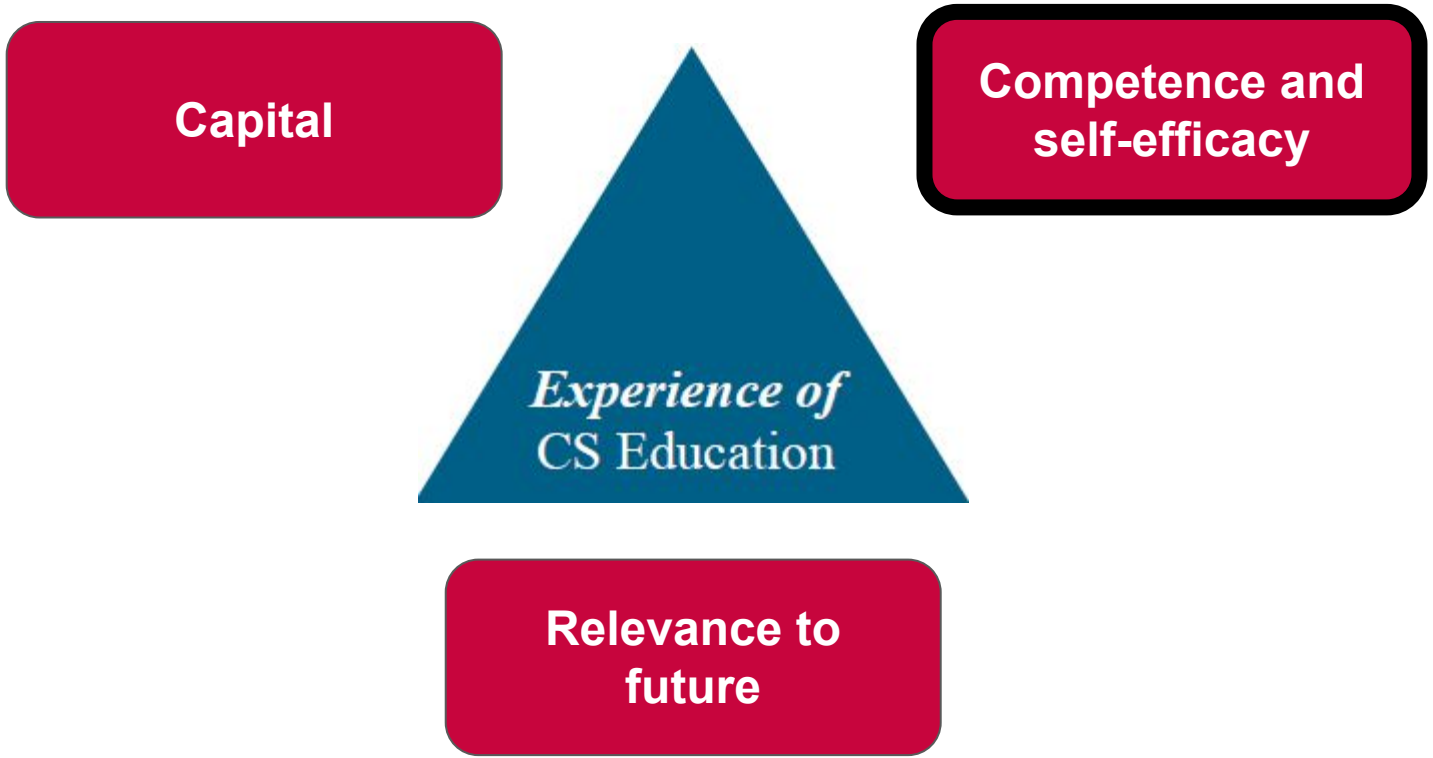
Economic capital - economic capacity to purchase ICT hardware and software

Cultural capital - participation in ICT education and training, both formal and informal, engagement with techno-culture

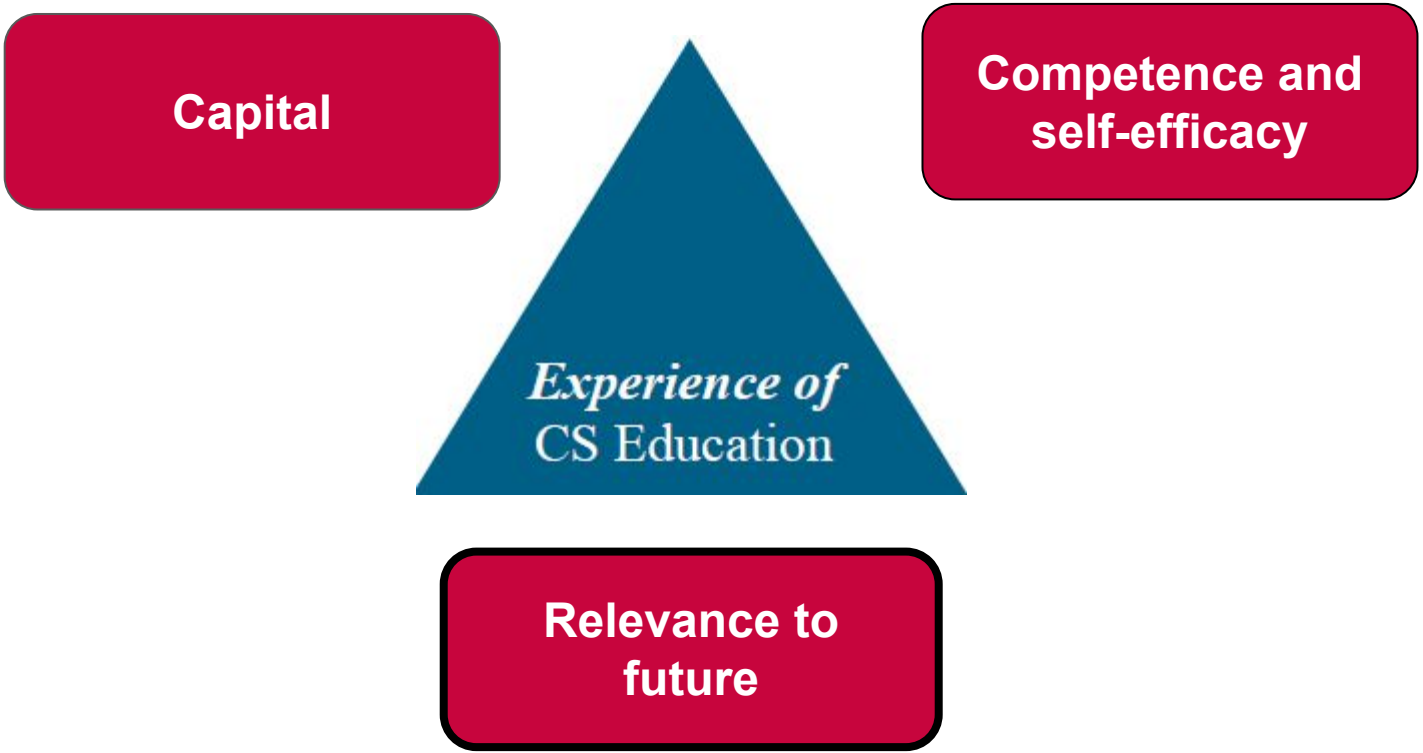
Social capital - networks of technological contacts and support, memberships, social groups, etc.

Adapted from Selwyn (2004)

Effects of SES on engagement with computing: England



Effects of SES on engagement with computing: England



Effects of SES on engagement with computing: England

"Our survey data revealed clear and persistent patterns in terms of who aspires to a career in science. These **patterns were evident from the end of primary school and not only persisted, but became more pronounced through secondary school**. In short, students who were significantly more likely than others to aspire to a career in science were the most socially advantaged students, but particularly boys and those from middle-class families, and especially those with a family member who has a science qualification and/or science-related job. **The largest gap in science aspirations was found at age 17/18, when the most socio-economically advantaged students were over two and half times more likely to aspire to be a scientist compared to their less advantaged peers.**"

Archer et al. (2020). ASPIRES 2: Young people's science and career aspirations, age 10-19.

Effects of SES on engagement with computing: England

CASE STUDY (Science aspirations):
Charlie is a working-class, White British, young girl who lives with her mother. Over the years, Charlie has had a range of ideas about what she would like to do in the future, although she has never aspired to a science or STEM Career. At age 18/19 she was studying beauty at college. Although Charlie enjoyed participating in science experiments at school, she found science lessons in general 'boring'. **In Year 8, she described feeling very different to the "proper clever people" in her science class…**

In Year 11 she chose not to take Triple Science at GCSE, saying that she "could not" study science for that many hours a week, and in Year 13 she said that she no longer participated in any science activities outside of school because "**it's got nothing to do with what I want to be, then there's no point in… it doesn't relate"**...

Archer et al. (2020). ASPIRES 2: Young people's science and career aspirations, age 10-19.

Outline

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The ‘Learn at Home’ campaign: Background

- Raspberry Pi Foundation initiative to deliver computers to disadvantaged young people
- Over **5100 Raspberry Pi computers** delivered to young people by May.
- Partnered with **80 youth and community organisations.**
- Recipients are 6-18, in full-time education, no resources to purchase a computer and do not qualify for DfE laptop initiative

The ‘Learn at Home’ campaign: Impact

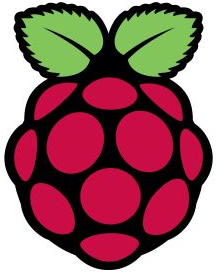
Ease of completing homework

Connecting with others

Having their own device

New opportunities for learning

Improved understanding of school work



Pilot study

Computing skills, beliefs and identities in young people from underserved communities

May 23-27, 2021

RESPECT CONFERENCE

The ‘Learn at Home campaign’ pilot study: Background

- Mandatory computing in England, but underrepresentation in optional CS qualifications
- “Fallacious archetype” (Pournaghshband & Medel, 2020, p.220)
- “Geek culture” may deter young people from studying computer science (Varma, 2007)

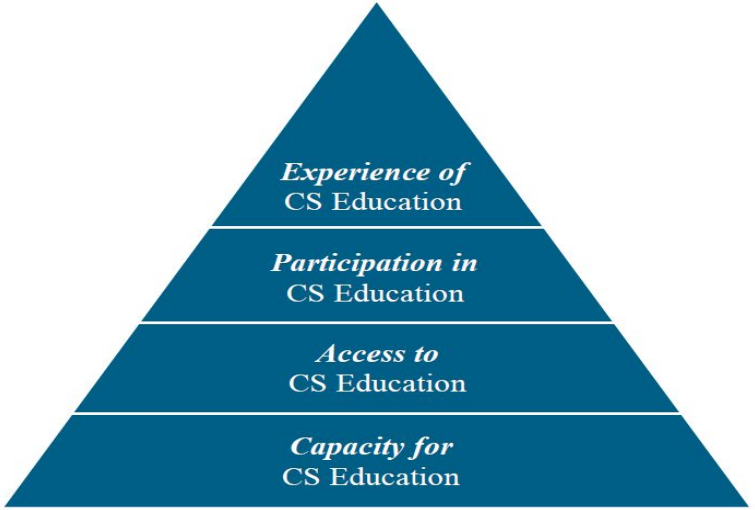


Figure 1. Levels of the CAPE Framework

Research question:

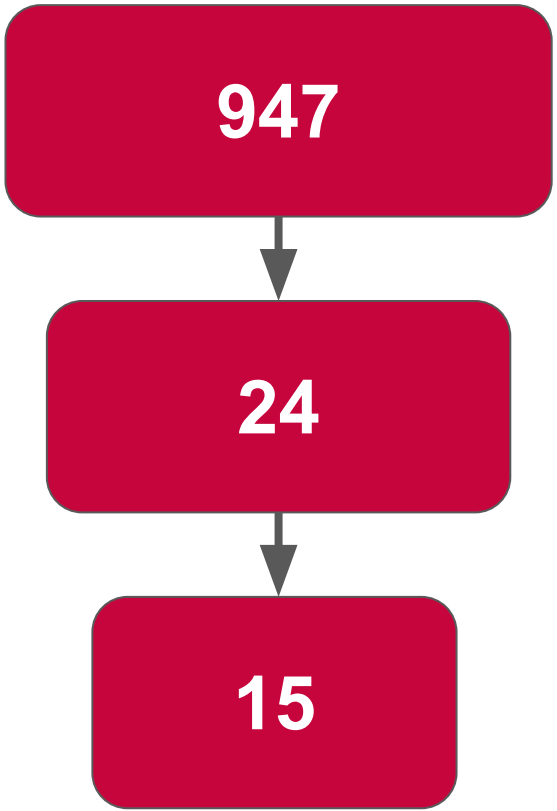
How do young people from underserved communities feel about computing and their own digital skills?

The ‘Learn at Home’ campaign: Research Interviews

Received computers in first wave

Shortlisted

Interviewed



Sample

	Boys	Girls	**Total**
White	4	2	**6**
Black/African/Carribean	2	1	**3**
Asian	0	2	**2**
Mixed race	1	1	**2**
Total	**7**	**6**	*13*

Age	**Count**	**Education level**
9-11	2	Primary
12-18	9	Secondary
19-22	2	Further

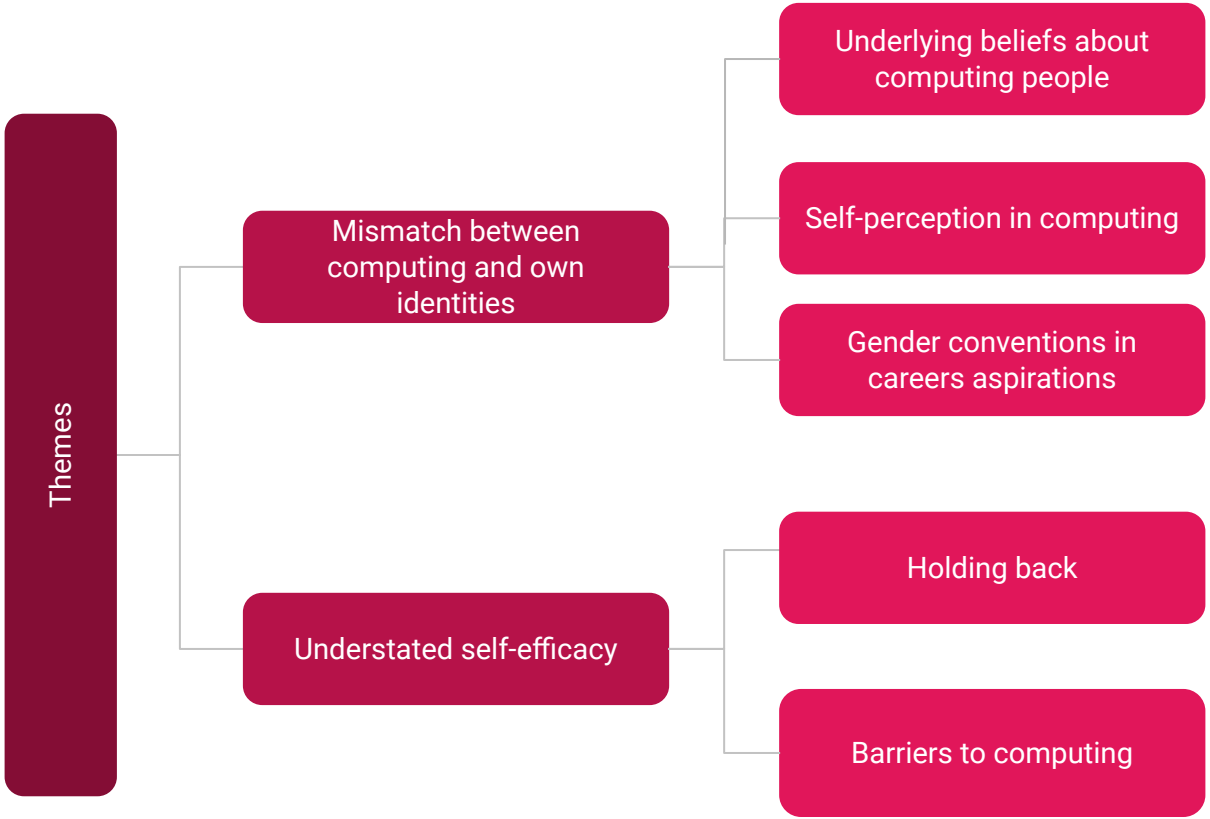
Methods

- Ethics

- Interviews
  - Feelings about computing
    - Becoming a computer person
    - Self-efficacy
  - Stereotypes
  - Future studies and careers

- Thematic analysis (Kuckartz, 2004)

Findings


Themes
Mismatch between computing and own identities
Underlying beliefs about computing people
Self-perception in computing
Gender conventions in careers aspirations
Understated self-efficacy
Holding back
Barriers to computing

Underlying beliefs about computing people

Characteristics computer person	Count
Smart	6
Clever	3
Intelligent	3
Nerdy/geeky	2
Problem-solving ability	2

“A bit smart. Very, very logical, because computers are very logical. Things like smart, clever, intelligent, because computers are quite hard. Really skilled, maybe” - 13, F, White British

Looks computer person	Count
Could be anyone	5
Don’t know	1
No answer	7

“I don’t think it’s like a person with glasses and all that. I think I know loads of different people. I use computers now” (16, M, White British).

Gender computer person	Count
Could be anyone	5
Boy	4
No answer	4

“Oh, they’re a boy, and they have loads of technology stuff in their house” (11, F, Asian)

Self-perception in computing

Yes/probably	8
Maybe/don't know	3
No	2

"I do use the computer, but I'm not an expert at it. And I feel like, with the computer, it relates to loads of online games. I don't normally play those kind of stuff… Maybe, I don't know. I think I could change my opinion of computering [sic] a bit, but I don't think I would be a computer person, I guess" (11, F, Asian)

Gender conventions in career aspirations

Boys

Careers	Count
Computing	2
Engineer	2
Other (plumber, paramedic, sports)	3

Girls

Careers	Count
Healthcare (doctor, nurse, & midwife)	3
Architect	2
No answer	1

Holding back

Good at using computers	Count
Yes	8
Average	5

- Making games, 3D modelling, programming in HTML, making music, etc.
- Both boys and girls reported similar self-efficacy in computing

Holding back II

- High self-efficacy but not a ‘computing person’

Case: young person who wanted to study computer science and become a game developer, had access to digital technologies, and knew relatives working in the field.

“I would say I already am to some extent [a computer person], but I could definitely be more” (13, M, White British)

- “Having to put their mind to it” or “could be one eventually”

Barriers to computing

- **Lower self-efficacy** → more barriers to computing reported
  - E.g. Improving maths, putting mind to it, working hard, or not having same “style”
- Even for those who were digitally skilled, barriers were still reported

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Interpretation findings & discussion

- Young people have narrow **stereotypes** of a computer person
- Belief that high level of **intelligence** is needed for CS → low levels of **belonging** and **enthusiasm** for studying CS
- Computer person construed as **“not like us”** (Wong, 2017, p.306)
- There is a difference between **“doing computing”** and **“being a computer person”** (Wong, 2017, p.299)

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Conclusion

- Aims current study
- Core findings
- Further research needed
- Implications further research
- Lesson Learned

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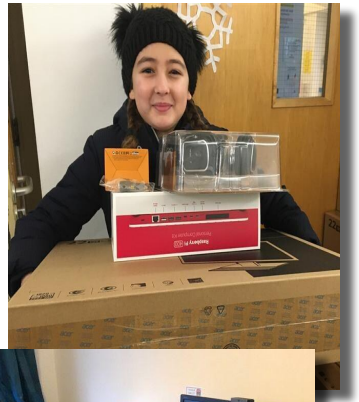
Key Takeaways

- The ‘digital divide’ does not stop at access to the internet, or to technology
  - Need to consider the impact of access on a range of educational, social and cultural outcomes

- Young people with less experience and engagement with computing outside of school may feel less competent than their peers, and may hold unrealistic perceptions of computer scientists

- Young people from low-income backgrounds have a range of other demographic characteristics that can influence participation and experience in CS



Links and resources

- Learn at Home Campaign
  - Webpage
  - Impact report

- CAPE framework summary

- ASPIRES-2 report on science capital

- Centre for Education and Youth / Microsoft: Closing the Achievement Gap in the Digital Classroom
  - Summary
  - Report

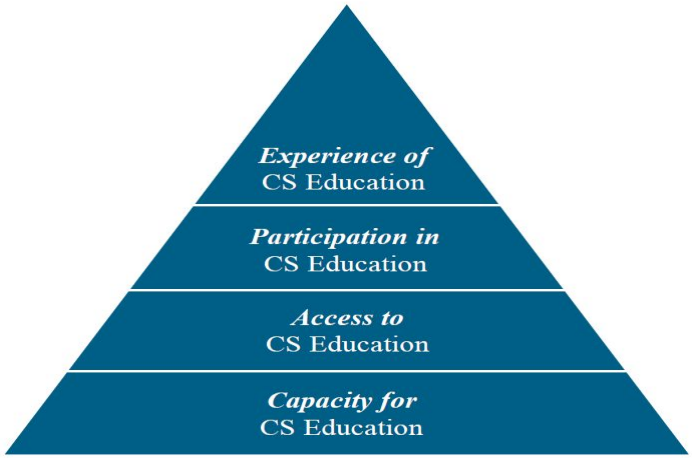
- Sutton Trust - measures to assess socioeconomic disadvantage

Discussion points

1. Based on your experiences, are there differences in how young people from low-income families participate in formal and non-formal computing activities compared to more affluent peers?

2. What have been your experiences of the impact of COVID on teaching and learning computing (formal and non-formal) and the ‘digital divide’?

3. What do you think the CAPE framework looks like in your context?
   - Which part of the pyramid requires more focus?
   - Does a section need to be broken into subsections?



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