Gender Balance in Computing: what the research says

katharine@raspberrypi.org
@IAmKatharineC
#rpfseminars

Katharine Childs
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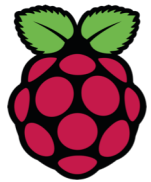
Overview

- Context
- Metaphors
- Key themes from the literature
- Deep dive into some of the themes
- Where next?



Context: English education system

Primary phase

R	1	2		3	4	5	6
4-5	5-6	6-7		7-8	8-9	9-10	10-11

End of Key Stage SATs

Secondary phase

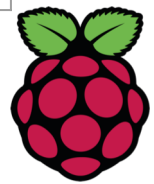
7	8	9	10	11
11-12	12-13	13-14	14-15	15-16

Subject choices

Formal qualifications

Post 16

16 - 18	Education, employment or training
18+	University, employment or training



Context: English education system

Primary phase

R	1	2		3	4	5	6
4-5	5-6	6-7		7-8	8-9	9-10	10-11

Computing

Computer Science
Digital Literacy
Information Technology

Secondary phase

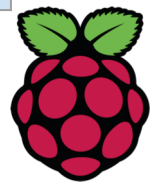
7	8	9	10	11
11-12	12-13	13-14	14-15	15-16

Subject choices

Post 16

16 - 18	Education, employment or training
18+	University, employment or training

Computer Science GCSE. A level. degrees
Vocational certificates, diplomas and degrees

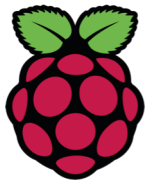


Context: Gender imbalance

Computer Science	2018	2019
GCSE	20.2%	21.4%
A level	11.8%	13.2%

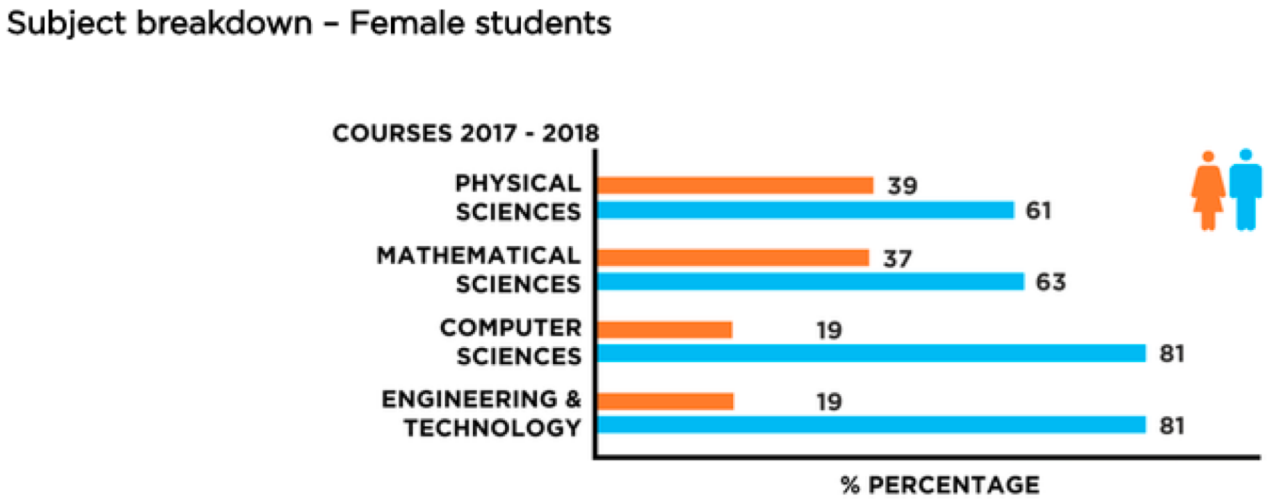
Source: jcq.org.uk

Girls are not currently well represented in computing at GCSE and A-level in England



Context: Gender imbalance

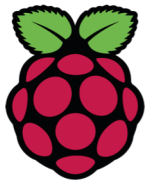
Girls are not currently well represented in computing in undergraduate degrees in the UK



Source: Stemwomen.org.uk

Metaphors in the literature

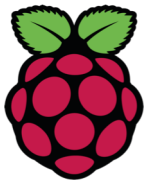
- The ‘incredible shrinking pipeline’ (Camp, 2002)
- Unlocking the clubhouse (Margolis and Fisher, 2002)
- The social turn (Kafai and Burke, 2013)



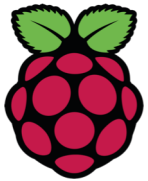
Key questions

1. What are the barriers which prevent girls' participation in computing?

2. Which interventions can support girls to choose computing qualifications and careers?



Why should schools teach computing?



Attainment in computing

A high-quality computing education equips pupils to use computational thinking and creativity to understand and change the world. (DfE, 2013)

- GCSE Computer Science – strong attainment but underperformance compared to boys (Kemp, Wong and Berry, 2019)

Source: Pixabay

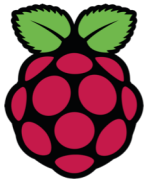
The social turn in programming

Writing code		Creating applications
Individual tools		Facilitating collaborative communities
Composing from scratch		Remixing the work of others

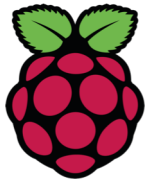
Kafai and Burke, 2013

Collaborative teaching approaches in STEM subjects have been shown to improve self-efficacy and achievement in girls

(Werner and Denning, 2009; Lorenzo et al 2006)



Where is computing relevant in society?

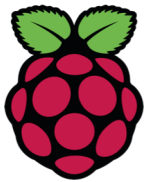


Real-world contexts

- Computing can seem like a very theoretical subject

- Bubble sort algorithm
  - theory - mechanics and efficiency of how the sort works
  - application - the usefulness of the data it is sorting

- Example data sets
  - Playing card values, ages, size of sports balls, heights
  - Number of fish eaten by dolphins in an aquarium



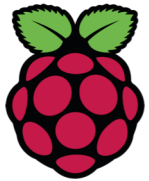
Real-world contexts

- Context is often very important for female students (Margolis and Fisher, 2002, Lyons 2006)
  - Realistic data sets
  - Choice of contexts
  - Agency to make own choice

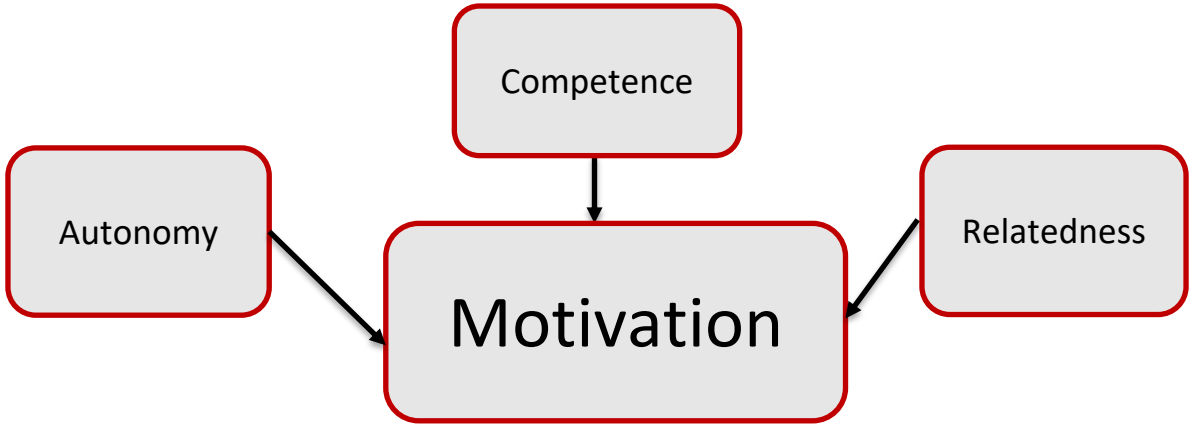
Source: Pixabay

- Female students had more positive attitudes towards a subject they can link to real world problems (Guzdial and Elliot, 2006)

Who is computing for?



Self-determination theory



- Relatedness is the most important of these three conditions for girls' motivation to study computing.
- A sense of belonging is a significant predictor of girls' motivation (Mishkin, 2019)

Representation & role models

- Two interpretations of ‘role models’

    1. Behaviours, attitudes and emotional reactions
    2. Aspirations and achievements

- Links to self-esteem (Wohlford, Lokman and Barry, 2004)

Source: Pixabay

Parental support

- Denner (2011)
  - emotional support
  - more support = higher perceived relevance

- Parental understanding and support affects attitudes toward a subject

Source: Pixabay

Non-formal learning

- Coding clubs have better representation of girls
  - 33% of attendees at CoderDojos (2017)
  - 40% of children at Code Clubs (2018)

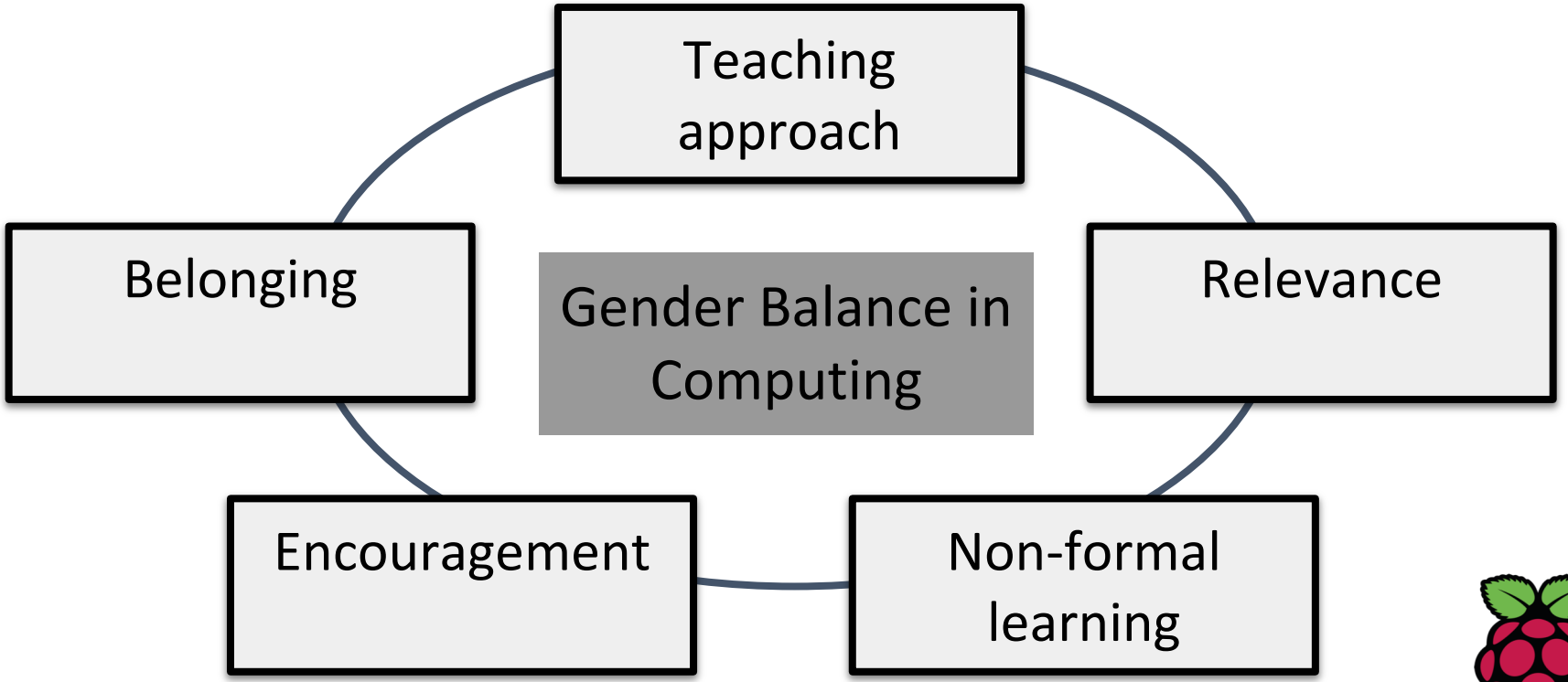
- There is potential to connect non-formal learning experiences to formal learning choices by showing girls how their experiences can contribute towards their goals

Source: Pixabay

Barriers and interventions

	Barrier	**Intervention**
Teaching approach	Only individual learning	Collaborative learning
Relevance	Focus on writing code and theory	Focus on solving real-world problems
Belonging	Lack of female representation in computing	Use role models to show representation
Encouragement	Unconscious bias in parent and teacher advice	Support to encourage girls into computing
Non-formal learning	No clear link to formal learning	Make links to formal learning explicit

Themed interventions



Spread the word

Information for schools:
https://teachcomputing.org/gender-balance

Newsletter sign-up:
ncce.io/gbicgenreg

Source: clipartmax.com

Emerging themes

- Inclusivity
  - Non-binary lens for gender approaches to explore statistically significantly differences
    (Pournaghshband and Medel, 2020)

- Intersectionality
  - Race, socioeconomic status, ability
    (Kemp, Wong and Berry, 2019, British Science Association, 2020)

Thank you

With grateful acknowledgement for work and support from colleagues across our partner organisations

Raspberry Pi

THE BEHAVIOURAL INSIGHTS TEAM

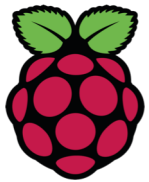
Apps for Good

WISE

National Centre for Computing Education

Discussion ideas

- Teaching approaches
- Role models
- Real-world computing
- Something else?



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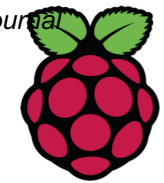

Differences between studies

	Black et al (2011)	**Townsend (1996)**	**Lang et al (2010)**
Context	Secondary schools, UK, booklet telling stories of women in tech (n=?)	Middle school girls, US, video taped college students (n=24)	Digital Divas program. secondary schools, Australia (n=24)
Modelling	Achievement	Behaviours, attitudes, achievements	Behaviour, attitudes
Proximity	In a printed booklet	On videotape	In the classroom as additional facilitators
Plurality	Individuals	Individuals	Individuals
Outcomes	Measured by distribution figures and qualitative teacher feedback	Attitude surveys (treatment vs control) immediately and after four months	Qualitative feedback from the students, teacher and university students