Inspiring more girls into computer science.

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“Computer science is not just about learning how to use the computer, or even just programming. Computer science is really about deeper learning — computational thinking, problem solving, design, algorithmic thinking, and creativity that goes into technological innovation. It crosses a broad range of career opportunities and it is important to expose kids to possibilities that they may not even know exist.” (Flapan. 2018)

http://newsroom.ucla.edu/stories/educating-for-equity-and-access-in-computer-science
The 21st Century Computer Science industry today.

• Economic growth.
• Global communication.
• Innovating sectors / communities world wide.
Only 1 in 4 CS jobs occupied by females.

(AAUW. 2018)
Potential impact...

Emerging technologies with limited-perspective(s).

Females lacking the digital skills to compete / function on an equal footing with their male peers.
Evidence for action...

**RECOMMENDATION 3** Research projects on pedagogy and curriculum development in computing should also investigate how to improve female participation.

**RECOMMENDATION 4** Government and industry-funded interventions must prioritise and evaluate their impact on improving the gender balance of computing.

*At GCSE, there is only 20% uptake from girls.*

(The Royal Society. 2017)
Improving equal opportunities for girls in CS.

- Removing Barriers,
  - gender stereotypes.
  - Accessibility.
  - un-inspiring content.

My research question – What are the drivers that would inspire girls to take up GCSE-CS?
Digital Divas Club programme.

AIMS;
• To change girls’ perceptions of IT careers.
• Educationally sound materials that tapped into their interests.
• Delivered in all-girl classes within the school curriculum, was a great success.

OUTCOMES;
• Indisputably led to an increased self-sufficiency with IT amongst girls.
• Challenged stereotyped understandings of IT as a male activity.
• Increased the pursuit of IT careers by young women.

“The girls who participated in the program reported increased confidence in using IT and our materials excited their interest and engaged them”.

(Fisher. 2015).
Research methodology & methods.

• Two 6 weeks action research studies of girls in Years 3 & 6 CS lessons using physical computing supported STE(A)M / Maker-space approach.
  • Observations, informal interviews and voluntary electronic questionnaires learning experience and what would inspire them to take up GCSE-CS / become a computer scientist.
  • Voluntary electronic surveys of Year 9 girls option choice for GCSE-CS and their viewpoints on CS and becoming a computer scientist.

• Voluntary anonymous participation electronic Survey of Parents, Educators, Researchers and as to importance of CS in/outside school.

• Voluntary anonymous participation electronic Survey of Women working in CS of what internal shifts to attract more females to the industry.
Innovative Pedagogy.

**Equity & Access – Inspiring girls to learn more about CS.**

Framework;
- TPACK – Methodology.
- 21CLD – Rubric for assessment.

Approach;
- Maker-space / STE(A)M = Active learning to nurture Computational thinking & 21st century Soft skills = Students feel empowered.

Tangible & accessible Resources;
- Physical Computing & Craft materials.
Data & Findings.

• Two data sets emerged – Beneficiaries & Enablers.
Themes & Drivers.

- **Equity & Access** – Inspiring girls to learn more about CS.

- **Creating** – With a purpose & reason = Relevance & Confidence.

- **Physical Computing** – What, why, how of CS = Accessibility, Awareness, Confidence and interest.

- **Collaborating** – Self-regulation = Fun & Interesting.
Interventions based on ‘OPP’.

**Overhauling.**
- GCSE-CS – Stripped back, less CS industry of old, more relevant for today’s teachers & learners.
- Integrating CS into other STE(A)M GCSE syllabi. – Putting the C into STEM (Wing. 2013).
- Fundamental changes to the industry to attract and retain more women in CS.

**Provision.**
- More accessibility to achievable CS in the community (Clubs / Media /CS Industry).
- CPD / Pedagogy.
- Resources & Support.

**Promoting.**
- Role models / Advocates Edu & Industry linking up – Awareness of career pathways for women.
- CS in the community.

Equity & Access – Inspiring girls to learn more about CS.
• “When I started my apprenticeship, I had only basic ICT skills. But I have learned so much in a short space of time and can now be set a task and be confident in the software I am producing”.

Lauren – having to make up for a lack of computing in school

Lauren is currently doing a one-year, level 3 software development apprenticeship at Viridian Housing Association in South-West London. Lauren left school at 16 with eight good GCSEs, despite protests from her teachers, who saw her future underpinned by A levels and a university degree. “My main goal was to go to work”, she says. “I was, and still am, driven by my passion for working”.

Lauren’s skills training is done in 1 – 2 week blocks in between work experience. “By the time I apply for my next job I will not only have a useful qualification but I will have gained real know-how in my chosen career”, she enthuses.

Lauren has learned a range of programming languages and operating systems. As part of the course, she must also do three in-depth projects, which require some research and independent learning. She has just completed her first one, which involved designing a survey to assess the company’s

References.


Appendices.

Overview of Feedback from my Research studies.
Data & Findings.

Beneficiaries – Year 3 Female Students.

- Lesson observations.

Resources. 2 x Micro:bits and Makecode.com to plan, design and programme a birdbox counter.

- Demonstrated computational thinking skills & approaches.
- Girls asked more questions.
- Worked in small groups with their female peers.
- Activity sought praise and encouragement from me.
- Were carefully and considerate in their approach.
- Showed more commitment to the project after the lessons.

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Data & Findings.

Beneficiaries – Year 6 Female Students.

• Lesson observations.

Resources. 2 x Micro:bits and Makecode.com to plan, design and programme a doorbell for the deaf.

• Demonstrated computational thinking skills & approaches.
• 70% girls worked in teams with their female peers.
• Girls initially demonstrated reluctance in confidence.
• In planning out their design, Girls demonstrated a greater empathy for the needs of a deaf person.
• Girls demonstrated more creativity in their design.
• Girls demonstrated more perseverance when hitting technical difficulties.

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Data & Findings.

Beneficiaries – Year 6 Female Students.

• Informal interviews.

Based on their recent CS lessons – doorbell project.

• Enjoyed the freedom, who to work with, planning out and choice of materials.
• Felt the were able to understand the problem their were solving and this helped them to engage and persevere through the project.
• Although initially feeling a lack of ability, they felt the microbit and Makecode website was a good resource which helped them understand how and why the device was programmed.
• Most were able to identified the computational thinking skills & approaches they used.
• All would definitely like to take GCSE-CS if they were able to create solutions to real world problems with computers in this way (STE(A)M / Makerspace).
Data & Findings.

Beneficiaries – Years 3, 6 & 9 Female Students.

• Voluntary Electronic Questionnaires;
  • Year 3 & 6 (Key stage 2)
    • 100% Enjoyed their CS lessons.
  • + Year 9 (Key stage 3)
    • 90% Used keywords to accurately demonstrate what a computer scientist is.
    • 93% Would consider a career in CS.
      • 59% Reflecting a desire to create & innovate by creating new software/hardware applications.
      • 20% Reflected a desire to solve problems i.e Cyber-security, Sustainability.
      • 14% Inspired by potential earnings.
Data & Findings.

Enablers – Parents (working professionals).

• Voluntary electronic surveys
  • Year 3, 6 & 9 (Key stage 2 & 3).

• Quantitative;
  • 25% Felt their daughter had access to CS activities in the community.
  • 90% Felt digital skills were either very important/essential for 21st century life.

• Qualitative;
  • Feeling that school was too prescriptive with regards to taking GCSE-CS.
  • Not enough career pathway guidance.
Data & Findings.

Enablers – Educators Researchers & female CS Industry experts.
  • Voluntary electronic surveys.

Qualitative;
When asked to consider what drivers are needed to attract more girls to GCSE-CS;

More initiatives in lower key stages that can feed into GCSE-CS (Digital leaders, Coding clubs)
Stripping back some of the technical content which is industry specific without practical exposure is too specialist for both teachers / students.
More links with other GCSE subjects.
As with other GCSEs Should reflect opportunity for practical self-directed creativity & collaborative project type working.
Syllabus to focus on relevance of CS in today's society solving real world problems / helping to improve quality of life appealing to the female empathic nature.
Family support.
Female role-models / advocates.
STEM/Maker-space approach.
Data & Findings.

• Enablers – Female CS Industry experts.
  • Voluntary electronic surveys.

Qualitative;
When asked to consider what drivers are needed to attract more women into CS industry;

• Hiring practices to remove potential of bias.
• Establishing a ‘tech- partnership. – Businesses / Education / Community.
• Raising awareness of CS careers jobs – not just for men.
• Equal pay / opportunities for women / flexible working environment.
• Family support. Maternity leave.
• Promoting female role- models as advocates for the industry.
  • Solving problems / helping to change the world for the better.