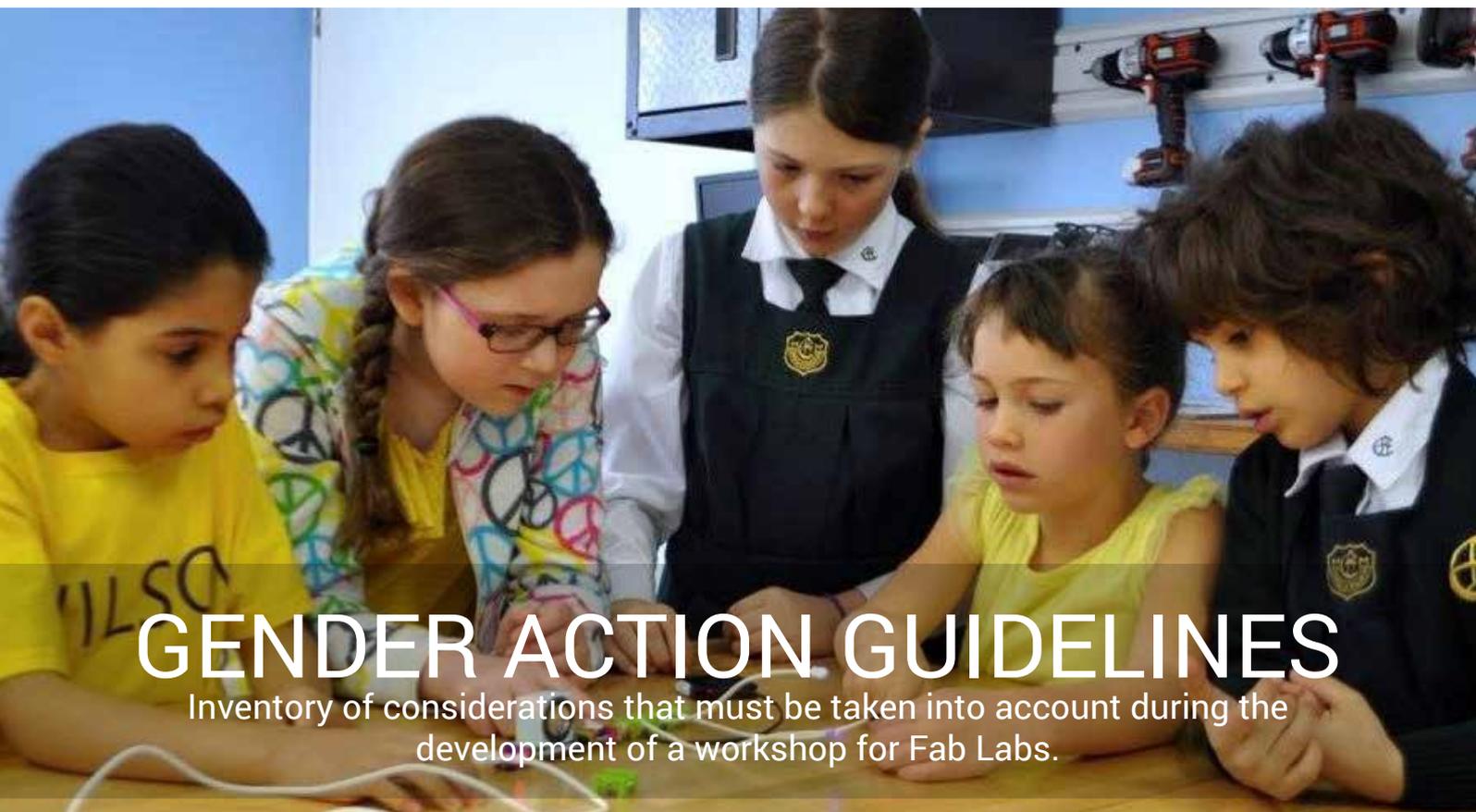


The logo for PHABLABS 4.0 features a stylized blue globe with three human figures inside, surrounded by orange radiating lines.

PHABLABS 4.0



GENDER ACTION GUIDELINES

Inventory of considerations that must be taken into account during the development of a workshop for Fab Labs.



PHOTONICS PUBLIC PRIVATE PARTNERSHIP

PHABLABS 4.0 is a European project where two major trends are combined into one powerful and ambitious innovation pathway for digitization of European industry: On the one hand the growing awareness of photonics as an important innovation driver and a key enabling technology towards a better society, and on the other hand the exploding network of vibrant Fab Labs where next-generation practical skills-based learning using KETs is core but where photonics is currently lacking.

Special attention will be given to create gender-sensitive material for the “Photonics Workshops” and “Photonics Challenger Projects” that can grab the interest of girls and have a lasting impact on their personal relation to science, technology and Fab Labs.

In this document you can read an inventory of considerations that must be taken into account during the development of a Workshop for Fab Labs.

This document was set up by Prof. Averil Macdonald from WISE. This is a Community Interest Company which promotes opportunities for women in science, technology, engineering and related fields in the UK. (www.wisecampaign.org.uk)



1. Introduction

- Aim** – to increase the number of females who consider studying Physics/Photonics
- Philosophy** – we must start from where the girls are (their self-identity). We must NOT expect them to change or to act like/become proto males.
- Motto** – equality of experience is not the same as equality of opportunity.

2. Background

Girls (around and after puberty) typically respond differently from boys to the incentives offered in life. This is a learned response (nurture not nature) resulting from a whole lifetime of different ‘nudges’ received or perceived from family, friends and society. We can’t change this. We can work WITH it so that girls receive the same opportunities as boys.

Caveat 1: For a minority of girls (e.g. the ~6000 of 375000 per year group in the UK who actively choose physics post 16) this does not apply – they like to be ‘different’ or don’t see that they are being different from the majority of girls. They are often termed ‘tom boys’ or attend a single sex school.

Caveat 2: there is a complete spectrum of feminine <–> masculine behaviours and responses. Some males are nearer the feminine end and some females are near the masculine end of behaviours. In all cases the term ‘female’ used here will refer to the typically feminine end of the spectrum but may include some males, and vice versa.

Note to females: many females in physics will recognise themselves as not exhibiting extreme feminine responses as described here.

Note to everyone: In developing activities and materials for PHABLABS 4.0 please don’t use your personal response (or that of physicists you know) as indicative of what is interesting/ exciting/ fascinating etc. to the majority of the population.

3. Remember Females and Males (typically) respond differently

- Excitement/inspiration/fun/fascination are good BUT are not enough to persuade most females to pursue STEM studies or careers
- **Males are interested in ‘what’ – females want to know the ‘so what’**
 - Males like to know the facts – what things do and why – **the CONTENT**
 - Female also like to know the significance – why it’s useful – **the CONTEXT**
- Females are interested in the **‘long game’** – e.g. they ask what this can lead to. Males live more in the here and now – e.g. it’s enough that it’s fun/exciting/fascinating.

N.B. Males continue to pursue activities of their childhood long into adulthood (e.g. the same games/sports/hobbies continue). Males see no problem with ‘self-gratification’ and life continuing to be ‘fun’. Females typically change their activities/hobbies/interests as they move into adulthood – and the focus of the new activity tends to be self-improvement/supporting other people/helping their children rather than self-gratification. Therefore, to engage young females we need to invoke the potential for the activity they are doing to work in the adult world. To engage young males the fact that the activity is ‘fun’ when they are young implies it will be ‘fun’ as they get older and they see no conflict there.

- Females need to feel they will ‘fit in’ (belong) in an environment/organisation/club before they will join (this is true into old age). Males tend to assume they will fit in anywhere.

4. To engage more of the females we need to:

- Explain the **'so what' of photonics** and not just show the 'exciting' things it can do. (this means emphasise the value of photonics to society – answer the question 'What's the point of photonics?')
- Show **the large range of opportunities in the adult world** that photonics offers them
- Allow the females to feel good about themselves in the photonics world (not just have fun)
- Describe the **personal attributes/aptitudes** that make good scientists and engineers
- Emphasise the wide range of people who work in STEM careers so that females will see they will fit in or 'belong' and can be happy and successful
- Include Mum in the conversation
- Let females see that STEM is for 'people like me'

5. What activities don't work?

- **Competitions** – males thrive on competition – it's often the best way to incentivise them (they like to show off that they are 'the best'). Females do not need competition to incentivise them. The outcome of a competition is that most participants are judged 'losers' so won't feel good about themselves. This is very off-putting for females. Males rarely care.
- **Hands-on activities** – most participants are already converted to STEM. If schools only bring those who are 'good at science' (those who will probably do science anyway) then we are wasting our time! Schools should be asked to bring those who are 'floating voters' (able but not yet convinced). Only then can we make an impact on numbers. Insist on the 50:50 rule – mized schools to bring groups that are 50% female.
- **Masterclasses** – are elitist indicating only 'the best' should study science. This is a peculiarly UK problem. Schools emphasise that only grade A students (potential Nobel Prize winners) should study science. This eliminates huge numbers of people who would make a very valuable contribution to STEM business. We should be as inclusive as, for example, history (everyone gets to visit the historical site) or Literature (everyone can watch the play)
- **After-school STEM clubs** – most females have other hobbies. The implication that science requires 'extra hours' puts off a lot of people. Shouldn't we be encouraging our potential scientists to have as broad a set of interests as possible?
- **Role Models** – are often so brilliant that they are seen as 'daunting' or as trying to change the females to 'be like them'. This is very off-putting.
- **Activities that don't involve Mum** – Mums are the biggest barrier to girls pursuing STEM careers. Not all Mums! But most mums have a stereotypical view of a STEM career as not being one where their daughter will be happy. Mums want daughters to be happy!

6. What activities can work for females?

- **Activities that are collaborative** – females thrive on team working and on projects that have a positive outcome for all involved.

FEMALES	MALES
Design a house to keep people as safe as possible in an earthquake	Build a house to test to destruction on an earthquake table. The group with the house that falls down last wins
Design a 'seatbelt' to stop an egg on a trolley being smashed when the trolley hits the wall.	Build a trolley to go as fast as possible down a ramp to hit the wall hardest. The most spectacular crash wins.
Add coloured lights to a soft toy that slowly go dim so that a child who is afraid of the dark can go to sleep happily.	Add coloured lights to a toy to make it brighter – the groups with the brightest toy wins.
Add lights/music to a soft toy so that an elderly person with dementia is helped to remember their childhood	Ditto
Design a marble-run to link to all the other marble runs to see how far the marble will go before it falls off	Design a marble run – the marble that gets to the end fastest wins

- **Activities that bring on a feeling of success.** Females are motivated by success – any activity MUST ensure that girls come out feeling that they have been a success/done a good job.
- **Activities that are not 'elitist'** – there should be no implication that only 'brilliant people' do photonics
- **Role models that are 'normal'** especially if they have personal stories where they failed but still carried on
- **Activities that include Mum** – either on the day or via a flyer to take home to show Mum

7. The importance of careers information

If we want to persuade females that photonics is worth pursuing we have to talk about the 'long game' – the wider range of possible careers available (beyond academic research).

- Females are more pragmatic than boys and will start to consider the consequences of their choices at an earlier age.
- Females are keen to ensure they keep options open (they don't want to paint themselves into a corner).

8. The importance of language:

A big barrier to females choosing STEM studies/careers is the perceived conflict between their emerging self-identity and the stereotype 'STEM' identity:

- We all start to create our self-identity (how we describe/think about ourselves) around puberty
- Females mostly describe themselves using **adjectives** – science uses verbs.
- Females (and their Mums) perceive a conflict between their emerging self-identity and their view of the STEM identity and perceive that they will not 'fit in'.
- **Females need to sense that they will 'fit in'** (sense of belonging) in order to choose a career/job

FEMININE LANGUAGE	MASCULINE LANGUAGE
Cheerful Committed Communal Connected Conscientious Considerate Cooperative De- pendable Empathic Friendly Helpful Honest Interdependent Interpersonal Intuitive Kind Loyal Modest Nurturing People-focused Pleas- ant Polite Quiet Reliable Responsible Sen- sitive Supporting Sympathetic Trustworthy Understanding Warm	Active Adventurous Ambitious Analytical Assertive Connected Autonomous Challeng- ing Competent Competitive Confident Coura- geous Decisive Determined Dominant Forceful Impulsive Independent Individual Intellectual Leader Logical Merit Objective Opinionated Outspoken Persistent Principled Superi- or Self-confident Self-sufficient Self-reliant Strong-willed

- Masculine wording does not affect females' confidence in their ability to do a job.
- Even when females are confident they can do the job, masculine wording leads females to identify:
 - lower sense of 'belongingness' in those careers
 - jobs are less appealing
 - less interest in applying for the job.
- **Gendered vocabulary had largest effect on females.**
- Males were only slightly more likely to find the masculine-worded jobs more appealing than feminine-worded jobs.
- There was no effect of gendered wording on males' feelings of belongingness within the occupation.
- Regardless of the type of job, females, ranked careers most highly in terms of interest when they included words that matched their gender.
- This effect persisted regardless of the nature of the role e.g. gender neutral roles such as estate agent, health management.
- Using gendered wording when talking about STEM
 - perpetuates gender inequality in male-dominated fields
 - risks females deciding not to apply
- Masculine vocabulary leads females to sense a low diversity/unwelcoming environment
- Masculine vocabulary leads females to anticipate they will not 'fit in'

9. What language doesn't work to attract females?

- "Engineers build bridges"
- "Scientists track satellites"
- "Engineers design new products"
- "Engineers make cars go faster"
- "Scientists do research" (the word 'to research' to UK teenagers means 'to google' – they are not

- inspired by a life googling to get info off the web)
- “Scientists solve problems” (problem is a very negative word – don’t we all avoid problems in normal life?)
- “Thinking like an engineer” (implies you have to behave like someone you’re not)

The problem:

- Science never talks about the sort of people that make good scientists (or engineers)
- THEREFORE most females can’t see themselves fitting into STEM scenarios

OUTCOME - females perceive that STEM is ‘not for people like me’.

10. What language does work?

FEMININ LANGUAGE	MASCULINE LANGUAGE
<ul style="list-style-type: none"> • We are a community of engineers who have effective relationships with many satisfied clients. • We are committed to understanding the engineering sector intimately. 	<ul style="list-style-type: none"> • We are a dominant engineering firm that boasts many leading clients. • We are determined to stand apart from the competition.
<ul style="list-style-type: none"> • Provide general support to project teams in a manner complimentary to the company. • Help clients with construction activities. 	<ul style="list-style-type: none"> • Direct project groups to manage project progress and ensure accurate task control. • Determine compliance with client’s objectives.
<ul style="list-style-type: none"> • Proficient oral and written communication skills. • Collaborates well, in a team environment. • Sensitive to clients’ needs, can develop warm client relationships. 	<ul style="list-style-type: none"> • Strong communication and influencing skills. • Ability to perform individually in a competitive environment. • Superior ability to satisfy customers and manage company’s association with them.
<ul style="list-style-type: none"> • Takes initiative and is able to work effectively in a team environment. 	<ul style="list-style-type: none"> • Self-starter with ability to perform individually in a competitive environment.

11. Advice

- Insist on the **50:50 rule** – mixed schools must bring 50% female to the event
- Insist on '**floating voters**' – ask schools to select students (male and female) who aren't convinced science is for them but have the ability. They should **not** bring those who have already made their minds up to study science.
- Ensure the title is evocative of the **value** of the activity (the 'so what') and not just a utilitarian title that says what is it – try to think why should a teenager bother to do this other than the act of doing.
- Create a **scenario** / story behind the activity to give it a context where the activity can be seen to have a positive impact on others in the real world
- Include group based projects – but **don't** set up mixed gender groups as males will dominate the apparatus and males will take notes
- Show females in all images – but **DON'T** show the males 'doing' and the females 'observing' or taking notes. All female groups are a positive image for females – look in any female magazine for evidence of how females like to see females portrayed.
- If supervising a school group, ensure you spend **as much time** talking to the females as talking to the males. Males often demand more of teacher's attention (often by doing silly things) while females get on with the task in hand. Females then perceive that they are of less value in STEM as teacher didn't talk to them very much or ask how they were getting on.
- Emphasise the **collaborative** aspect of the activity – explain why the ability to work with others is a real asset in photonics
- Bring in role models who have failed or have other **personal** stories to tell – and make sure they talk about their personal attributes (using adjectives) as well as what they do (using verbs). Female participants are interested in what types of people the role models are.
- Have a **Mums and Daughters** session - design a 'make and take' activity where mums and daughters work together – i.e. it requires 2 pairs of hands. But emphasise Mum is helping and not that she needs to be an expert herself otherwise she will shy away. Don't stop Dad helping but it's far better if it's mum
- Link the activity to potential **careers** in photonics
- Describe the **personal attributes** of people who are successful in photonics (use adjectives)
- Emphasise that people like them are **happy and successful** working in photonics
- Talk openly about the **starting salaries** of STEM careers compared with non-STEM – young people need to know the consequence of their decisions
- Create a **take-home flyer** to show Mum/Grandma/sister about what photonics does and what the daughter can do if she keeps studying physics
- Check that the **language** in any materials is sufficiently feminine (this doesn't disadvantage the males so there's no risk).