# Improving Gender Balance in Ireland

# Summary of Key Findings

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**Eilish McLoughlin, Deirdre O'Neill and Georgina Fagan**

***CASTeL, Dublin City University***

IMPROVING GENDER BALANCE IRELAND

@IGBIreland

www.igbireland.ie

info@igbireland.ie

# Programme Partners

The Centre for the Advancement of STEM Teaching & Learning (CASTeL), at Dublin City University (DCU) is multidisciplinary research team focussed on enhancing science and mathematics education at all educational levels, supported by evidence-based research and contributing to international good practice. CASTeL members, comprising of scientists, mathematicians, educationalists from across DCU's Faculties of Science and Health and Institute of Education, lead and participate in formal and informal STEM education projects, nationally and internationally.

Institute of Physics (IOP) in Ireland has a significant record in supporting the teaching and learning of physics through the provision of workshops, conferences and classroom resources. IOP has developed a number of programmes to address issues around the low uptake of physics in schools by girls. The Improving Gender Balance in Ireland programme is part of a wider IOP initiative across England and Scotland. IOP in Ireland works closely with CASTeL on a number of other educational and public engagement projects.

Science Foundation Ireland (SFI) invests in academic researchers and research teams who are most likely to generate new knowledge, leading edge technologies and competitive enterprises in the fields of science, technology, engineering and maths (STEM). The Foundation also promotes and supports the study of, education in, and engagement with STEM and promotes an awareness and understanding of the value of STEM to society and, in particular, to the growth of the economy.

# Programme Overview

Improving Gender Balance in Ireland aims to increase the engagement and understanding of students, particularly girls, studying physics at second level. This programme sought to take a holistic approach to changing students' experience with physics and works collaboratively with schools, teachers and students to change perceptions of who can study science and tackle the inequities that prevent students from engaging in physics and STEM careers. The specific objectives of this programme, as shown in Figure 1, were:

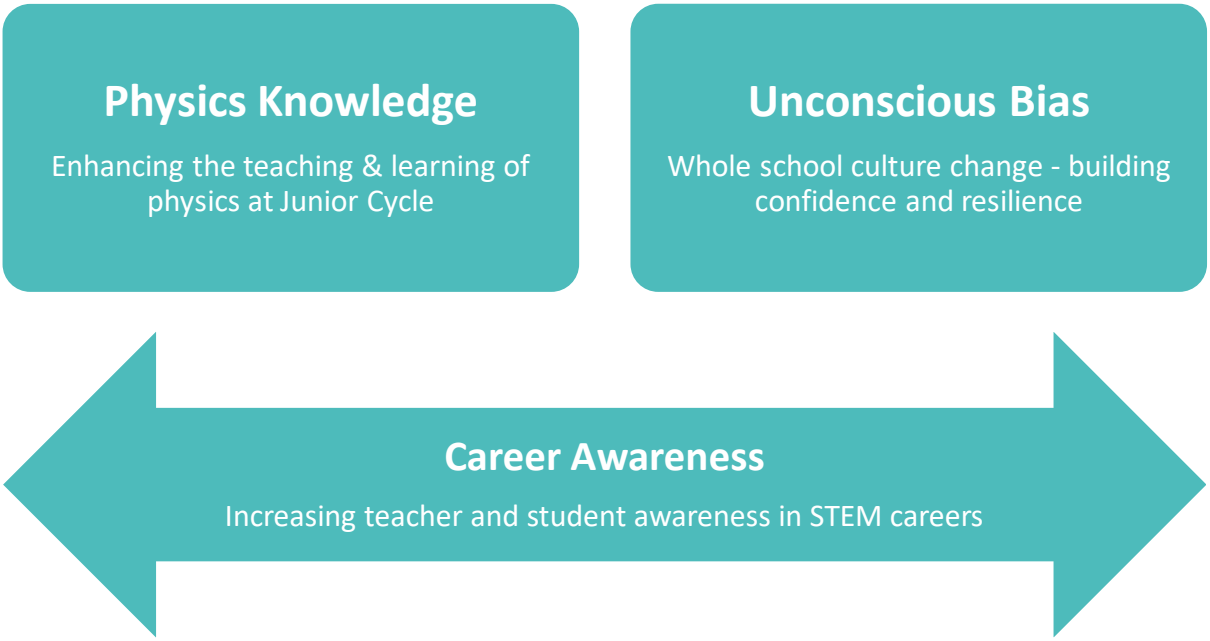



**Figure 1: Improving Gender Balance Ireland Programme Objectives**

A three-strand approach to address these objectives was implemented in Irish second level schools, over two phases during 2017-2019. In Phase I, seven second level schools were identified and recruited to partner in this programme for a two-year period. This included 2 all-girls, 5 coeducational and 2 designated-disadvantaged schools with a total of 405 teaching staff, of which 51 were science teachers. In Phase II an additional 21 second level schools: (13 coeducational, 5 all-girls and 3 all-boys) with a total of 1163 teaching staff were recruited from across eight counties. The impact of the programme was evaluated using qualitative and quantitative data collected and analysed by both internal and external evaluators.

# Workshop Design Principles

86 ninety-minute science workshops were facilitated in twelve locations over a two year period. Substantial efforts and resources were allocated to designing these workshops to address the three programme objectives, namely, deepening teacher's content knowledge for teaching physics, increasing awareness of unconscious bias and gender stereotyping, and increasing awareness of careers in STEM. The process adopted for designing each workshop involved three main aspects:

i. Design & Development: Two weeks preparation for every 90-minute workshops, including workshop design, sourcing resources, timetabling, co-designing and refining.
ii. Reflection & Evaluation: Facilitator reflection, teacher reflection and feedback, data analysis and evaluation.
iii. Implementation: Gathering resources, facilitation, travel time.

Each workshop considered the i) design and development, ii) reflection and evaluation and iii) implementation as the key aspects in finalizing a workshop structure, content, approach and execution. Each science workshop followed three design principles: content knowledge for teaching, career & societal awareness and unconscious bias, in an effort to address each of the three objectives of the programme, as illustrated in Figure 2.

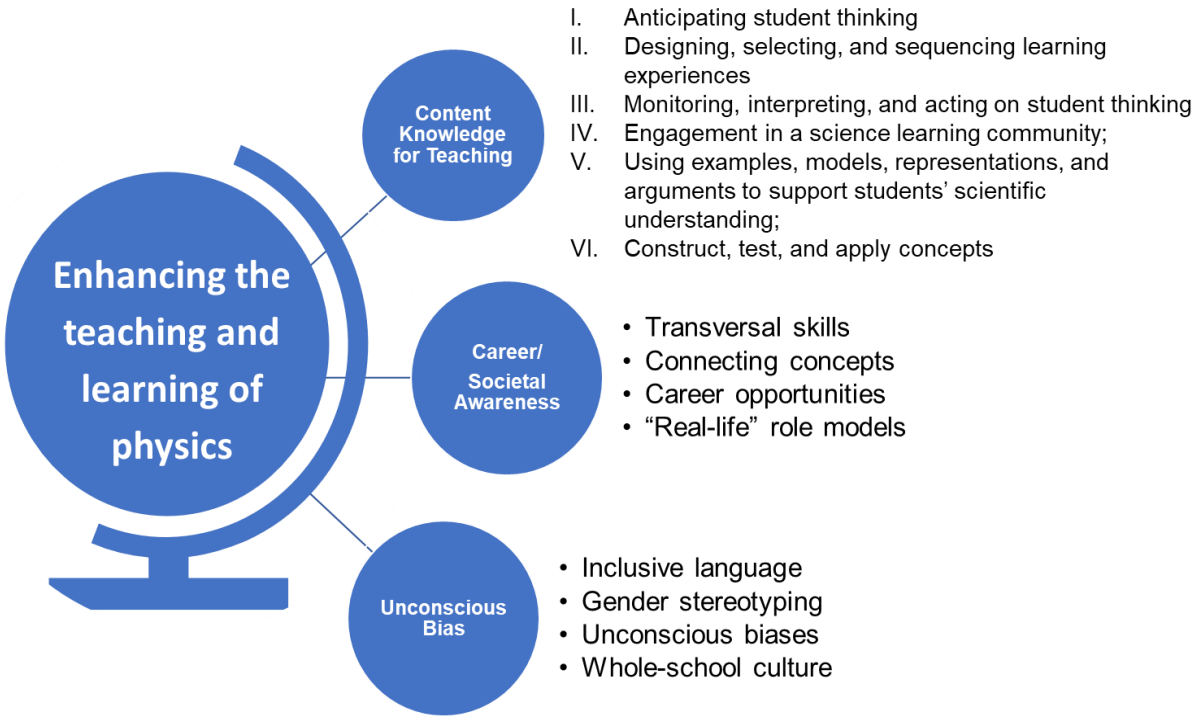



**Figure 2: Science Workshop Design Principles**

# Programme Impact

## 7 Second Level Schools

Participated in Phase I from August 2017-2019

## 21 Second Level Schools

Participated in Phase II from August 2019 - December 2019

## 132 Science Teachers

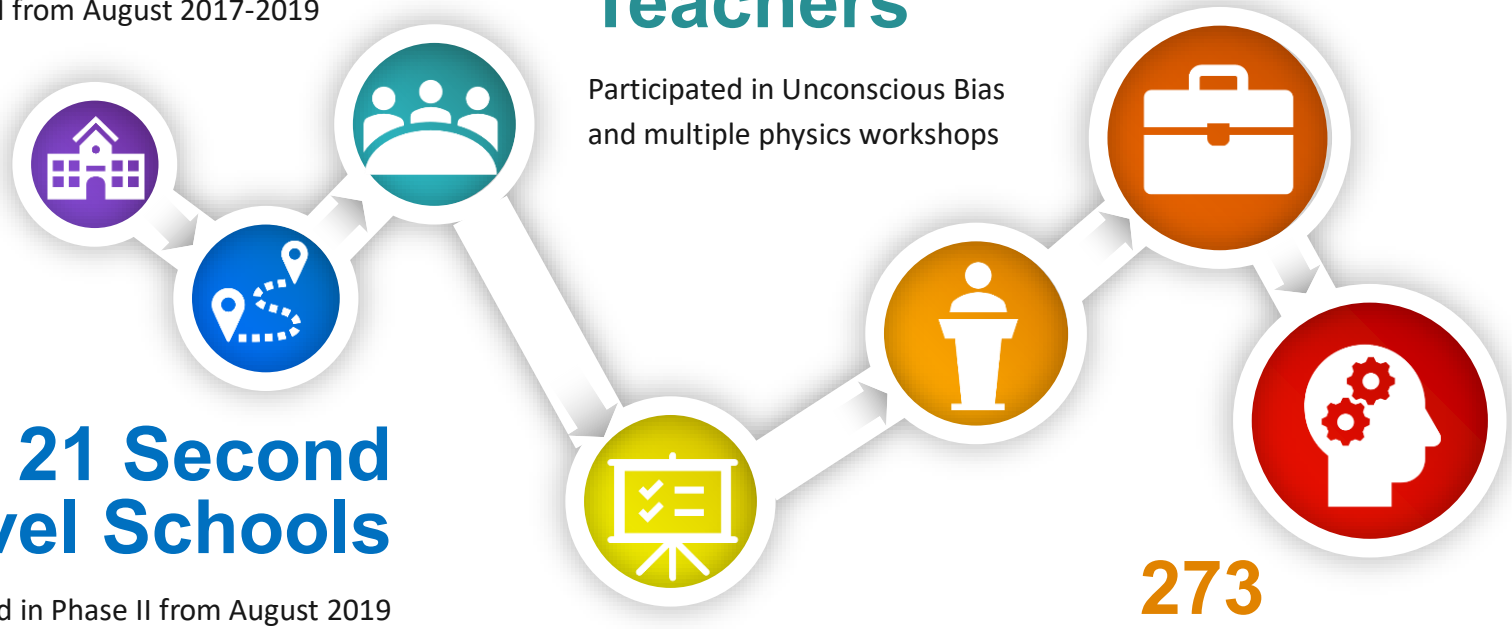
Participated in Unconscious Bias and multiple physics workshops

## 240 Second Level Teachers

Participated in workshops facilitated over 2 days for two years of iWish Conferences

## 300 Second Level Students

From four schools participated in unconscious bias & career awareness workshops



## 1568 Second Level Teachers

Engaged in unconscious bias workshops.

## 273 Researchers and Teachers

Participated in talks/workshops at science/teacher education conferences.

# Key Programme Findings

The key finding of this programme was to identify **nine essential steps** towards achieving Equity and Inclusion in STEM Education (Figure 3). These nine steps present a robust framework for national implementation of the Improving Gender Balance in Ireland programme to support the teaching and learning of physics in all Irish second level schools.


**Figure 3: Nine Essential Steps towards achieving Equity and Inclusion in STEM education**

- **Commitment of School Management and Leaders**: School leader engagement in workshops was effective in advocating and supporting teachers to address unconscious in the school. School leaders are key drivers in sustaining this programme and dependence on them to relay information to all staff and follow up on their progress is valuable.

- **Collaborating between Key Stakeholders**:

Engaging external key stakeholders to discuss and advise on logistics and other avenues of opportunity for the programme proved to have wider scope in its outcomes than just input into the programme objectives. Key stakeholders also engaged in using the programme as a vehicle for culture change in their own practice e.g. PDST engaging in unconscious bias workshops and conversations with the programme team.

> ***"Your work provided the perfect stimulus for our team dialogue and the stats and insights you brought added a layer of depth and quality to our bank of information."***
> **Acting Team Leader PDST Health and Wellbeing Team - Post Primary**

- **Challenging Barriers to Inclusion**: Evaluation of this programme has identified the key challenges for STEM education in Ireland as student's self-efficacy in STEM; students, parents and teachers lack awareness of STEM careers; impact of negative stereotypes and preconceptions; lack of resources for STEM subjects in school; and lack of awareness of STEM in society.

- **Raising Awareness of Unconscious Bias**:

> ***"[Unconscious bias] as long as it's just to the forefront of everybody's thinking when it comes to their planning…"***
>
> **Phase II non-science teacher**

The audits of the school websites highlighted the lack of awareness around unconscious bias and gender/subject stereotyping. The imagery associated with physical science subjects was male dominated and Physics was generally listed at the bottom of the subject choices available at Senior Cycle.

➢ **Bringing Together Research and Practice**:

Findings have highlighted the importance of research-practice collaborations to address the three-strands of this programme. The inconsistencies exhibited in the survey responses from all teachers further corroborate the need for a whole school approach to raising awareness of unconscious bias and gender stereotyping in school policies and practices.

***"I have applied a good lot of the strategies that I've learnt, in the classroom with my own first year class and I actually think there's a better atmosphere in the class…just simple things the I have the room set up, the way I have them divided, the way I question myself in class…the way I assign roles"***

**-Phase I non-science teacher**

***"Sometimes it can be difficult to actually be disciplined as a department to come together and to actually work on something specific that's related to the classroom, you know I think it's very useful…it certainly brings a good focus to the group and I think as well it puts out a template for maybe how departmental meetings could be held going forward even when DCU are not working with us, you know."***

**– Phase I Science teacher**

➢ **Professional Learning Opportunities**:

Teacher reflections from both all staff and science teachers indicate a need for more opportunities for professional learning. The difference in impact of Phase I and Phase II suggests that sustained and ongoing professional learning opportunities are required to effect real change in classroom practice and school culture.

➢ **Active Learning in Physics**:

An inquiry-approach was used in workshop facilitation so that teachers could experience learning through inquiry and model the workshop approach in the physics classroom.

***"..we did careers [in the workshop] and I said that was a great, very novel way that we would never have thought of before because we would teach science separately. I would have done it with science in general, but I thought it was a great idea when you're teaching a particular topic to show the careers that somebody who has an affinity for that topic might pursue."***

**-Phase II Science teacher**

- **Deepening Confidence and Competence in the teaching and Learning of Physics**:

Science teachers identified their key challenges in teaching physics, and these were addressed through the design and implementation of science teacher workshops. The feedback from science teachers indicates that increasing their understanding of basic physics concepts is as beneficial to them as focusing on pedagogical approaches.

> ***"I am learning so much and know that my students are benefitting too as a result. I can actually say that I am really enjoying teaching Physics now too due to a better understanding of some of the concepts."***
>
> **– Phase I Science teacher**

- **Building Resilience in Students**: Creating experiences for students to reflect on unconscious bias and gender stereotyping issues is important to building resilience in students (see results of survey in Table 1). Encouraging students to become their own advocates of building resilience proved to be an effective method of encompassing the student voice with one school employing a train-the-trainers model to students rolling out unconscious bias workshops.

**Table 1: Student Sense of Belonging in Science and Physics**

| | Findings | Implications |
|---|---|---|
| Lower Secondary | Males have higher self-efficacy in science than females | *Females in a single sex **science** class are more marginalized than males or females in a mixed science class** |
| | Females in a mixed school have higher Social Belonging, Ability Belonging and Self-Efficacy than females in an all-girls school | |
| | Ability Belonging is a predictor of Intentions to Persist in science for males only | *Intentions to Persist in science is not significant at lower secondary level* |
| | Self-Efficacy is a predictor of Intentions to Persist in science for both males and females | |
| Upper Secondary | Males have greater Intentions to Persist in Physics than females | *Female social belonging is lower than males in Physics class* |
| | Females in a mixed school have lower Intentions to Persist in Physics than females in an all-girls school | *Females in a mixed physics class are more marginalized than those in a single sex physics class ** |
| | Social Belonging is a strong predictor of Intentions to Persist for both males and females | |

*High percentages of female students who rank Biology as most interested science subject are included in this cohort

**Limitation of low numbers of females studying Physics needs to be considered in sample size

# National Implementation

For national implementation in Ireland, it is proposed that seven programme officers are required for 5 years in order to implement all three strands of the Improving Gender Balance Programme, operating in three regions with ~ 720 second level schools in Ireland (Figure 4). Commitment to achieving these programme objectives has been received for national roll-out of IGB programmes in England and Scotland through provision of five years funding from the respective Departments of Education.

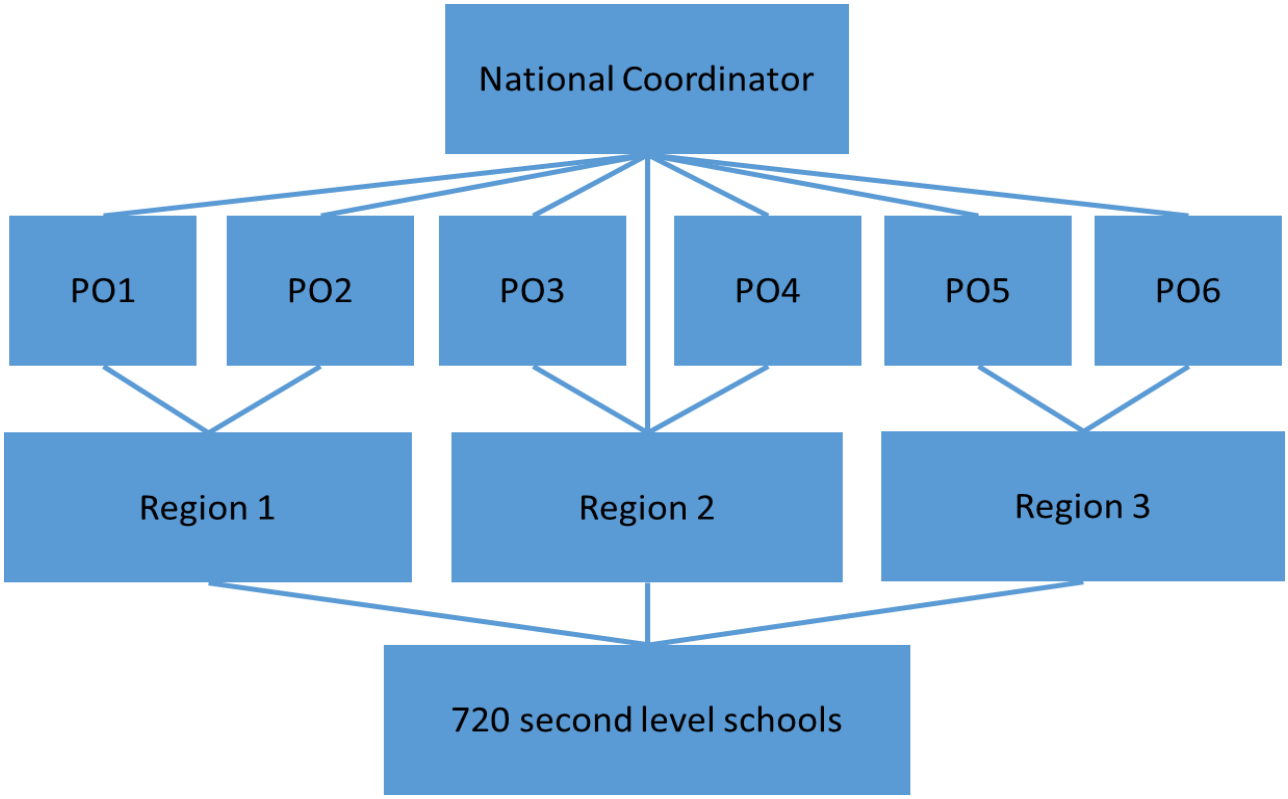



**Figure 4: National Implementation Organisational Structure**

*National Coordinator:* The role of the national coordinator is to provide leadership and coordination to the design, implementation and evaluation of the programme.

*Programme Officers*: The role of six programme officers (PO1-P06) is to liaise with representatives of each school to coordinate dates for teacher workshops, design and facilitate unconscious bias and science workshops in each region.

National Implementation will involve using an evidence-based approach to the design and implementation of professional learning opportunities for teachers (see figure 5). The programme will maintain its core elements of fostering professional learning communities, working within and across curricula and providing ongoing and sustained support for teachers. Unconscious bias workhops will be facilitated in-school and involve the entire teaching staff. Science workshops wil be faciliated in regional locations with support clusters of science teachers from across and between schools forming their own professional learning communities.


**Figure 5: National Implementation Design Principles**

**Note: To read the full report of the Improving Gender Balance in Ireland programme (2017-2019) and details on the programme design, implementation and findings, please visist www.igbireland.ie**

Improving Gender Balance in Ireland programme aims to increase the engagement and understanding of students, particularly girls, studying physics at second level. This programme seeks to take a holistic approach to changing students' experience with physics and works collaboratively with schools, teachers and students to change perceptions of who can study science and tackle the inequities that prevent students from engaging in physics and STEM careers. This programme was first implemented in Ireland (2017-2019) through the coordination of CASTeL at Dublin City University in a strategic partnership with the Institute of Physics in Ireland and Science Foundation Ireland.

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