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Who Chooses Science? Subject take-up in the *Growing Up in Ireland* study.

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Introduction

- Across the world, there is a strong case made for increased participation and diversity in STEM fields.
- A particular problem is that socio-economic background; gender and ethnicity are all associated with STEM study.
- In the OECD, Ireland had below average share of 15 year olds aspiring to pursue STEM careers (OECD, 2012).

Previous work drew on a **national survey** of over **4,000 students in 100 secondary schools** in Ireland to identify the school and student factors which influenced student take-up of Chemistry, Physics, Biology and higher Maths for the Leaving Certificate (Smyth and Hannan 2004, 2006, 2008).

Research Aims

This study sets out to build on this earlier research by examining the influence of school and student factors on subject choices in upper-second level by

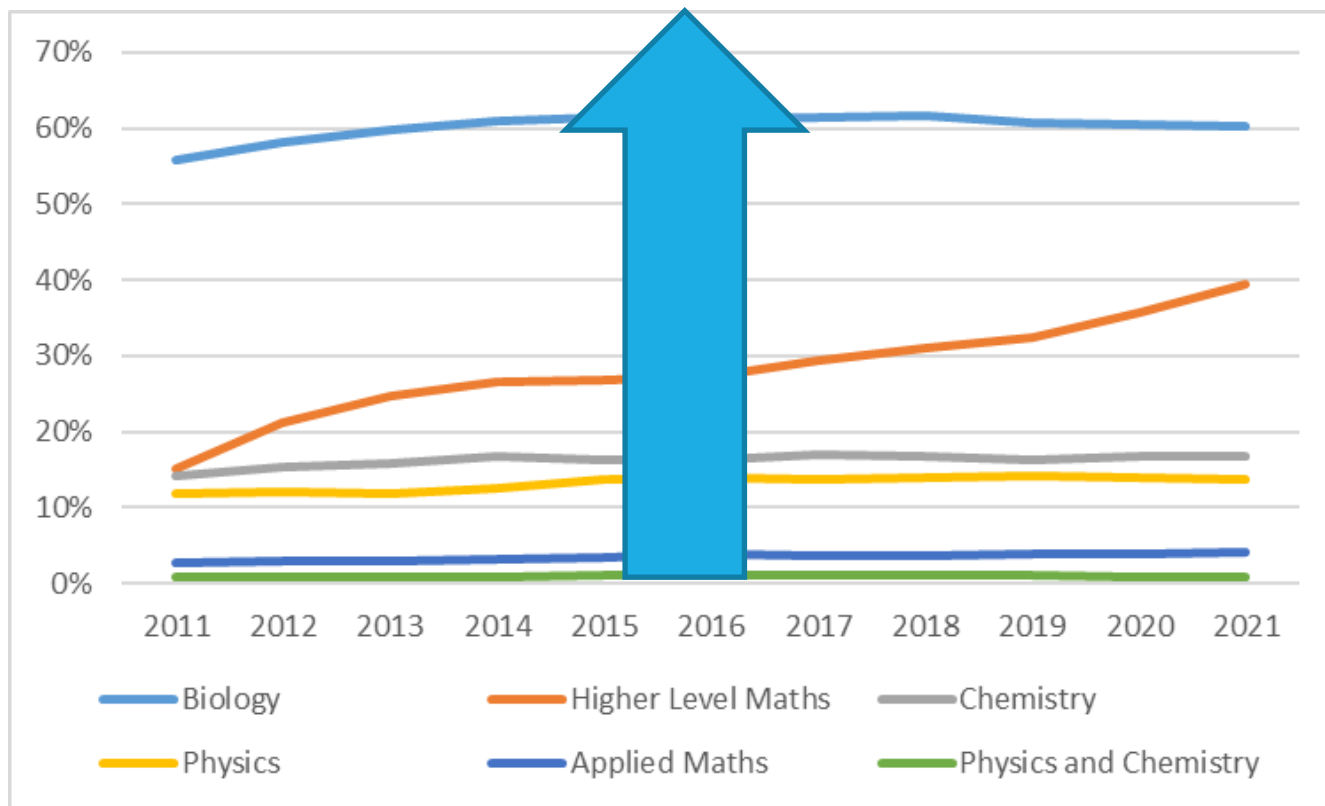
- extending it to take a **life-course approach** with an emphasis on the **science pipeline (“turning points”)**.
- focusing on the uptake of scientific subjects in the Leaving Certificate taking account of previous experiences from age 9.
- taking account of school differences both in the provision and take-up of Physics, Chemistry, Biology.

Few studies have focused on how schools matter.

Data and Methodology

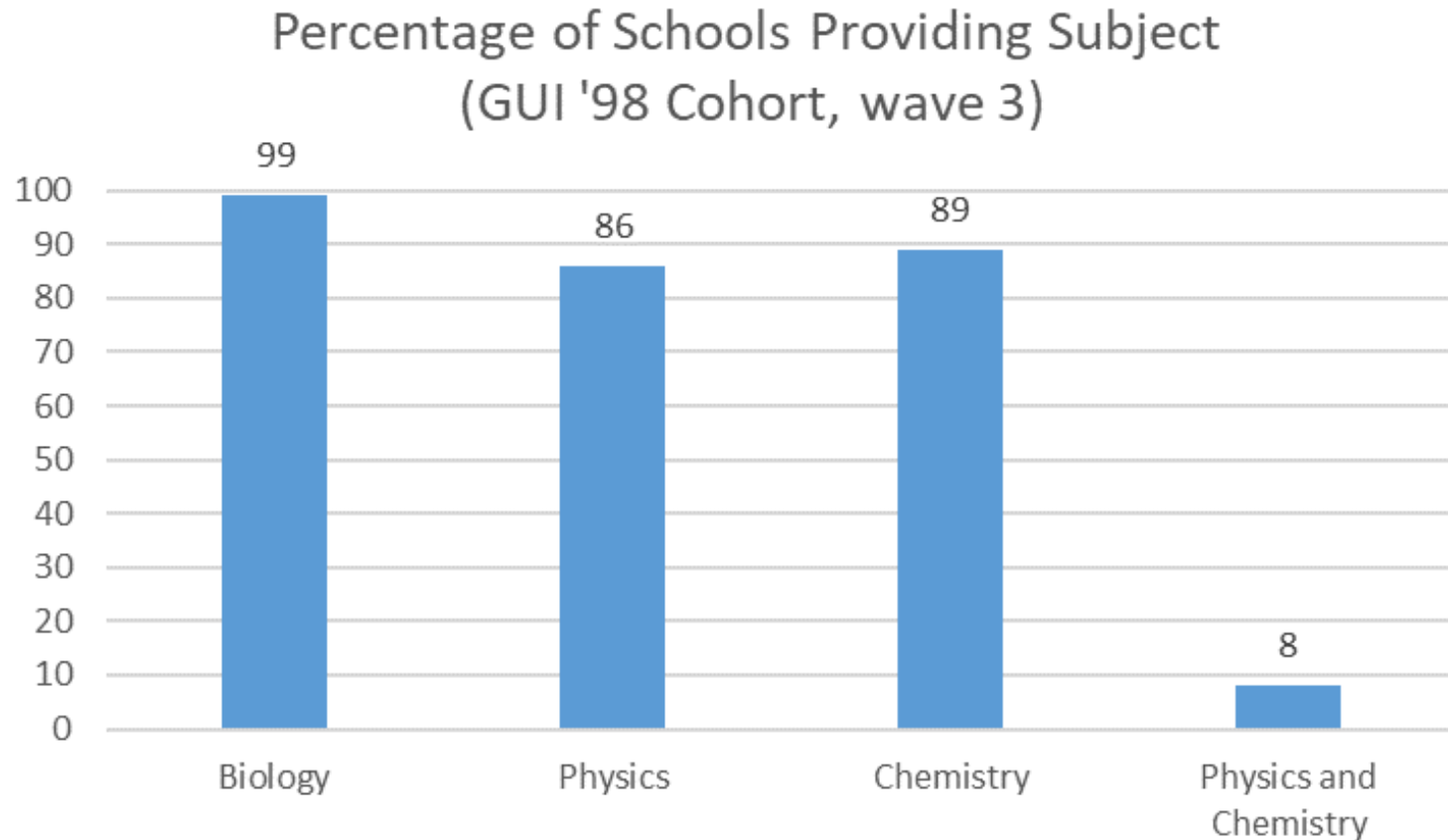
- Waves 1, 2 and 3 of GUI Cohort '98.
- 9 year-olds were sampled through the primary school system – surveyed children and their parents, classroom teacher and school principal.
- Followed up at 13 and 17/18 years of age – 6036 young people.
- Logistic regression models on subject provision (436 principals).
- Cross-classified multilevel models on uptake allowing for complexity of transfers between primary and second-level schools.

The take-up of scientific subjects at Leaving Certificate level (2011-2021)



- Sources: Educational Indicators (various years) and careersportal.ie

Science Subject Provision



- All fee-paying schools offered Physics and almost all offered Chemistry.

School Factors and Provision

- Fee paying/Non-fee paying
- DEIS/Non-DEIS
- Urban/Rural
- School Size (quintiles)
- Gender composition of the School (mixed, boys, girls)
- Subject specialisms (science)
- Offer TY
- Principal's views on numeracy difficulties (% students)
- Principal's views on lab facilities (Likert scale)

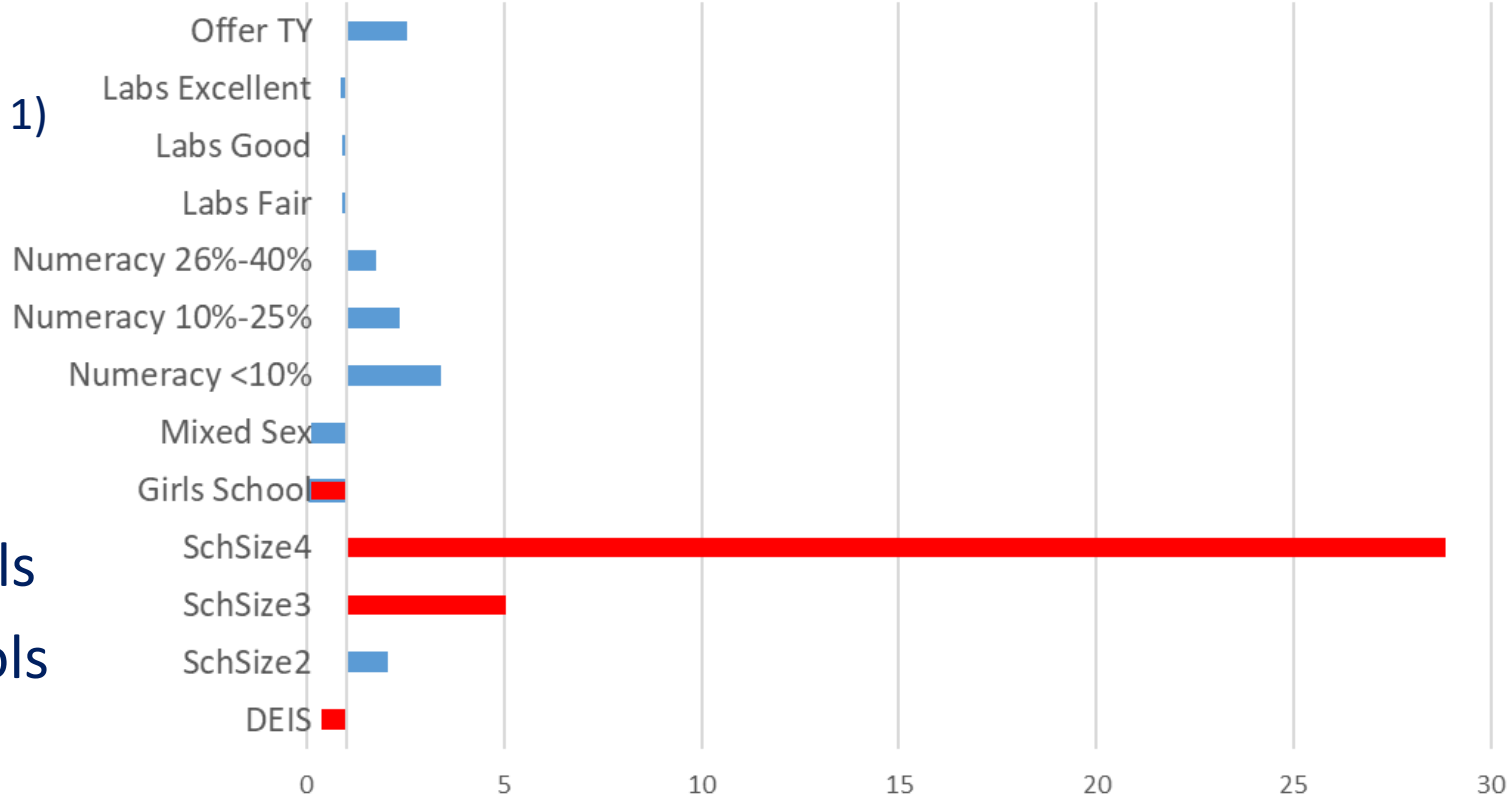
The Provision of Physics

Binary logistic regression models (GUI '98 cohort wave 3)

Odds Ratio

Increases with:

- School Size
(ORs greater than 1)



Less likely in:

- DEIS Schools
- Girls' schools
(ORs less than 1)

The Provision of Chemistry

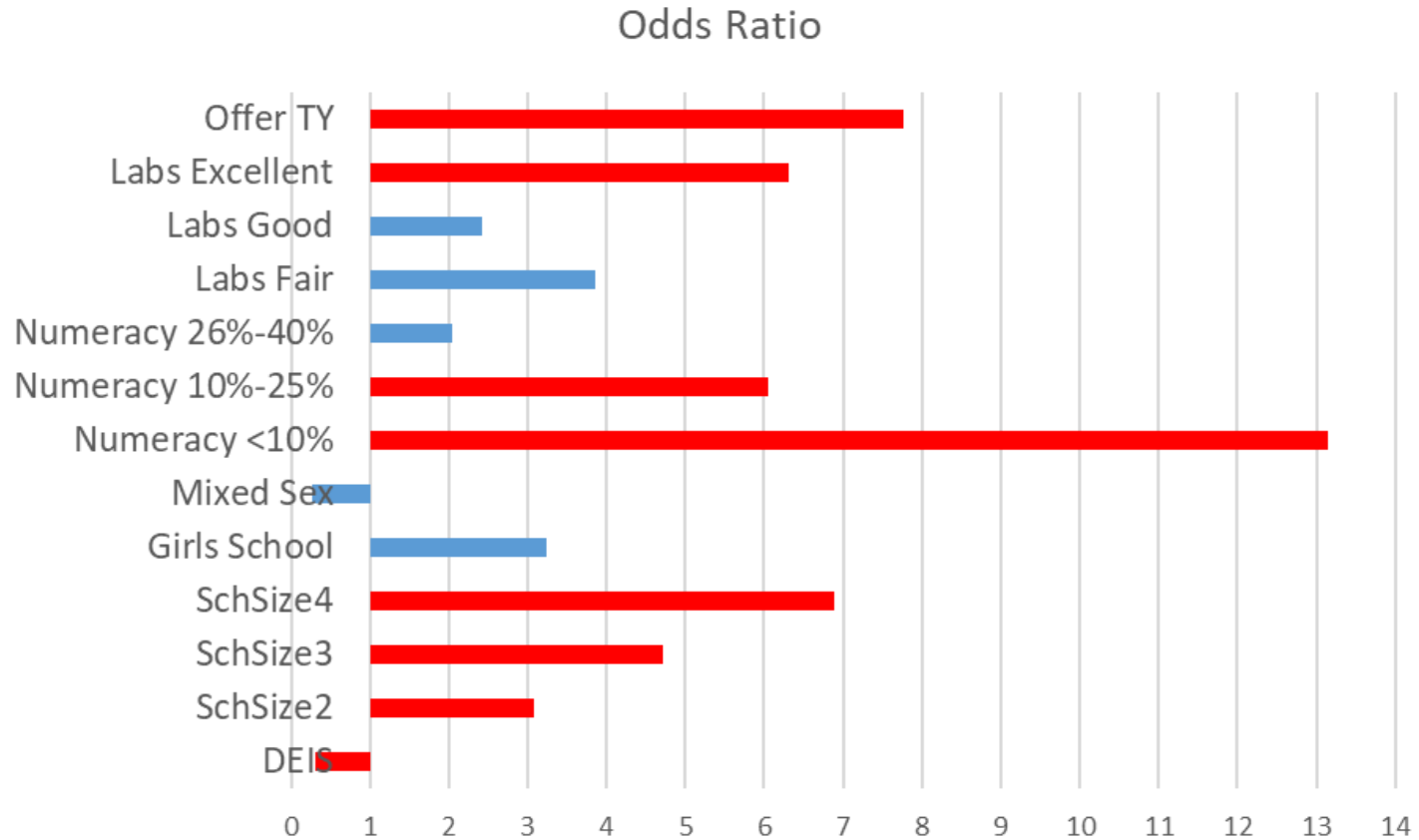
Binary logistic regression models (GUI '98 cohort wave 3)

Increases with

- School Size
- Numeracy
- Lab facilities
- Offer TY

Least likely

- DEIS Schools



The combined subject: Trade-off with Physics.

The uptake of scientific subjects

Social Background

- Gender
- Mother's educational level
- Migrant family
- Lone parent (at age 9); at subsequent waves
- SEN
- Science capital (field-specific cultural capital)

Primary School

- Gender Mix
- DEIS status
- Math Facilities
- School Ethos
- Maths scores
- Attitudes to Math
- Occupation aspirations at 9

Secondary School

- Gender Mix
- Fee-paying
- DEIS status
- School Size
- Science Labs
- New School
- JC Maths score
- Attitudes to Math
- JC Science score
- Attitudes to Science
- Occupation aspirations at 13
- Took TY

Take-up of Physics (1)

Cross-classified multi-level models (GUI '98 cohort wave1- 3)

- **Background**
 - Lower among girls
 - Strong gradient by mother's education
 - Lower in lone-parent and migrant families
 - All but gender mediated through lower secondary performance
 - Small effect of science capital
- **Primary school experiences**
 - Higher if attended a girls' single-sex school
 - Lower in Rural DEIS schools
 - Lower if sometimes/never liked Maths
 - Higher if higher Maths test score at age 9
 - Higher if you aspired to becoming a scientist at age 9

Take-up of Physics (2)

Cross-classified multi-level models (GUI '98 cohort wave1- 3)

- **Second-level experiences**
 - No variation by gender mix or school size
 - Slightly higher in newer schools
 - Lower in DEIS and higher in fee-paying
 - Higher if find JC science and Maths interesting (related to science capital)
 - Lower if find JC Maths difficult and higher if find JC science 'not difficult'
 - Positive effect of JC grades in Maths and Science; stronger for Maths (but strong gender interaction here)
 - Significant between-school variation in take-up despite controlling for all these factors

Take-up of Chemistry

Cross-classified multi-level models (GUI '98 cohort wave1- 3)

- **Background**
 - Somewhat higher among girls
 - Gradient by mother's education
 - Lower in lone-parent families
 - Somewhat higher with science capital
- **Primary school experiences**
 - Higher if higher Maths test score at age 9
 - Higher if aspired to science occupation at age 9
 - Lower in Urban Band 1 and rural DEIS schools
- **Second-level experiences**
 - Lower in DEIS schools (mainly because of lower Maths engagement)
 - Slightly higher if find JC science interesting and 'not difficult'
 - Higher if higher JC science and Maths grade (gender interaction)
 - Significant variation in take-up between second-level schools

Take-up of Biology

Cross-classified multi-level models (GUI '98 cohort wave1- 3)

- **Background**

- Higher among girls
- NS by background

- **Primary school experiences**

- Slightly higher if higher Maths test score at age 9
- Lower in Urban Band 1 DEIS schools

- **Second-level experiences**

- Slightly higher if find JC science interesting
- Higher if higher JC science grade and lower for boys with higher math grades.
- Higher if took Transition Year
- Lower in DEIS schools
- Significant variation in take-up between second-level schools

Conclusions

Is science an élite subject?

How do schools promote 'science for all'?

- Physics and Chemistry are not made available to all students.
- Between-school variation is important so some schools foster an orientation to science.
- Experience of, and performance in, primary Maths is highly influential – implications for current primary curriculum review.
- “Science” does not just suffer from a “gender problem”.
- Policy: greater recognition of the power of social background, gender and their intersection; issue of science engagement in DEIS schools.
- Further research: explore cross-school variation in gender and other influences. Closer look at the role of gendered career aspirations.

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