A Pedagogical Pathway to Enhance Science Identity in Disadvantaged Males

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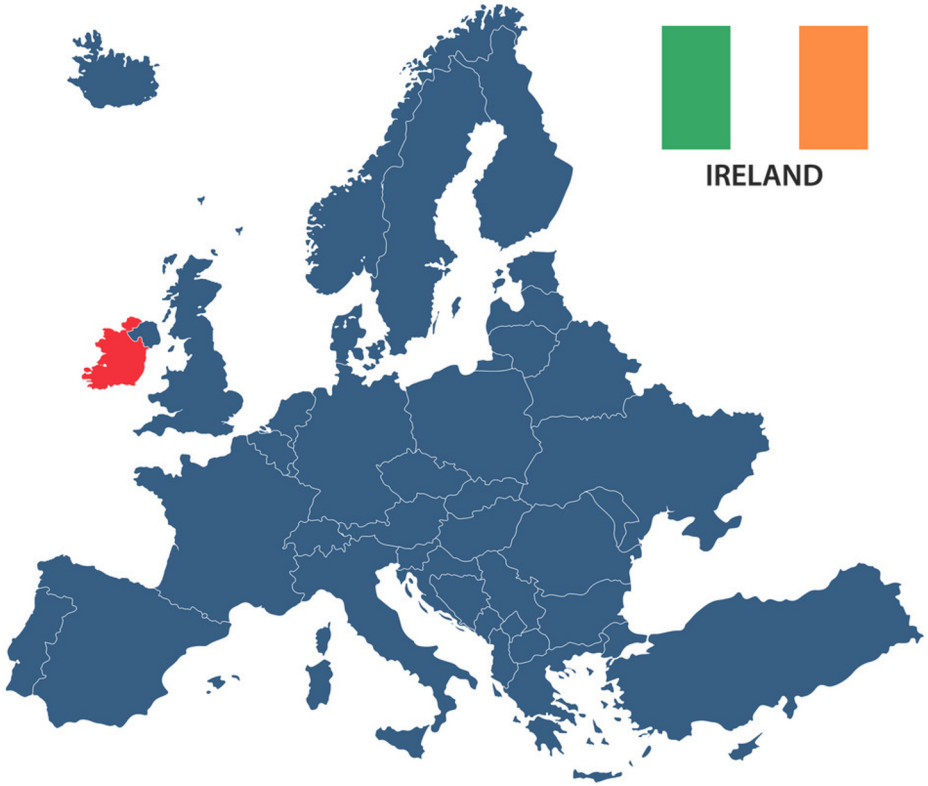
Who are we?

CENTRE FOR PEDAGOGY AND PUBLIC ENGAGEMENT RESEARCH

SCHOOL OF EDUCATION NUI GALWAY



Centre for Pedagogy and Public Engagement Research (CoPPER)

- Researchers and Lecturers in the **School of Education** at the **National University of Ireland Galway**
- We established **CoPPER**, 2 years ago, a **Research Centre** in our University that specialises in **research in formal and informal education**.
- Currently, work across 10 national/EU projects work with a research team of 7.

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It's not JUST Science....

For some, Science is viewed as …

https://www.istockphoto.com/search/2/image?mediatype=illustration&phrase=science+lab

https://medium.com/@Sugirjan/perception-vs-reality-e6b0788f2cb2

However, Science is **SO** much more….

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- This project, 'It's not JUST Science' sets out to use **Science** as a **key** that opens the door for **disadvantaged males into higher education**.
- We aim to achieve this aim by providing opportunities to develop **Science Identity**.
- Before we talk about Science Identity….
    - Why disadvantaged males?
    - Why higher education?

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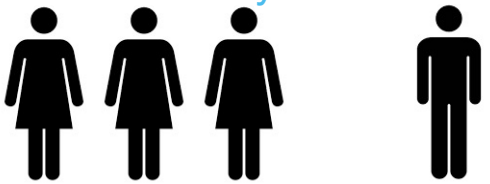
Disadvantaged males accessing higher education

- Males from socio-economic disadvantaged communities often underperform on science achievement tests relative to mainstream school cohorts and do not see themselves as capable in science, or of being a scientist. (DES, 2016; Archer et al., 2020).

General Education Population

V

Socio-Economically Disadvantaged



- Intersecting literature suggests that increasing student science identity has the potential to interrupt this pattern.

- Thus, this paper considers a suite of teaching strategies, designed as a pedagogical pathway to support enhancing male science identity with Biology.

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Science Identity and Self Concept

- Student attitudes towards science subjects are mixed.
- Young people are exposed to competing images that form their personal understanding of what a scientist is and who can be a scientist and begin to align their identity with those norms.

- Social forces play a strong role in determining the requirements for participating resulting in students balancing their own aspirations and interests with the expectations imposed on them by their peers, families, and teachers (Varelas et al., 2011).
- As students get older, they begin to refine in themselves what it means to be a person who is successful in science and whether or not they belong. Some students begin to feel they do not identify as a science person because they do not align with the expectations of a "good" or "brainy" student (Archer et al., 2016).

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Science Identity and Self Concept

- Archer et al. (2016) found that white, male students from families with higher earnings, connection and experience in a science related industry felt the most confident in science subjects receiving encouragement by teachers, streamed into more rigorous classes, and receiving greater career guidance because they are seen as sufficiently "clever."
- Girls, students of colour, and students from families with lower incomes, participate in higher level science classes in secondary school in far fewer numbers despite having strong interest, support from their family, and personally valuing science learning.
- Biological Sciences are prominent across Higher Education offerings in Ireland
- Students who do not take Biology second level education: a resulting impediment to progress to higher education arises, opportunities to access financially rewarding positions, and above all, contribute to a sustainable healthy society.

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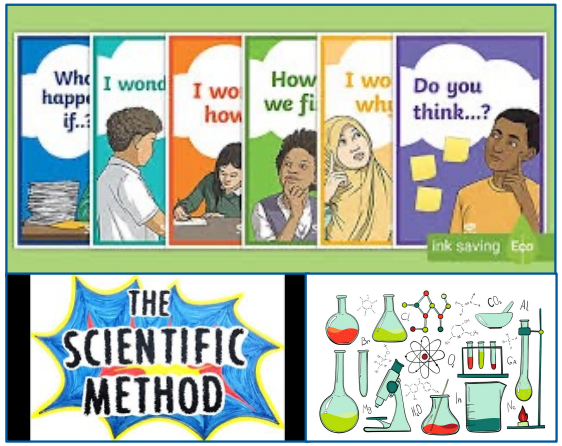
Problem Socio-economic disadvantaged males should have a Biology pathway into Higher Ed

Theoretical Solution Scholarship tells us 'improve **Science Identity**'

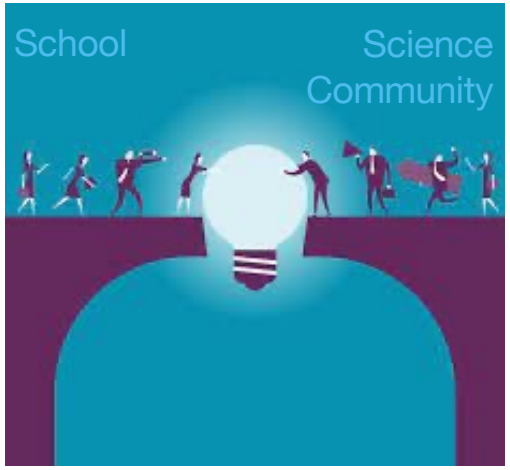
Conceptual Solution Scholarship tells us:

a. Integrated Teaching

b. Scientific Inquiry



c. Free Choice Learning



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Improve Science Identity through Integrated Teaching

- Start from everyday lived experience of students and apply it to the sciences, as it *provides a foundation for more abstract concepts* [McCauley et al., 2022].
- Considering the identity work necessary to engage in science learning. *How do they take to Biology, if Physics is their topic of interest?* It is important that students are allowed to explore how different disciplines are related and used together to solve real problems [McCauley et al., 2022].
- Interestingly, this blending of disciplines has been shown to interrupt science self-concept trends and promote participation in biology for male students [Jansen et al., 2019].

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Improve Science Identity through Integrated Teaching

Start from everyday lived experience of students

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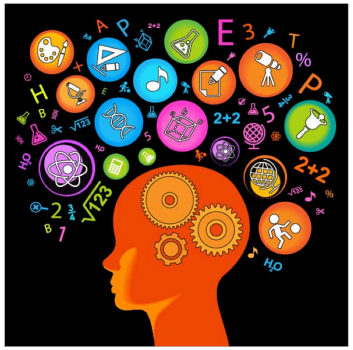
Blended Science Discipline Teaching Approach

Enhanced Self-Identify in Biology for Males

However, a recent study of Irish science teaching found that interdisciplinary methods are not common in the post-primary setting [DES, 2020].



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Improve Science Identity through Scientific Inquiry

- Student-led science learning that incorporates inquiry and problem solving is widely seen as an effective method for *increasing relevancy and authenticity* [USDE, 2015; DES, 2016; Godec et al., 2017].

- Students are encouraged to experiment and make mistakes while understanding that *there may not be one single correct answer*, participating in a more meaningful science experience [Artigue et al, 2012; Whannell et al, 2018].

- Inquiry-based learning has been shown to motivate and engage learners who are low-achieving or come from less privileged backgrounds by allowing multiple entry points and perspectives to engage in science learning [Krajcik et al, 2000].

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Improve Science Identity through Scientific Inquiry

Student-led Inquiry & Problem Solving as, Relevant Learning

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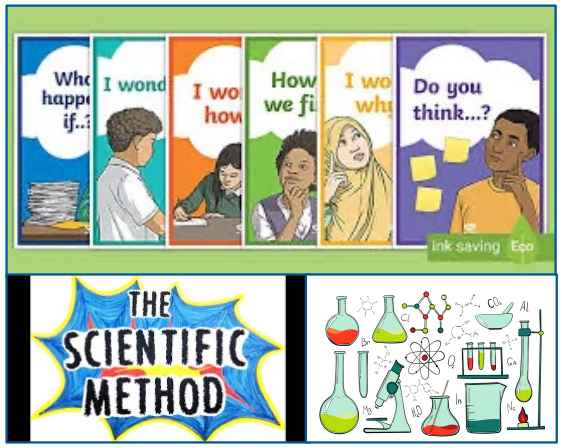
Scientific Approach – Trial and Error welcome.

Motivate and engage low achieving less privileged learners

Hopeful, as inquiry learning is being promoted with new Irish junior science curricula (2016) & also incoming senior science curricula (for 2023)



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Improve Science Identity through Free Choice Learning

- Children from lower socioeconomic status households are much less likely to experience informal science learning [HFRP, 2016]. If students do not see the connection to their lives, if there is no relevancy, they are less motivated to learn [Darling-Hammond et al, 2020] or consider a career in science.

- Studies show that informal science education is *particularly* impactful for students who don't feel they belong in science. This choice & exploration in less-formal settings is vitally important to motivation, improves understanding and significantly contributes to lasting science knowledge. [Fail & Dierking, 2010].

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Improve Science Identity through Free Choice Learning

Informal Science with Free-Choice and Life Relevancy

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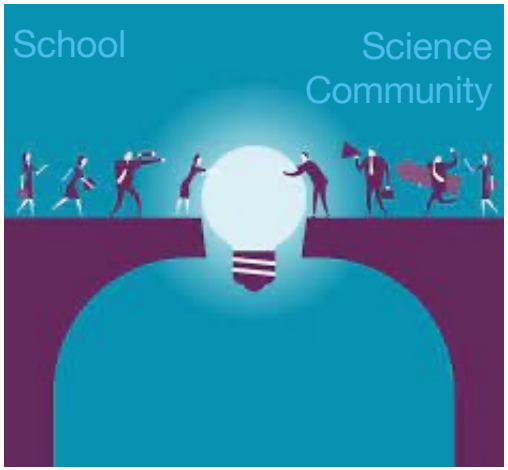
Motivates learning and lasting science knowledge in particular for those who don't feel they belong.

Thus, schools need to forge partnerships in the community & provide students with opportunities to learn in less formal settings [Russell et al, 2013].



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Problem Socio-economic disadvantaged males should have a Biology pathway into Higher Ed

Theoretical Solution Scholarship tells us 'improve **Science Identity**'

Conceptual Solution Scholarship has informed our Triadic Conceptual Framework

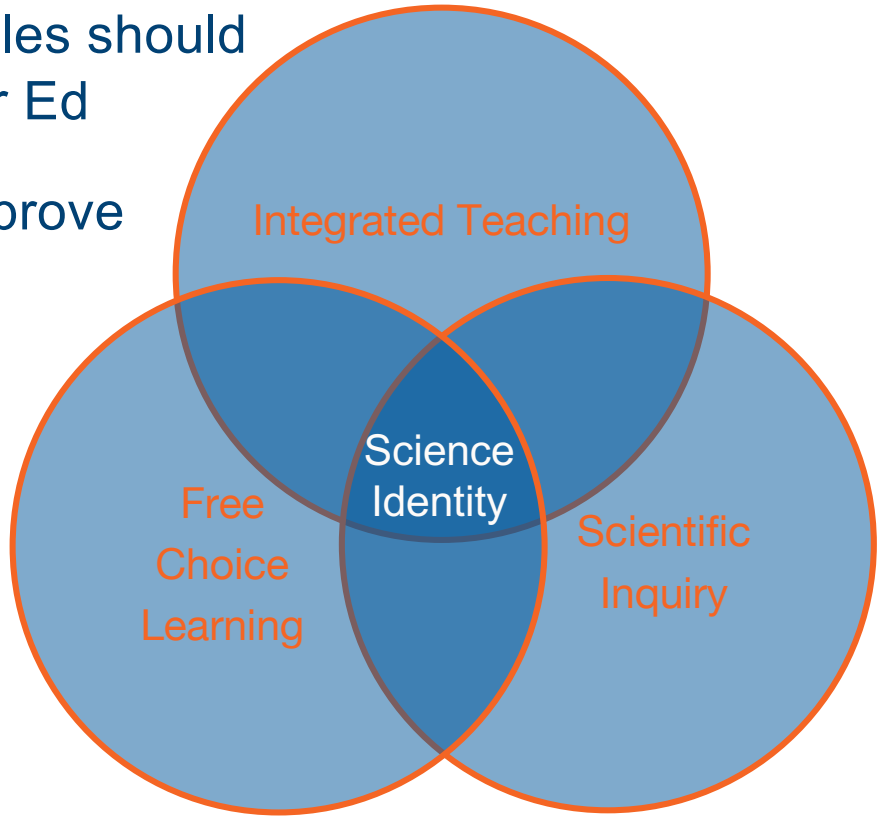

Fig. Conceptual Framework Towards a Biology Pedagogical Pathway for Disadvantaged Males

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Next Steps

Design-based research project due to commence in Summer 2022 & it will trial interventions based on the **Science Identity Conceptual Framework** and produce actionable knowledge for others to consider.

Looking forward to future conversations.

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References

To Reference this Presentation:

McCauley, V. and Flynn, P. (2022). A Pedagogical Pathway to Enhance Science Identity in Disadvantaged Males. *Paper Presentation*. The New Perspective in Science Education International Conference in Florence, Italy, 17-18 March 2022. https://doi.org/10.13140/RG.2.2.13589.81128

To Read more in our Paper:

McCauley, V., Tierney, C. and Flynn, P. (2022). A Pedagogical Pathway to Enhance Science Identity in Disadvantaged Males. *Conference proceedings*. New Perspectives in Science Education 2022. 11th edition: Florence, Italy: Filodiritto Editore. https://conference.pixel-online.net/NPSE/files/npse/ed0011/FP/4495-ESTR5462-FP-NPSE11.pdf

Other references listed in this presentation are available in the conference proceedings paper above.

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