New Perspectives in Science Education
International Conference
NEW PERSPECTIVES in SCIENCE EDUCATION

"Yes, Biology is for me!": Raising the Science Capital of Boys

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Abstract

Some male students struggle to see the study of Biology as being relevant to the lives that they lead. If students don't opt to take Biology at upper post-primary school, then they are excluded from a wide range of pathways to higher education and the possibility of developing a scientific-enhanced transversal skill set that will benefit them in life more generally. This research considers the perceived barriers that males (aged 15-16 years) from marginalised communities in Ireland face, when deciding that Biology is 'not for them'. Further, it proposes a pedagogical disruption through the introduction of a co-designed (students, teachers, teacher educators, educators, sociologists) module that celebrates the essence of the Science Capital Teaching Approach, in an attempt to enthuse adolescent males' engagement with Biology. The Science Capital Teaching Approach draws on Bordieu's work about capital and social reproduction and is a way of teaching that convinces students of the value of science, in this instance biology, in their daily lives. The approach does this by a) personalising and localising the content, b) eliciting young people's ideas, valuing their contribution, and linking it to the topic, and c) building the science capital dimension (for example that Biology leads to lots of jobs, not just jobs that are traditionally associated with it). This paper opens the conversation around male student intent to study Biology for their final two years of second level education, derived from participant survey results. Further, it outlines subsequent pedagogical pillars to support the proposed intervention, targeting males who are yet to be convinced that 'Yes, Biology is for me!'

Keywords: *Marginalised adolescent males; Science Capital Teaching Approach; Post-primary science education, Biology Education, Science Teaching, Bordieu.*

1. Introduction

Some male students struggle to see the study of Biology as being relevant to the lives that they lead. Science participation inequalities in post-16, remains an international policy concern [1]. Whilst many research studies focus on the science experiences of students in male dominant disciplines such as computer science, engineering, and physics [2], fewer have explored the imbalance of access pathways through female dominant disciplines. If students don't opt to take Biology in their final years of second level school, then they are excluded from a wide range of pathways to higher education and the possibility of developing a scientific-enhanced transversal skill set that will benefit them in life more generally. This is particularly pertinent if we consider the insufficient numbers of students following science-related careers, fundamental to economic growth globally [3], let alone the value of a more scientific public. Theoretical and empirically informed literature suggests that levels of student science capital correlate with one's science identity, study, work, and aspirations [1]. Thus, this paper considers a pedagogical module design that embeds the Science Capital Teaching Approach (SCTA) in a six-week Biology module for male students in marginalised communities, transitioning from lower to upper secondary school, with a view to positively influence their science identity.

2. Choice through a capital lens

Bourdieu's theories on social stratification, suggest that how one chooses to present one's social space to the world depicts one's status [4] and that habitus is the learned set of preferences or dispositions by which a person orients to the social world. Habitus is rooted in family upbringing (socialisation within the family) and conditioned by one's position in the social structure; it shapes the parameters of people's sense of agency and possibility. Bourdieu [5] sees the forms of capital as mutually constitutive, in that economic capital affords the time and resources for investment in the development of children's cultural capital, which is associated with future educational and occupational success and, in turn, contributes to the accumulation of economic capital. While economic and cultural capital are important predictors of self-concept; social capital, value gained through relationships with others, particularly individuals who hold valuable forms of capital has significant influence [6].

The teacher-student relationship is one of the most important forms of social capital, where a teacher's power for change cannot be undervalued [6]. If we consider that the science capital of a student is a function of the quality of the relationship with their teacher; then the attitude and behaviour of a teacher can significantly impact content knowledge transfer to the student, a student's interest in science, their aspiration to study science, and whether or not they feel they belong in science [6]. As such, the authors look to science capital, as a conceptual tool developed by [1], which employees Bourdieu's theoretical frameworks, to understand how social capital affects males's aspirations and involvement in Biology. Science capital provided by teachers is particularly significant in fields where students are members of an underrepresented group [6]. In short, everyone has different amounts of science capital, and this affects whether or not they feel that science is for them. This paper considers a science capital teaching approach as a persuasive pedagogy to support male student uptake in Biology.

3. Science Capital Pedagogical Approaches

A student's science capital can be directly influenced by science experiences at school [7]. The quality and content of teaching, grounded in practical pedagogy, are denoted as large determinants of student interest and engagement in learning [8]. Godec and colleagues at University College London have devised a Science Teaching Capital Approach, and an instructional handbook, to be adopted by those who wish to implement a teaching approach that convinces students of the value of science in their daily lives. The conceptual framework is illustrated in Figure 1 below.

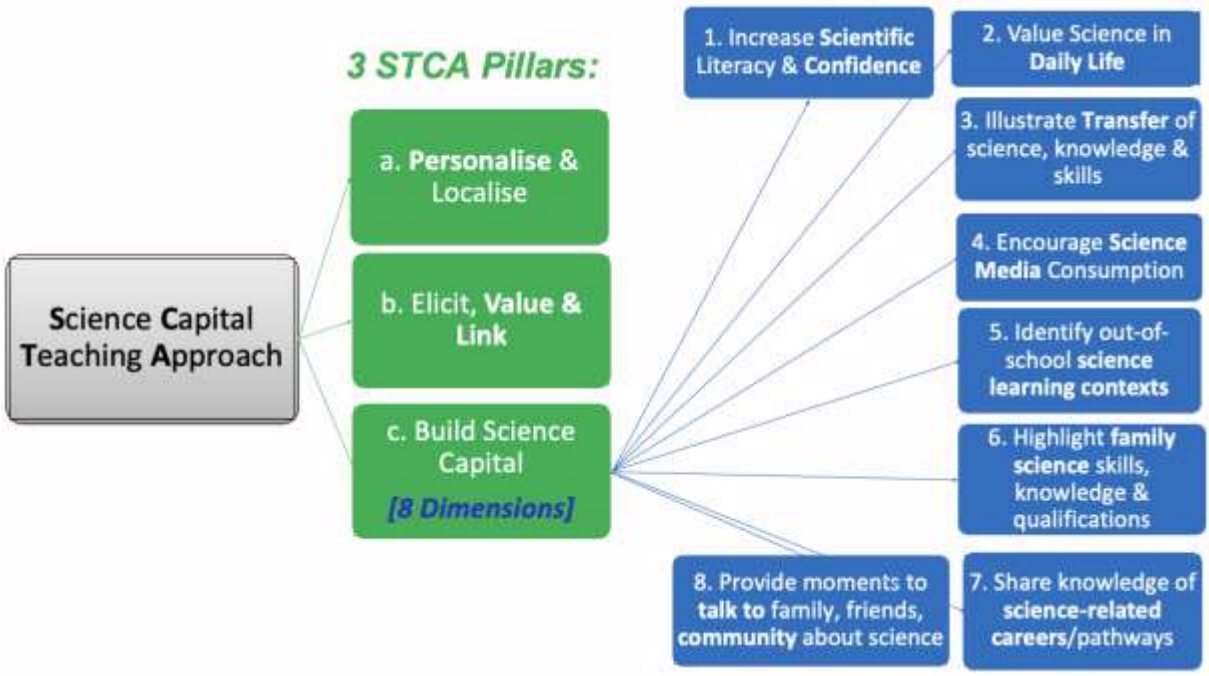

Fig. 1. The Conceptual Framework of the Science Capital Teaching Approach [7]

Cognisant of the fact that the Irish national uptake by males of Senior Cycle Biology is at least half of that of females [9], this paper argues that the design components of the SCTA framework are best suited to enthuse adolescent male' engagement with Biology. A pilot survey was conducted with 12 schools in marginalised areas in the West of Ireland (N of pupils=125), with returns from 44 males, relaying their reasons for not choosing any science subject for senior cycle (the final two years of second level education). Feedback indicated that 6% noted an adversity to the teacher; 19% noted a perception of excessive rote learning material; and 54% shared that they had no interest in science and could not see a pathway for them in subsequent science careers [21% accounted for individual items].

If we focus on the dominant barrier alone, the SCTA framework has a significant role to play. Regarding students not having an interest or seeing a career pathway for them that benefits from science, the three STCA pillars address this. The first two pillars present clear strategies that draw students into science to awaken their interest and sense of belonging:

- Personalise & Localise (connecting to student's interests/context)
- Elicit, Value & Link (eliciting previous knowledge, valuing the contribution, and linking it to science)

Further, in terms of clarifying science career pathways, or career pathways that avail of science skills (e.g., Sports Coach, Game Designer), Science Capital Dimension's 2, 3, 6 and 7 (in Figure 1) provide opportunities for teachers to initiate these discussions, with the overall emphasis on broadening what student's perceive as Science [7]. Some key trigger questions for teachers to consider around these dimensions are outlined in Figure 2 below.

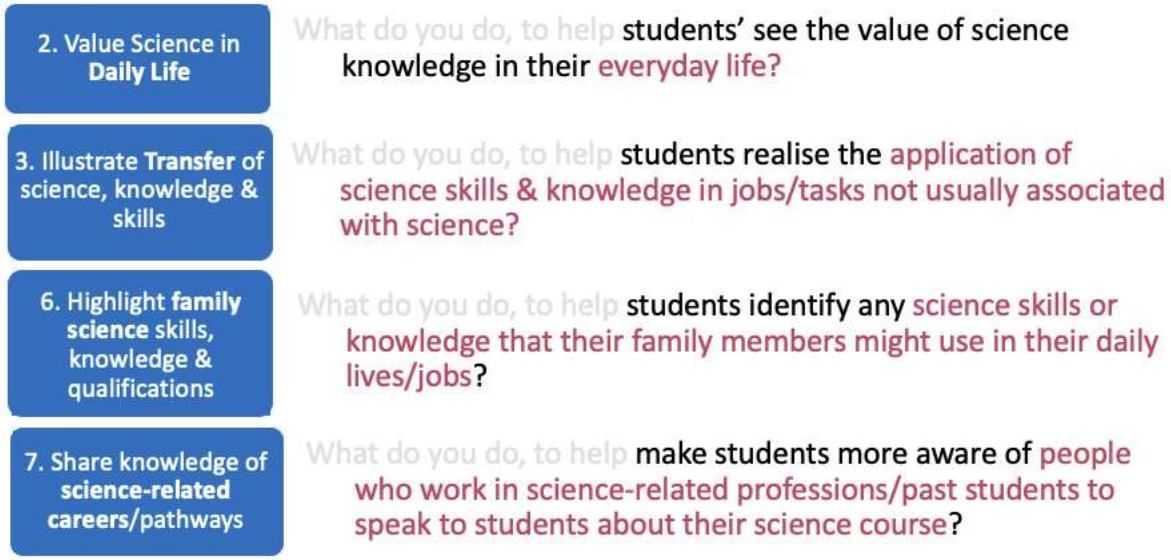

Fig. 2. Trigger Questions derived from the Science Capital Teaching Approach (adapted from [7])

Thus, with the SCTA as a pedagogical scaffold, researchers recruited 5 teachers, teaching in a marginalised school setting across Ireland to trial this framework through a 6 week in-school module, with approximately 100 students. Teacher training was conducted in January 2023. Data collection will involve pre-and post-student questionnaires and teacher post-module structured reflections in Spring 2023 to ascertain the influence of the Science Teaching Capital Approach on students and teachers alike. Results are forthcoming.

4. Conclusion

Higher education (HE) can be a daunting place for students, especially those from underrepresented backgrounds [10]. Teachers can play an impactful role in raising student science capital, particularly for these cohorts and this paper presents a pedagogical model intentionally designed for this purpose. The evidence base [11] states that SCTA can positively impact a student attitude towards science, and the uptake of senior science subjects, in this instance Biology. Therefore, using a social capital approach framework, it is hoped that the incorporation of this pedagogical model into a formal second level education setting will not only address some of barriers that males from marginalised communities in Ireland face when choosing Biology, but will take a step in convincing the community of students that a pathway through Biology to higher education is a pathway for them.

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