University of Glasgow

Bosede-Toluhi Obatomi, Ann (2026) *Exploring Science Capital in a London-based Further Education college: diverse science students' and their teachers' [mis]conceptualisations, and inclusive strategies.* Ed.D thesis.

https://theses.gla.ac.uk/86054/

Copyright and moral rights for this work are retained by the author

A copy can be downloaded for personal non-commercial research or study, without prior permission or charge

This work cannot be reproduced or quoted extensively from without first obtaining permission from the author

The content must not be changed in any way or sold commercially in any format or medium without the formal permission of the author

When referring to this work, full bibliographic details including the author, title, awarding institution and date of the thesis must be given

Enlighten: Theses
https://theses.gla.ac.uk/
research-enlighten@glasgow.ac.uk

Exploring Science Capital in a London-Based Further Education College: Diverse Science Students' and their Teachers' [Mis]conceptualisations, and Inclusive Strategies.

Ann Bosede-Toluhi Obatomi

Submitted in fulfilment of the requirements for the Degree of Doctor of Education (EdD)

School of Education, College of Social Sciences,

University of Glasgow

September 2025

Abstract

This study critically examines the [mis]conceptualisation, experience, and operationalisation of Science Capital (SC) within the vocational applied science sector at a Further Education (FE) college in North London. Drawing on Archer et al.'s (2013, 2015) multidimensional SC framework, which is adapted from Bourdieu's theories of *capital*, *habitus*, and *field* (Bourdieu and Passeron, 1990; Bourdieu and Wacquant, 1992), this study adopts an interpretivist-constructivist paradigm to explore how multi-ethnic, socio-economically diverse students and their teachers perceive and experience SC in a post-compulsory FE college setting.

Using semi-structured interviews with 13 students and 4 teachers, analysed through Braun and Clarke's reflexive thematic framework (2006, 2019, 2024), SC is revealed as a fluid, context-sensitive construct shaped by identity, institutional structures, and socio-cultural experiences. A key contribution of this study is the introduction of linguistic capital, particularly English language proficiency (ELP), as a critical mediator of science engagement. EALS students reported facing compounded barriers in comprehension and participation, which dominant SC models often overlook.

In addition, an intersectional lens highlights how ethnicity, gender, socioeconomic status, and language interact to shape SC unevenly. This study critiques Western-centric epistemologies embedded in SC frameworks, advocating for the inclusion of non-Western knowledge systems and culturally embedded literacies. SC is reconceptualised as dynamic and developmental, shaped by informal learning, media engagement, and institutional support. This study calls for culturally responsive pedagogies, linguistically inclusive curricula, and targeted interventions.

Keywords: Science Capital; Further Education; Vocational Science; Linguistic Capital; Intersectionality; English Language Proficiency; Non-Western Epistemologies; Educational Inequality; Interpretivist-Constructivist Research; Inclusive Pedagogy; Post-compulsory Education.

Table of Contents

Abstract		(i)
Table of Contents		(ii)-(vii)
Author's Declaration		(viii)
List of Figures		(ix)
Acknowledgements		(x)
Declaration of the Use of Generative AI Tools		(x)
Definitions/Abbreviations		(xi)
Chapter 1	Introduction	1
1.1	Introduction	1-3
1.2	Research Overview	3-4
1.3	Statement of the Problem	4-5
1.4	Research Questions	6
1.5	Context	6-8
1.6	Theoretical Frameworks Employed	8-9
1.7	Dissertation Overview	10-11
1.8	Conclusion	11
Chapter 2	Science Capital Theoretical Conceptualisation	12
2.1	Introduction	12
2.2	Intersectionality Framework	12-13
2.3	UK Government Science Policies for FE Colleges	13-17
2.4	Bourdieusian Theoretical Frameworks	17-25
2.5	Science Capital	25
2.5.1	Introduction	25

2.5.2	Theoretical and Conceptual Foundations of Science Capital	25
2.5.2(a)	Science Capital: Archer et al.'s Theoretical Conceptualisation	26-32
2.5.2(b)	Science Capital: International Studies	32-34
2.5.2(c)	Science Capital and Social Identity Theory	34-35
2.5.2 (d)	Science Capital and The Critical Race Theory	35-36
2.5.2 (e)	Reflexive Commentary	36-37
Chapter 3	Science Capital Operationalisation	38
3.1	Introduction	38
3.2	Informal science learning experiences	38-40
3.3	Science Capital and Habitus	40-44
3.4	Science Capital and Science-related Media Consumption	44-45
3.5	Science Capital and FE Colleges: The London Context	45-50
3.6	Gender and Science Capital	50-55
3.7	Socioeconomic Status and Science Capital	55-57
3.8	Ethnocultural Background	57-59
3.9	English Language Proficiency and Science Capital	59-61
3.10	Science Capital and Intersectionality	62-69
3.11	Limitations of the Science Capital Framework	69-71
3.12	Science Capital and Coloniality of Power	71-78
3.13	Decolonising Science Capital	78-79
3.14	Conclusion	79-80
Chapter 4	Methodology	81
4.1	Introduction	81-82
4.2	Research Paradigm: Interpretivism-Constructivism	82-83
4.3	Similar Research Design	83-85

4.4	Data Gathering	86
4.4.1	Qualitative Interview Using RTA	86-87
4.4.2	Semi-structured Interview	87-88
4.4.3	Participant Sampling and Recruitment	88
4.4.3.1	Purposive Sampling	88-89
4.4.3.2	Participants' Sampling Procedure	89-90
4.4.3.3	Reflexive Considerations …Limitations of ..Sampling Strategy	91-92
4.4.4	Interview Protocol,Structure..Reflexivity..Framework Mapping	92-93
4.4.4 (a)	Structure and Components of the Interview Protocol	94-96
4.4.4 (b)	Interview Protocol Design: Reflexivity, Sensitisation Priming	96-101
4.4.5	The Pilot Interview	101
4.4.6	The Zoom Interviewing Process	101-103
4.4.7	Evaluating the Interviewing Process	103
4.5	Data Analysis	103
4.5.1	Introduction	103-104
4.5.2	Braun and Clarke's Six-Stage Reflexive Thematic Analysis	104-113
4.6	Ethical considerations	114-115
4.7	Positionality, Reflexivity and Power Dynamics	115
4.7.1	Introduction	115-116
4.7.2	My Personal and Professional identities	116-117
4.7.3	Researcher Positionality: Ontology, Epistemology, and Axiology	117-118
4.7.4	Philosophical Positionality: Pragmatism	118
4.7.5	My reflexivity	119-120
4.8	Trustworthiness and Authenticity	120-123
4.9	Conclusion	123

Chapter 5	Findings	124
5.1	Introduction	124
5.2	Perceptions and Impact of Science Capital	124-125
5.2.1	Definitions and Descriptions of Science Capital	126-129
5.2.2	First Time of Hearing about Science Capital	129-131
5.2.3	Interest and Motivation to Study Science	132-134
5.2.4	Perspectives on Relevance of Science	134-136
5.2.5	Perspectives on Relevance of Science Capital	137-139
5.2.6	Informal Science Learning Environments	139-142
5.2.7	Perspectives on Science Media Consumption	142-144
5.2.8	Perspectives on Scientific Literacy	145-147
5.2.9	Perspectives on Progression	148-150
5.3	Intersectional Dimensions and Science Capital	151
5.3.1	Ethnocultural Background and Science Capital	151-154
5.3.2	Gender and Science Capital	154-157
5.3.3	Habitus and Science Capital	157-160
5.3.4	Socioeconomic Status and Science Capital	160-162
5.3.5	English Language Proficiency and Science Capital	162-165
5.4	Unexpected findings	165
5.4.1	English Language Proficiency Limitation	165-169
5.4.2	Insufficient Focus on Equality, Diversity and Inclusion	169-170
5.4.3	Tendency Towards Deterministic Science Capital Conception	170-171
5.5	Participants' Recommendations	171-173
Chapter 6	Discussion, Implications and Conclusion	173
6.1	Introduction	173

6.2	Revisiting Purpose of Study	174-175
6.3	Summary of Key Findings	175-179
6.4	Responding To Research Questions	179
6.4.1	Perceptions and Impacts of Science Capital	179-182
6.4.2	Intersectionality and Science Capital	183-186
6.5	Study's Contributions to Knowledge	186
6.5.1	Being/doing science and institutional recognition (RQ1)	187
6.5.2	Science capital enacted within FE as an institutional field (RQ1)	187-188
6.5.3	English language proficiency as linguistic science capital (RQ2)	188
6.5.4	Digital and informal science as context-dependent capital (RQ1)	188-189
6.5.5	Intersectionality as a structuring principle of science capital (RQ2)	189-190
6.5.6	Decolonising science capital through a postcolonial lens	191
6.5.7	Wider relevance for Further Education contexts	191
6.6	Reflexivity on the Influence of My Positionalities on Interpretation	192-195
6.7	Study's Methodological and Contextual Strengths and Limitations	196-198
6.8	Study's Practice-Policy Implications and Recommendations	198
6.8.1	Institutional Recognition of Science Capital	199
6.8.2	Linguistic Recognition Beyond English Language Proficiency	200
6.8.3	Pedagogical Alignment with Learner Strengths	200
6.8.4	Intersectionality as a Structuring Principle of Science Capital	200-201
6.8.5	Epistemological Recognition and Decolonising Science Capital	201
6.8.6	Wider FE Practice–Policy Implications	201-202

6.9 Future Research: Extending Recognition-Centred SC in FE 202-205

6.10 Final Reflections and Study Conclusion 205-207

References 208-247

Appendices 248-374

Author's Declaration

"I declare that, except where explicit reference is made to the contribution of others, that this dissertation is the result of my own work and has not been submitted for any other degree at the University of Glasgow or any other institution."

Printed Name: Ann Bosede-Toluhi Obatomi

Signature:

List of Figures

		Page
Figure 1	Research Questions	6
Figure 2A	Intersectionality of Ethnicity, Socio-economic Status and GCSEs Status	63
Figure 2B	Intersectionality of Gender Socio-economic Status and GCSE Status	64
Figure 2C	Intersectionality of Language Proficiency, GCSEs and Socio-economic Status	65
Figure 2D	Intersectionality of Gender, Ethnicity, Culture, Religion, SES and ELP	66
Figure 3	Mapping Interview Questions to Archer et al.'s (2015) SC Framework	93
Figure 4	Braun and Clarke's Six-Stage Reflexive Thematic Analysis	106
Figure 5	Word Cloud of Dominant Words	107
Figure 6	Table of Final Themes and Sub-themes	112
Figure 7	Table of Final Themes	112
Figure 8	Flow Chart of Final Themes and Sub-themes	113
Figure 9	EDI-Informed Pseudonyms for Participants' Coded References	125
Figure 10	A Proposed Expanded Science Capital Model From The Findings	191
Figure 11	The NVivo14 Coding Frequency Chart of Participants' Responses	192

Acknowledgements

I would like to express my deepest gratitude to the EdD team, especially to my supervisors, Professor Catherine Lido and Dr. David Morrison-Love; your guidance, expertise, and unwavering support have been instrumental throughout this research journey. Your critical insights and encouragement have shaped both the direction and depth of this study.

To my family, thank you for your prayers, patience, love, and belief in me, especially during the most challenging moments; your support has been my foundation. I am especially grateful to my colleagues and students, who participated in this study; your openness and reflections enriched this research in ways that cannot be overstated. To my friends, thank you for your encouragement, understanding, and for reminding me to take breaks when I needed them most.

This study is dedicated to my father, Chief Paul Oluwayomi Obalaiye Toluhi, of blessed memory, whose wisdom, strength, and quiet resilience continue to inspire me every day. Baba, your memory has been a guiding light throughout this programme.

Declaration of the Use of Generative Artificial Intelligence Tools

I acknowledge the use of Microsoft Copilot (Microsoft Corporation, https://copilot.microsoft.com) between July 2025 and April 2026 to support proofreading, clarity enhancement, and language refinement in this work. I also acknowledge the use of Paperpal (Cactus Communications, https://paperpal.com) during the same period to assist with locating relevant peer-reviewed literature, screening academic sources, and providing additional language-editing suggestions. In accordance with University of Glasgow guidance, these tools were used with critical oversight, and full responsibility for the content, analysis, interpretation, and academic judgement remains entirely my own.

Definitions/Abbreviations

Acronyms	Full term/description
A Level	General Certificate in Education Advanced Level
BME	Black and Minority Ethnic
BRICS	Brazil, Russia, India, China & South Africa
CC	Cultural capital
DfE	UK Department for Education
DSIT	UK Department for Science, Innovation and Technology
FE	Further education - In England, 'any study after secondary education that's not part of higher education (that is, not taken as part of an undergraduate or graduate degree)' (GOV.UK, 2025, p.1).
GCSE	The General Certificate of Secondary Education -
HE	Higher education (undergraduate or graduate degree in UK)
Ofsted	The Office for Standards in Education, Children's Services and Skills
R &D	Research and Development
SC	Science capital
SET	Science Engineering and Technology
SFSCs	Sixth Form Schools and Colleges
STEM	Science, Technology, Engineering and Mathematics
UofG	University of Glasgow
UofG CoSS Research Ethics Committee	University of Glasgow College of Social Sciences Research Ethics Committee (UofG CoSS Research Ethics Committee)

Chapter 1: Introduction

1.1 Introduction

In an era marked by rapid scientific and technological transformation, the demand for inclusive, high-quality science education has become not merely a pedagogical concern but a societal imperative. As global economies increasingly pivot toward knowledge-intensive sectors, such as artificial intelligence (AI), biotechnology, data science, and cutting-edge medical and technological developments, science education emerges as a critical lever for driving innovation and enabling social mobility. However, within the context of FE colleges in England, particularly in multi-ethnic and socio-economically diverse urban cities like London, science is often not experienced as a pathway to empowerment but as a domain of exclusion and structural inequity (Trust for London, 2021, 2025). The uniqueness of London as this study's setting is that it is a 'global city' (Saskia, 2001, p.127), based on its very high finance, trade, and cultural rankings, with about 100 countries represented, 41% of whom were born outside the UK. For instance, of the 52.30 million London residents, over 3 million Indians, 1.75 million Romanians, 1.5 million Polish, 1.3 million Pakistanis, and 1.17 million Nigerians live in London (Trust for London, 2025). Most FE colleges in London, including mine, are representative of these statistics (Section 3.5), with most of my students being first- or second-generation immigrants, according to my college's data (College SAR, 2024/25).

Furthermore, despite its potential to democratise opportunities, science education in FE settings frequently reproduces existing social hierarchies. Various studies in England (Archer et al., 2015, 2020) and internationally (Henriksen, Dillon and Ryder, 2015; Du and Wong, 2019; Jones et al., 2021) reveal how some students from marginalised backgrounds, especially those from working-class and racially minoritised communities, tend to encounter science as a culturally alienating and institutionally gatekept field. These students often struggle to see themselves reflected in the curriculum, pedagogical approaches, or the professional trajectories that science education appears to endorse. Instead of being positioned as future scientists, engineers, or innovators, they are sometimes subtly and overtly steered away from science pathways, likely reinforcing cycles of under-representation and disenfranchisement.

This disconnect is particularly acute in cosmopolitan cities such as London, where FE colleges serve as vital post-compulsory (secondary school) educational spaces for diverse populations.

Here, the promise of science as a tool for upward mobility and civic participation may sometimes be undermined by systemic barriers, ranging from curriculum design and assessment practices to institutional culture and resource disparities. For instance, as detailed in Section 3.5, in London, 26% live in poverty, with 38% of non-White families and 53% of single families affected (Trust for London, 2025). This may result in a science education landscape that, while outwardly committed to inclusion, often may not be able to deliver on this for some learners who need it most.

Hence, this study among some students and their teachers in my department, a vocational applied science department in a North London FE college, investigated how science capital (SC) is [mis]conceptualised, experienced, and operationalised. The lens of '*Science Capital'*, a sociological theoretical framework developed by Archer et al. (2013a, 2015b, 2020a; Archer, Dewitt and Osborne, 2014; Archer, Dewitt and Willis, 2014) (Sections 2.5 and 2.6) that builds on the Bourdieusian theories of capital, habitus, and field (Bourdieu and Passeron, 1990; Bourdieu and Wacquant, 1992) and social reproduction of inequalities (Section 2.4) was employed to explain disparities in science engagement. Archer et al. (2015, p.929) state that 'science capital' refers to:

> Scientific forms of cultural capital (scientific literacy, science dispositions, symbolic forms of knowledge about the transferability of science qualifications), science-related behaviours and practices (e.g. science media consumption, visiting informal science learning environments, such as science museums), science-related forms of social capital (e.g. parental scientific knowledge, talking to others about science).

While the SC framework has been extensively applied to compulsory (primary and secondary) education in England, its relevance and application in post-compulsory FE college settings remain underexplored.

Drawing on 17 qualitative semi-structured interviews with students (13) and teachers (4), this study addressed this critical gap by examining how SC is perceived, enacted, and potentially [mis]understood in the post-16 vocational science context of my department. Furthermore, in light of the increasing diversity within FE college settings in England (Section 3.5), the inclusive strategies employed to support diverse group of students, many of whom navigate the complex intersections of identity, culture, and educational experiences, were explored. This study was therefore underpinned by a commitment to equity and inclusion, drawing on a favourite Pauline quotation in Galatians 3:28 (Holy Bible, New International Version), "There

is neither Jew nor Gentile, neither slave nor free, nor is there male and female, for you are all one….". This, to me, sums up the equity, diversity and inclusiveness (EDI) that should pervade science education in my FE sector and emphasises the continuous need to pursue equity for all my students, irrespective of background or status.

1.2 Research Overview

This study investigated how science is [mis]conceptualised and experienced in an FE context, drawing on qualitative semi-structured interviews with students and their science teachers. It explores how these experiences are shaped by intersecting dimensions of diversity, equity, and inclusion, as [mis]understood and enacted through the lens of science capital (SC) theory. SC, a sociological theoretical framework developed by Archer et al. (2013a, 2014, 2015b, 2020a), builds upon Bourdieu's cultural capital theory (Bourdieu and Passeron, 1990; Bourdieu and Wacquant, 1992), referring to the science-specific cultural and social capitals that influence individuals' engagement with and aspirations in science. The SC framework, formulated by Archer et al. (2013, 2015), remains the most powerful tool to date for understanding how young people in compulsory education in England engage with science. This reveals how science participation is shaped not only by knowledge but also by identity, social networks, and cultural narratives, as detailed in the literature review (Sections 2.5 and 2.6).

Additionally, Archer et al.'s longitudinal ASPIRES studies (Archer et al., 2013a, 2020a), which have tracked the science aspirations and identities of young people in England since 2009, demonstrate that the uneven accumulation of SC contributes to persistent inequalities in science participation, shaping who feels entitled to belong in science and who is likely to be systematically excluded from it. While the SC framework has been extensively applied to compulsory (primary and secondary) science education in England (Archer et al., 2013 2013a, 2014, 2015, 2020, 2020a; King et al., 2015; Godec et al., 2017, 2018; Mujtaba et al., 2018; Moote et al., 2019, 2020) and internationally (Henriksen, Dillon and Ryder, 2015; Du and Wong, 2019; Jones et al., 2020), there remains a significant gap in understanding how SC manifests in post-compulsory education, particularly in FE colleges, which serve some of the most socio-economically and culturally diverse student populations in England. This study addresses this gap. Sections 2.5 and 2.6 evaluate the existing literature on SC and situate its relevance to the FE college sector. By focusing on the lived experiences of students and their teachers, this research aims to illuminate how SC is [mis]conceptualised, experienced, and

operationalised in my department, and how these [mis]conceptualisations intersect with broader issues of diversity and inclusion, including socioeconomic background, ethnicity, gender, and language

1.3 Statement of the Problem

While the SC framework has been extensively applied to compulsory (primary and secondary) education in England to understand disparities in science engagement and progression, its significance in the post-compulsory FE college vocational science sector remains significantly underexplored. An important difference between pre- and post-compulsory science FE education in England is that, in the latter, all students choose to enrol in science (rather than being mandated), with the majority of them being interested and motivated enough, albeit for various reasons, to do so. However, very few existing studies on SC in and outside the UK have captured the SC perceptions and experiences of students in FE colleges. SC studies have predominantly focused on compulsory education (DeWitt et al., 2010; Dewitt, Archer and Osborne, 2014; Archer et al., 2015, 2020, 2020a; King et al., 2015; Godec et al., 2017, 2018; Mujtaba et al., 2018; Christidou, Papavlasopoulou and Giannakos, 2021; Kontkanen et al., 2024), leaving a gap in understanding how SC is [mis]conceptualised and experienced by learners in FE college contexts in England and elsewhere. The few post-compulsory studies on SC outside England (Wilson-Lopez et al., 2017) and in England include an investigation into the profiles of students who study STEM subjects at advanced and degree levels (Cordiroli Mcmaster, 2017). Furthermore, a survey of 17-18-year-old students' SC patterns (Moote et al., 2019, 2020) and explorations of SC and STEM identity among some undergraduate students (Black and Hernandez-Martinez, 2016; Godec et al., 2024) have been reported.

This gap is especially critical given the demographic complexity of FE colleges, which often serve students from minoritised ethnic backgrounds, lower socioeconomic groups, and non-native English-speaking communities. These learners frequently encounter systemic barriers to science engagement and progression (Section 3.5), however, their voices and experiences are largely underrepresented in the current literature. By focusing on this demographic, this study seeks to illuminate how intersecting factors, such as race, class, gender, and language, shape students' access to and perceptions of SC, thereby contributing to a more inclusive understanding of their SC. Additionally, there is limited insight into how science educators in FE college settings in England perceive and respond to their students' and their own SC.

Teachers' [mis]conceptualisations and pedagogical strategies are pivotal in shaping students' science identity and aspirations; however, little is known about how these are enacted in vocational science environments in the FE college sector. Without a nuanced understanding of both student and teacher perspectives, efforts to promote inclusive science education and SC risk being superficial or misaligned with learners' lived realities. Furthermore, the limited qualitative research in this area compounds the problem, as it restricts the depth of insight into the socio-cultural dynamics that influence science engagement in the region. Hence, this study's qualitative approach allows for a deeper exploration of experiences, contrasting the predominantly quantitative methods used in prior SC research (Archer et al., 2013a, 2020a). This methodological shift is essential for capturing the nuanced ways in which students and teachers may [mis]conceptualise SC and inclusion within vocational education.

The inclusion of teachers' perspectives further enriches the analysis, offering insights into pedagogical strategies and institutional practices that may either reinforce or challenge existing [in]equalities. In addition to its theoretical contributions, this study has practical implications for curriculum design that may be linked to national educational policies. By identifying inclusive strategies that enhance SC among underrepresented learners, this study can support efforts to improve equity, access, and social mobility in science education. This is particularly relevant given the ongoing concerns about socioeconomic disparities in post-16 progression (SFCA, 2021; College SAR, 2024/25) and the need to diversify pathways into science-related careers.

Therefore, this study seeks to address these gaps by employing SC, both as a conceptual framework and as an analytical lens, to interrogate how science is [mis]conceptualised and enacted through learning and pedagogical practices. Particular attention is given to how SC interacts with issues of diversity and inclusion, especially in vocational science contexts, where students' backgrounds and experiences may diverge significantly from the dominant narratives of science success. By examining the socio-cultural dimensions of SC, this study aims to contribute to a more equitable and contextually grounded understanding of SC in the post-compulsory education context in an FE college in London.

1.4 Research Questions

Given the limited application of the SC framework in FE colleges in England and the need to understand how diverse learners engage with vocational science in this sector, this study seeks to address the following research questions (Figure 1). These questions are designed to explore the conceptual, experiential, and pedagogical dimensions of SC in a context where equity and inclusion are both critical and contested. By engaging with these questions, this study seeks to generate new knowledge that can contribute to informing policies, practices, and theories in science education, particularly within the under-researched domain of this study's context.

Figure 1: Research Questions

RQ 1: How do students and teachers perceive science capital, and how do these perceptions influence their science engagement?

RQ 2: How do intersecting dimensions of identity, such as gender, ethnicity, socioeconomic background, and English language proficiency, influence participants' science capital?

1.5 Context

This study was conducted at a FE college in North London, where I currently serve as the Curriculum Manager for Science and Engineering and teach Chemistry. The college is characterised by a diverse, multi-ethnic student population, the majority of whom are English as an Additional Language Speakers (EALS). This demographic profile provides a context for exploring how intersecting factors, such as socioeconomic status, ethnicity, cultural background, gender, and language proficiency, shape students' SC and their engagement with science education. The lived realities of these learners, often marked by structural inequalities and educational disadvantages, make the FE sector a critical site for investigating equity in science learning. The FE sector in England plays a pivotal role in supporting post-16 learners' progression to higher education (HE), apprenticeships, and employment. However, as detailed in Section 3.5, evidence suggests that social class-linked disparities continue to affect access and outcomes in post-secondary FE (Association of Colleges, 2019; Office of Students, 2020b) and HE (Osborne, 2003) in the UK (Dewitt and Archer, 2017). These disparities are particularly pronounced in urban colleges serving marginalised communities

(Trust for London, 2025), where students may face compounded barriers to participating in science-related pathways.

Within this context, the principles of Equity, Diversity, and Inclusiveness (EDI) are not only policy imperatives (FCA, 2021; Cabinet Office, 2024) but also pedagogical necessities. For colleges serving diverse, multi-ethnic, and socio-economically disadvantaged populations, as in this study's context, EDI is not merely a compliance issue but a pedagogical imperative. Hence, EDI in FE is concerned with creating inclusive learning environments that recognise and respond to the diverse needs of learners. It encompasses curriculum design, staff development, and institutional culture, all of which should be aligned to ensure that students from under-represented backgrounds are not only present but also meaningfully engaged in their learning (College SAR, 2024/25).

Furthermore, the UK national agenda of widening participation (DfE, 2025d; Osborne, 2003) reinforces the importance of inclusive education by aiming to increase the representation of learners from disadvantaged and historically excluded groups in higher education (HE). In the FE context, widening participation initiatives should increase the enrolment of students from low-income households, ethnic minority communities, and those with limited prior achievements. However, 'widening participation' is different from 'access', which refers to the removal of structural and systemic barriers that prevent learners from fully engaging with educational opportunities; While 'widening participation' addresses who enters the system, 'access' interrogates how learners experience the system once they are inside. In this study, access barriers include limited science capital, language challenges, cultural disparities, and socio-economic constraints, factors that are particularly salient in FE settings where students often arrive with fragmented educational histories and minimal exposure to science-related experiences outside the classroom (Archer et al., 2015; College Self-Assessment Report 2024/25). My college's context was further informed by a longitudinal review of institutional inspection reports, which highlighted shifting priorities in curriculum provision, learner progression, and equality-related practices over time (College Ofsted Reports, 2011, 2020, 2022).

By situating this study within this complex and dynamic educational landscape, it aims to contribute to a more nuanced understanding of how SC is shaped, constrained, and potentially transformed within the FE sector. It also seeks to advocate for more equitable and culturally responsive approaches to SC acquisition that align with both EDI principles and widening participation goals while critically addressing the persistent access barriers that continue to marginalise certain learner groups. In doing so, the study aligns with calls for inclusive science education practices that recognise and value the diverse forms of knowledge, experience, and identity that learners bring to the classroom (Archer et al., 2015; College SAR, 2024/2025; SFCA, 2021). Against this backdrop of structural inequality and demographic diversity, Section (1.6) outlines the theoretical frameworks that underpin this study's analysis of SC from an EDI viewpoint.

1.6 Theoretical Frameworks Employed

As introduced in this section and detailed in Sections 2.4 and 2.5, the theoretical frameworks for this study are grounded in (i) the Science Capital theoretical conceptualisation developed by Archer et al. (2013a, 2015) (Section 2.5), which reconceptualises science engagement through the lens of cultural capital, encompassing science-related knowledge, attitudes, experiences, and social networks. This framework is particularly pertinent in the FE sector, where learners often possess non-traditional educational trajectories and limited exposure to science-related resources, thereby influencing their capacity to engage with and succeed in science. SC is not merely an individual attribute but is shaped by broader social structures and institutional practices, which are best understood through Bourdieusian theories of capital, habitus, and field (Bourdieu and Passeron, 1990; Bourdieu and Wacquant, 1992) (Section 2.4). These theories provide a foundation for analysing how educational inequalities are reproduced. In the FE context, the concept of habitus is particularly useful for understanding how students' dispositions towards science are shaped by their socioeconomic backgrounds, while the notion of field allows for an examination of how FE institutions operate as contested spaces where different forms of capital are [de]valued.

Furthermore, Crenshaw's (1989, 1991, 1998) theory of intersectionality (Sections 2.2 and 3.10) deepens this analysis by emphasising the multiplicity of social identities and the ways in which their intersections produce unique experiences of marginalisation. Within FE science

education, intersectionality enables a critical examination of how race, gender, and class interact to shape students' access to resources, pedagogical support, and recognition. For example, a Black female student from a working-class background may encounter compounded barriers that policies targeting singular dimensions of inequality do not adequately address. Furthermore, Tajfel and Turner's (1978, 1979) Social Identity Theory (SIT) (Section 2.5.2c) complements this by offering insight into the psychological mechanisms through which individuals affiliate with social groups. In the FE sector, where students often navigate complex identity formations, SIT helps explain how group membership, whether based on ethnicity or gender influences students' sense of belonging in science classrooms. According to this theory, individuals categorise themselves and others into social groups, leading to in-group favouritism and out-group bias. In science education, this dynamic may manifest in the marginalisation of students who do not conform to the dominant norms of scientific identity, thereby affecting their participation and achievement.

Critical Race Theory (Ledema and Calderón, 2015; Delgado, 2017; Stefancic and Harris, 2017) (Section 2.5.2d) further interrogates the structural dimensions of race and racism within educational institutions. CRT challenges the notion of meritocracy and colour-blindness by exposing how systemic inequities are embedded in curricula, assessment practices, and institutional cultures. In the FE sector, CRT provides a lens for analysing how racialised students experience science education, not only in terms of access but also in terms of epistemic inclusion, that is, whose knowledge is valued, whose voices are heard, and whose experiences are legitimised, in accordance with Bourdieusian 'symbolic violence' (Section 2.4). For instance, the lack of culturally responsive pedagogy is indicative of the exclusions that CRT seeks to illuminate.

These theoretical frameworks are not discrete but are interwoven, collectively offering a multidimensional analytical lens. SC theory draws directly from Bourdieu's conceptual toolkit, whereas intersectionality and CRT extend the analysis to include power relations and systemic discrimination. SIT bridges sociological and psychological perspectives, providing insights into how identity and group dynamics influence educational engagement. Together, these frameworks enable a comprehensive exploration of how science is conceptualised, taught, and experienced in FE settings, particularly among students from diverse and historically marginalised backgrounds. The next section (1.7) provides an overview of the dissertation.

1.7 Dissertation Overview

This dissertation comprises seven chapters, each contributing to a critical and nuanced exploration of science capital within the study's context. Chapter 1 introduces the study by outlining its aims, the central research problem, and the theoretical frameworks that underpin the enquiry, namely, Bourdieu's theory of practice (Bourdieu, 1977, 1977a,1977b, 1977c, 1977d, 1984, 1986, 1989, 1990, 1995; Bourdieu and Passeron, 1990; Bourdieu and Wacquant, 1992), and Archer et al.'s conceptualisation of science capital (Archer et al., 2010, 2013a; 2014; 2015; 2016, 2020a). It also establishes the relevance of the research within the FE sector and presents the guiding research questions, thereby laying the conceptual and methodological foundations for the subsequent chapters. Building on this foundation, Chapter 2 presents a comprehensive literature review that situates the study within the UK educational policy landscape (Section 2.3), while engaging critically with Bourdieusian concepts such as habitus, field, and capital (Bourdieu, 1977, 1977a,1977b, 1977c, 1986, 1990, 1995) (Section 2.4). The chapter then examines Archer et al.'s science capital framework (Archer et al., 2010, 2013a, 2014, 2015, 2016, 2020a) (Sections 2.5 and 2.6), incorporating discussions of intersectionality and the structural challenges faced by learners in the English FE sector.

Chapter 3 transitions from theoretical exploration to practical application by focusing on the operationalisation of science capital in education research. It reviews the literature on the SC framework's limitations (Section 3.11), interrogates its entanglement with colonial structures of power (Section 3.12), and proposes decolonial strategies for making science education more inclusive and culturally responsive (Section 3.13). Chapter 4 outlines the methodological approach, detailing the qualitative design, the use of semi-structured interviews, the rationale for participant selection, and ethical considerations. It also explains the analytical strategy, drawing on Braun and Clarke's reflexive thematic analysis (Braun and Clarke, 2006, 2013, 2016, 2019, 2020, 2022, 2024).

Chapter 5 presents the empirical findings, organised thematically and supported by participant narratives, which are interpreted through the lens of the theoretical frameworks introduced earlier. Chapter 6 deepens this analysis by discussing the findings in relation to the existing literature, offering a critical interpretation of how science capital manifests within the FE context, as exemplified by the study population. Finally, Chapter 6 concludes

the dissertation by synthesising the key insights, acknowledging the study's limitations, and offering recommendations for policy, practice, and future research to promote equity and inclusion in science education across the FE sector in England.

1.8 Conclusion

Having established the rationale, theoretical foundations, and structural outline of the dissertation in Chapter 1, the next chapter reviews the literature that informs this study in detail. Chapter 2 conducts an extensive review of studies that examine relevant global and national education policies, engage with Bourdieusian theory, and explore the development and application of Archer's science capital theoretical framework. This review situates the research within existing scholarly debates and identifies key gaps and tensions that justify the study's focus on equity and inclusion in science education within the FE sector.

Chapter 2

Science Capital Theoretical Conceptualisation

2.1 Introduction

Building on the theoretical foundations and research rationale established in Chapter 1, this chapter critically reviews the existing literature that informs the study's conceptual and empirical frameworks. It begins by examining UK education policies that shape science education (Section 2.3), with particular attention to how these policies intersect with issues of equity and access in the Further Education (FE) sector (Section 2.3). The chapter then explores key theoretical constructs, including Bourdieu's notions of habitus, field, and capital (Bourdieu, 1977, 1977a,1977b, 1977c, 1986, 1990, 1995) (Section 2.4), which underpin the study's analytical lens. Central to this review is Archer et al.'s science capital framework (Archer et al., 2010, 2013a; 2014; 2015; 2016, 2020a) (Section 2.5), which is interrogated in relation to intersectionality, media engagement, and sociocultural factors. The social identity theory (Tajfel, 1978) (Section 2.5.2(c)) and the critical race theory (Ledema and Calderón, 2015; Delgado, 2017; Stefancic and Harris, 2017) (Section 2.5.2.(d) are also employed. Through this review, this chapter identifies gaps in the literature and establishes a scholarly context for operationalising science capital in localised settings such as the FE sector in England.

2.2 Intersectionality Framework

As introduced here and detailed in Section 3.10, one of the highlights of this study is the engagement of an intersectional lens to explore how students' and teachers' [mis]understandings of SC and inclusion may be shaped by intersecting identities within the study's context. Coined by Crenshaw (1989, 1991, 1998), intersectionality is a framework for understanding how overlapping aspects of identity, such as gender, race, class, religion, and culture, may interact to shape experiences of diversity, privilege, and oppression. In science education, this theory offers a critical lens for examining how these identities and systemic structures may influence access to and engagement with science. This reveals that SC is not equally distributed and that barriers are compounded rather than additive. By situating SC

within these intersecting axes of power and [dis]advantages, SC analysis moves beyond additive models of possible [dis]advantages to a more nuanced understanding of how structural [in]equities shape science participation and aspiration.

Additionally, Government science-related policies often shape the conditions under which FE colleges operate, and these structural decisions intersect with the diverse identities of learners in ways that can either widen or mitigate inequities. Thus, FE colleges serving multicultural communities with higher proportions of students from working-class and other marginalised backgrounds can find themselves disproportionately constrained in their capacity to deliver inclusive science education. The uneven distribution of resources, specialist staffing, and employer partnerships (Trust for London, 2021a, 2021b, 2025) means that policy implementation is usually inconsistently experienced across the sector; it tends to compound pre-existing inequalities embedded in students' social situations. Understanding FE science provision through an intersectional lens reveals how policy decisions, though seemingly neutral, tend to reproduce patterns of [dis]advantage, shaping which learners can fully access, progress within, and feel a sense of belonging in science pathways. Hence, the next section (2.3) focuses on how the implementation of UK government science-related policies tends to impact FE colleges and their capacity to deliver equitable science learning.

2.3 UK Government Science Policies and Further Education Colleges

This section reviews of how UK government science policies and strategies implemented in England tend to shape the conditions within FE colleges in England. Education policy in FE increasingly reflects global economic priorities, where competitiveness, performance, and skills formation are emphasised, often narrowing how learning and value are defined (Dale and Robertson, 2004b; Lauder et al., 2006). UK policy discourse has increasingly framed public understanding of science and engineering as a priority, positioning engagement, awareness, and communication as routes to participation and legitimacy within scientific fields, while emphasising the importance of developing a technologically skilled workforce to meet future economic demands (DfE, 2019a, 2025, 2025b, 2025c; DSIT, 2024, 2025a, 2025b; GOV.UK, 2015, 2025). Within the English FE system, statutory guidance places responsibility

on providers to monitor and sustain young people's participation in education or training, thus, shaping institutional priorities around progression, retention, and employability rather than broader forms of learning or recognition (DfE, 2016, 2018). Also, the realities within FE institutions often reflect chronic under-investment and structural inequities (DfE, 2019b, 2023a, 2024a, 2024b 2025a, 2025b; Kalliomäki et al., 2024; Kontkanen et al., 2024). Meanwhile, the FE sector in England serves a disproportionately high number of disadvantaged learners (Augar Review, 2019; Office for Students, 2020a; Ofsted, 2021, 2023; GOV.UK, 2021b; Lewis, Bolton, and Hubble, 2021; Powell and Francis-Devine, 2021; SFCA, 2021; Trust for London, 2021a, 2021b, 2025), and continues to face significant challenges in delivering high-quality science education. These may include funding disparities, staffing shortages, and limited infrastructure, all of which undermine the sector's capacity to fulfil national and individual science ambitions. By examining these tensions, this section highlights the disconnect between policy rhetoric and institutional realities, setting the stage for a deeper analysis of how these conditions may affect learners' science identity and aspirations.

The latest UK government 'Spending Review 2025 Policy Paper' was published in June 2025 (GOV. UK, 2025) pledged to increase Research & Development (R&D) funding across the UK to £22.6 billion per year by 2029-30, with £410 million to be provided for a Local Innovation Partnership Fund to support local leaders to drive innovation excellence across the UK, among other pledges linked to STEM education and industries in the devolved countries of England, Scotland, Wales and Northern Ireland. Additionally, the Department for Science, Innovation and Technology (DSIT) pledged a 'Transformative £86 billion boost to science and tech to turbocharge economy, with regions backed to take cutting-edge research into own hands' (DSIT, 2025a, p.1). While these allocations are ambitious, their impact on FE colleges tend to remain limited historically. These policies aim to boost national competitiveness but often overlook the structural barriers that limit science engagement among underrepresented groups (Kalliomäki et al., 2024; Kontkanen et al., 2025; The Royal Society, 2024).

The Science and Technology Framework (published on 28 April 2025) (DSIT, 2025b) is the latest UK government flagship policy that aims to position the UK as a global leader in science and technology while aiming to improve the lives and economic resilience of its citizens. It outlines a strategic plan to boost national growth and innovation by focusing on ten key areas including developing critical technologies such as AI and quantum computing, promoting UK

strengths globally, increasing research and development investment, building a skilled workforce, expanding international collaboration, and enhancing research infrastructure. While visionary, its focus on elite science and innovation ecosystems risks marginalising FE learners, who are often excluded from high-status STEM pathways. Kalliomäki et al., (2024, p.1) argue that such policies often instrumentalise inclusion to serve economic agendas, resulting in a "decoupling dilemma" where inclusive rhetoric is not matched by structural changes. In addition, such policy's ambition may be constrained by practical realities such as budget limitations and politicking, thus highlighting the need for government policies to be depoliticised and accompanied by sustained investments that transcend the rhetoric of the government of the day, especially in FE contexts.

The DfE (2025a), which aims to make post-18 education more flexible by allowing learners to access funding for modular study (DfE, 2025a), is another relevant UK government policy that will replace the HE student finance and advanced learner loans when commences in September 2026; its aim is to 'transform the post-18 student finance system to create a single post-18 student funding system' (p.1). Furthermore, a key FE-specific science education policy is the Post-16 Skills Plan and Technical Education Reform, which is a suite of reforms, including T Levels and Institutes of Technology, aimed at strengthening technical science education in FE colleges (DfE, 2023a). T Levels, the latest UK government policy initiative to streamline and improve post-16 qualifications, are a set of two-year post-GCSE (General Certificate of Secondary Education) courses in England, equivalent to three Advanced Levels (AL), combining classroom learning with industry placement and offering a technical route alongside AL and apprenticeships. Launched in 2020 and developed with employers, T Levels aim to prepare students for skilled work, apprenticeships, or further study (DfE, 2023b; T Levels Official Website, (n.d.)). These initiatives are designed to promote employer engagement and applied learning, which can enhance SC by connecting classroom science to real-world contexts. However, critics argue that the reforms risk reinforcing social stratification by tracking working-class students into vocational routes with limited progression to higher-status STEM careers (DfE, 2016a; 2016b).

Other government policies that impact science education in FE colleges include Local Skills Improvement Plans (LSIPs) (DfE, 2024a) that align FE provision with local employer needs, ensuring that science education meets regional labour market demands; STEM Priority

Funding (DfE, 2025b) where STEM subjects receive higher funding rates to encourage provision and investment in science education; Apprenticeship Reforms (DfE, 2025c) that include shorter apprenticeships, streamlined assessments, and new science-related pathways like lab tech and biotech; Digital and EdTech Strategy (DfE, 2019a) that promotes digital infrastructure and tools like virtual labs to enhance science teaching and learning; SEND and Inclusive Education Policy (DfE, 2014) that requires science education to be inclusive and accessible for learners with special educational needs and disabilities; Teacher Recruitment and Retention Strategy (DfE, 2019b) that supports the recruitment and retention of science teachers through incentives, workload reduction, and early career support; Green Skills and Sustainability Strategy (DfE, 2023) that embeds climate science and sustainability into curricula to prepare learners for green careers; and the Ofsted Education Inspection Framework (Ofsted Inspection reports, n.d.) that assesses the quality and intent of science curricula, teaching, and learner outcomes in FE. Ofsted reports often highlight challenges such as inconsistent teacher training, limited industry links, and a narrow curriculum focus that often fails to reflect students' experiences.

The Advanced British Standard (ABS) Proposal (2024) is another government policy initiative in the pipeline aimed at a unified post-16 qualification combining academic and technical education (DfE, 2024b) to break down the binary divide between A-levels and vocational science, offering a more inclusive model. However, its success, if and when implemented, hinges on how science is framed within the qualification, whether as a gatekeeper or gateway to opportunity. These policies have the potential to democratise science education for adult learners in FE colleges. However, as noted by Kontkanen et al. (2024), the success of such initiatives depends on how SC is operationalised in curriculum design and whether learners' social and cultural contexts are meaningfully addressed. A counterargument is that vocational science pathways already provide inclusive opportunities for diverse learners; however, research shows that vocational tracks can reinforce social stratification if they are perceived as lower-status or disconnected from academic progression routes (DeWitt and Archer, 2017).

In FE settings, students often arrive with low SC due to prior educational disadvantage (DeWitt and Archer, 2017). In my opinion, much needs to be done to bridge the diversity, inclusion, and policy-practice gap in FE colleges. Despite rhetorical commitments to inclusion, many policies fail to address the intersectional barriers faced by FE science learners, particularly those from minoritised, working-class backgrounds. Cobian et al.'s

(2024) study on inclusive science education argues that true inclusion requires challenging the dominant norms of "excellence" and reimagining science as a pluralistic, socially embedded practice. Basu and Barton (2007) and Carlone (2006) advocate science curricula that connect with students' everyday lives. However, such approaches remain limited in FE colleges, where accountability pressures and narrow curricula constrain innovation. The Advanced British Standard could support more flexible, learner-centred science education, but only if equity is embedded in its design and delivery.

In addition, the conceptualisation of science as abstract, exam-driven, or elite can either reinforce or challenge these barriers (Godec, King and Archer, 2018, 2024). Kontkanen et al. (2025) emphasise the need for conceptual clarity in how SC is applied in policy and practice. Without this, well-intentioned reforms risk becoming tokenistic and ineffective. Mamlok-Naaman (2024) further argues that inclusive science education requires systemic support, including teacher training and curriculum redesign, elements that are often limited from current FE policies. In light of the structural challenges outlined in UK government science policies and their potential impact on FE colleges, the next section (2.4) applies Bourdieusian theoretical frameworks to critically analyse how these systemic conditions may shape students' science-related dispositions, aspirations, and access.

2.4 Bourdieusian Theoretical Frameworks

Bourdieu's Theory of Practice (Bourdieu, 1977, 1977a,1977b, 1977c, 1977d, 1984, 1986, 1989, 1990, 1995; Bourdieu and Passeron, 1990; Bourdieu and Wacquant, 1992) explains the link between individual action and social structures. Thus, as expatiated in this section, this theory is summarised as follows: [(Habitus) × (Capital)] + Field = Practice. According to this formula, practice (an outcome) within a social space (field) emerges from the interactions of internalised disposition (habitus) and externalised useful resources (capital). Bourdieu and Passeron's Theory of Social Reproduction focus on the functions and power of education to [re]produce social inequalities, hence extending and applying the Bourdieusian Practice Theory to the perpetuation of educational inequalities. Bourdieu and Passeron postulate that 'every power which manages to impose meanings and to impose them as legitimate by concealing the power relations which are the basis of its force, adds its own specifically symbolic force to those power relations' (Bourdieu and Passeron, 1990, p.4). Bourdieu and

Passeron also assert ‘all… pedagogic actions are, objectively, symbolic violence insofar as it is the imposition of a cultural arbitrary by an arbitrary power’ (Bourdieu and Passeron, 1990, p.5).

Habitus is one of the Bourdieusian tripartite conceptualisations of the interplay of field-habitus-capital. Habitus is one’s predisposition that results from internalised learning activities that have the power of being transformed into cultural capital within a social field. For instance, the 3Rs in education (reading, writing, and ‘rithmetic) are family habitus accumulated at an early age that can be leveraged later to enhance academic achievements, engaging with science-related media, and visiting science museums. The family is the main source of habitus (primary habitus); habitus is not natural but acquired. Fields (such as education and science) are the subspaces within multidimensional societal spaces where the distribution of capital (valuable assets and exchangeable resources, such as education, that accord their possessors advantages within a social field (Broady, 2014; Archer et al., 2015) occurs. Bourdieusian class refers to one’s position and predisposition within a field. Each field has its own rules (doxa) by which an individual is allocated a legitimate position in the field. Bourdieu’s concept of the field provides a macro-level lens for understanding how educational inequalities are structured and reproduced. Within this framework, individuals’ positions are shaped by their habitus and access to capital, which interact with the logic and hierarchies of specified social spaces (that is, fields).

Habitus plays a central role in shaping students’ dispositions toward science by influencing their engagement, aspirations, and their sense of belonging. Operating subconsciously, habitus guides behaviour in ways that feel intuitive yet are deeply socially conditioned. It is not static or uniform; rather, it is multiscalar, historically sensitive, and capable of transformation. For instance, habitus provides a framework for analysing how intersecting dimensions of identity, such as gender, ethnicity, socio-economic background, and language proficiency, interact with the science field to either facilitate or hinder access to SC. This means that the more concealed (misrecognised) the power inherent in a form of domination, the more successful it will be in inculcating and legitimising its ideology. For instance, the 3Rs (reading, writing, and ‘rithmetic) are the fundamental skills required for education at all levels and are therefore taught in schools. An example involving students BB and DD illustrates Bourdieu’s notion of concealed arbitrariness, where the dominant cultural capital, English language proficiency and early exposure to the 3Rs, is treated as neutral and universally accessible despite being deeply rooted in specific UK socio-cultural contexts. BB,

born in England and socialised into dominant linguistic and educational norms, enters the classroom with a family habitus aligned to the field, giving them an unacknowledged advantage over DD, whose high SES background is offset by their recent immigration and Iranian Farsi-based early education.

According to Bourdieu and Passeron (1990), BB's advantage is misrecognised as a natural ability rather than the product of prior cultural conditioning, thereby legitimising unequal starting points. The institutional failure to recognise and compensate for DD's linguistic and cultural displacement constitutes symbolic violence, as the educational system imposes dominant norms while disregarding alternative forms of capital. Consequently, DD experiences disadvantage not because of a lack of ability or effort, but because their habitus is misaligned with the expectations of the classroom field to read and write in English. This dynamic reinforces educational inequalities under the guise of meritocracy, illustrating how symbolic structures perpetuate exclusion while appearing to be neutral.

Empirical studies further illuminate these dynamics. The findings of Moll et al's. (2023), in their study of secondary school students in Luxembourg, challenged traditional assumptions about socio-cultural reproduction, showing that academic excellence is not directly tied to parental socio-economic status but is more closely associated with highbrow cultural capital and structural social factors such as immigration and family employment. Gender also emerges as a significant factor, particularly among privileged students, suggesting that habitus formation is shaped by complex and intersecting influences. Additionally, Ignatow and Robinson (2017) engaged habitus to analyse how students engage with science through digital platforms, reporting that students from working-class backgrounds may cultivate scientific dispositions through YouTube tutorials or online communities, even when formal educational opportunities are limited. Hence, habitus offers a powerful lens for understanding how students navigate the science field by revealing how their dispositions are shaped by social conditions.

For a capital to be considered 'symbolic', according to Bourdieu, it must be recognised and accepted as valuable in the field where it is expressed. For instance, while a PhD qualification in science is valued in scientific research and is symbolic capital in this field, it is unrecognised in the skiing industry. In addition, enhancing my students' SC through well-structured visits to The Science Museum and The Natural History Museum in London will directly contribute to their symbolic capital because the knowledge and skills gained will

directly enrich their scientific literacy. However, a visit to The Victoria and Albert Museum, though desirable, will not have a similar effect in the science field. Additional forms of capital identified by Bourdieu, which work singly and also interrelate to position someone in a field, include economic capital (monetary and materialistic possessions and wealth accumulation), social capital (family relations and connections), educational capital (such as qualifications), and cultural capital. Cultural capital (CC), as theorised by Bourdieu (1986), is a non-economic know-how acquired by individuals that confers them with distinctive advantageous attributes and legitimises their position of power over others in a field, resulting in social inequalities. It exists in three forms: embodied (knowledge that resides within, such as reading ability), objectified (acquisition of materials, such as expensive cars), and institutionalised (obtained formally, such as qualifications). In education, these forms are unequally distributed and aligned with the dominant commonly accepted norms to the disadvantage of, say, the minoritised and racialised groups, thus [re]producing social [dis]advantages.

CC is Bourdieu's most popular key concept, which, along with economic capital, constitutes the most powerful and effective asset (Bourdieu and Passeron, 1990). Thus, Bourdieu's theory of cultural reproduction is considered the most insightful cultural reproductive model (Giroux, 1983). He postulates that, although there is a differential accumulation of CC linked to educational attainment based on one's social class background, educational systems assume the possession of CC by all students, thus disadvantaging students who are unlikely to have it. For instance, the one-size-fits-all vocational science syllabi mandated by examination boards and their structured examinations do not meet the needs of my students' demographic diversity. Therefore, it is contingent on us as curriculum planners and teachers to find innovative pedagogical methods to meet the diverse needs of our students. This is very challenging in my experience; however, awareness of this need is a starting point for addressing inequity. In my department's Level 3 science groups, Native English Language Speakers (NELS) possess the dominant linguistic capital, with the likelihood to navigate classroom spaces with ease, while their English Additional Language Speakers (EALS) peers may face barriers to linguistic access and recognition. These disparities, rooted in familial privilege, contribute to institutional legitimisation and the likely reproduction of inequality (Bourdieu's 'misrecognition') (James, 2015), where something (a situation, process, or action) is not recognised for what it truly is. Instead, it is attributed to another realm of meaning, often concealing underlying interests or inequalities in the process.

Research consistently shows that CC shapes outcomes by aligning institutional expectations with those of the middle class. Grenfell (2009) argues that policy and pedagogy privilege middle-class dispositions by embedding them in curricula and classroom practices. Quaye and Pomeroy (2022) similarly show that students from higher socio-economic backgrounds possess science-related CC, that will likely enhance confidence and achievement. Cartwright (2022) critiques CC as racialised, revealing how White-led institutions selectively value traits in non-White students that signal non-threateningness. This insight parallels the SC, which is also shaped by institutional perceptions of legitimacy. For instance, Reay et al. (2007) show how white middle-class families seek multicultural capital while marginalising working-class students, with their children's 'omnivorousness", fluidity across cultural spaces, emerging as a form of capital and reinforcing privilege. In this study's context, such assets are evident in my students who persist and take the initiative, challenging deficit narratives and calling for the inclusive recognition of diverse engagement. These studies affirm that CC is not neutral; it is classed, racialised, and institutionally mediated, shaping the students who are legitimised within science education.

On the contrary, the more a teacher knowingly (or usually unknowingly) legitimises and reproduces dominant habiti while disguising its symbolic violence, the more effective the perpetuation of social inequalities will be. For instance, in the UK higher education (HE) sector, the valuing of academic AL over vocational AL qualifications as entry requirements (Bowls, 2012) inculcates and communicates the dominant middle class's habitus and cultural arbitrary as natural and legitimate, while relegating the cultural capitals of the dominated lower class groups, such as many of my students who study vocational science. This means that most HE institutions in the UK will not accept my vocational science students to study medicine and dentistry for what seem to me to be inequitable reasons, including the lack of academic rigour in vocational science (Advancing Access, 2021). This aligns with the UK Universities and Colleges Admissions Service (UCAS) findings that49% of English 18-year-olds with post-16 vocational qualifications who enter HE, 3% enter higher tariff providers. This is significantly less likely than those with academic-based qualifications (27%)' (UCAS, no date). However, UCAS' seeming acceptance of this status quo is intuitive by advising that' prospective students and their advisers should check university and college websites before making decisions and submitting applications' (UCAS, no date), indicating that no national policy change is on the horizon. This is despite my students having equivalent qualifications and extensive planning, research, experimentation, analysis, and report writing skills gained from their mainly coursework-based assessments. My team proactively addresses this disparity

by partnering with and exposing our students to organisations that work with FE colleges to prepare students for the required selective UK University Clinical Aptitude Test (UCAT) for admission to medicine and dentistry.

Furthermore, Bourdieu and Passeron (1990) highlight language's role in reproducing social inequalities. They see language as a valuable cultural capital (linguistic capital), which is acquired and exchangeable for other forms of capital and subject to invisible political and power relations. This means that my Native English Language Speakers (NELS) students, whose linguistic capital is assumed to be more desirable, are likely positioned to navigate their field more successfully than their English as Additional Language Speakers (EALS) peers, whose linguistic capital is 'othered', given that English is the only recognised language of teaching and learning in England. The implication of this includes the national policy-driven legitimisation of English language and the consequential disadvantages to my EALS students compared with their NELS peers who are likely to navigate their examinations and coursework assessments better, partly because of their reading, writing and comprehension habiti. In addition, successful navigation of the scientific field requires comprehension, demonstration, and utilisation of specialised scientific terminologies and expressions that include research, analysis, and evaluation of experimental results and report writing, most of which are not formally taught. These are usually acquired as primary habitus by many NELS students through, for example, visits to museums, educated parents, and an acquired flare for learning. On the contrary, their EALS peers, who have little of such habitus, will likely experience difficulties; this is another example of Bourdieu's 'misrecognition' (Bourdieu and Passeron, 1990) that contributes to social inequalities.

However, the EALS students' prior experiences of being taught in their native (non-English) language can potentially equip and constrain them. Where pedagogies encourage translanguaging and cross-linguistic practices, EALS students will likely harness their habitus-linked linguistic capital (such as scientific reasoning and sophisticated argumentation in their native language) that is transferable to English medium science. In contrast, and as is most likely to be currently practised in the FE science sector, if English language alone is legitimised as the currency of cognition, teaching, and assessment, these assets are often devalued or rendered invisible, thus converting potential advantages into disadvantages. The potential implications of this study are evaluated in Section 6.9.

Additionally, Reay's (2004) critical review of Bourdieu's conceptual triad–habitus, capital, and field–emphasises the need for deeper engagement with these ideas in educational research. She aligns with the view that habitus is not a static mindset, but a dynamic, embodied structure shaped by personal and collective histories. Reay also expands Bourdieu's framework to include gender and racial identities, challenging its class-centric origins while advocating for an intersectional analysis. This is particularly relevant to RQ1, as students' and teachers' perceptions of SC are shaped by how their embodied dispositions align with the cultural logic of science education. For RQ2, Reay's intersectional lens provides a framework for understanding how gender, ethnicity, socioeconomic background, and language proficiency may interrelate and combine to influence access to and development of SC. Other empirical studies illuminate how habitus and field interact to shape educational trajectories. Hang and Zhang (2024) highlight the diversity within non-traditional students and propose a framework for understanding habitus transformation, showing that engagement with science is shaped by both reflexivity and identity. Wong and Liao (2022) reveal how rural students in elite Shanghai universities initially struggle due to misaligned habitus but gradually adapt, though structural barriers persist.

Similarly, Reay (2021) documents how working-class students at elite UK universities experience emotional dissonance and exclusion as their habitus clashes with dominant middle-class norms. These studies suggest that science engagement is not merely a function of access or ability but is deeply influenced by how students perceive their place within the field. If science is perceived as culturally exclusive or institutionally rigid, students may disengage despite their academic potential. This is echoed in Crozier, Reay and Clayton's (2019) study, which shows how working-class students develop hybrid identities to navigate elite university spaces using strategies such as code-switching and resistance.

Further insights come from Nairz-Wirth, Feldmann, and Spiegl (2017), whose study on university dropouts in Austria reveals how habitus misalignment leads to symbolic violence and self-blame among working-class and immigrant students. Their findings underscore the importance of relational strategies that consider both student and staff habitus and the institutional handling of capital. Turnbull et al. (2019) extend this analysis to gender disparities in physics education, showing how institutional habitus in male-dominated fields fails to signal belonging to female students, reinforcing gendered inequalities. These studies collectively inform RQ2, demonstrating how intersecting identities, such as gender, race, class, and immigrant status, shape SC access. They also reinforce the need for institutional

transformation rather than individual adaptation. In the context of my FE department, these findings support an intersectional approach to SC, advocating for inclusive pedagogies, culturally responsive curricula, and support systems that validate diverse forms of knowledge and expression, moving beyond the narrow definitions of academic success.

However, despite its analytical power, Bourdieu's framework has limitations that are particularly relevant to this study. A central critique of this approach concerns its tendency to underplay individual agency. This means that although Bourdieu acknowledges habitus as generative, his emphasis on structural reproduction can obscure the ways in which individuals resist and negotiate dominant norms. Scholars such as Cartwright (2022) and Davies and Rizk (2017) have argued for greater recognition of agency, especially among marginalised groups whose educational trajectories often defy deterministic models. Another tension lies in the operationalisation of this capital. Grenfell (2009) cautions against reducing complex social phenomena to quantifiable indicators, such as museum visits or parental qualifications, which risk oversimplifying the symbolic and embodied dimensions of capital theorised by Bourdieu. This is particularly problematic in studies of science capital, where such reductive tendencies may fail to capture the nuanced ways in which students engage with science. Furthermore, Bourdieu's framework requires adaptation to contemporary context. Ignatow and Robinson (2017) highlight how digital environments challenge traditional habitus formation, suggesting that concepts such as field and capital must evolve to remain analytically relevant. These critiques underscore the importance of using Bourdieu's theory not as a rigid explanatory model but as a flexible, reflexive tool that can illuminate the interplay between structure and agency, especially in diverse and dynamic educational settings such as Further Education.

However, as explicated in Section 2.4, one criticism of Bourdieusian cultural capital and Archer et al.'s (2015) science capital is that they are mainly true in Western societies. In non-Western cultures, where the concept of social class is usually different, the expressions of habitus and capital are different. For instance, science habitus and capital are not formalised in most Nigerian families. An illiterate Nigerian mother does not require museums or books to motivate her children to study medicine; rather, the family's financial needs and strongly held cultural values of obedience and respect for parents' desires are enough to motivate the children to do as they are told. Personally, this family value resonates strongly with me because a culturally motivated reason for doing this EdD programme is a promise I had made to my dad when he asked, 'when are you going to do your PhD?' I responded, 'I will'.

Hence, I desire to complete this programme to honour his memory. My children are motivated and proud of me for embarking on this programme, and they are my number one cheerleader, unsolicited informing their friends about what their mother is up to. The high significance of such non-Western cultural capitals is mainly unrecognised and undervalued by Bourdieu's and other Western-centric definitions of cultural capital, thus, constituting a crucial omission in the holistic understanding of cultural capital. In conclusion, Bourdieu's theory of social reproduction provides a foundational lens for this study by explaining how classed, racialised, and institutionally mediated resources shape students' [in]access, recognition, and success in science-education. The significance of this study is that Archer et al. (2013a, 2015) adopted Bourdieu's cultural capital theory as the basis for the development and conceptualisation of their science-specific cultural and social capitals, which they refer to as 'science capital'. Grounded in Bourdieu's theory, the next section examines how Archer et al. and other researchers extended his concepts to develop the 'Science Capital' framework within science education research.

2.5 Science Capital

2.5.1 Introduction

Building on Bourdieu's theories of practice and social reproduction in the previous section (2.4), the concept of 'Science Capital' (SC) offers a powerful extension of his ideas into the domain of science education. Developed by Archer et al. (2013a, 2015), SC reframes Bourdieu's cultural and social capital to capture the science-specific resources, dispositions, and experiences that shape students' engagement and their trajectories. This framework has gained prominence for its ability to illuminate how structural inequalities, mediated by class, race, gender, and language, affect access to and recognition in scientific fields. Crucially, SC challenges meritocratic assumptions by revealing how institutional norms privilege certain forms of capital while marginalising others. As such, it holds significant potential for informing policy and practice, particularly in FE college contexts, where diverse learners often encounter systemic barriers to their success. This literature review highlights SC's relevance to equity-focused science education and its implications for transforming institutional cultures and theoretical tensions. This section critically examines SC's theoretical and conceptual foundations (2.5.2), operationalisation and measurement (2.5.3), applications in (FE) educational research (2.5.4), theoretical and methodological limitations (2.5.5), policy implications (2.5.6) and conclusion (2.5.7).

2.5.2 Theoretical and Conceptual Foundations of Science Capital

2.5.2(a) Science Capital: Archer et al.'s Theoretical Conceptualisation

As evaluated in this section, Science Capital (SC), developed by Archer et al. (2010, 2013a, 2014, 2015, 2016, 2020a), builds on Bourdieu's theory of cultural capital to explain how science-related knowledge, attitudes, behaviours, and social networks influence individuals' engagement with science. SC, as developed by Archer et al. (2013a, 2014, 2015, 2020a, 2020b, 2020c, 2020d), offers a powerful sociological framework for understanding persistent inequalities in science education. Drawing on Bourdieu's theory of cultural capital, SC conceptualises science-related knowledge, attitudes, behaviours, and social networks as forms of capital that shape individuals' engagement with science. Crucially, SC is not a fixed trait but a dynamic, socially constructed, and institutionally mediated resource deeply embedded in the structures of education and society. Archer et al. (2015) formally articulated the concept of 'Science Capital', revealing that SC is unevenly distributed: only 5% of students were classified as having high SC, while 27% had low SC. This distribution was strongly patterned by cultural capital, gender, ethnicity, and academic achievement, and was closely linked to students' science identities, self-efficacy, and post-16 aspirations. Thus, SC functions serves as a mechanism through which cultural and social contexts shape science trajectories, potentially narrowing diversity and equity.

The ASPIRES and ASPIRES 2 (10-year) longitudinal studies (Archer et al., 2013a; 2020a) provide an empirical foundation for SC research. The studies were strengthened by a longitudinal design. The longitudinal approach applied to the qualitative data collection meant that the same students and parents were interviewed at each phase of data collection, allowing the researchers to track how the divide persisted and evolved over time from ages 10 to 19. The studies reveal entrenched inequalities in science aspirations and participation, shaped by the intersecting factors of social class, gender, and ethnicity. Across all ages, boys were significantly more likely than girls to agree that they would like to become scientists, with the biggest gender difference in science aspirations being found in Year 13 (age 17/18) (Archer et al., 2020a).

In addition, students from socio-economically advantaged families showed significantly higher science aspirations, with the largest gap found at age 17/18, when the most socio-economically advantaged students were over two and half times more likely to aspire to be

scientists compared to their less advantaged peers (Archer et al., 2020a). Although most students reported positive attitudes toward science, only 16% aspired to science careers (Archer et al., 2020a). This “being/doing divide” (p.2) is a key concept reported by Archer’s team, which describes a significant gap between students' interest in science and their aspirations for science careers (Archer et al., 2013a; 2020a), thus reflecting a disconnect between enjoyment and career intention, with aspirations disproportionately held by boys, students from advantaged backgrounds, and those with high SC.

The ASPIRES and ASPIRES 2 studies (Archer et al., 2013a; 2020a) also gauged the “being/doing divide” (Archer et al., 2020a, p.2) in science through large-scale mixed methods that tracked young people from age 10 to 19, with data collected at six time points, conducting over 40,000 quantitative surveys and 660 repeat qualitative interviews with young people and parents in England (Archer et al., 2020a). Across this decade of data collection, the surveys captured students’ interest in doing science, where the majority consistently reported finding school science interesting, valuing scientists’ work, and perceiving strong parental support; however, this contrasted with markedly lower aspirations to be scientists, with only approximately 16% expressing a desire for a science career (Archer et al., 2013a, 2020a). Using Likert scale instruments (Archer et al., 2013a, 2015, 2017, 2020a; Moote et al., 2019) covering attitudes, aspirations, self-concept, parental influences, peer cultures, and cultural capital, the studies revealed that high engagement with science learning does not translate into equivalent career intentions.

The longitudinal data highlighted stark inequalities in how the (“being”) aspirations are distributed; the aspiration component was measured by directly asking students about their career intentions (Archer et al., 2020a). Around 16% of the 40,000 young people aged 10-18 surveyed for the agreed that they would like to become scientists in the future, which contrasts sharply with the high interest levels reported. Boys, students from middle-class and socio-economically advantaged families, and especially those with familial science qualifications or careers, were significantly more likely to aspire to science pathways, with gender and social class gaps widening by age 17/18 (Archer et al., 2020a; Moote et al., 2019, 2020). Tracking the same participants over time demonstrated the persistence and reinforcement of this divide, evidencing that enthusiasm for “doing” science (interest measurement) rarely develops into an identity or aspiration to ‘be’ a scientist (Archer et al., 2013a, 2020a). The interest component was measured through survey questions capturing how students perceived their science learning experiences ((Archer et al., 2020a). The majority of

students aged 10-18 agreed that they learned interesting things in science classes, reported relatively strong parental valuing of science, and expressed generally positive views of scientists, including doing valuable work.

However, a significant proportion of students (81% of Year 6, 80% of Year 8, and 79% of Year 9 students) agreed that scientists are 'brainy'(Archer et al., 2013a). This perception that science careers are only for the exceptional 'brainy' few may be putting off the majority of young people from seeing science careers as 'for me', irrespective of how well they feel they do in school science, according to the studies. Hence, this “being/doing divide” (Archer et al., 2020a, p.2) suggests that addressing science aspirations requires moving beyond simply increasing interest in science. Instead, interventions should focus on how science careers are perceived and represented, particularly challenging stereotypes about who belongs in science as exemplified by some students’ responses on how limited English language proficiency affected their access to science (Sections 5.3.5 & 6.5.4).

Furthermore, gender differences in science aspirations were reported to widen progressively over time in the ASPIRES longitudinal studies (Archer et al., 2020a; Moote et al., 2019, 2020), with young women being more likely than young men to comment on the alignment of science with masculinity, particularly in explaining their lack of identification with or aspiration to science (Archer et al., 2020a). Girls reported that science was portrayed as a male-dominated subject, with discussions focusing on great male scientists rather than on women's contributions to science (Archer et al., 2020a). Although boys and girls tend to begin secondary school with relatively similar levels of interest in science, a consistent gap in the desire to become scientists emerged early in adolescence and became increasingly pronounced as students aged (Archer et al., 2020a; Moote et al., 2019, 2020). Throughout the studies, boys were more likely than girls to state that they would like to become scientists, but this divergence was not static; it amplified during their teenage years (Moote et al., 2019, 2020). By Year 13 (age 17/18), the gender gap reached its largest point, with boys significantly more likely to sustain science career aspirations, while girls’ aspirations declined despite maintaining comparable levels of interest in classroom science (Moote et al., 2019, 2020).

This widening divide tends to be shaped by intersecting factors such as gendered stereotypes about who “belongs” in science, differences in science self-concept, and the cumulative influence of family expectations, peer cultures, and broader societal messages, all of which

increasingly position science, particularly physical sciences, as a more naturalised pathway for boys rather than girls. A host of persistent gendered stereotypes may underpin the widening gap in science aspirations by shaping how young people interpret who science is "for." Science, particularly physics, engineering, and other high-status STEM fields, is frequently framed as masculine, rooted in inaccurate assumptions that scientific talent is innate and that boys are naturally more adept at technical or abstract thinking, thereby encouraging boys to identify with scientific identities while discouraging girls (Archer et al., 2020a).

These norms often intersect with cultural imagery that tends to depict scientists as white, middle-class men, thus limiting girls' sense of belonging by providing few recognisable role models. Simultaneously, dominant expectations that girls are more caring or people-oriented channel them towards relational fields and away from physical sciences, even when their achievement is high. Such stereotypes may also erode girls' science self-concept, reinforcing beliefs that boys are intrinsically better at science or mathematics and diminishing girls' confidence in pursuing advanced pathways (Archer et al., 2020a; Moote et al., 2019, 2020). School and peer cultures often reproduce these patterns through the disproportionate encouragement of boys to study science, gendered classroom practices, and social norms that position certain sciences as incompatible with female identity. Media representations tend to cast male scientists as the default and female scientists as rare or narrowly characterised as exceptions (Archer et al., 2020a; Moote et al., 2019, 2020). Together, these intersecting stereotypes tend to constrain girls' identification with science and limit their progression into science careers.

Earlier research has identified similar patterns; for instance, Osborne, Simon and Collins, (2003) documented declining interest in scientific careers, particularly in the physical sciences, and persistent gender disparities. Their review emphasised the importance of teaching quality, culturally inclusive curricula, and pedagogical approaches that contextualise science within students' lived experiences. DeWitt et al. (2010; 2013), working within the ASPIRES project, also found that many primary school pupils, particularly those from Pakistani and Bangladeshi backgrounds, held high science aspirations and positive attitudes, yet these did not always translate into attainment or progression in the subject. Their findings challenge deficit narratives and point to structural barriers as the key obstacles. Aspirations were most strongly influenced by parental attitudes, school science experiences, self-concept, and informal science engagement, with demographic factors playing nuanced roles.

The Wellcome Trust (2011) study similarly found that while science was valued and seen as important for future careers, engagement was shaped by personal interest, teacher quality, hands-on learning, and real-world relevance. The study reported that students criticised the examination-heavy nature of science and showed limited informal engagement, highlighting a disconnect between science's societal value and its personal relevance.

Furthermore, Archer et al. (2012) extended Bourdieu's framework by introducing the concept of 'family habitus' (p.1), exploring how familial environments shape children's science aspirations. They found that middle-class families with science-specific capital were better positioned to foster science engagement, while working-class families often lacked the cultural infrastructure to support science aspirations, leading to a "science as peripheral" phenomenon (p. 1). The authors emphasised the non-deterministic nature of habitus and called for systemic efforts to make science a career that children would consider. Subsequent studies have reinforced and expanded upon these insights. King et al. (2015) examined secondary school teachers' conceptualisation and implementation of SC following professional development in England. Their findings revealed significant variability in teachers' ability to operationalise SC pedagogically, indicating that while scientific literacy and dispositions were commonly addressed, dimensions such as science media consumption and out-of-school learning were often neglected in the literature.

This study highlighted a disconnect between theoretical understanding and classroom practice, shaped by contextual constraints, teacher beliefs, and institutional support. This underscores the need for professional development that integrates conceptual clarity with practical strategies and emphasises the full spectrum of SC, including its relevance to the wider job market. Archer et al. (2020a) further examined engineering and science aspirations among students aged 10–16, identifying persistently low engineering aspirations, particularly among girls, from an early age. They highlighted the influence of cultural capital and the perception of STEM as elitist (Bourdieu, 1986) and argued for systemic changes in engineering education and culture rather than focusing solely on individual aspirations. These findings reinforce the SC framework's emphasis on the interplay between individual agency and structural conditions in shaping scientific trajectories.

Additionally, DeWitt, Archer and Mau (2016) found that students with greater cultural capital maintain stronger science aspirations, implying that SC reflects and reinforces existing advantages. Essex and Haxton (2018) observed that students with high SC are more motivated

by scientific elements in educational projects, suggesting that early exposure and cultural familiarity with STEM shape learning behaviours. Moote et al. (2020) reported that students with high SC, often supported by enriched familial and social environments, are more likely to pursue post-compulsory science qualifications, reinforcing cycles of advantage and limiting access for those with lower SC. Godec et al. (2018), using qualitative methods in an inner London school, explored student engagement through Bourdieu's concept of the field. They showed how classroom environments privilege students whose habitus and capital align with field expectations and reported that narrow definitions of engagement marginalised students whose dispositions did not visibly conform despite their understanding of engagement norms. These findings call for broader, more inclusive pedagogical approaches that recognise diverse forms of participation.

Meanwhile, Mujtaba et al. (2018), surveying 4,780 disadvantaged students across 25 schools, found that science and chemistry aspirations were most strongly associated with extrinsic motivation (perceived utility), followed by intrinsic interest and perceived support. They reported that socioeconomic status had minimal independent influence when students' subjective beliefs were accounted for, underscoring the importance of extracurricular activities and supportive teaching practices in fostering aspirations among disadvantaged learners. Moote et al. (2019; 2020) extended SC research to older students in England, analysing patterns among 17–18-year-olds. Their studies revealed persistent inequalities and a decline in SC with age, with a stable proportion of high-SC students and an increase in low-SC students. SC remained patterned by gender, ethnicity, cultural capital, and prior science experiences, with boys, South Asian students, and those in top science sets reporting higher SC. High-SC students were more likely to pursue post-compulsory science, especially physics. The widening post-16 gap underscores the need for targeted interventions and policy attention to address these persistent inequalities. These studies reaffirm the uneven distribution of SC and its association with gender, ethnicity, and cultural capital, emphasising the lasting influence of early educational experiences and the need for nuanced policy interventions to diversify science participation in the UK.

Regarding the transferability of SC and science qualifications, Black and Hernandez-Martinez (2016) reconceptualised SC by distinguishing its exchange value (e.g. credentials) from its use value (e.g. identity and interest), arguing that STEM identity development is essential for meaningful engagement. Their case studies revealed that identification with STEM mediates how SC is perceived and utilised. DeWitt, Archer and Mau (2016) similarly emphasise the

visibility of qualification value, noting disparities in SC distribution across socio-economic and ethnic lines. Mujtaba et al. (2018) identify perceived utility as the strongest predictor of aspirations among disadvantaged students, highlighting the role of motivation, pedagogy, and family influence in shaping science trajectories. In response to these challenges, the Science Capital Teaching Approach (SCTA), developed by Archer's team (Archer et al., 2020d), focuses on personalising science education, expanding the definition of what constitutes science, and utilising learners' experiences as foundational elements.

This approach aims to make science more relatable and accessible by building on students' existing knowledge, attitudes, experiences, and social contacts. It represents a pedagogical shift towards inclusive, culturally responsive teaching that recognises and values diverse forms of science engagement. Collectively, these studies offer a robust theoretical and empirical foundation for understanding the persistent inequalities in science education. They underscore the importance of early, inclusive, and culturally responsive interventions that move beyond aspiration-raising to dismantle structural barriers and reimagine science as a socially embedded and accessible field. In the next section (2.5.2(b)), a literature review of international studies on SC is conducted to capture international perspectives.

2.5.2(b) Science Capital: International Studies

International studies of SC reveal its conceptual versatility and show that local cultural values, institutional structures, and intersectional identities significantly shape how SC is enacted and experienced. These international perspectives offer a broader, richer understanding of SC's applicability and limitations than Western-centric studies (2.5.2(a)) and trace a trajectory from teacher conceptualisation to student experience across varied educational levels. Studies conducted across diverse contexts, including the United States, Canada, Spain, Ireland, New Zealand, Norway, and Hong Kong, demonstrate that while SC offers a valuable lens for understanding science engagement, its operationalisation must be sensitive to local systems, cultural values and intersectional identities. Tan et al. (2013) explored how middle school girls from non-White backgrounds in the U.S. navigate science identities and found that despite academic success and STEM interest, these students experienced gaps in identity as school science failed to reconcile personal identities with classroom norms. Race, class, and stereotype threats emerged as critical influences, underscoring the need for a culturally responsive pedagogy.

Similarly, Wade-Jaimes et al. (2021) found that Black middle school girls struggled to identify as scientists despite positive engagement in formal and informal STEM contexts. This disconnect between participation and identity calls for a systemic reimagining of science education that affirms cultural identities and challenges the dominant narratives about who belongs in science. In Spain, Grimalt-Alvaro et al. (2022) examined STEM self-identification among 1,004 high school students and found gendered patterns, with boys favouring technology and engineering and girls leaning toward science. These findings challenge the notion of STEM identity as a unified construct and suggest that current educational approaches may inadvertently reinforce gender stereotypes in the science field. The authors advocate for a more integrative STEM curriculum that includes non-STEM subjects to foster inclusivity in the field. Vincent-Ruz and Schunn (2018), studying over 1,300 urban U.S. students, confirmed science identity as a distinct and powerful predictor of participation; girls' science identity had greater behavioural impact, yet remained lower overall, reinforcing the need to foreground identity development in science education. King et al. (2015), in Ireland, found that gender stereotypes and social isolation hindered female STEM undergraduates' self-perception and informal learning, advocating for inclusive peer environments.

Ceglie (2021) highlighted faculty roles in building SC among underrepresented U.S. students through mentoring, advising, and research engagement. Ennes et al. (2022) extended this focus to early childhood, showing how family engagement and home-based science activities shape STEM aspirations. Gender differences in parental involvement suggest that families may unconsciously reinforce gender expectations. Turnbull et al. (2020), in New Zealand, identified teacher and peer attitudes as key predictors of science self-concept, with male students reporting higher confidence and university generational status influencing outcomes, suggesting a gendered habitus in science. Yonas et al. (2020) used podcasts featuring diverse scientists to help biology students envision their possible identities, successfully shifting their perceptions of who belongs in science. Gonsalves et al. (2021) and Christidou et al. (2021) further demonstrate how informal and outreach settings can challenge exclusionary norms and foster identity development.

Collectively, these studies affirm the SC's relevance across global contexts and align with the findings of studies conducted in England (Section 2.5.2 (a)). They reinforce the SC's core premise that science engagement is shaped by the dynamic interplay of individual agency and

structural conditions and must be reimagined as socially embedded and culturally accessible. While most studies in England and internationally resonate with my experience as an experienced (20+ years) science educator in the FE colleges sector in England, as already noted with Bourdieu's conceptualisation of cultural capital (Section 2.4), the studies are too narrow and Western-centric to address the experiences of multi-ethnically and socio-economically diverse student populations, like my students; hence, the concept of SC needs to expand to encompass intersectional, inclusive, and identity-affirming approaches, as reiterated throughout this study. The following section (2.5.2(c)) builds on the theoretical and conceptual underpinnings of SC by examining how SC intersects with Social Identity Theory (Tajfel and Turner, 1979) to illuminate the identity-based nuances underpinning science engagement.

2.5.2(c) Science Capital and Social Identity Theory

Social Identity Theory (SIT) by Tajfel and Turner (1979) and Bourdieu's concept of habitus offer complementary insights into how participants perceive and engage with SC. While Bourdieu's habitus emphasises how long-term social conditioning shapes individuals' dispositions and practices, often reproducing inequality when habitus misaligns with the dominant field, SIT emphasises how individuals define themselves through group memberships (for instance, gender, ethnicity, academic discipline) and how these identities influence behaviour, motivation, and belonging. SIT focuses more on psychological processes and intergroup dynamics than on structural reproduction. In this study's context, SIT provides a lens through which to explore how students and teachers perceive science as a social identity. This allows for an investigation into whether students see themselves as "science people", and how teachers may reinforce inclusive or exclusive norms. This is significant because female students who do not identify with the perceived traits of the science group (for example, elite, male-dominated) may feel alienated, leading to reduced motivation, confidence, and persistence in science education.

SIT also offers a nuanced understanding of how intersecting identities, such as gender, ethnicity, socioeconomic background, and language proficiency, may shape students' sense of belonging and engagement with science. Unlike Bourdieu's structural focus, SIT highlights how multiple social identities interact and influence SC through perceived group dynamics and identity significance. For example, a working-class female student may face compounded

barriers if science is viewed as a middle-class male domain. SIT helps uncover how these layered identities affect students' psychological engagement and self-concept, adding depth to Bourdieu's framework by addressing the social and emotional dimensions of inclusion/exclusion. This dual perspective is significant for developing more inclusive science education practices in departments such as mine in FE colleges, where diverse student populations require both structural and identity-based support. By extending the analysis of identity formation, the next section (2.5.2 (d)) engages with Critical Race Theory (Delgado, Stefancic, and Harris, 2017) to interrogate how SC is racialised within educational structures and shaped by systemic inequalities.

2.5.2 (d) Science Capital and The Critical Race Theory (CRT)

CRT has become a foundational framework in educational research, offering a lens through which to examine how race and racism are embedded in the structures, practices, and discourses of education. Originating in the 1970s from critical legal studies and radical feminism, CRT emerged in response to the perceived stagnation of civil rights progress in the United States. Foundational scholars such as Derrick Bell, Kimberlé Crenshaw, and Alan Freeman developed CRT to interrogate the systemic nature of racism and challenge dominant ideologies that uphold racial hierarchies (Delgado, Stefancic, and Harris 2017). In education, CRT has evolved into a robust interdisciplinary approach that critiques the ways in which race and power operate and shows how educational content and delivery often reflect dominant (white, Eurocentric) norms, marginalising the experiences and knowledge systems of racially minoritised students. In HE, CRT scholarship has focused on themes such as colour-blindness, selective admissions policies, and campus racial climate. These studies reveal how institutions often maintain racial inequities under the guise of neutrality and meritocracy (Ledesma and Calderón, 2015). A central tenet of CRT is that racism is not an aberration but rather a normal and enduring feature of society. It asserts that race is a social construct and that different groups are racialised in shifting ways depending on political, economic, and social needs.

CRT also emphasises intersectionality, recognising that race intersects with other identity markers, such as gender, class, and language, to produce complex and layered experiences of oppression. Importantly, CRT in education has moved beyond critique to embrace Critical Race Praxis, a commitment to engaging with the realities of marginalised communities and developing actionable strategies for change. This praxis-oriented approach encourages

scholars and practitioners to challenge institutional racism through theoretical analysis and practical interventions. While CRT has faced critiques, such as its perceived pessimism or lack of concrete remedies, recent scholarship has responded by offering tools and frameworks that support equity-driven educational reforms. Ledesma and Calderón (2015) argue that CRT in education has matured into a revolutionary project that unapologetically centres on race and racial justice. They emphasise the importance of grounding CRT in its legal and ethnic studies roots while adapting it to address contemporary educational challenges. Moreover, they call for a more rigorous and historically grounded application of CRT that remains responsive to the evolving needs of racially marginalised communities.

CRT provides a critical framework for exploring how potentially racialised students and staff perceive science as a cultural and institutional space. This prompts an examination of whether science education reflects dominant (often white, Eurocentric) norms that marginalise other ways of knowing and being. By focusing on systemic power and institutional practices, such as curriculum design and teacher expectations, CRT can help uncover how these structures may reinforce racial disparities in science participation. It also encourages the use of counter-narratives to centre the experiences of ethnic minority students, revealing how feelings of exclusion or stereotyping may shape their engagement with the sciences. In addition, CRT's commitment to intersectionality makes it particularly well-suited. This allows for a nuanced analysis of how race interacts with other identity markers to shape access to SC. For example, a Black female student from a low-income background may face compounded barriers in science education due to racial bias, gender expectations, and economic disadvantage. CRT reveals how these intersecting oppressions are embedded in institutional structures and everyday interactions and emphasises the importance of amplifying student voices to challenge dominant assumptions about who belongs in science. This approach not only deepens our understanding of inequality but also supports the development of more inclusive and equitable educational practices in the future.

2.5.2 (e) Reflexive Commentary

As a Black female science educator working in a FE college in England, my lived experience within a structurally stratified educational landscape informs my reflexive engagement with CRT, enabling a critical interrogation of how race, power, and institutional practices shape science participation and representation for minoritised learners. I occupy a dual role as both an insider within the FE system and a member of a historically marginalised group, which

affords me unique insights into the racialised dynamics of science education while also necessitating ongoing reflexivity to mitigate bias and ensure analytical rigour. This positionality requires me to challenge dominant narratives that often render Black learners invisible within science discourse and to spearhead the voices and experiences of those whose trajectories are shaped by systemic exclusion.

My engagement with CRT is not merely theoretical but personal, rooted in my commitment to equity and transformation within science education. I recognise that my identity may influence the interpretation of data, and I approach this with conscious awareness of the power relations embedded in both the research process and the study's context. Thus, by situating myself within the research, I aim to disrupt the presumed neutrality of traditional educational enquiry and advocate for a more inclusive and critically engaged approach to understanding the SC. This reflexive stance is aimed at enhancing the credibility of the study and aligning with one of its broader aims: illuminating how race, identity, and capital intersect in shaping science aspirations and engagement in the study's context. Building on the theoretical alignment between SC and identity formation, the next section (Chapter 3) examines how these concepts are operationalised within empirical research to capture their influence on science engagement.

Chapter 3
Science Capital Operationalisation

3.1 Introduction

This chapter critically evaluates the literature on how informal science learning experiences (Section 3.2) may contribute to students' [non]accumulation of science capital and how habitus (Section 3.3) may mediate individuals' dispositions towards science. This evaluation extends this exploration of' science-related media consumption (Section 3.4) and the specific dynamics of the London context (Section 3.5). This section situates these within broader gendered (Section 3.6), socio-economic (Section 3.7), and ethnocultural contexts (Section 3.8). Attention is given to the role of English language proficiency (Section 3.9) and the compounded effects of intersectionality (Section 3.10). Furthermore, this section highlights how overlapping identities may produce differentiated access to science-related opportunities. The limitations of the science capital framework (Section 3.11) are also interrogated, while engaging with criticisms rooted in the coloniality of power (Section 3.12) and advocating for a decolonial approach to conceptualising science engagement (Section 3.13). Through this review, this chapter highlights some of the structural inequities embedded within science education and proposes pathways towards more inclusive and socially just practices.

3.2 Informal science learning experiences

Informal science learning environments (ISLEs), including museums, nature-based activities, and extracurricular programmes, play critical roles in shaping science aspirations and identities, particularly among underrepresented groups (DeWitt and Archer, 2015, 2017). For instance, Christidou et al. (2021) show how everyday activities like fishing and hiking foster ecological awareness and observational skills, while Ceglie (2021) highlights how ISLEs cultivate science-related behaviours that support STEM pathways. Jones et al. (2021) linked early informal experiences to long-term motivation and career aspirations through constructs such as self-concept and perceived usefulness. DeWitt, Nomikou and Godec (2019) demonstrated that inclusive and interactive museum experiences can foster agency and

identity, even among students with low SC. Mujtaba et al. (2018) found extracurricular engagement to be strongly correlated with increased aspirations.

Grimalt-Álvaro, Gibbins, and Menzer (2015) investigated whether a specially designed, voluntary Facebook application could support young people (ages 16–25) in developing scientific literacy by debating socio-scientific issues outside of school. Their findings show that participants engaged in on-topic, civil, and sophisticated argumentation, demonstrating participation, epistemic reasoning, and social co-construction of ideas comparable to formal learning environments. Their study revealed that informal online spaces, especially those already embedded in young people's daily lives, can become effective contexts for practising scientific argumentation and connecting with wider scientific discussions. Framed through the concept of SC, their study highlights how such informal digital environments can broaden young people's access to scientific discourse, offering opportunities to build confidence, scientific identity, and engagement beyond traditional classroom structures. By allowing learners to participate voluntarily, express their views, and connect scientific issues to real-world debates, the Facebook application supported the accumulation of cultural, social, and identity-based science capital, elements often unequally distributed across student populations.

The findings suggest that informal social media settings can supplement formal science learning, provide new pathways for young people to see themselves as competent participants in scientific discussions, and help bridge gaps between students with differing levels of existing science capital. Furthermore, in her reflective piece on Habig, Gupta and Adams'(2021) study, Hecht (2021) interrogates the role of informal science education institutions in advancing equity and justice while upholding scientific rigour. She explores the tension between preparing youth to succeed within existing scientific paradigms and empowering them to challenge the institutional structures that define these paradigms. Hecht questions whether the scientific community itself has evolved in response to the inclusion of diverse youth, arguing that informal science spaces must not only familiarise learners with scientific language and practices but also enable them to redefine the boundaries of science.

However, access to ISLEs remains limited. DeWitt and Archer (2017) and Archer et al. (2020b) identified socioeconomic status, ethnicity, and structural barriers, not lack of interest, as key constraints. For instance, in my department, cultural and religious norms restrict some girls from travelling independently, limiting their access to institutions like The Science Museum. In addition, King et al. (2015) note that many teachers feel ill-equipped to facilitate out-of-school science learning environments, especially when external collaboration is required, limiting students' exposure in under-resourced schools.

Hence, while informal science experiences are linked to science aspirations, their transformative potential is limited by inequitable access. Research on science centres and museums highlights informal learning as highly influential but unevenly experienced, shaped by prior knowledge, cultural positioning, and access, rather than operating as a neutral or universally beneficial resource (Chng and Tan, 2024).Their effective integration with formal education requires collaboration, curricular alignment, educator support, inclusive practices, and longitudinal research to ensure a sustained impact, particularly for minority and working-class families. These findings underscore the need for inclusive practices and targeted interventions to support students, especially those from minority and working-class families. As recommended in Section 6.9, FE college science educators like me need to engage more with ISLES in curriculum planning to ensure better liaison with ISLES, which enables structured and inclusive approaches. While ISLES shapes science engagement through experience and access, the next section (Section 3.3) explores how these engagements are filtered through habitus, influencing how SC is internalised, valued, and enacted.

3.3 Science Capital and Habitus

A recurring theme in the literature is the foundational role of family SC in shaping students' science identities and aspirations. All the studies reviewed consistently highlighted the significance of family held science knowledge, skills, and qualifications in influencing students' science engagement. Collectively, these studies suggest that students from families

with higher SC are more likely to develop positive science self-concepts, perceive science as accessible, and aspire to science-related careers. For instance, Mujtaba et al. (2018) and Rüschenpöhler and Markic (2020a) report strong associations between family SC and students' science self-concept and perceived abilities. These findings suggest that parental scientific knowledge may not only influence aspirations but also shape students' confidence in their science capabilities. Rüschenpöhler and Markic (2020b) demonstrated the uneven distribution of a more specific concept of chemistry capital across families to advance similar arguments. Their findings revealed that students lacking familial connections to chemistry are more inclined to apply to schools with lower entry requirements, suggesting a likely direct link between family chemistry capital and students' educational choices. This notion of chemistry capital being "translated" into individual student capital may underscore the intergenerational transmission of science-related dispositions and resources. It also raises questions about equity and access to science education, particularly for students from underrepresented or non-science backgrounds.

For instance, if a middle-class art connoisseur mum (Ann) interests her 10-year-old daughter (Maureen) in art appreciation and takes her on excursions to art galleries, Ann has the pedagogic authority to engage Maureen in familial work that creates an art habitus in Maureen. The informal teachings of art appreciation and excursions are the actions that inculcate art cultural capital in Maureen, while the galleries are examples of educational systems, albeit informal ones. If Maureen does Level 3 vocational science at age 17, her art habitus will likely stand her in better stead over her working-class peer (Vicky) in understanding how scientific forensic analysis can be engaged to detect art forgeries. In addition, her art habitus is the type of predisposition a teacher will find useful to build on, thus, endearing her knowledge to the teacher and giving her a double advantage over Vicky. This aligns with Bourdieu and Passeron's (1990) theory that educational systems are designed to monopolise the production of pedagogic agents who are constrained to reproduce the dominant group's cultural arbitrariness.

Thus, Maureen's advantage is likely to translate into higher academic capital, better grades, and prospects of accessing a top-class HE and a good middle-class career like her mother's, such as an art forensic analyst, a job obtained through her mother's contacts (social capital).

The symbolic violence in this example is that Maureen's transition to a high-tariff HE is assumed to be based on her natural academic abilities (meritocracy), while Vicky's inability to do the same may be attributed to laziness, with no consideration for the role of habitus that enables Maureen to accumulate the symbolic capitals needed. This agrees with Bourdieu and Passeron (1990) that 'the specific productivity of all pedagogic work… is a function of the distance between the habitus it tends to inculcate…and the habitus inculcated by all previous forms of pedagogic work and, ultimately, by the family…' (Bourdieu and Passeron, 1990, p.72). However, Turnbull et al. (2020) present a counterpoint, finding no significant connection between parents' valuation of science and students' science self-concept. In my experience, my students are likely to lack many of the assumed habitus that can be translated into symbolic capital in their classrooms; hence, their teachers should continue to increase their SC accumulation through existing structured enrichment and industrial work experience activities, which they enjoy and find beneficial to their learning.

Furthermore, some studies that examine the influence of parental SC on students' future science participation (Archer, Dewitt and Osbourne, 2014; DeWitt and Archer, 2015; Archer and Dewitt, 2015b, 2016; DeWitt et al., 2016; Du and Wong, 2019; Diamond, 2020) report that parental science careers and qualifications not only provide role models but also shape students' perceptions of science as a viable and desirable career path. Du and Wong (2019) emphasised the role of parental encouragement and modelling in fostering students' science aspirations, particularly in Asian contexts where parental expectations are culturally significant. Similarly, Diamond (2020) highlighted how parental engagement in science-related discussions at home contributes to students' science identity formation.

From a personal perspective, my decision to pursue the EdD programme is deeply rooted in my family habitus, particularly my father's influence, whose passion for education and science shaped my early educational experiences and aspirations. He enrolled me in kindergarten two years ahead of time, instilling a lifelong love of learning, primarily through books, which continues to define my personal and professional identity. Although he was disappointed that I did not become a medical doctor, his values of discipline, academic excellence, and intellectual curiosity remain central to how I raise my own children and approach my role as a science educator. These formative experiences have not only fuelled

my commitment to widening participation in science, especially for females, but also positioned me as an ardent lifelong learner, which is currently enabling me as a user of electronic media for professional, personal, social, and educational purposes, reflecting a dynamic evolution of my learning practices within a now digitally connected world.

Jones et al. (2021) reported that family-based science achievements positively influence students' perceptions of science and their task values, that is, the importance and usefulness they attribute to science learning. This finding reinforces the motivational dimension of parental scientific knowledge, suggesting that visible family success in science can enhance students' engagement with and valuation of science tasks. DeWitt and Archer (2015) and DeWitt et al. (2016) also reported that parental involvement in science-related activities and careers significantly predicts students' aspirations to pursue science. This aligns with my personal example, where my family habitus is biased towards science education and careers, with all of us in the family studying post-compulsory science, while all but one did science-related courses at HE and pursued scientific careers. Stahl et al.'s (2021) study also introduces a relational dimension to the discussion, by emphasising how geographies of place and parent–child relationships can mediate the impact of family SC. Their study revealed that the effectiveness of parental scientific knowledge is dependent on the quality of familial relationships and the socio-geographic context in which families are embedded.

This nuanced perspective suggests that SC may also be dynamically shaped by relational and contextual factors that can either amplify or constrain its influence. Ceglie's (2021) study, however, provides a perspective on the limitations of parental SC, particularly for minority students. The study found that minority students often do not receive science-related social capital from their families or communities, highlighting systemic inequities in access to science resources and support. This finding aligns with the broader critiques of SC frameworks that may inadvertently privilege middle-class, majority culture norms. This underscores the need for more inclusive models that account for diverse forms of capital and support, including non-Western conceptualisations, as explained in Section 2.5.5(a) – (c)). In conclusion, there is ample evidence in the literature that knowing people in science-related roles, whether through family, peers, institutions, or educators, can significantly enhance students' science identity and aspirations. The next section (3.4) considers how engaging with

scientific media as a form of SC is interpreted through habitus, shaping how individuals internalise and respond to media-related experiences.

3.4 Science Capital and Science-related Media Consumption

Science media consumption has emerged as a significant, yet under-theorised, component of SC. Key studies indicate that media engagement plays a crucial role in shaping students' science identities, aspirations, and self-concepts. For instance, Kontkanen et al. (2024) in a recent systematic review confirm that while science media is frequently mentioned in studies of SC, it is rarely the focus. They call for more robust theoretical and empirical work to understand how media consumption contributes to science capital development, particularly in diverse sociocultural contexts. King et al. (2015) also note that teachers frequently lack the pedagogical tools to integrate students' media-based science engagement into classroom practice, potentially limiting science media's potential to reinforce science identity and aspiration. Relating to the forms and modalities, science media consumption varies in form and impact. Christidou et al. (2021) found television to be the most common source, though its passive nature and limited post-16 relevance raise concerns for FE settings like mine, in my opinion. Rüschenpöhler and Markic (2020a) highlight students' active engagement with platforms like YouTube, while noting issues of content accuracy, which is also a concern in my department, thus underscoring the need for critical media literacy. Wilson-Lopez et al. (2017) showed that Latinx students use smartphones, applications, and games to engage with science in multimodal, participatory ways, while Glaze (2018, 2018b) emphasised that informal digital environments can foster scientific literacy and lifelong engagement when students critically evaluate content.

Family influence is a recurring theme in science media consumption. Black and Hernandez-Martinez (2016) showed that family engagement, such as watching science documentaries or discussing scientific topics, can support students' aspirations, for instance, in physics, aligning with SC's emphasis on familial and cultural resources in identity formation. Jensen and Wright (2015) also argue for a broader conceptualisation of SC that includes cultural capital and digital equalities; they criticise the narrow operationalisation of SC in some

studies and advocate for a more intersectional approach on how media access and engagement are shaped by class, race, and gender. Regarding science media and science self-concept, Turnbull et al. (2020) found that access to science-related resources, including media, was not a significant predictor of students' science self-concepts. This suggests that mere exposure to science media is likely to be insufficient; what matters is how students interpret and internalise the content. This finding highlights the importance of relevance, identity alignment, and critical engagement in media-based science learning for these students. Kontkanen et al. (2024) echo this point, noting that SC is not simply about access but about the activation of resources in meaningful ways. This insight calls for pedagogical strategies that help students connect media content with their lives, interests, and identities. The reviewed literature reveals a complex and evolving relationship between science media consumption and the SC. On the one hand, digital and traditional media offer accessible and engaging pathways for science learning. However, disparities in access, critical engagement, and pedagogical integration limit their transformative potential.

A media-related cause for concern among some of my colleagues in the department is what they consider the threat of artificial intelligence (AI) impeding the originality of students' learning, assignments, and coursework assessments. While I consider this concern about originality valid, particularly in science education, where critical thinking and enquiry are foundational, I recognise the pros and cons of embedding AI. AI can personalise learning and improve access, but it also raises concerns about originality and academic integrity. While AI supports engagement and efficiency, some of my colleagues worry that it may undermine independent thinking in students' coursework, making clear guidance and ethical integration essential to balance its educational benefits and risks. I advocate for revising assessment strategies, embedding digital ethics, and educating students on responsible AI use rather than shutting it down. Following the discussion on science-related media consumption and its influence on SC in this section, the next section examines how these dynamics and others, such as gender and ethnicity, are likely to be reflected within the unique institutional and socio-cultural landscape of science departments in London FE colleges, as exemplified by the author's department.

3.5 Science Capital and FE Colleges: The London Context

Following the discussion on science-related media consumption and its influence on SC, this section examines how these dynamics are reflected within the institutional and socio-cultural landscape among the study population and possibly in other FE colleges in London. Ample evidence shows that FE colleges in London, as a post-compulsory sector that offers mainly vocational and traineeship courses to post-16 students, tend to attract predominantly working-class, ethnic minority, and migrant students who are more likely to face entrenched structural disadvantages, particularly when compared to their peers in the 'academic' Sixth Form Schools and Colleges (SFSCs), who are largely middle or upper class (Augar Review, 2019; Office for Students, 2020a; Ofsted, 2021, 2023; GOV.UK, 2021b; Lewis, Bolton and Hubble, 2021; Powell and Francis-Devine, 2021; SFCA, 2021; Trust for London, 2025a, 2025b, 2021c). In contrast, the Applied Science programmes undertaken by participants were structured around the Pearson BTEC Level 3 National Extended Diploma specification, which emphasises applied scientific knowledge, few examinations, mostly coursework-based assessments, and occupational relevance, shaping how science learning is recognised and valued within FE contexts (Pearson Edexcel, 2019).

Hence, intersecting factors such as social class, ethnicity, migration status, and language tend to shape FE learners' educational experiences. In addition, the 2020 Ofsted report (College Ofsted report, 2020) for my college, one of London's largest FE colleges in England, reveals that a substantial proportion of learners exhibit multiple deprivation characteristics, including low socio-economic status, ethnic minority backgrounds, and immigrant status. For instance, English for Speakers of Other Languages (ESOL) has emerged as the largest subject area, underscoring the linguistic diversity and complex educational needs of the student body (College Ofsted report, 2020). Additionally, my college reflects the diversity of local communities. According to my college's 2024–2025 Self-Assessment Report (College SAR, 2024/25), 70% of learners were from non-White backgrounds; 53% and 47% were female and male, respectively, with the college serving some of London's most deprived areas. For instance, over 60% of learners came from the lowest three bands of social deprivation, which was significantly higher than the national FE colleges' average of 44%, with more than 40% living in England's most deprived wards. These communities face persistent challenges, such as unemployment, income instability, and debt, exacerbated by the COVID 19 pandemic, yet

learners continue to demonstrate strong ambition and view education as a pathway to prosperity (Trust for London, 2025).

The latest London's Poverty Profile (Trust for London, 2025) reports that 26% of Londoners live in poverty (the highest in England); 38% live in non-White families, and 53% of single parents' families live in poverty, with higher than the London average 'repossessions', 'out-of-work benefits', and no qualifications at 19' (Trust for London, 2025, p.1), with 18% and 35% 'of children in poverty before and after housing costs', respectively, in 2023/24 (Trust for London, 2025, p.1) in my college's borough. Not much appears to have changed. Nationally, the Association of Colleges (2019) reported that 26% of 16–18-year-olds and 32% of adult learners in FE colleges were from ethnic minority backgrounds, with 70% of FE colleges situated in London's most deprived boroughs. Powell and Francis-Devine (2021), drawing on Office for National Statistics (ONS) data, highlighted that unemployment rates among Pakistani and Black populations (9%) were more than double those of White populations (4%).

Educational disadvantage is further evidenced by POLAR4 data, an area-based measure of young participation in HE across the UK. Using data derived from the 2011 Census, it allocates local areas into five quintiles according to the proportion of 18-–30-year-olds who enter HE. Quintile 1 (Q1) denotes the lowest level of participation, while Quintile 5 (Q5) represents the highest, thereby providing a comparative indicator of the likelihood that young people from different areas will progress to HE. Most London FE colleges that cater for vocational courses such as my students' vocational AL science, fall within Q4, while comparatively, their SFSCs (Sixth Form Schools and Colleges) peers, which specialise in academic AL subjects are predominantly located in Q5 (Office for Students, 2020b).

This disparity is often reflected in progression rates, where, for instance, SFSC students achieved a 47% progression rate to HE, compared to 36% for other schools and colleges (SFCA, 2021). Funding inequities further compound these challenges, with SFSCs receiving significantly higher net funding than FE colleges (GOV.UK, 2021b). In addition, the Office for Students (2020a) reports that disadvantaged pupils are nine months behind age 11 and two

years behind the end of secondary school. Additionally, in 2019/20, 16% of FE students aged 16–18 claimed free school meals (evidence of deprivation) at age 15, compared to only 8% in SFSCs (Association of Colleges, 2019). The Sixth Form Colleges Association (2021) asserts that SFSCs consistently outperform other non-selective providers in academic outcomes, a trend that is closely linked to resource allocation and socio-economic composition.

These deprivation profiles are of significant relevance to my college, which spans five mostly deprived London boroughs, thus serving as a microcosm of London's diverse and deprived communities. The students' enrolment profile reflects this demographic complexity, with 3% of the 2024-2025 science enrolments in my campus being White, 17% Any Other White, 46% Black, Black British, Caribbean or African, 20% Asian or Asian British, and 13% Mixed or Multiple Ethnic groups, according to the UK ethnicities 2021 Census classification (Office for National Statistics, 2022). In addition, 56% and 37% of my students self-identified as female and male, respectively, with the rest not specifying, while 59% were 16-18- and 41% were 19+-year-olds. These demographic patterns are historically consistent, as successive Ofsted reports describe the college as serving particularly diverse and deprived communities, with over 100 first languages spoken (College Ofsted Reports, 2011, 2020, 2022).

Many students are migrants who are likely to possess substantial skills and work experience; however, they often face systemic barriers prior to formal education, including linguistic challenges, economic instability, and limited access to educational resources. This context contributes to the rationale for examining SC and its intersectional dimensions among some Level 3 students and their teachers. Thus, the demographic diversity and low socioeconomic backgrounds within most London FE colleges offer a critical lens through which to explore how ethnicity, gender, cultural background, and economic status shape science engagement, aspirations, and identity, as exemplified by my department. Furthermore, my students tend to enter vocational science courses with fragmented educational trajectories. For instance, many complete secondary education in England but fail to achieve the requisite grade 4 in five GCSE subjects, including science, while others, educated outside the UK in their formative, compulsory education stages, possess equivalent but non-traditional English qualifications. These pathways tend to contribute to broader structural inequalities in access to science education and its progression.

Government policies may also contribute to these challenges. While national science and education strategies emphasise the need for a technologically skilled workforce (GOV.UK, 2015), chronic underfunding in the FE sector undermines this ambition. The Augar Review of Post-18 Education and Funding (2019) states:

> Post-18 (or 'tertiary') education in England is a story of both care and neglect, depending on whether students are among the 50 per cent of young people who participate in higher education (HE) or the rest. The panel believes that this disparity must be addressed. This is a matter of fairness and equity and is likely to bring considerable social and economic benefits to individuals and the country at large. It is our core message.

This review describes FE funding as "inadequate to cover essential maintenance or to provide modern facilities, and funding flows are complex to navigate", while noting a "steep, steady decline in investment" (p.5). This underinvestment affects infrastructure, staffing, and student support, disproportionately impacting disadvantaged students. Teacher recruitment and retention are particularly affected, with insufficient funding for training contributing to shortages in key areas, such as science. Despite evidence that high-quality teaching improves outcomes for disadvantaged students (House of Commons Education Select Committee, 2021), working conditions and bureaucratic pressures often threaten to exacerbate teacher retention issues, limiting the FE sector's capacity to deliver high-quality science education in the UK.

Institutionally, FE colleges operate as autonomous corporations under the Department for Education, navigating a complex funding system that allocates resources based on student age, programme type, and additional needs (GOV.UK, 2021a). Although the funding formula includes provisions for disadvantaged students, such as high-needs and area-cost adjustments, these remain insufficient. Between 2010–11 and 2019–20, funding per student in FE colleges fell by 12% in real terms (Lewis, Bolton and Hubble, 2021); in my opinion, this may incentivise high enrolment, often at the expense of entry standards and pedagogical quality. In addition, large class sizes, overstretched resources, and rising workloads may compromise teachers' ability to tailor learning to individual needs. The recent worldwide COVID-19 pandemic intensified these pressures, increasing the demand for upskilling and retraining among

unemployed populations, while FE institutions struggled to meet these needs with limited resources. In my experience, most FE colleges have not had an end-of-year net financial surplus in the last 10 years; rather, deficits and how they would be managed by further cuts here and there were always declared. As summarised by the Augar Review (2019, p.5):

The FE sector is demoralised, has little to spend on mission groups, and is consequently under-reported in the media and under-represented in Westminster. No prior government has considered further education a priority. The consequence has been decades of neglect and a loss of status and prestige among learners, employers, and the public at large. Taken together, these intersecting factors create barriers for vocational science students in FE colleges. Having examined how SC operates within the socio-economic and institutional context of London FE colleges, Section (3.6) explores how gender further mediates students' experiences and engagement with science.

3.6 Gender and Science Capital

While the socioeconomic and institutional contexts of London FE colleges significantly shape students' access to and engagement with science, gender adds a critical layer of complexity. As a framework, SC is not gender-neutral; rather, it is deeply influenced by gendered norms, expectations, and representations that affect how learners perceive themselves and are perceived within scientific fields. Numerous studies have consistently shown that female students, particularly those from working-class and ethnic minority backgrounds, often encounter implicit and explicit barriers to science participation, including limited role models, gendered assumptions about ability, and a lack of cultural alignment between their experiences and dominant science discourses (Archer et al., 2012, 2013a, 2015, 2020a; DeWitt and DeWitt, 2014; King et al., 2015; DeWitt Archer, 2017; Vincent-Ruz al., 2018; Moote et al., 2019, 2020; Turnbull et al., 2020; OECD, 2021; Wade-Jaimes et al., 2021; Grimalt-Alvaro, 2022). These dynamics are especially pronounced in vocational pathways, where science is frequently framed in masculinised and technical terms that may alienate female learners. This section explores how gender intersects with other dimensions of

identity to shape students' science aspirations, confidence, and trajectories within the FE sector.

Global and regional studies consistently highlight how these factors influence girls' and women's participation in STEM, despite decades of policy interventions aimed at promoting gender equity. UNESCO (2017a, 2017b van der Weide) and NESET (Network of Experts working on the Social Dimension of Education and Training) (Evagorou et al., 2024) provide comprehensive overviews of these disparities, noting that women remain underrepresented in STEM fields globally and across Europe. UNESCO's multilevel model attributes these gaps not to biological differences but to socialisation processes, structural barriers, and cultural norms that shape girls' self-efficacy and motivation; for instance, although women constitute 35% of STEM HE enrolments, their participation declines at more advanced levels. NESET similarly found that academic performance parity between girls and boys does not translate into equal representation in STEM careers, suggesting that factors beyond ability, such as societal expectations and institutional cultures, most likely play decisive roles.

In alignment, the Global Gender Gap Index 2020 (WEF, 2020) shows that although 68.6% of the global gender gap has been closed, with educational attainment nearing parity at 96.1%, the gaps persist in developing nations, where over 10% of girls aged 15–24 remain illiterate, while some countries still need to close more than 20% of their education gaps. According to the report, although some countries have achieved full parity, women's skills often fail to align with high-growth sectors such as AI and engineering, limiting access to future-oriented roles, thus, highlighting the need for systemic investment in education and policies that bridge the gap between women's skills and emerging labour market demands. These findings are echoed by the OECD (2021), which identifies self-perception, confidence, and career aspirations as heavily influenced by gender norms and cultural attitudes.

Hence, SC can be a pivotal construct for understanding gendered trajectories in STEM. It encompasses access to cultural capital, early educational tracking, and familial structures, all of which are unevenly distributed across social groups (Adamuti-Trache and Andres, 2008). The ASPIRES studies (Archer, 2012; Archer and DeWitt, 2014) illustrate how girls'

science aspirations are shaped by the versions of femininity they perceive as compatible with science, influencing their view of STEM as a viable and desirable path. Moote et al. (2019) extend this by showing how gender and ethnicity intersect to compound disadvantages, particularly for minority girls who often lack access to informal science learning and relatable role models. Individual-level traits, such as self-efficacy, which is often lower in girls despite equal or superior academic performance, alongside contextual factors, such as family support and early exposure to STEM, are critical in shaping engagement (Balta et al., 2023; Johnson et al., 2022).

The transition from education to employment further reveals stark gender disparities, with men more likely to enter and remain in STEM fields, and progress across disciplines and countries remains slow and uneven (Stoet and Geary, 2018). Institutional factors were also central to the findings. Gender-inclusive curricula, equitable pedagogical practices, and the presence of female role models have been shown to enhance participation (EU STEM Coalition, 2020; Chan, 2022). However, the Australian Education Council (2015) stressed that isolated interventions are insufficient; instead, systemic, large-scale strategies that address individual, contextual, and institutional barriers simultaneously are necessary to achieve meaningful change. Studies indicate that science identity is co-constructed through interactions with SC and institutional norms, often resulting in disadvantages for marginalised students (Gonsalves et al., 2021).

Furthermore, cultural perceptions of STEM as being incompatible with communal values, such as helping others, deter women's participation (Diekman et al., 2017). Neoliberal academic structures, which privilege competitive and individualistic norms, exacerbate these disparities by marginalising relational and collaborative approaches more commonly preferred by women (Mellén and Angervall, 2021). Naukkarinen and Bairoh (2020) critique the epistemological foundations of STEM disciplines, arguing that dominant paradigms exclude alternative ways of knowing, thereby alienating women and other marginalised groups. In addition, subject-specific studies, particularly in physics, have revealed how recognition and affective experiences are vital to identity development. According to Hazari, Sadler, and Sonnert (2013), girls often receive less encouragement and fewer opportunities for meaningful engagement, which undermines their physics identity. Students' perceptions of science's

relevance to their lives also shape aspirations, with gendered patterns in how relevance is internalised (Sheldrake, Mujtaba and Reiss, 2017). For instance, physics is culturally constructed as a masculine domain, with pedagogical practices and classroom cultures reinforcing male dominance and alienating female students (Francis et al., 2017). Gonsalves (2018) explored these dynamics in the Indian context, showing how cultural and familial expectations intersect with institutional norms to constrain women's science identities.

Media representations further reinforce masculine stereotypes, shaping perceptions of who belongs in science (Kerkhoven et al., 2016). Even when academically qualified, women are less likely to apply to STEM programmes, suggesting that institutional cultures should actively affirm women's sense of belonging (Delaney and Devereux, 2019). Career intentions among underrepresented students are shaped not only by academic achievement, but also by identity, belonging, and perceived barriers (Wong et al., 2022). Retention and progression in STEM are also influenced by gendered expectations and institutional climates, with women often facing subtle forms of exclusion and devaluation that threaten to undermine their persistence (Macdonald, 2014; Makarova et al., 2019). Mentorship and community support are reportedly essential for sustaining engagement (May et al., 2022), whereas early exposure and parental encouragement play foundational roles in shaping science aspirations (Luo et al., 2021). Together, this body of research underscores the need for a holistic and intersectional approach to gender equity in STEM.

Addressing the gender gap requires not only targeted interventions at the individual level but also structural reforms that challenge entrenched norms, transform institutional cultures, and expand SC access for all learners. Teachers and schools are frequently positioned as compensatory agents to bridge these gaps. Black and Hernandez-Martinez (2016) underscore the role of inspirational teachers who extend learning beyond the curriculum by organising science clubs, inviting guest speakers, and sharing personal narratives as pivotal in shaping students' science identities, particularly for those without science-related figures at home, as follows: In my department, we have proactively cultivated such practices, including inviting female STEM professionals and alumni to speak with students, which has demonstrably increased student engagement and aspiration. For example, our engineering cohort saw a

three-fold increase in female enrolment in 2024–25, and over the past three years, female science enrolment has consistently outpaced males.

However, Kelly et al. (2019) identified the lack of sufficient female STEM role models as a key barrier to girls' participation in science. Their study found that exposure to women in science through guest talks, videos, or mentoring significantly increased girls' perception of science as a viable career. They advocate for the intentional diversification of scientific representation in educational settings. Pedagogical strategies also play a compensatory role in this regard. Rüschenpöhler and Markic (2020b) showed that storytelling and case studies of diverse scientists can help students, particularly girls, develop science identities, even in the absence of familial science role models. In addition, King et al. (2015) reported that some teachers lack confidence in leveraging external science connections, such as inviting scientists into classrooms or engaging parents with science qualifications.

My college addresses this by supporting staff in building partnerships with STEM professionals and encouraging the use of parental expertise as a resource for teaching. In the absence of such efforts, opportunities for meaningful engagement with science professionals are diminished. For instance, as the only female teaching staff and curriculum manager for science and engineering in my department, I am acutely aware of my role as a mentor and role model. I proactively promote female participation through individualised guidance on issues of concern and (HE)progression pathways. Mothers navigating the balance between study, progression routes, and their home lives often come to me for advice and guidance because they know that I have experienced their situation and can empathise and guide them.

In my opinion, connecting with my female students in this way is an example of social capital that is hardly recognised by Bourdieusian and Archer et al.'s popular conceptualisations, but which is of important significance to my genderised, multi-ethnic, and socio-economically diverse female students who are mothers. In addition, some of my students, mostly mothers, often struggle with balancing their pre- and post-school childcare responsibilities with their course timetabling for reasons that include the family's inability to afford the very expensive

after-school clubs in London and belonging to single household families. As a minority female curriculum manager who belongs to similar communities and understands the challenges, my insider positionality enables me to proactively manage this by scheduling their lessons to start later and/or finish earlier to accommodate their childcare responsibilities. If this is not possible, other negotiations, including attending a second group of the same course for some lessons, are agreed upon.

Another gendered unintended consequence for my female students is that, as a result of familial responsibilities and restrictive cultural or religious norms, most of them are constrained to attend London universities from home, potentially limiting their geographical mobility and access to broader academic opportunities in the UK. Hence, as an ethnic minority educator who has experienced some forms of cultural marginalisation similar to those faced by many of my students, I empathise with their challenges and use my leadership position to advocate for inclusive practices and mitigate such barriers, where possible. This positionality also informed my choice of research focus. For instance, many student and teacher participants in this study were unfamiliar with the concept of science capital, as reflected in their responses, which underscores the need for broader dissemination and contextualisation of SC frameworks in the future.

Taken together, these studies illustrate how gender, particularly when combined with working-class and minority ethnic identities, may continue to shape students' sense of belonging, perceived competence, and access to valued forms of participation in science education. In FE contexts, where science is often positioned through narrowly technical, masculinised discourses, these intersecting barriers can further constrain the aspirations and progression of marginalised groups. However, gendered inequalities do not operate in isolation from one another. They are deeply entwined with broader structural factors, including socioeconomic status, which influences science-related resources, networks, and cultural alignments available to learners. The next section examines how socioeconomic disadvantage interacts with SC, highlighting how classed experiences compound or mitigate the gendered patterns discussed in this section.

3.7 Socioeconomic Status and Science Capital

Studies indicate that socioeconomic status (SES) remains a powerful determinant of SC, shaping not only access to educational resources but also the cultural narratives and institutional structures that influence whether science is perceived as relevant and attainable. A consistent pattern emerges in the literature, with students from higher SES backgrounds tending to possess greater SC, benefiting from parental support, extracurricular opportunities, and alignment between home and school values (Archer and Hutchings, 2000; Archer et al., 2013a, 2020a; Moote et al., 2019). These advantages are not merely material but also cultural, reinforcing a sense of belonging and entitlement within scientific spaces. In contrast, students from lower-SES backgrounds often face structural and symbolic barriers that constrain their engagement with science. Wong (2015) mapped how minority ethnic students navigate science participation, revealing that while many express high aspirations, these are frequently undermined by limited access to SC and institutional gatekeeping. His qualitative findings underscore that interest alone is insufficient; without the necessary cultural and social resources, aspirations rarely translate into sustained participation in the field. Similarly, Archer and Hutchings (2000) explore how working-class youth from ethnically diverse backgrounds perceive HE, finding that decisions around participation are shaped by discourses of risk, cost, and benefit. For many, university is not seen as a guaranteed route to social mobility but as a gamble, framed by the belief that it is not for people like them. Macdonald (2014) reinforces this, highlighting how underrepresented groups internalise exclusionary messages about science and STEM careers, leading to sense of alienation. This sense of exclusion is not only economic but also cultural in nature. Prieur and Savage (2013) argue that cultural capital is dynamic and evolves.

In addition, emerging forms of capital, such as digital literacy and informal scientific knowledge, are unevenly distributed and often unrecognised by formal education systems. This misrecognition is likely to marginalise working-class students, whose forms of capital tend to be devalued in academic settings. As digital fluency and familiarity with scientific discourse become gatekeeping mechanisms, students from lower SES backgrounds, who often lack access to these emerging capitals, are increasingly excluded. These dynamics reinforce structural inequalities and shape not only educational choices but also identity. Pedagogical practices play a critical role in reinforcing or challenging these inequalities. Sheldrake, Mujtaba, and Reiss (2017) argue that when science is taught as abstract and disconnected

from real-world applications, it tends to alienate students from lower SES backgrounds, who may not see its relevance to their lives.

Conversely, pedagogies that emphasise relevance and societal impact can foster greater engagement and aspiration. Darling-Hammond et al. (2020) support this view, calling for a systemic shift in science education, moving beyond content transmission to foster meaningful connections that resonate with students' experiences. The finding that educational attainment is more strongly predicted by socioeconomic background than by actual competencies (Boliver and Capsada-Munsech, 2024) validates this study's focus on how prior educational histories intersect with science capital and perceived inclusion. Moreover, Torche (2021) highlights that relative educational mobility has worsened for recent cohorts in low-income countries and that public investment in education is a key correlate of mobility (van der Weide et al., 2021). The effects of socioeconomic status on students' access to and accumulation of SC intersect closely with their ethnocultural backgrounds, shaping distinct patterns of opportunity, recognition, and participation, which are explored (Section 3.8) explores.

3.8 Ethnocultural Background and Science Capital

Rather than being a neutral or universally distributed resource, SC is embedded in social structures and cultural narratives that influence whether science is perceived as accessible, relevant, or culturally compatible. Archer, DeWitt, and Osborne (2015) offered a compelling account of how Black students and their parents perceive science and science careers. While science is often viewed as valuable, it is simultaneously perceived as "not for us," reflecting a dissonance between dominant scientific cultures and Black cultural identities. This disconnect is rooted in systemic underrepresentation, a lack of relatable role models, and perceived cultural incompatibility in science fields. Wong (2015) extends this analysis through a qualitative mapping of minority ethnic students' science participation, identifying how achievement, aspiration, interest, and capital often intersected. His findings show that while many minority students possess high aspirations, these are frequently constrained by limited

access to informal science learning, parental science knowledge and racialised experiences within educational institutions.

The concept of 'science debt' introduced by Archer et al. (2020a, p.3) further illustrates how Black students, despite expressing strong science aspirations and self-concept, often encounter persistent barriers in translating these aspirations into post-16 science participation. This framework has proven particularly illuminating in understanding such disparities in STEM, as it highlights how systemic inequalities accumulate over time, creating a debt that students must overcome to persist in science careers. Moote et al. (2019) reinforce this by identifying patterns of SC among 17/18-year-olds in England, showing that White middle-class students are more likely to possess high SC, while ethnic minority students often rely on individual resilience rather than systemic support.

Science identity, or the sense of oneself as a science person, is also shaped by cultural and ethnic identity. Hazari, Sadler, and Sonnert (2013) explored how gender, race, and ethnicity intersect to influence science identity among college students. Their findings revealed that underrepresented students often struggle to reconcile their cultural identities with the dominant norms in science, which are frequently White and male. Gonsalves (2018) and Gonsalves et al. (2021) delve into the experiences of Indian and Indian-origin students, illustrating how cultural values, family expectations, and community narratives shape their science identity. Their studies report that while Indian-origin women may pursue STEM careers due to familial encouragement and the cultural valorisation of science careers, they also navigate tensions between traditional expectations and Western academic norms. Importantly, Gonsalves et al. (2021) highlighted the cognitive and cultural resources these students bring, such as multilingualism and transnational experiences, which can enrich science learning but are often unrecognised or undervalued in formal education settings. The social cognitive framework applied by Lent et al. (2013) adds further nuance by examining the predictors of adjustment to engineering majors across gender and race/ethnicity. Their study underscores the importance of self-efficacy, outcome expectations, and support systems, noting that ethnic minority students often report lower self-efficacy and fewer role models, which negatively impacts their persistence in STEM fields.

These findings align with Archer and Hutchings' (2000) sociological analysis of how young working-class students from ethnically diverse backgrounds construct HE. They identified discourses of risk, cost, and benefit that shape decision-making, with many students perceiving HE, and by extension, science careers, as risky investments with uncertain returns. These perceptions are often compounded by racialised and classed experiences of exclusion, reinforcing the notion that science is not a space in which they naturally belong. In conclusion, students' ethnocultural backgrounds tend to shape how their knowledge, identities, and experiences are valued within science learning, as further explicated in Sections 3.11, 3.12, and 3.13. These dynamics intersect closely with English language proficiency, which further mediates access to and expression of SC, as reviewed in the next section (Section 3.9).

3.9 English Language Proficiency and Science Capital

English Language Proficiency (ELP) tends to play a pivotal role in shaping students' access to and accumulation of SC; however, it remains largely underdeveloped in dominant SC theories such as Archer et al.'s (2013a, 2020a). However, within Bourdieu's conceptualisation of capital, linguistic capital is a recognised form of cultural capital (Bourdieu and Passeron, 1990) that influences individuals' ability to navigate and succeed in institutional fields. In the context of science education, ELP tends to function as a form of linguistic capital that mediates students' ability to comprehend scientific discourse, articulate understanding, and engage with science-related practices. When ELP is limited, students may possess the curiosity, motivation, and even conceptual understanding necessary for science engagement but may lack the linguistic tools to convert these into recognised forms of SC. This potential disconnect supports the notion that SC is unequally accessible to all students (Archer et al., 2013a, 2020a) and calls for an amendment to the SC description that incorporates language as a factor in the acquisition and recognition of SC.

Additionally, the relationship between ELP and SC is becoming increasingly significant in global educational contexts, where English dominates scientific discourse and instruction. This dynamic is particularly complex for multilingual learners, whose linguistic assets are

often undervalued in formal science education (Jarmouni et al., 2017; Seloma and Ramaila, 2021). Wilson-Lopez et al. (2017) offer a compelling expansion of the SC framework through their study of Latinx high school students from immigrant, working-class backgrounds in the U.S. Drawing on Bourdieu's theory of capital (Bourdieu, 1986; Bourdieu and Passeron, 1990), we demonstrate how students mobilise multilingual abilities, social networks, and institutional resources to navigate engineering projects. Their findings highlight the importance of recognising embodied and community-based capital, such as literacy practices and problem-solving experiences, as legitimate forms of SC, advocating for curricula that allow students to activate these assets meaningfully. However, limited ELP can pose significant barriers to learning science. Students often struggle with scientific terminology and conceptual understanding, which can hinder both their academic performance and SC development (Jarmouni et al., 2024). In multilingual classrooms, integrated approaches that combine language and content instruction have proven effective in enhancing both scientific knowledge and linguistic competence (Relyea and Hwang, 2025; Chauca, Ortiz and López, 2023). The role of teacher language proficiency is also critical; Seloma and Ramaila (2021) show that educators with strong Cognitive Academic Language Proficiency (CALP) in English are better equipped to convey complex scientific ideas, whereas those with limited proficiency may inadvertently obstruct learning.

Osborne's (2002) article 'Science Without Literacy: A Ship Without a Sail?' critiques the marginalisation of reading, writing, and argumentation in science education despite their centrality to scientific practice. He argues that most public engagement with science occurs through texts and mediated accounts rather than direct empirical work, yet school science continues to privilege laboratory activities that often function more as rhetorical performances than as genuine enquiry. Osborne challenges the narrow curricular focus on science as an empirical endeavour, contending that this neglects the complex, multi-meaning nature of scientific language and its role in constructing meaning and argument. He calls for a reconceptualisation of science education that foregrounds literacy, advocating curricula and assessment strategies that recognise the multi-semiotic and discursive dimensions of science. His metaphor of science education without literacy as "a ship without a sail" (p.203) powerfully illustrates the limitations of current pedagogical models, while his critique of the laboratory as a theatrical space invites a deeper reflection on the educational value of practical work and the epistemological assumptions underpinning it.

Assessment practices further complicate this landscape. Standardised tools often fail to capture the nuanced linguistic capabilities of multilingual learners, necessitating more responsive and inclusive evaluation methods (Patterson and Schneider, 2024). Addressing these challenges requires targeted professional development for educators, equipping them with strategies to support students' engagement with science in both their first language and English (Ramalingam and Islam, 2024). Institutions must also rethink curriculum design to honour linguistic diversity, while promoting English proficiency. Integrating language support into science instruction and encouraging collaborative learning in students' preferred languages can bridge comprehension gaps and build on their existing knowledge.

In my experience, my EALS students face compounded challenges, particularly when their limited ELP intersects with their socio-cultural responsibilities. Beyond the linguistic barriers that affect their ability to engage with assessments and scientific discourse, many students, especially those from migrant backgrounds, are sometimes absent from lessons due to caregiving obligations. For instance, a recurring pattern involves students accompanying non-English-speaking family members to medical appointments, immigration interviews, or social service consultations, often because they are the only English speakers in the household. These absences, while rooted in familial duty and cultural expectations, may have significant consequences for learning continuity, assessment readiness and progression. Missed instructional time disrupts the cumulative nature of science learning, particularly in vocational pathways, where practical skills and conceptual scaffolding are essential.

Moreover, the pressure of managing adult responsibilities alongside full-time study can affect students' concentration, confidence, and sense of belonging in academic spaces. These experiences underscore the need for more culturally responsive and flexible educational practices that acknowledge the lived realities of EALS learners and support their academic resilience. Taken together, these insights highlight the need to reconceptualise SC theory to explicitly incorporate ELP as a form of linguistic capital, recognising its crucial influence on students' ability to access, express, and be recognised within science education, particularly for EALS and marginalised learners whose engagement is shaped by the intersection of linguistic, cultural, and socioeconomic factors.

3.10 Science Capital and Intersectionality

The discussion of ELP (Section 3.9) highlights how linguistic capital intersects with SC to shape students' access to and participation in science education in often inequitable ways. However, ELP represents only one of several intersecting identities through which SC is developed and recognised. Adopting an intersectional perspective is therefore necessary to understand learners' holistic experiences. Drawing on Crenshaw's theory of intersectionality (1989, 1991, 1998), this section considers how SC is mediated by the interaction of race, gender, class, language, and culture, illuminating the layered and compounded \[dis]advantages experienced by students across multiple social categories. For example, a working-class Black female student is likely to face different intersecting \[dis]advantages than a middle-class White female student or a working-class Black male student. Conversely, a White female participant may benefit from racial privilege while simultaneously experiencing gender-based marginalisation. These dynamics underscore the importance of an intersectional approach to understanding educational experiences and social capital acquisition.

An intersectional lens is central to this study given the diversity of the college's science students and teachers and the systemic barriers they may face. A key strength of intersectionality within SC research is its capacity to surface hidden power relations and marginalised voices often overlooked in traditional analyses. By examining how identities intersect, researchers gain a more nuanced understanding of the barriers and opportunities shaping engagement with science education. Existing studies demonstrate how exclusion in science is frequently compounded across multiple axes. For example, Carlone, Johnson, and Scott's (2014) science identity framework highlights how women of colour navigate science through performance, competence, and recognition, shaping how science is internalised or resisted. Similarly, Hazari, Sadler, and Sonnert (2013) show how gender and ethnicity mediate science identity development, particularly in physics, while Collins (2015) frames intersectionality as a knowledge project centred on power and social justice.

Figures 2A-2D below are examples of purpose-designed Venn diagrams of the student participants' demographics (Appendix 2) that explore key patterns of intersected

[dis]advantages, highlighting the complex and layered nature of these influences. Collectively, the intersections represent compounding advantages: Gender and Culture indicate identity fit with prevailing norms; Gender and Capital identity fit with material and linguistic resources; Culture and Capital join cultural fit with socioeconomic and language [did]advantages. The core intersection reflects maximal alignment and resourcing, where learners are most likely to experience science as accessible, legitimate, and "for people like me" (Archer, 2013a, 2020a). Alignment with institutional norms and access to resources can combine to increase science capital. The more clusters that overlap for a learner, the more likely the learner is to perceive science as accessible, thereby easing progression and strengthening science identities.

Figure 2A: Intersectionality of Black Ethnicity, Socio-economic Status (SES), and GCSEs Status

Figure 2A highlights a possible intersection of racial and economic marginalisation. Black learners from lower SES backgrounds could face compounded barriers, including institutional racism, lower teacher expectations, and poor curriculum dynamics (Gillborn, 2008; Strand, 2014). Despite these possible challenges, some participants attain good GCSE grades, which might indicate resilience (Wynne, 2014; Black and Hernandez-Martinez, 2016; Moote et al., 2019) within structurally constrained contexts. Anti-racist educational practices, culturally responsive pedagogy, and socio-economic uplift strategies are essential to disrupt the [re]production of racialised educational inequalities.

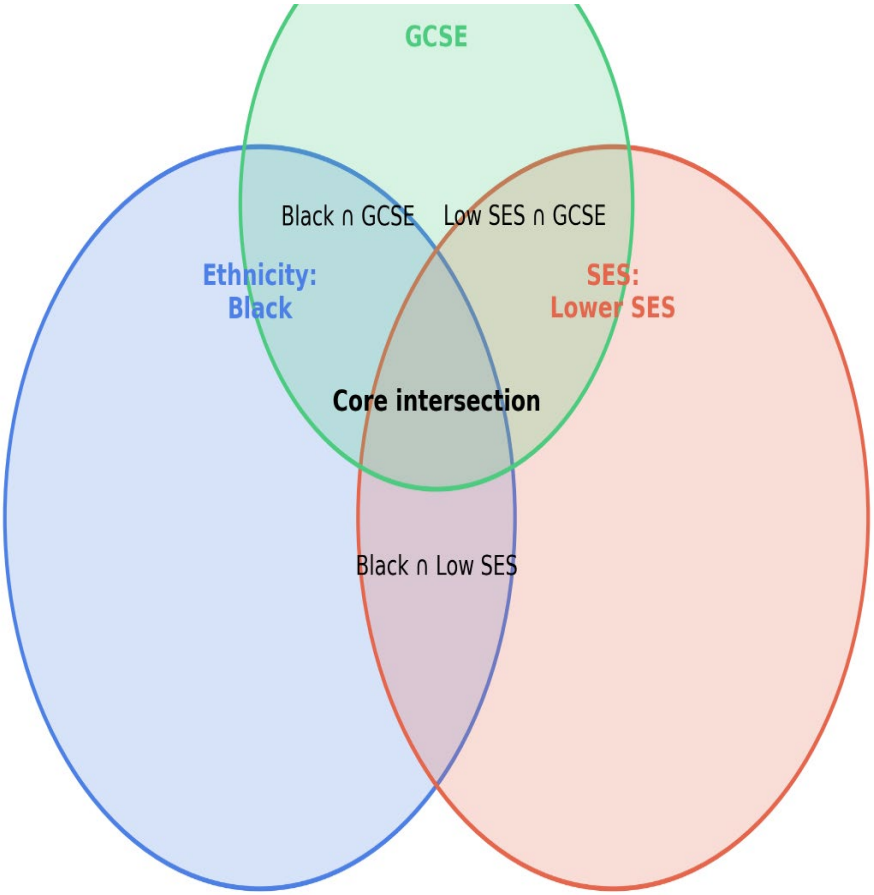


Figure 2A:

Intersection A: Black ∩ Low SES – compounded barriers; institutional racism; lowered expectations and curriculum mismatch.

Intersection B: Black ∩ GCSE – attainment present; resilience and supportive contexts likely factors.

Intersection C: Low SES ∩ GCSE – achievement despite resource limits.

Intersection D: Core Intersection (Black ∩ Low SES ∩ GCSE) – resilience within constrained contexts.

Figure 2B: Intersectionality of Gender Socio-economic Status and GCSE Status

Figure 2B illustrates the intersection of gender (female), low socio-economic status (SES), and educational attainment (UK GCSEs). Applying an intersectional lens (Crenshaw, 1989; 1991; 1998), the overlap highlights where compounded [dis]advantages may shape learners' experiences, outcomes, and mobilisation of capital in education. Drawing on cultural capital theory (Bourdieu, 1986; Bourdieu and Passeron, 1990), underrepresentation in GCSE attainment suggests systemic barriers linked to gendered expectations and socio-economic constraints.

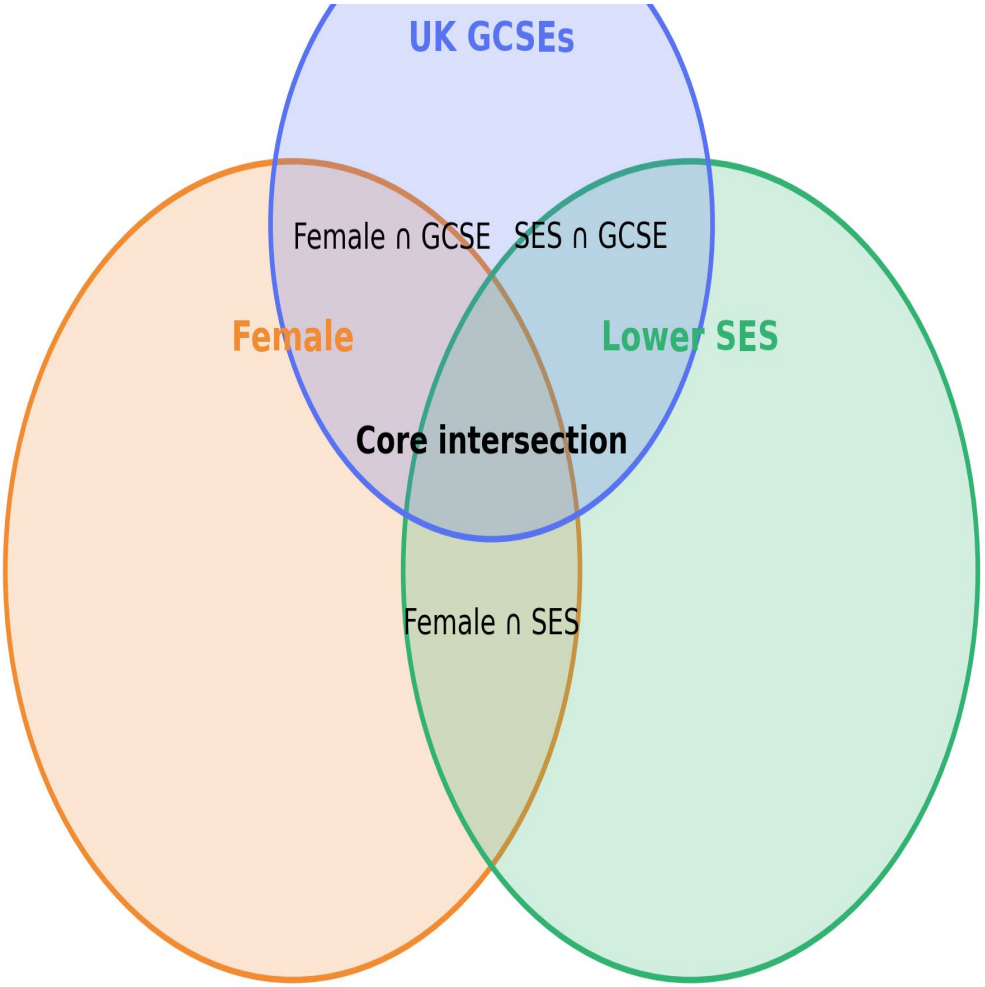


Figure 2B:

Intersection A: Female ∩ low SES — gender–SES overlap; exposure to structural constraints shaping progression.

Intersection B: Female ∩ GCSEs — attainment suggesting resilience and supportive contexts enable success.

Intersection C: Low SES ∩ GCSEs — achievement despite limited resources, indicating effective support.

Intersection D: Core intersection — Female + low SES + GCSEs; resilience within constraint, highlighting pathways to strengthen (e.g. mentoring, equitable guidance, anti-bias pedagogy).

Figure 2C: Intersectionality of Language Proficiency, GCSEs and Socio-economic Status

The student participants in Figure 2C achieved UK GCSEs despite socioeconomic constraints, as indicated by their low SES. Their educational success may reflect individual resilience or access to compensatory resources, such as community support or targeted school interventions. Also, as EALS learners, they often face linguistic barriers that intersect with economic disadvantage, which might limit their access to mainstream science curriculum and assessment success. Inclusive language policies, differentiated instructions, and community-based support could be beneficial to improving outcomes.

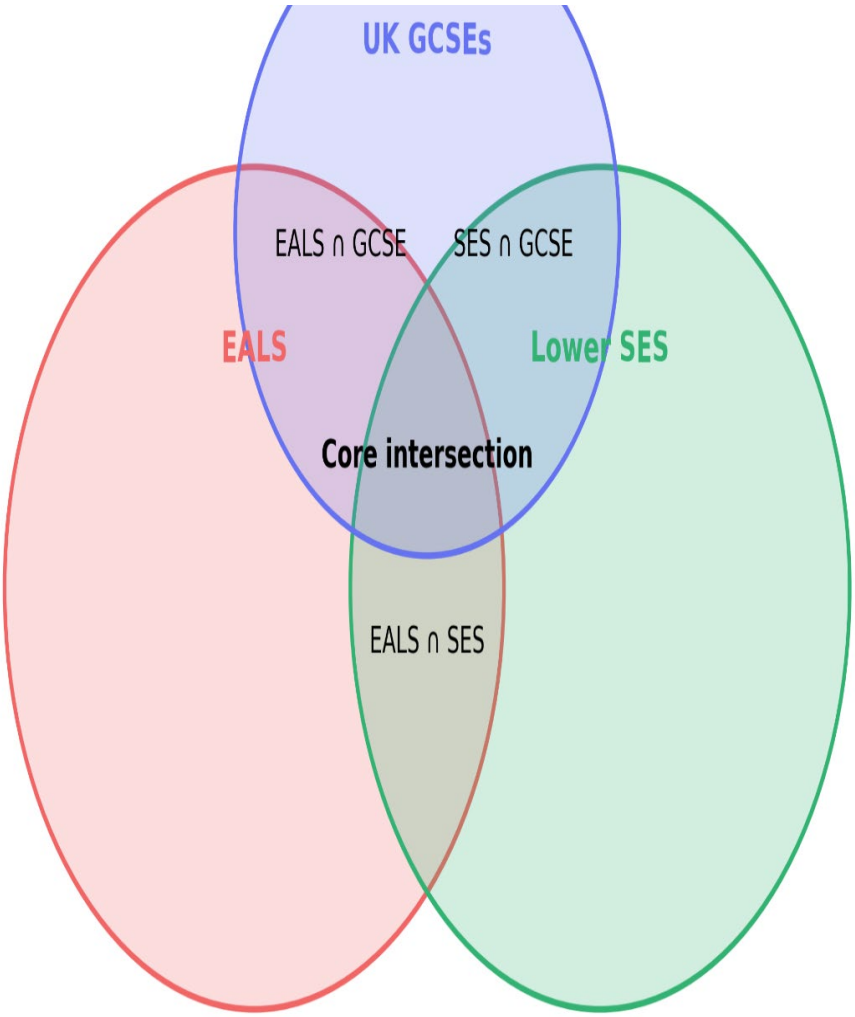


Figure 2C:

• Intersection A (EALS ∩ SES): EALS learners are likely concentrated in lower SES groups, where linguistic and economic disadvantage possibly intersect.

• Intersection B (EALS ∩ GCSE): EALS learners attaining GCSEs; reflects varied prior schooling and alignment challenges with UK curricula.

• Intersection C (SES ∩ GCSE): Low SES learners achieving GCSEs, indicating possible resilience and effective support.

• Intersection D (EALS ∩ SES ∩ GCSE): Learners facing combined linguistic and socioeconomic disadvantage who still achieved GCSEs, possibly showing resilience within constraints.

Figure 2D: Intersectionality of Gender, Ethnicity, Culture, Religion, SES and ELP

Figure 2D is a purpose-designed, imaginary intersectionality Venn diagram that illustrates how three domains, gender alignment with dominant norms, cultural majority identity (national and religious), and capital advantage (high SES and high English language proficiency), may intersect to shape students' science capital. Individually, each cluster confers forms of recognition, access to resources, and reduced friction within institutions.

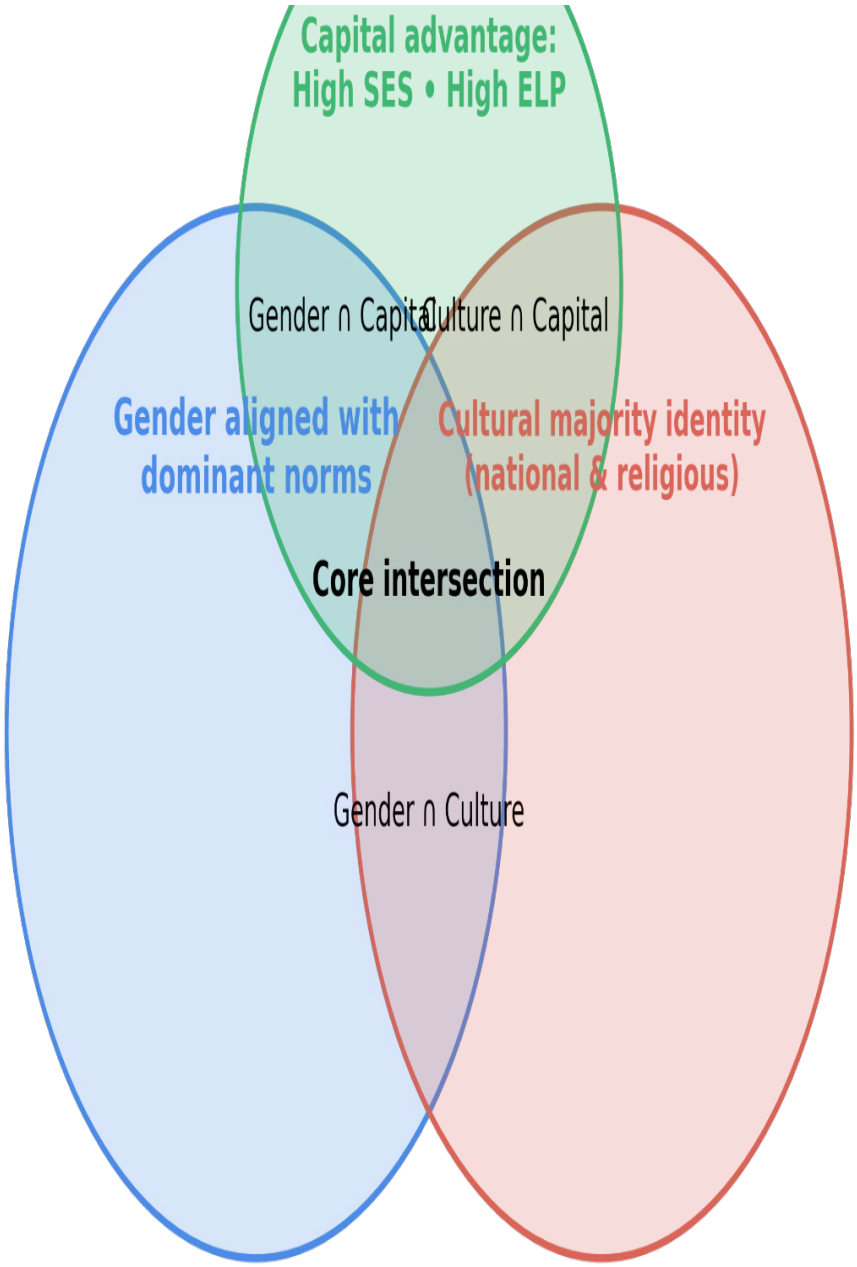


Figure 2D:

Intersection A: Gender ∩ Culture – dominant-norm gender + cultural majority; possibly stronger institutional fit and fewer cultural barriers.

Intersection B: Gender ∩ Capital – dominant-norm gender + high SES/ELP; confidence and access strengthened by resources and language.

Intersection C: Culture ∩ Capital – cultural majority + high SES/ELP; strong alignment with school norms plus resource-based advantages.

Intersection D: Core intersection (all three) - maximum alignment and resourcing; highest likelihood of mobilising science capital.

Archer et al. (2020a) also demonstrated how gendered and racialised narratives shape science identity formation. Reznik et al. (2023) apply a feminist intersectional lens to informal science learning, revealing how race, class, and gender intersect to marginalise girls of colour and those from low socio-economic backgrounds. Bilen (2024) offers a more recent and context-specific contribution by examining how gender, religion, and ethnicity intersect to

shape science aspirations among London students. Their findings revealed that science engagement is not merely cognitive but deeply cultural, shaped by students' experiences and social positioning. This aligns with Bang and Medin's (2010) argument that science education must validate Indigenous and non-Western epistemologies to be truly inclusive. Regarding intersectionality and structural changes, the SC framework aligns with intersectionality theory in recognising how overlapping disadvantages shape educational outcomes. For instance, The Scottish Government's 2022 report (Scottish Government, 2022) conceptualises individuals as shaped by interlocking social categories within systems of power, stressing that effective policy must address these dynamic interrelations. A key contribution is its emphasis on reflexivity, which encourages policymakers and researchers to examine how their identities influence knowledge and policy. This extends intersectionality beyond analysis to confront structural bias. The report also demonstrates its practical value through case studies, such as the intersection of poverty and racial inequality during the COVID-19 pandemic.

Furthermore, Farrell's (2023) institutional reflections highlight how intersectionality informs diversity, equity, and inclusion work across the UofG's College of Science and Engineering, stressing the need for structural change, inclusive language, and the social model of disability in STEM education for students with disabilities. Although this is not a formal study, it supports intersectionality in science education policy and practice. Alghamdi's (2024) doctoral thesis explores how gender intersects with socioeconomic status, education, and employment to shape mental health outcomes for Saudi women, while Salehjee and Watts (2022) examine how two British South Asian Muslim girls navigate science identities in a single-sex school, showing how intersecting identities, gender, religion, ethnicity, and class shape aspirations and experiences, contributing directly to intersectionality-informed science education.

Read's (2024) study in the HE sector across Europe problematised the concept of 'diversity' in academia, which, in the author's view, is often narrowly defined as proportional representation across categories such as gender, sexuality, race, ethnicity, class, age, religion, and disability, based on national population statistics, while relying on oversimplified and socially constructed categories that attempt to quantify complex and

subjective identities. The study argues against institutional diversity goals that risk becoming a superficial exercise in numbers driven by commercial and managerial logic rather than a genuine commitment to equity and inclusion. Although Read's study did not focus on SC or FE colleges, it offers relevant insights. This confirms the need for the intersectional approach of this study, showing how multiple identities such as gender, race, and class shape academic engagement. Her critique of how certain knowledge forms are privileged suggests that diverse students' ways of knowing may be undervalued in FE science education settings. She also calls for qualitative, in-depth research to challenge inequitable practices, in line with the approach of this study.

From an international perspective, the OECD (2023a, 2023b, 2025a, 2025b, 2025c, 2025d) working paper presents a comprehensive policy-level analysis, arguing that intersectional approaches yield more effective educational interventions by recognising the interconnectedness of identity dimensions and their socio-historical contexts. Countries embedding intersectionality into governance and school-level practices report improved participation and socioemotional outcomes. Seebacher et al. (2021) conducted a large-scale European study involving 1,486 young people aged 8–21 years in non-formal science education settings. Combining intersectionality with science learning ecologies, the study found that male learners from affluent backgrounds are most likely to connect with science, while those from lower socioeconomic backgrounds, regardless of gender, struggle to see its relevance.

This challenges simplistic gender-based explanations and underscores the need for inclusive science education that reflects learners' complex identities, especially in FE colleges, where underrepresentation is common. Bielinis (2019) explores gender, diversity, and intersectionality in adult education, critiquing traditional gender constructs and advocating pedagogies that foster agency and challenge entrenched power structures, an approach highly relevant to this study, which bridges youth and adult learning. Although intersectionality offers a powerful framework for understanding inequalities in SC, its application is not without challenges. Bright et al. (2016) highlighted the need for clearer theoretical predictions and methods for testing intersectional hypotheses, advocating for a causal interpretation to enhance analytical precision. Burge et al. (2018, p.10) caution against inadvertently reinforcing marginalised groups as the "Other" or treating certain identifiers as

foundational, underscoring the importance of reflexivity in applying intersectional approaches within science education.

Methodologically, intersectional analysis presents complexities. Cuádraz and Uttal (1999) emphasise the difficulty of simultaneously analysing individual biographies and broader social structures, advocating in-depth interviews and inductive questioning to distinguish personal experiences from systemic issues. Nash (2008) critiques the theoretical clarity and methodological rigour of intersectionality, identifying unresolved paradoxes such as the absence of a defined methodology. Despite these challenges, intersectionality remains a promising lens for exploring SC and educational inequality. Cho, Crenshaw and McCall (2013) propose viewing intersectionality as an analytic sensibility rather than a fixed theory or method, allowing for flexible, context-sensitive application across diverse educational settings and research questions. As demonstrated through the participants' narratives, science engagement is deeply embedded within the broader structures of social [in]equality, requiring a more nuanced and context-sensitive theoretical approach. These insights set the stage for a critical examination of the limitations that could be inherent in Archer et al.'s (2013, 2015) widely accepted science capital framework, particularly its limited evidence to account for the lived realities of marginalised groups and its tendency to reproduce dominant epistemologies and normative assumptions in science education.

3.11 Limitations of the Science Capital Framework

Although the SC framework is increasingly influential, it is not without significant criticism. A primary concern is the grounding of SC in Western scientific paradigms, which risks marginalising non-Western epistemologies and reinforcing colonial hierarchies in science education (Elshakry 2010; Jensen and Wright 2015; Kalolo 2015; Perera 2011). This limitation, which is further explored in Section 3.12 (Science Capital and Coloniality of Power) and Section 3.13 (Decolonising Science Capital), underscores the need for epistemic plurality in conceptualising science engagement in schools. Jensen and Wright (2015) further argue that isolating SC as a distinct construct obscure the broader cultural mechanisms of exclusion that Bourdieu's original theory already captures. They question the necessity of separate science-

specific capital, suggesting that science-related resources can be subsumed within Bourdieu's existing cultural capital framework (Bourdieu, 1990). Moreover, they critique Archer et al.'s operationalisation of SC (Archer et al., 2013a, 2020a), warning that it may inadvertently reinforce dominant power structures rather than dismantling them. They call for systemic educational reform that addresses structural injustice rather than narrowly focusing on science-specific interventions or valorising existing scientific institutions. While I agree on the need to broaden Archer et al.'s framework to reflect the complex, intersectional realities of learners, I contend that Bourdieu's original cultural capital formulation (Bourdieu, 1990) does not adequately capture the specificity of science-related cultural and social capitals. The empirical evidence in this study supports the distinctiveness of SC as a necessary analytical framework.

Another limitation lies in the potential for the popular SC framework to perpetuate deficit narratives by emphasising what students lack rather than recognising their existing cultural wealth (Godec, King and Archer, 2018). Additionally, its application has been largely confined to school-aged populations, with limited exploration among post-compulsory (16+ year-olds), adults, or vocational education contexts. This is particularly problematic in the FE college setting of this study, where students are disproportionately from working-class, racially minoritised backgrounds, with many tending to have non-traditional, non-British educational backgrounds. Kalliomäki et al. (2024) caution that inclusion rhetoric in science policy often lacks substantive structural reform, warning that frameworks such as SC risk becoming superficial markers of equity unless embedded within broader institutional transformation. Thus, while the SC framework, rooted in Bourdieu's field-habitus-class triad and extended by Archer et al. (2013a, 2020a), offers valuable insights into the reproduction of social inequalities in science, its application needs to be critically and contextually nuanced. The assumption that SC acquisition can be standardised through curriculum and policy overlooks the complex, intersecting identities of FE college science students, as exemplified in my department.

In a diverse department such as mine, where ethnicity, class, gender, and language intersect, a deeper interrogation of how SC is experienced, interpreted, and valued is essential, an endeavour this study undertakes. These insights suggest that the current widely accepted SC

framework would benefit from a re-evaluation to incorporate a more intersectional and inclusive lens that recognises the fluidity of identity, the influence of non-Western epistemologies, and the transformative potential of educational interventions. Such theoretical expansion would not only enhance the explanatory power of SC but also support the development of pedagogical practices that are more responsive to the diverse realities of learners. These limitations in the SC framework, particularly its insufficient engagement with linguistic diversity, cultural epistemologies, and structural inequalities, necessitate a deeper interrogation of the sociohistorical factors that shape educational access and participation. Furthermore, SC may not be fully understood without considering the enduring legacies of coloniality that inform whose knowledge is valued, whose identities are legitimised, and whose access to science is facilitated or constrained by it. The following section (Section 3.12) explores this intersection more critically, examining how the coloniality of power may continue to influence the construction and distribution of SC in contemporary educational contexts.

3.12 Science Capital and Coloniality of Power

Having identified some limitations of the SC framework, particularly its Eurocentric orientation and insufficient engagement with linguistic and cultural diversities, this section situates SC within the broader structures of historical and epistemic power by examining how the coloniality of power may continue to shape the production, recognition, and circulation of SC in educational contexts. As introduced in the preceding section (Section 3.11), SC's foundation in Western scientific paradigms risks marginalising and delegitimising non-Western indigenous and alternative knowledge systems by privileging Eurocentric definitions of legitimate science (Elshakry, 2010; Perera, 2011; Jensen and Wright, 2015; Kalolo, 2015). Critical perspectives on global knowledge production highlight how dominant education systems privilege Northern epistemologies, marginalising alternative ways of knowing and reproducing global hierarchies of value (Dale and Robertson, 2004a). This Western centrism perpetuates colonial power structures, particularly in non-Western contexts, where science is often viewed as a pathway to socioeconomic mobility (Mezieobi and Ibekwe, 2017). Research on global knowledge production shows that scientific work from the Global South receives systematically lower recognition and citation impact than

comparable work from the Global North, reflecting structural inequalities rather than differences in quality (Confraria, Mira Godinho and Wang, 2016).

Applying the poststructuralist lens inspired by Foucault (2003) that knowledge is never neutral or objective, but is always entangled with power, is instructive. According to Foucault, what counts as 'truth' is shaped by dominant discourses, which Foucault calls "regimes of truth" (Read, 2024, p.395), which are socially accepted ways of knowing, often legitimised through institutions like science and academia. These regimes define not only what is considered valid knowledge but also who produces and judges it. However, as Foucault (2003, p.7) asserts, there is always resistance, alternative or 'subjugated knowledges', including those rooted in non-Western traditions, spiritual practices, or community-based understandings that can challenge dominant narratives. This is particularly relevant in studies of SC, where Western epistemologies often marginalise other ways of knowing. Recognising the multiplicity of knowledge, as done in this section and supported by the participants' responses (Section 5.4.2), opens the space for more inclusive approaches to science education and engagement, especially in contexts where non-Western perspectives have historically been excluded or undervalued, as discussed in Section 6.5.5.

In addition, the participants' narratives (Section 5.4.2) reveal how SC is shaped not only by individual agency but also by enduring systems of power that tend to privilege Western norms and marginalise alternative ways of knowing. This calls for a theoretical expansion informed by postcolonial perspectives (Said, 1979; Spivak, 1988), which challenge the dominance of Eurocentric epistemologies and highlight the coloniality of power in shaping educational structures. Postcolonial theory establishes how knowledge production is historically shaped by colonial power relations, privileging Western epistemologies while marginalising or delegitimising non-Western ways of knowing (Said, 1979; Spivak, 1988). Said's (1979) concept of *Orientalism* demonstrates how Western institutions construct hierarchies of knowledge that position Western rationality, empiricism, and the scientific method as universal and superior while framing other epistemic traditions as deficient, informal, or pre-modern. He argues that Western scholarship and cultural production systematically constructed the "Orient" as exotic, backward, irrational, and inferior, in contrast to a rational, modern, and

progressive West. This system of representation was not passive; it actively shaped political, educational, and intellectual structures, reinforcing Western dominance.

In addition, Spivak's (1988, p.271) question, *"Can the subaltern speak?"* further highlights how dominant discourses systematically silence or misrecognise the epistemic contributions of colonised or racialised subjects, even within seemingly inclusive frameworks. Within the context of science education, postcolonial scholars argue that science has often been framed as a Western achievement, obscuring the historical and contemporary contributions of non-Western knowledge systems and reinforcing Eurocentric standards of legitimacy (Elshakry, 2010; Perera, 2011). This theoretical lens provides a critical framework for interrogating how SC, as a dominant explanatory model, may reinforce colonial hierarchies of knowledge by narrowly defining what counts as valuable science-related resources, dispositions, and practices. Through this lens, knowledge production becomes a form of social power, where who gets to define truth, whose expertise is valued, and whose ways of knowing are dismissed. When linked to SC, Said's analysis highlights how Western institutions have historically privileged certain forms of scientific knowledge while marginalising or delegitimising the scientific, technical or empirical traditions of non-western societies. This effect is a hierarchised global knowledge economy in which some communities are seen as naturally scientific and others as culturally or intellectually lacking.

Thus, from an SC perspective, Said's *(1979) Orientalism* helps to explain why access, recognition, and participation in scientific fields remain uneven across social and cultural groups. Orientalist narratives shape expectations about who "belongs" (p.5) in science and whose knowledge counts, influencing educational pathways, curriculum content, and public perceptions of scientific authority. This means that individuals from communities historically framed through Orientalist discourse may encounter reduced opportunities to accumulate SC, fewer role models, lowered expectations, or the devaluation of their cultural knowledge. Therefore, understanding Said's critique supports efforts in education to broaden science participation by recognising and challenging the cultural biases that shape science identities, opportunities, and aspirations.

Furthermore, according to Spivak (1988), *the subaltern,* those positioned at the lowest levels of social, political, and epistemic hierarchies, are structurally prevented from speaking or being heard within the dominant systems of knowledge. Even when *the subaltern* attempts to speak, their voice is often mediated, rewritten, or silenced by institutional powers, including Western academic, political and intellectual frameworks. When viewed through the lens of science capital, Spivak's critique highlights how scientific knowledge systems often privilege Western epistemologies while marginalising the knowledge practices, experiences, and intellectual contributions of communities outside dominant power structures. The result is that certain forms of scientific understanding are recognised as legitimate, while others, particularly those rooted in colonised, Indigenous, or non-Western contexts, are mostly undervalued or rendered invisible.

When applied to science education and participation, Spivak's analysis reveals how structural inequities shape who is recognised as a legitimate knower in science. Students from minoritised or historically colonised backgrounds may find that their cultural knowledge, linguistic resources, or community science practices do not translate into recognised forms of science capital because the curriculum privileges dominant narratives of science as Western, universal, and culturally neutral. *The subaltern's* inability to "speak" (Spivak, 1988, p.287) within these systems mirrors the limited legitimacy granted to their scientific identities and experiences. Challenging this requires actively creating educational structures that amplify marginalised voices, legitimise diverse ways of knowing, and disrupt the power relations that determine whose knowledge counts in science. In doing so, science capital becomes not just an individual attribute but a reflection of broader socio-historical structures that must be transformed for equitable participation.

Hence, scientific literacy instruments and frameworks, largely developed by Western institutions (Laugksch, 2000; Roberts, 2007), are likely to embed cultural biases that undervalue Indigenous knowledge systems. For instance, the limited research from populous regions such as the BRICS (Brazil, Russia, India, China, and South Africa) and Global South countries further underscores the need to expand the cultural contexts shaping science engagement. In addition, Li and Guo's (2021) bibliometric analysis of the scientific literacy literature from 1980 to 2019 revealed a pronounced dominance of Western, particularly North

American, perspectives. Using CiteSpace to analyse 9,578 records from Scopus, they found that the field is overwhelmingly shaped by Western institutions, with 96% of publications in English. This linguistic dominance threatens to marginalise non-English-speaking researchers and reinforce cultural imperialism. The limited representation of non-Western contributors (Li and Guo, 2021) raises concerns about the narrow framing of scientific knowledge and exclusion of culturally relevant understandings.

Additionally, despite their potential, non-Western media practices face persistent challenges, with epistemic marginalisation threatening to exclude non-Western knowledge systems from mainstream science discourse. For instance, digital divides, such as unequal access to technology and infrastructure, tend to alienate certain groups from fully participating in digital science media. Representation gaps further exacerbate exclusion, with minority voices significantly underrepresented in global science media, thereby limiting the visibility of role models. For instance, the OECD PISA tests have been criticised for privileging Western norms of scientific literacy, which hardly align with the experiences of students in non-Western settings. Negative stereotypes in media portrayals, such as those identified by Dixon and Azocar (2006), undermine the science identity of minority youth, particularly when scientists are predominantly depicted as white and male. Perera (2011) highlights the tension non-Western students face in reconciling their cultural identities with Western scientific norms, where their science engagement is often driven by the perceived prestige and economic promise of science careers rather than intrinsic scientific interest. Kalolo (2015) advocates for culturally responsive science education that aligns with students' experiences, while Gumbo, Nnamdi and Anamezie (2021) further demonstrate that learners exposed to culturally relevant science materials perform better than those taught exclusively through Western curricula. This raises concerns about the applicability of Archer et al.'s SC framework beyond Western societies. Concepts such as habitus, capital, and social class are culturally contingent and may not seamlessly translate across global contexts. For instance, Mezieobi and Ibekwe (2017), in a study conducted at the University of Port Harcourt, Nigeria, highlighted how regional and cultural contexts shape family expectations, particularly in education and career planning.

In my experience, science habitus and capital are not formalised in Nigerian families; an illiterate Nigerian mother does not require museums, books, or science knowledge to guide her child to do science. She knows that she wants her child to become a medical doctor, an engineer, or a lawyer (the three most valuable vocations in Nigeria), not because she has science habitus or capital to decide, but because, to her, this is the only way she plans to improve the family's socio-economic, especially financial, well-being. Her aspiration and motivation for training her child to become a medical doctor or other high-earning professions is purely economic; hence, she will not settle for non-economically rewarding professions. Socio-culturally, therefore, a typical Nigerian family will not encourage their children to do sports as their main vocation, despite football's immense popularity in the country. In addition, despite Nigeria's booming entertainment industry, many parents still view careers in music, acting, or dance as risky and lacking long-term security (Mezieobi and Ibekwe, 2017), while careers in painting, sculpture, fashion design, or graphic arts are often seen as hobbies rather than viable professions. Thus, in my opinion, the Bourdieusian/Archer et al.'s cultural capital and SC theoretical frameworks are insufficient to explicate science learning and progression outcomes among the mainly multicultural student population in my department; therefore, it is worth exploring the [in]significance of SC to such 'othered' population, as done in this study. Additionally, literature on non-Western educational contexts (Hwang, 2010; Kalolo, 2015; Gumbo et al., 2021) supports the view that SC, as conceptualised by Archer et al. (2013a, 2020a), inadequately captures the motivations and mechanisms of science engagement in multicultural and economically diverse populations.

Furthermore, the SC framework's emphasis on students' misconceptions risks adopting a deficit lens, portraying non-Western learners as lacking rather than recognising the cultural assets they bring to science education (Chigeza, 2011; Habig, Gupta and Adams, 2021; Hecht, 2021). Chigeza's (2011) study argues for a capacity-building approach to science education for minority and marginalised students, responding to Alfred Schademan's work on African American youth and their cultural practices. Chigeza introduces the concept of 'cultural resources' (p.403), comprising cultural disposition, community cultural wealth, and cultural capital, to critique deficit models that presume a lack of knowledge among these students. Through a case study involving Australian Indigenous students and the use of Kup Mauri, a traditional cooking method, he demonstrated how embedding cultural contexts and native Creole languages into science instruction enhances conceptual understanding. This

paper reconceptualises minority students as 'field negotiators' (p.410) who must navigate multiple knowledge systems, languages, and cultural frameworks to succeed in Western science education. This reframing shifts the focus from perceived deficiencies to the complex negotiations these students undertake and calls for an expanded definition of science literacy that includes storytelling, ceremony, and other culturally embedded modes of knowledge transmission, offering a transformative vision for inclusive science curricula.

Also, Habig, Gupta and Adams' (2021) study examines how deficit narratives in informal science education can be challenged. Focusing on three participants in the Lang programme at the American Museum of Natural History, the authors adopt an asset-based perspective to explore how young people mobilised six forms of capital–aspirational, linguistic, familial, social, navigational, and resistant–throughout their engagement with the museum and into their post-secondary education and early scientific careers. The findings demonstrate that the participants' pre-existing cultural wealth, when combined with the resources acquired through the program, fostered resilience, broadened their sense of possibility, and supported sustained engagement in STEM. Four emergent themes–resilience in adversity, expansion of opportunity, cultivation of STEM networks, and continuity of STEM experiences–highlight the dynamic and non-linear nature of STEM pathways. The study identifies missed opportunities in harnessing certain forms of capital, particularly familial, linguistic, and resistant, suggesting avenues for more inclusive and empowering programme design.

Critically examining the notion of 'becoming a science person' (p.3), Hecht (2021) highlights how this often entails conforming to Eurocentric norms and calls for a deeper engagement with community cultural wealth that interrogates the very nature of science. She proposes that informal science education could serve as 'cultural refugia' (p.7), which are spaces where dominant scientific frameworks are negotiated and reimagined. A particularly compelling insight is the call to reconceptualise 'authentic scientific research' (p.6) as a synthesis of diverse epistemologies, challenging binary classifications such as the living/non-living dichotomy, and advocating for a more inclusive, culturally responsive vision of science education. This deficit framing can influence curriculum design, entrenching Eurocentric content, and marginalising contributions from the global South (Elshakry, 2010). Even well-intentioned inclusive strategies may become vehicles of cultural imperialism if they impose

Western norms under the guise of equity (Chigeza, 2011). Global education policies, shaped by Western institutions, often reinforce these dynamics by aligning local reforms with international benchmarks that privilege Western standards (OECD, 2023a). Using SC as a comparative metric across diverse contexts risks unfairly evaluating non-Western systems using Western criteria, perpetuating colonial hierarchies in educational assessment (Jensen and Wright, 2015). In addition, the dominance of English in scientific discourse further exacerbates linguistic imperialism, excluding non-English-speaking communities from meaningful participation in science (Chigeza, 2011; Habig, Gupta and Adams, 2021; Hecht, 2021).

3.13 Decolonising Science Capital

Given that traditional SC research often overlooks the epistemological diversity of science engagement across cultures, as explicated in the previous section (Section 3.12), a critical dimension of decolonising SC involves recognising the role of non-Western and minority cultural media practices in fostering science learning, identity formation and empowerment. For instance, Kontkanen et al. (2024), in a systematic review of 32 studies, found that non-Western and informal media practices remain underrepresented in SC research, calling for greater attention to culturally embedded media, particularly digital and community-based forms of media. To address these issues, targeted interventions such as cross-cultural research collaborations, culturally responsive assessment tools (Lederman, 2007), increased representation through funding and mentorship (Osborne and Dillon, 2008), multilingual publishing (Roberts and Bybee, 2014), and decolonised science curricula have been proposed. Li and Guo (2021) also highlight a gap in recent research clusters, particularly regarding emerging technologies and media in science communication.

Indigenous media, such as community radio, oral storytelling platforms, and language revitalisation apps, can also play a vital role in transmitting ecological and scientific knowledge (Riggins, 1992; Christiansen, 2004; Deuze, 2006; Wilson-Lopez et al., 2017; Quan, 2024). These platforms blend traditional and Western science, offering hybrid knowledge systems that can potentially enhance SC in culturally affirming ways. For instance, indigenous

radio stations in Africa, Latin America, and Australia broadcast content on environmental stewardship, astronomy, and traditional medicine, challenging the binary between scientific and non-scientific knowledge. In many African contexts, mobile phones and community-based digital platforms are central to formal and informal science learning. Local YouTube channels, WhatsApp groups, and SMS-based health campaigns disseminate scientific information in local languages and in culturally relevant formats. Among the African, Asian, and diasporic communities in England, many of whom are represented in my department, ethnic media and transnational digital networks serve as important sources of science-related content. Students often consult media in their native languages to translate and understand scientific and English terminologies, a practice recommended by both students and teachers to enhance their comprehension and engagement.

Christiansen (2004) also highlights the role of transnational and ethnic media in shaping news consumption among immigrants in Europe, showing how digital satellite broadcasting facilitates access to homeland news and fosters diasporic affiliation. Immigrants often prefer international news sources over national ones, possibly reflecting a critical stance toward mainstream media and a desire for broader representations. This aligns with scholarship that emphasises the empowering role of ethnic media in multicultural societies (Riggins, 1992; Deuze, 2006). Additionally, Korean and Indian YouTube creators produce STEM tutorials that blend cultural references with technical knowledge, while Wilson-Lopez et al. (2017) found that Latinx adolescents use ICTs to engage in science projects rooted in community concerns, such as environmental justice and public health. Latinx communities also engage with science through bilingual media, community television, and grassroots campaigns. Quan (2024) illustrated how Malaysian platforms, such as TikTok and YouTube, feature content on herbal medicine, environmental practices, and food science, blending traditional knowledge with modern formats. These media serve as informal science learning environments when community-driven and culturally situated.

3.14 Conclusion

The literature on SC acknowledges its growing influence on science education policy, particularly in efforts to address persistent inequalities in the participation of science. Central to this discourse is the recognition that science education must move beyond traditional, narrow definitions of scientific knowledge to embrace more inclusive and student-centred approaches. For instance, The Science Capital Teaching Approach (SCTA) exemplifies this shift, aiming to personalise science learning by connecting it to students' experiences and recognising the diverse forms of capital they bring to the classroom. This pedagogical orientation aligns with broader equity agendas; however, its implementation remains uneven. Empirical studies reveal a disconnect between theoretical understanding and classroom practice, with teachers often struggling to meaningfully operationalise SC. Certain dimensions of SC, such as science-related social networks or cultural capital, are frequently 'othered' to the disadvantage of non-Western epistemologies and are often underutilised, reflecting both conceptual ambiguity and practical constraints within educational settings. However, if conceptualised with equity and inclusiveness, SC can offer a valuable conceptual framework for addressing the complex, intersecting factors that shape students' engagement with science, particularly among underrepresented groups. This study's emphasis on recognising and legitimising non-dominant forms of knowledge and experience resonates with inclusive education goals and provides a lens through which to interrogate structural barriers in science learning.

However, to fully realise its transformative potential, future research should focus on bridging the gap between SC theory and practice, especially in underexplored contexts such as FE colleges. This includes developing and evaluating interventions that embed SC principles into teacher education, curriculum design, and institutional policies. Longitudinal studies could further illuminate the sustained impact of SC-informed pedagogies on students' science identity, aspirations, and career trajectories. Such work would move the field beyond aspiration-raising initiatives toward systemic change, reimagining science education as a socially embedded, culturally responsive, and accessible domain for all learners. To investigate how SC operates within an FE context and may influence science engagement, the next chapter outlines the methodological framework underpinning this study.

Chapter 4: Methodology

4.1 Introduction

This chapter explores how SC operates and influences the participants' engagement with science in response to the research questions (RQs) (Section 1.4). The methodological framework underpinning this study is outlined below. Grounded in a critical interpretivist-constructivist paradigm, this study adopts a qualitative approach to capture the nuanced experiences of both students and teachers in my department. Through semi-structured interviews (Section 4.4.2), this research sought to uncover how SC is likely to be understood, enacted, and constrained within FE settings, as exemplified within my department. This chapter also details the research design (Section 4.4.3), participant selection (Section 4.4.4), analytical strategies employed (Section 4.5) and ethical considerations (Section 4.6), to ensure reflexivity (Section 4.7), rigour (Section 4.8), and relevance to the study's aims. To frame the study's qualitative orientation, the next section (Section 4.2) outlines the interpretivist-constructivist paradigm underpinning the research design and epistemological stance. To situate these methodological choices epistemologically, the next section (Section 4.2) outlines the interpretivist-constructivist research paradigm underpinning the study's design and analytic approach.

To address the two research questions, how participants understand and interpret SC (RQ1), and how intersecting aspects of identity shape access to and mobilisation of SC within my department (RQ2), the research design incorporated 17 one-to-one semi-structured interviews with students and teachers. This approach generated the depth and contextual richness required for an interpretivist-constructivist analysis. The interview data were analysed using Braun and Clarke's (2006, 2021) reflexive thematic analysis (Section 4.5.2), enabling an abductive movement between Archer et al.'s (2015) conceptualisation of SC and the meanings participants constructed during the interviews. Triangulation was achieved through the inclusion of the students and their teachers as participants, the theoretically informed interview protocol (Section 4.4.3), and the reflexive analytic processes underpinning the study (Section 4.5.2). The design is supported by a purposive sampling strategy (Section 4.4.4), the development of an interview protocol (Section 4.4.3), a transparent and ethically grounded data collection procedure (Section 4.4.6), and adherence to institutional ethical requirements (Section 4.6). Together, these elements provide a coherent methodological

foundation for exploring how SC is understood, enacted, and constrained within the study's FE context. Having established the interpretivist-constructivist research paradigm as the philosophical foundation of this study, the next section (Section 4.2) examines comparable research designs that are methodologically consistent with this approach.

4.2 Research Paradigm: Interpretivism-Constructivism

This section introduces the interpretivist-constructivist paradigm employed, detailing its ontological, epistemological, and methodological assumptions, and explaining its suitability for examining how science capital is understood and enacted within FE contexts. This paradigm recognises that knowledge is socially constructed and shaped by context, experience, and perspective. Interpretivism-Constructivism is particularly suited to exploring the nuanced and subjective dimensions of SC within FE, where learners' identities, aspirations, and engagement with science are influenced by complex socio-cultural factors. Rather than seeking generalisable truths, this paradigm prioritises depth of understanding and meaning making, allowing for the exploration of how participants interpret their experiences within the study's context. By adopting this stance, this study aims to uncover the relational and contextual dynamics underpinning science participation, particularly among underrepresented groups.

Weaver and Olson (2006, p. 460) state that "paradigms are patterns of beliefs and practices that regulate inquiry…by providing lenses, frames and processes through which investigation is accomplished." Grounded in a constructivist ontology, interpretivism-constructivism states that reality is multiple, relative, and socially constructed (Hudson and Ozanne, 1988). It rejects the notion of a singular, objective truth, instead recognising that meaning is shaped by individuals' social positions and experiences. Epistemologically, interpretivism-constructivism adopts a subjectivist approach, viewing knowledge as co-constructed through the interaction between me as the researcher and the participants (Thomas, 2013). This contrasts with the objectivist claims of positivism, which assumes context-free truth (Denzin and Lincoln, 2023). Instead, interpretivism-constructivism acknowledges my positionality and influence, embracing the idea that enquiry is shaped by values, assumptions and reflexive engagement (Lincoln and Guba, 2000; Weaver and Olson, 2006).

Methodologically, interpretivism-constructivism favours qualitative approaches that allow for a deep exploration of meaning. Techniques such as interviews and participant observations are used to access rich contextual data (Cohen, Manion and Morrison, 2017). In this study, semi-structured interviews (Section 3.4.2) were chosen to explore participants' conceptualisations of SC and their diversity and inclusion experiences. These interviews are understood as co-constructed narratives, where meaning emerges through dialogue and interpretation (Rubin and Rubin, 2005). My role as the primary instrument of data collection and analysis was central to the interpretivist-constructivist enquiry. Reflexivity and positionality (Section 3.7) were therefore essential for maintaining transparency and ethical integrity. This paradigm is particularly suited to the study's aim of exploring how SC is perceived and enacted in my department, enabling critical engagement with the interplay between personal histories, institutional discourses, and pedagogical ideologies (Denzin and Lincoln, 2023). While interpretivism-constructivism offers rich, contextually grounded insights, it also presents challenges regarding reliability, generalisability, and researcher bias. These limitations were acknowledged and addressed through ethical safeguards, reflexive practice, and strategies to ensure trustworthiness and authenticity, as explained in Section 4.8. Having established the interpretivist-constructivist research paradigm as the philosophical foundation of this study, the next section (Section 4.3) examines comparable research designs that are methodologically consistent with this approach to research. Having established the interpretivist-constructivist paradigm as the study's philosophical foundation, the next section (Section 4.3) examines research designs that are methodologically consistent with this stance.

4.3 Similar Research Design

This section reviews similar qualitative research designs grounded in interpretivist-constructivist approaches to demonstrate the methodological coherence and validity of the adopted design. Given the adoption of an interpretivist-constructivist paradigm, which emphasises the subjective interpretation of social phenomena and the co-construction of meaning between the researcher and participants, it is essential to consider research designs that are epistemologically and methodologically aligned with this worldview to validate the chosen design (Korstjens and Moser, 2017). Therefore, this section examines

the research design employed in interpretivist-constructivist studies, highlighting its suitability for exploring complex, context-dependent human experiences in a manner consistent with the philosophical stance outlined in the preceding section.

Several qualitative studies using an interpretivist-constructivist paradigm and semi-structured interviews informed this study's design, particularly in exploring science capital and STEM engagement. Fischer et al. (2024) examined how the Science Capital Teaching Approach (SCTA) (Archer et al., 2020d) supports sustainability competence in Finnish classrooms. Their use of semi-structured interviews and Braun and Clarke's (2006, 2021) reflexive thematic analysis aligns closely with this study, especially in its focus on co-constructed meaning and pedagogical influence on students' perceptions of sustainability and science. Fischer et al. (2024) grounded their study in an interpretivist-constructivist paradigm, guiding all stages of design and analysis. Their approach centred on understanding how Finnish primary educators interpreted the SCTA (Archer et al., 2020d) in sustainability education. Reflexivity was integrated throughout the study. The lead researcher collaborated with the co-authors and student teachers to translate the Finnish materials, ensuring cultural and linguistic accuracy (Fischer et al., 2024).

To explore the participants' perspectives, they conducted semi-structured interviews with five teachers and one assistant, balancing consistency with flexibility to probe emerging themes. The interview protocol, which consisted of 14 open-ended questions, was refined to align with the study's theoretical framework. The interviews averaged 35 minutes and were transcribed using intelligent verbatim methods, preserving semantic clarity while minimising extraneous data. A key strength of this study was its integration of multiple qualitative data sources within an interpretivist-constructivist framework. In addition to the interviews, 208 instructional materials, including lesson plans, slides, textbooks, videos, and web content, were analysed. This triangulation enabled cross-validation and enriched contextual interpretation, such as linking teachers' reflections on thermal energy to corresponding teaching resources (Fischer et al., 2024). Their study also demonstrated strong reflexes and positionality.

They addressed linguistic and cultural challenges through collaborative translation, external proofreading, and iterative clarification with student teachers, reflecting their awareness of their influence on data interpretation. Transparency in data analysis was evident through the use of Braun and Clarke's (2006, 2021) six-phase thematic analysis, supported by verbatim transcription, member checking, and detailed documentation. These practices ensured analytical rigour and enhanced the trustworthiness of the findings. Their study demonstrated the effectiveness of semi-structured interviews in generating rich, contextual insights into science education and validated the use of the interpretivist-constructivist paradigm for exploring how individuals make sense of their educational experiences. The similarities between Fischer et al.'s (2024) study and mine are that both are grounded in an interpretivist-constructivist paradigm and employ semi-structured interviews with reflexive thematic analysis.

While quantitative methods have been widely used in SC research (Archer et al., 2015, 2017; Moote et al., 2019), qualitative approaches, although less common (Archer et al., 2010; Turnbull et al., 2020), are better suited to the exploratory nature of my study. With a small sample of 17 participants, one-to-one semi-structured interviews allowed for deeper engagement with individual perceptions and meaning making. However, Stanley and Robertson's (2024) review of qualitative research in science education highlights that many studies lack robust interpretivist-constructivist practices such as reflexivity, member-checking, and analytic transparency, thus underscoring the importance of methodological integrity in the design of my study. Having established methodological alignment through similar research designs, the next section (4.4) outlines the specific data-gathering strategies employed to implement its interpretivist-constructivist framework. Having established the methodological alignment of the research design, the next section (Section 4.4) outlines the data-gathering strategies employed.

4.4 Data Gathering

This section details the qualitative data gathering procedures employed to ensure coherence with the study's interpretivist constructivist framework. Following the identification of a research design consistent with this paradigm, the data gathering strategy was structured to capture rich, contextually embedded responses through a series of interrelated components. Sections 4.4.1 and 4.4.2 provide the rationale for employing qualitative semi structured interviews, in alignment with the study's philosophical commitments. Section 4.4.3 outlines the development of the interview protocol, which was theoretically informed and iteratively refined. Section 4.4.4 details the participant selection and recruitment strategy, using purposive sampling to ensure diversity across educational and demographic dimensions. Section 4.4.5 presents the pilot interview, conducted to test and enhance the reliability of the instruments. Finally, Section 4.4.6 describes the interview process, including ethical considerations, rapport building strategies, and logistical arrangements. Collectively, these steps ensured a reflexive, and methodologically rigorous approach to data collection. The next section (4.4.1) introduces qualitative interviews, which form the first stage of the data collection process and capture participants' perspectives.

4.4.1 Qualitative Interview Analysed Using Reflexive Thematic Analysis

In line with the interpretivist constructivist paradigm outlined earlier in Section 4.2, qualitative interviewing was selected as the primary method of data collection because it enables the exploration of participants' meaning-making processes in depth and context. This approach directly supports the study's aim of understanding how SC is interpreted, enacted, and constrained within my FE department. Qualitative interviews are well suited to examining complex, socially situated constructs such as identity, aspiration, and engagement, offering "rich, detailed and thick descriptions" (Braun and Clarke, 2013, p. 5) that quantitative approaches cannot provide. Kvale (1996, 2007; Kvale and Brinkmann, 2015) conceptualises qualitative interviews as structured yet purposeful conversations designed to "unfold the meaning of participants' experiences" (Kvale, 1996, p. 1). Rubin and Rubin (2005) similarly describe them as extended dialogues shaped by the researcher's active interpretive role.

Hence, Braun and Clarke's reflexive thematic analysis (RTA) is employed as detailed in Section 4.5.2.

Kvale's metaphors of the "miner" and the "traveller" (Kvale, 1996, pp. 3–4) further illustrate the epistemological stance underpinning this study. The miner reflects a modernist view, treating knowledge as "given" (Kvale, 1996, p. 3) and waiting to be extracted, whereas the traveller aligns with postmodern constructivism, portraying the researcher as a co-explorer gathering evolving stories through dialogue (Kvale, 1996, 2007; Kvale and Brinkmann, 2015). Thus, rather than extracting fixed truths, evolving understandings were co-constructed with participants. Dunne, Pryor, and Yates (2005) reinforce this view by describing interviews as adaptable, text-generating methods that require reflexivity.

Within this study, qualitative interviews therefore enabled both students and teachers to articulate their understandings of SC, as well as their experiences of inclusion, marginalisation, and pedagogical practice. While qualitative interviewing is inherently time-consuming and subject to challenges such as power dynamics, subjectivity, and interviewer influence, these limitations were addressed through reflexive strategies (Section 4.7) and transparency in analytic decision-making (Section 4.8). The next section (4.4.2) explains why semi-structured interviews were specifically chosen for data collection.

4.4.2 Semi-structured Interview

Building on the rationale for qualitative interviewing in Section 4.4.1, semi structured interviews (SSIs) were selected as the most appropriate format for generating the depth and flexibility required within an interpretivist constructivist study. SSIs offer a balance between consistency across participants and openness to the developing insights (Brinkmann, 2014; Roulston, 2021), making them particularly suitable for exploring how individuals conceptualise and negotiate SC within a diverse FE context. Compared with structured interviews, which risk restricting participants' accounts, and unstructured interviews, which may lack focus, SSIs enable the exploration of their perspectives while allowing them to introduce meanings that matter to them (Morris, 2015). This was essential for probing the

dimensions central to both research questions. Their dialogic nature also supports the co construction of meaning between me as the researcher and the participants, aligning with the interpretivist constructivist commitments outlined in Section 4.2.

The use of pre-determined questions, supplemented by probes and follow up prompts, allowed for adaptive questioning and deeper exploration of individual perspectives (Galletta, 2013). This flexibility was particularly valuable for examining the intersectional dimensions of SC, where participants' experiences often cut across multiple identity markers. However, challenges such as potential inconsistencies in data collection and risks of misrepresentation, especially with regard to not being an experienced interviewer, were mitigated through reflexive strategies (Section 4.7), employing an interview protocol (Section 4.4.3), and interview piloting (Section 4.4.5) (Newhart and Patten, 2023). To ensure methodological rigour and alignment with the study's theoretical framework, the following section (Section 4.4.3) outlines the formulation of the interview protocol that guided the semi-structured interviews.

4.4.3 Participant Sampling and Recruitment

Participant sampling and recruitment are central to the depth and analytical value of qualitative research. In interpretivist constructivist studies, sampling prioritises rich, contextualised insights rather than statistical representation. This section outlines the purposive sampling strategy, recruitment procedures, and ethical and methodological considerations guiding these decisions, before reflecting on the associated limitations and safeguards.

4.4.3.1 Purposive Sampling

As categorised (Appendices 2, 3A–3C), the final sample for this study comprised 13 student participants drawn from a cohort of 41 Level 3 Year 1 and Year 2 science students; participants were purposively sampled using their organic criteria. This means that they were grouped according to their relevant demographic and educational characteristics (For instance, SES, ethnicity, gender, EAL/NEL status, and education history) (Appendices 2, 3A–3C), ensuring that the final sample reflected the volunteer's heterogeneity. Hence, there was no deliberate attempt to [de]select participants based on their characteristics, as all the volunteers were recruited. Purposive sampling prioritises analytic depth and contextual insight over statistical representation (Palinkas et al., 2013; Vasileiou et al., 2018; Richards, 2021; Newhart and Patten, 2023; Silverman, 2024), aligning with interpretivist-constructivist approaches that highlight situated meaning (Denzin and Lincoln, 2005; Maxwell, 2005). The following subsection (4.4.3.2) outlines the procedures used to recruit the student participants.

4.4.3.2 Participants' Sampling Procedure

As outlined in Appendices 3A–3C, purposive sampling was used to recruit participants whose demographic, educational, and linguistic profiles enabled in-depth exploration of SC within this study's context. Guided by an intersectional approach (Crenshaw, 1989; 1991; 1998), sampling was designed to capture variation rather than representation, allowing analysis of how SC is experienced, mobilised, and recognised across different social locations. Triangulation was strengthened through the inclusion of all 4 science teachers working with the sampled cohorts, alongside all the 13 the student volunteers. Teachers were included not only as instructional informants but as institutional actors who shape the recognition, mediation, and valuation of SC within FE classrooms (Silverman, 2024). This enabled complementary perspectives on how SC operates across learning and teaching practices.

Procedurally, three Level 3 science course groups, consisting of two Level 3 Year 1 cohorts and one Level 3 Year 2 cohort, were approached. Level 3 was selected deliberately as the college's post-compulsory science pathway, distinct from Levels 1 and 2, which are broadly

equivalent to pre-GCSE and GCSE provision. Focusing on students who had voluntarily opted to continue with science beyond compulsory schooling allowed the study to examine SC at a point where engagement, aspiration, and progression are actively negotiated. While a baseline level of interest in science was assumed, this decision also enabled exploration of how motivation alone may be insufficient for recognition or progression within FE science. An initial profiling exercise was conducted using college records to map the demographic composition of the three cohorts by age and gender (Appendix 3A). Of the 41 eligible students, 12 were females aged 16–18, 1 was a male aged 16–18, 16 were females aged 19+, and 12 were males aged 19+. Students were then re-grouped using an intersectional recruitment profile that incorporated ethnicity, prior compulsory GCSE education, socioeconomic status, English language proficiency, gender, age, and educational history (Appendices 3B–3C). This ensured maximum variation in relation to key dimensions shaping SC, rather than reliance on single-axis categorisation. All students in the sampled groups were invited to participate, and volunteers were allocated in a way that maximised intersectional diversity. For example, Participants A, D, and L identified as Any Other White, while E, F, H, and J identified as Asian/Asian British (Appendix 2). Participants B, C, and K identified as Black/Black British (Caribbean/African), female, English as additional language speakers, and from lower socioeconomic backgrounds. This approach enabled the study to examine how combinations of identity and structural positioning shaped access to and recognition of SC, rather than treating demographic characteristics as isolated variables.

Recruitment was conducted ethically and independently from participants' educational assessment. Ethical approval was granted by the University of Glasgow College of Social Sciences Research Ethics Committee. Invitations to participate were sent via email (Appendices 4A and 4B), clearly identifying my role as a University of Glasgow doctoral researcher and separating the study from any professional teacher–student relationship. In-class recruitment was avoided to minimise pressure or perceived academic consequences. Participant Information Sheets, Privacy Notices, and Consent Forms (Appendices 1; 5A–5D), all approved by the Ethics Committee, outlined the study's purpose, data handling procedures, and participants' rights (Davies and Hughes, 2014). In total, 13 of the 41 eligible students volunteered to participate. Their demographic characteristics were purposively and organically employed to support analytic depth rather than numerical representation. While this sampling strategy ensured transparency, reflexivity, and alignment with the study's

theoretical aims, it also introduced limitations that are critically examined in the following subsection (Section 4.4.3.3).

4.4.3.3 Reflexive Considerations and Limitations of the Sampling Strategy

This subsection reflects critically on the limitations associated with the purposive, volunteer-based sampling strategy, aligning directly with the theoretical and methodological decisions outlined in Section 4.4.3.2. Consistent with an interpretivist-constructivist approach, these limitations are treated as contextual conditions that shape the research process and analysis, rather than as methodological flaws to be eliminated (Silverman, 2024). Making these conditions explicit supports transparency, reflexivity, and analytic credibility.

A key limitation concerns self-selection. Participation was voluntary, which may mean that those who chose to take part were more confident, reflective, or comfortable articulating their experiences of science. For instance, students who felt able to talk about their educational trajectories may have been more likely to volunteer. This means that some perspectives, particularly those marked by disengagement or reluctance to speak, may be under-represented. However, this limitation must be understood in relation to the study's aims. All Level 3 science students and teachers within the sampling frame were invited to participate, and no subgroup was selectively targeted. The recruitment profile was then used to maximise intersectional variation across the full cohort (Flick, 2022). While self-selection may have shaped how experiences were narrated, it did not undermine the study's capacity to explore how SC is experienced, recognised, and negotiated within the FE context studied.

A second limitation relates to my insider role as both researcher and manager within my department. This positioned me within existing professional hierarchies and carried a risk of perceived power imbalance. To mitigate this, recruitment was conducted outside teaching spaces, invitations were issued from a University of Glasgow email address, and all materials emphasised voluntariness, anonymity, and the absence of any impact on grades or professional relationships (Appendices 4A; 5A–5C). Interviews were arranged outside timetabled teaching hours, and participants were repeatedly reminded of their right to

decline or withdraw without consequence. Data were pseudonymised, and reflexive notes were maintained throughout. These measures reduced the likelihood that participation was shaped by obligation rather than choice, and supported independent engagement.

Of the 41 eligible students, 17 initially volunteered, with four withdrawing prior to interview, resulting in a final sample of 13 students. While small in numerical terms, this sample was appropriate for the study's qualitative aims. The intersectional, maximum-variation design prioritised analytic depth over representativeness, enabling examination of patterned similarities and differences across gender, ethnicity, socioeconomic status, language proficiency, and educational history. Including all four science teachers further strengthened triangulation by situating student accounts within institutional and pedagogical contexts. In other words, sufficiency was judged in terms of meaning and contrast rather than scale.

Overall, the limitations of the sampling strategy reflect the trade-offs inherent in a theory-driven, intersectional qualitative design. While self-selection and insider positionality shaped the research context, they were actively managed and analytically integrated rather than treated as neutral background factors. Importantly, several of the tensions identified here, such as confidence, voice, and whose experiences are most readily articulated, are taken forward as substantive analytic concerns in Chapters 5 and 6.

4.4.4 Interview Protocol Design and Structure: Reflexivity, Sensitisation, and Framework Mapping

This section explains how the interview protocol (Appendix 1) was designed and structured, and how theoretical considerations were balanced with openness to participants' own perspectives. To make this logic visible from the outset, Figure 3 is presented first. Figure 3 formulated as a design map rather than a coding scheme. Hence, it shows how the interview questions were organised in relation to Archer et al.'s (2015) SC framework, indicating which questions were informed by each broad component of SC and where intersectional influences were built into the interview protocol. Figure 3 therefore provides an overview of how theory guided question coverage without determining how participants responded. The discussion

that follows uses Figure 3 as a reference point, explaining how each part of the framework informed the interview structure, how questions were intentionally overlapping and open-ended, and how reflexive safeguards were built in to avoid constraining participants' meaning-making.

Figure 3: Mapping Interview Questions to Archer et al.'s (2015, pp.929-931) Science Capital Framework

Archer et al.'s (2015, pp.929-931) Index of Science Capital	Subcomponents	Description (Archer et al., 2015)	Related Interview Questions (Appendix 1)	Notes: Similarities & Differences Across Components
(i) 'Scientific forms of cultural capital'	**'Scientific literacy'**	Ability to acquire and apply scientific knowledge and skills; understanding scientific principles and how science works.	• RQ1 Q1: Meaning of SC • RQ1 Q3: Opinions on SC definition • RQ1 Q4: Relevance of SC to teacher/student role • RQ1 Q6: Relevance of SC to science education	Focuses on *knowledge and skills*; overlaps with dispositions when discussing confidence or identity.
	'Science dispositions'	Value placed on science; attitudes, identity, perceptions of scientists and science usefulness (DeWitt, Archer & Osborne, 2014).	• RQ1 Q1–6 (all involve attitudes/values) • Gender Q1–2 (gendered attitudes) • Ethnicity Q1 (identity and belonging)	Strong overlap with *identity* and *motivation*; differs from literacy because it concerns *values*, not skills.
	'Symbolic knowledge of transferability of science qualifications'	Awareness of the value of science qualifications for future careers (Claussen & Osborne, 2013).	• RQ1 Q4: Relevance of SC to teacher/student • Socioeconomic Q1: Advantages/disadvantages for different SES groups	Connects SC to *future aspirations*; overlaps with social capital when networks influence career knowledge.
(ii) 'Science-related behaviours and practices'	**'Science media consumption'**	Engagement with science-related media (TV, online content).	• RQ1 Q5: Engagement with SC booklet and links • Cultural/Linguistic Q1–2 (language and access to media)	Behaviour-based; differs from cultural capital because it concerns *frequency of engagement*, not knowledge.
	'Visiting informal science learning environments'	Participation in out-of-school science activities (e.g., museums).	• Socioeconomic Q1: SES influence on access • Ethnicity Q4: Barriers/privileges in accessing SC	Strongly shaped by SES, ethnicity, and cultural background; differs from media consumption in requiring physical access.
(iii) 'Science-related forms of social capital'	**'Knowing someone who works in a science job'**	Access to science-related networks (family, friends).	• Socioeconomic Q3–4: Breadwinner occupation • Ethnicity Q3–4: Influence of background on networks	Overlaps with symbolic capital when networks inform career pathways.
	'Parental scientific knowledge'	Parents' science qualifications, careers, and involvement.	• Educational Background Q1–3 • Cultural/Linguistic Q3, Q6–7	Strongly linked to *educational background*; differs from "knowing someone" because it focuses on *family*, not wider networks.
	'Talking to others about science'	Frequency and nature of conversations about science.	• RQ1 Q1–6 (general SC understanding) • Cultural/Linguistic Q1–2 (language barriers) • Ethnicity Q4 (comfort discussing science)	Connects to dispositions (confidence) and literacy (ability to discuss science).
Intersectional Influences (Cross-cutting)	**Gender, ethnicity, SES, culture, language**	How interconnected diversities shape access to and use of SC.	• All RQ2 questions (Educational, SES, Gender, Ethnicity, Culture) • Intersectionally Inclusive Strategies Q1–2	These factors *cut across all SC components*, shaping access, utilisation, and identity.
Inclusive Strategies	**Curriculum and classroom practices**	Approaches to level the playing field of SC.	• Intersectionally Inclusive Strategies Q1–2	Focuses on *practical application* rather than SC components themselves.

Building on the overview provided in Figure 3, the following section (4.4.4 (a)) explains how each component of the SC framework informed the design of specific interview questions, while preserving flexibility and openness in participants' responses.

4.4.4(a) Structure and Components of the Interview Protocol

Figure 3 presents the organising logic of the interview protocol by mapping the interview questions directly onto Archer et al.'s (2015) index of science capital. Figure 3 explains how theoretical dimensions informed question development without prescribing participant responses. This means that in practical terms, Figure 3 functioned as a design map, ensuring that all key components of SC were explored systematically, while the questions themselves remained open-ended and responsive to participants' own meanings. As illustrated in Figure 3, the interview protocol was structured around three inter-related dimensions of Archer et al.'s SC conceptualisation: (i) 'scientific forms of cultural capital,… (ii) science-related behaviours and practices,… and (iii) science-related forms of social capital' (Archer et al., 2015, pp.928-931). Each of these dimensions informed clusters of questions rather than single items, allowing participants to engage with similar ideas from different angles. This means that the interview protocol prioritised depth and relational understanding over checklist-style coverage.

The first dimension, 'scientific forms of cultural capital', was operationalised through questions addressing scientific literacy, dispositions, and perceptions of qualification value. The research questions were treated as socially and contextually situated, shaped by professional experience, theoretical engagement, and emerging insights, rather than as fixed or purely technical instruments (Rapley, 2022). For instance, questions such as RQ1 Q4 and RQ1 Q6 explored how participants understood the relevance of SC to their roles and to science education more broadly. These questions reflected Archer et al.'s framing of scientific literacy as not only knowledge and skills, but also understanding how science works and why it matters. Similarly, questions across RQ1 Q1–Q6 were designed to elicit science-related dispositions, including confidence, interest, identity, and perceived usefulness of science. Rather than asking participants to confirm pre-defined traits, these questions invited reflection on how attitudes and values towards science had developed over time. In addition, symbolic knowledge of the transferability of science qualifications was explored through RQ1 Q4 and Socioeconomic Q1, which asked participants to consider how science

qualifications are valued for future study or employment. Figure 3 shows how these elements overlap conceptually, and the interview design intentionally allowed such overlap to surface rather than forcing strict boundaries.

The second dimension, ‘science-related behaviours and practices’, focused on how participants engaged with science in everyday and informal ways. As shown in Figure 3, science media consumption informed RQ1 Q5, which prompted participants to reflect on the SC booklet and associated online materials. The purpose was not to measure frequency of media use, but to understand how participants accessed, interpreted, or made sense of science-related information. Visiting informal science learning environments, such as museums or science centres, informed Socioeconomic Q1 and Ethnicity Q4. These questions explored how access to informal learning spaces was shaped by socioeconomic position, cultural background, and opportunity. In other words, behavioural practices were examined as situated and uneven, rather than as neutral indicators of engagement.

The third dimension, ‘science-related forms of social capital’, addressed relationships and networks that supported or constrained science engagement. Figure 3 shows how knowing someone who works in a science-related job informed Socioeconomic Q3–Q4 and Ethnicity Q3–Q4, which explored how family or community networks influenced access to science knowledge and opportunities. Parental scientific knowledge was examined through Educational Background Q1–Q3 and Cultural/Linguistic Q3 and Q6–Q7, focusing on parental education, involvement, and science-related experience. Importantly, talking to others about science was explored across multiple questions, particularly within RQ1 Q1–Q6 and Cultural/Linguistic Q1–Q2, recognising that conversation, confidence, and language are central to how science capital is enacted. As Figure 3 indicates, this social dimension overlaps with dispositions and literacy, reinforcing the relational nature of SC rather than treating it as a set of isolated factors.

Beyond these three core components, intersectional influences were built into the protocol as cross-cutting considerations rather than standalone categories. Figure 3 clearly positions gender, ethnicity, socioeconomic status, culture, and language as shaping access to all dimensions of SC. This principle guided the structure of RQ2, with questions designed to cut

across the entire framework rather than sit at its margins. For example, Gender Q1–Q2 examined how gender norms influenced confidence, participation, and identity in science, while Ethnicity Q1–Q4 explored how cultural background affected access to resources, networks, and recognition. Socioeconomic Q1–Q4 examined material and structural factors shaping opportunity, and Cultural/Linguistic questions addressed language as a mediating factor in participation and assessment. This design ensured that intersectionality was embedded within the protocol rather than added analytically after data collection.

The inclusion of questions on intersectionally inclusive strategies further extended Archer et al.'s framework. As indicated in Figure 3, these questions asked participants to reflect on practical ways of levelling the SC playing field through curriculum design, pedagogical practice, or institutional support. By moving beyond description to application, these questions aligned directly with RQ2 and with the study's broader aim of informing inclusive practice within FE contexts. Overall, Figure 3 demonstrates that the interview protocol was guided by theory but did not dictate how participants should respond. Instead, it provided a transparent structure that ensured comprehensive engagement with SC, while the abductive and reflexive approach described next in Section 4.4.4(b) maintained openness to unexpected or contradictory perspectives. In conclusion, the theoretically informed but flexible structure of the interview protocol provided a coherent foundation for data generation. Section 4.4.5 describes how the interview protocol was tested and refined through a pilot interview.

4.4.4 (b) Interview Protocol Design: Reflexivity, Sensitisation, and Priming

The interview protocol (Appendix 1) formed a central component of this study's qualitative design, providing the structure through which participants' understandings, experiences, and interpretations of science capital SC were explored. Given that the research questions required depth, nuance, and attention to lived experience, the protocol was designed to balance theoretical clarity with openness to participants' own meanings. This section explains *what was done*, *why particular decisions were made*, how associated risks, particularly priming, were recognised and managed, and how these decisions shaped the data. It also reflects critically on what would be done differently in future research.

A key methodological decision concerned the use of Archer et al.'s (2012, 2013, 2013b, 2015, 2015b) SC framework within the interview design. "Science capital" (Archer, et al., 2025, p.928) is a specialist theoretical construct unfamiliar to most participants. Preliminary discussions with participants indicated that most of them had not heard of the term "science capital" before this study, hence, without clarification, many might interpret "capital" in highly individualised or inconsistent way; for instance confusing it with economic capital or generic effort. For this reason, a decision was taken to provide participants with a SC definition (Appendix 1) and explanatory materials outlining SC (Appendix 1B) prior to part of the interview. This decision was discussed with my supervisors and piloted before data collection. The intention was not to impose a framework, but to create a shared point of reference that would enable participants to engage meaningfully with the concept under discussion.

However, I recognised that providing theoretical materials in advance introduced a risk of priming because participants could orient their responses around the provided materials rather than articulating their own perspectives, or infer what kinds of answers were expected (Brinkmann and Kvale, 2018; Schwarz and Bohner, 2001). The risks of biasing participants' responses were weighed against the risks of each participant working from a personalised and potentially radically different understanding of SC. It was therefore decided that the SC framework materials provided pre-interview would be used as a *sensitising guide*, serving as a flexible, preliminary guide, not as prescriptive coding framework (Blumer, 1954, 2006; Bowen, 2006, 2019; Charmaz, 2014). This means that the SC materials provided were given as provisional, flexible ideas intended to guide participants' thinking rather than impose fixed interpretive categories on them.

Furthermore, the interview protocol was developed using an abductive design consistent with this study's interpretivist–constructivist framework and the participants' responses. This approach was chosen over purely deductive or inductive designs. A deductive design would have treated the SC framework as a fixed set of categories against which participants' experiences were tested (Patton, 2015), while an inductive design would have generated data solely from participants' narratives without reference to existing SC concepts (Thomas, 2006; Charmaz, 2014; Creswell and Poth, 2018). In contrast, abduction allowed the SC framework to

serve as a provisional guide, open to re-interpretation in light of participants' own perspectives, unexpected or contradictory insights (Timmermans and Tavory, 2012). This approach moved away from collecting fixed opinions, such as the SC framework dimensions, and instead allowed participants to reflect and refine their thinking as the interviews unfolded (Berner Rodoreda et al., 2020).

In practice, this meant that the SC framework informed the overall structure of the interview protocol, as outlined in Figure 3, while open-ended questions, prompts, and probes created space for participant-led meaning-making. Crucially, the interview questions were sequenced so that participants' unprompted views were elicited first. This means that early questions (RQ1.1–RQ1.2) explored participants' own understandings of science, science learning, and influence before any reference to SC was introduced. Only later (RQ1.3) was the SC definition presented, and participants were explicitly invited to critique, reject, or extend it (Appendix 1). This sequencing created an opportunity for the participant's own perspectives to be captured independently of the SC framework, which reduced anchoring effects. Even where it was likely that they might have read and therefore derived some of their perspectives from the SC materials provided pre-interview, they were specifically invited to interrogate them in light of their own perspectives and experiences, rather than accept them, hence, affording them ownership to their views.

Hence, when the SC materials were introduced, they were framed as provisional and open to challenge. Participants were asked questions such as, "What do you agree or disagree with about this definition, and why?" rather than being asked to confirm or apply it. This positioned participants as active contributors rather than passive recipients of theory. In practice, participants did not simply reproduce the framework. Many questioned, refined, or resisted key elements, which provides evidence that the framework guided discussion without fixing meaning. For instance, some participants specifically challenged what they perceived as the normative emphasis within the SC framework, particularly its focus on parental scientific background. Diego rejected this assumption, stating that "science capital can be wrong… because I do not have any parents that have introduced me to science other than school or STEM projects," directly contesting the idea that family transmission is a necessary condition for science engagement. Similarly, Ravi and Jamal re-centred SC around wider

social contexts, with Ravi emphasising learning through “the people around you” and Jamal highlighting reliance on “external resources” beyond family.

Others disputed the limited attention given to practice and effort, with Diego arguing that SC grows through “doing experiments and seeing things work,” a view reinforced by Kai and Noah’s repeated emphasis on hands-on and applied learning. Fatima and Thabo further resisted the framework’s background-led orientation by highlighting motivation, with Fatima asserting that she had succeeded through long-term “hard work,” and Thabo stressing that “wanting to learn” was central. Overall, these accounts show that participants did not simply accept the dominant SC narrative but actively questioned, revised, and extended it. This demonstrates that the SC framework provided functioned as a point of dialogue rather than a constraint on participants’ interpretations.

Additionally, participants’ own definitions of SC further support this interpretation by showing active engagement and revision rather than acceptance of a fixed SC model. Teachers articulated SC in varied and expansive ways that moved beyond a narrowly familial focus. For example, Mr Chen described SC as shaped by “cultural social norms, equipment, lecturers, [and] the capabilities of lecturers,” emphasising institutional and material contexts alongside family influence. Mr Morgan framed SC more biographically, defining it as “a total experience from different parts of life,” which explicitly challenges any singular or inflexible definition. Students similarly drew on diverse sources beyond parental background. Amina described SC as emerging from “how the people around me shaped me… my aunt… my close friend,” while Fatima highlighted informal routes, including “friends, teachers… volunteering… anything scientific.” Several participants also revised or extended their definitions during probing, indicating reflective meaning-making rather than adherence to a pre-given structure. For instance, Noah initially spoke of familiarity with science but later connected SC to “cultural factors or educational level or family backgrounds,” demonstrating how understandings evolved through discussion. In other words, participants engaged with the given SC framework critically and selectively, grounding their responses in lived experience rather than reproducing a single, normative definition.

Furthermore, additional safeguards were applied at the analytic stage. For instance, Noah reported strong motivation and sustained engagement with science despite lacking family science background, stating that “no one in my family really studied science,” directly challenging the normative emphasis on parental scientific capital. Similarly, Sofia offered internally inconsistent reflections on background and identity, at times acknowledging cultural or religious influence on science participation while later distancing herself from these explanations. Rather than resolving such tensions to fit the SC framework, these responses were preserved to avoid over-generalisation and to maintain analytic openness (Silverman, 2024). In other words, retaining these cases limited the imposition of theory during interpretation and allowed participants’ lived experiences to complicate and refine the analytical model.

However, despite these measures, the use of pre-interview SC materials remains a potential limitation. Even when participants challenged the SC framework, its presence may have influenced which aspects of experience were emphasised. This means that certain dimensions of science engagement may have been more readily articulated than others. Recognising this, the study treats the provision of materials as a trade-off that enabled shared understanding while introducing the possibility of priming. Reflecting on this decision, future studies would adopt a different approach. Specifically, a two-phase interview design would be used. In Phase A, participants would be invited to discuss their experiences of science, learning, and influence without any reference to SC or related terminology. Only after these accounts were fully articulated would the SC framework be introduced in Phase B, presented explicitly as an object for critique rather than as a guide. Participants would then be asked to compare, reinterpret, or reject the SC framework in light of their earlier responses. This design would further strengthen interpretive validity by separating participant meaning-making from theoretical engagement.

In summary, the decision to provide participants with SC materials was deliberate. It was made to support meaningful engagement with a specialist construct while recognising the risk of priming. Through careful sequencing, clear invitation to critique, and analytic safeguards, the SC framework guided but did not dictate participants’ interpretations. The diversity, resistance, and revision evident in participants’ accounts demonstrate that their perspectives

remained central. Nonetheless, the reflection presented here recognises the limits of this approach and sets out clearly how interview design would be refined in future research.

4.4.5 The Pilot Interview

A pilot interview was conducted with a science teacher from another FE college in London to refine the clarity, relevance, and effectiveness of the interview protocol prior to full implementation. This preliminary stage enabled evaluation of the protocol's alignment with the research questions, the sequencing and pacing of the interview, and the practicalities of using Zoom for audio-visual data collection (Appendices 6A and 6B). It also provided an opportunity to assess the clarity of the questions, the flow of the conversation, and the suitability of the technological setup. The pilot generated several important amendments; verbose or repetitive questions were removed, and others were re-phrased to improve clarity and accessibility. The sequencing of questions was refined to create a more coherent narrative flow, and adjustments were made to the questioning technique to allow more space for participants to elaborate. The pilot also confirmed that a 45–60 minute timeframe was appropriate and that Zoom was reliable for audio and video recordings. Equally valuable were the reflexive insights gained from conducting the pilot. These included the importance of clear openings, active listening, and allowing pauses without rushing to fill them. Such insights informed the approach in subsequent interviews, helping to create a more comfortable and dialogic environment for participants. Overall, the amendments made following the pilot strengthened the interview protocol and enhanced the quality and consistency of the final data collection process.

4.4.6 The Zoom Interviewing Process

My preference for Zoom over face-to-face interviewing was shaped directly by the relational, ethical, and epistemic tensions of my insider position within my department. As both researcher and curriculum manager, and as a Black ethnic minority, migrant, EAL academic, I was acutely aware that my institutional authority and racialised visibility could shape how participants responded to me in person. In earlier classroom and corridor interactions, for

example, several students had hesitated to discuss experiences of linguistic marginalisation or feeling out of place in science, and colleagues had occasionally softened critiques of departmental practices when speaking to me in managerial contexts. This means that conducting interviews face-to-face risked reproducing the same hierarchical and racialised dynamics that participants were being asked to reflect on, potentially inhibiting their willingness to articulate sensitive experiences relating to science capital, socioeconomic disadvantage, racialisation, gender, and migration (Seitz, 2016; Gray et al., 2020). Zoom introduced a form of mediated distance that softened these dynamics by reducing such authority and re-positioning me as a student-researcher, a listener, rather than a manager (Seloma and Ramaila, 2021). In other words, the platform helped create an interactional space in which participants could speak more freely about issues that might have remained constrained in a face-to-face encounter shaped by institutional proximity and my dual role.

It is important to acknowledge that Zoom was not without limitations. Face-to-face interviewing can offer richer embodied detail, fuller access to non-verbal communication, and a more immersive sense of interpersonal presence, qualities that can deepen qualitative insight (Lo Iacono, Symonds and Brown, 2016). However, in this study, these potential advantages were outweighed by the risk that in-person interviewing would amplify power asymmetries and suppress the very narratives this study sought to understand. This means that the "strengths" of face-to-face interviewing could have become methodological liabilities in an insider-researcher context. Zoom, by contrast, preserved the core features of qualitative interviewing, visual cues, rapport, and conversational flow, while enhancing confidentiality where participants consented (Archibald et al., 2019; Gray et al., 2020).

Additionally, conducting interviews on-site ensured stable connectivity and private rooms, and high-quality digital recordings imported directly into NVivo 14 supported accurate transcription and systematic analysis (Miles, Huberman and Saldaña, 2014). Although Zoom inevitably limited access to some embodied non-verbal detail, these constraints were mitigated through slower pacing, explicit check-ins, and the option for participants to disable video during sensitive discussions. In other words, the method did not diminish the quality of the data; instead, it enabled participants to articulate experiences that might have been inhibited by the interpersonal pressures of face-to-face interviewing. Overall, Zoom was not simply a pragmatic choice but a methodologically and ethically coherent approach that

aligned with my positionality, minimised power asymmetries, and safeguarded the authenticity and integrity of participants' accounts within the realities of insider research. Also, online synchronous interviewing has been shown to support rich qualitative data generation while offering flexibility, accessibility, and participant comfort, making it particularly appropriate for research involving diverse participants (Janghorban, Latifnejad-Roudsari and Taghipour, 2014).

4.4.7 Evaluating the Interviewing Process

The interview process was designed to uphold methodological rigour, reflexivity, and ethical integrity (Finlay and Gough, 2008; Saldaña, 2021). Aligned with the interpretivist-constructivist paradigm, it balanced structure with flexibility, beginning with a pilot study to refine the design and logistics, including the use of separate rooms to enhance recording quality. Multiple forms of documentation (for instance, Zoom recordings, notes, and transcripts) supported data richness and reflexivity. Ethical safeguards were prioritised through informed consent, confidentiality, and efforts to minimise power imbalances. I adopted a non-hierarchical stance, presenting myself as a UofG student, dressing informally, and conducting the interviews in neutral, familiar settings. Open-ended questions and active listening encouraged comfort and meaningful participation, while reflexive journaling helped monitor my positionality and improve my technique (Berger, 2013; Roulston, 2021). Although member checking was offered, it was not accepted. Nonetheless, the process demonstrated iterative learning and a commitment to improvement, particularly in reducing leading questions over time (Creswell and Creswell, 2018; Brinkmann and Kvale, 2018, 2018b). However, limitations such as potential bias, some participants saying what they thought I would like to hear, and time intensity were acknowledged and addressed in the relevant sections. Overall, the interviews contributed to the credibility, dependability, and confirmability of the study's findings (Given 2008; Rubin and Rubin 2005; Roulston and Choi 2018; Savin-Baden and Major 2023). With the data collection process complete, the next section (4.5) outlines the analytical procedures used to interpret the interview data in alignment with the study's interpretivist-constructivist framework.

4.5 Data Analysis

4.5.1 Introduction

Data analysis was guided by the interpretivist-constructivist paradigm and involved participant selection, semi-structured Zoom interviews, audio-visual responses, reflexivity, ethical considerations and transcription. Although overlapping and cyclical (Bloomberg, 2022), the process is presented stepwise for transparency. Braun and Clarke's Reflexive Thematic Analysis (RTA) (Braun and Clarke, 2006, 2013, 2016, 2019, 2020, 2022, 2024; Willig et al., 2017) was employed to iteratively code and theme participants' transcribed responses (Given, 2008; Braun et al., 2019a, 2019b). NVivo 14, a Computer-Assisted Qualitative Data Analysis Software (CAQDAS) (Lumivero, 2023), provided by UofG IT, supported digital analysis alongside the manual formulation of the final themes. NVivo 14 was used to support the organisation, coding, and analysis of the interview transcripts. NVivo14 was selected for its compatibility with Braun and Clarke's RTA, particularly its support for flexible coding and theme development. The software enabled efficient transcript importation, line-by-line coding, and exploration of thematic relationships. While NVivo14 enhances transparency and reflexivity through its visual audit trail (Braun and Clarke, 2020), it did not replace my analytical judgements. Manual review and note-taking were employed to ensure deep engagement with the data. Despite the initial learning curve, NVivo14 proved valuable in supporting a rigorous and reflexive analytic process. Appendix 16 outlines the NVivo glossary.

4.5.2 Braun and Clarke's Six-Stage Reflexive Thematic Analysis

Braun and Clarke's RTA qualitative analytic method, which emphasises the active role of the researcher in knowledge production, was employed. Thematic Analysis (TA) is a foundational method for identifying, analysing, and interpreting patterns of meaning across qualitative datasets (Given, 2008; Braun et al., 2019a, 2019b). Three distinct approaches have emerged within TA: coding reliability, codebook, and reflexive (Braun et al., 2019a, 2019b; Clarke and Braun, 2019). Among these, RTA stands out for its philosophical grounding in interpretivism-constructivism and emphasis on researcher subjectivity and reflexivity. This flexibility contrasts with the structured, rule-bound nature of codebook approaches, which often impose predefined categories on the data. Unlike coding reliability approaches, which are

rooted in positivist traditions and strive for objectivity and replicability, coding in RTA is fluid and iterative, allowing codes to evolve as understanding deepens. This interpretive stance positions the researcher not as a neutral observer but as a storyteller, whose reflexive engagement with the data is central to the analysis.

The choice of Braun and Clarke's RTA is thus both methodological and philosophical in nature. This aligns with the study's interpretive paradigm, which values contextualised meanings and acknowledges multiple realities. As Braun and Clarke (2022) note, RTA's adaptability makes it particularly suitable for qualitative research that seeks to explore complexities without imposing rigid theoretical frameworks. Its emphasis on reflexivity ensures that the analysis remains grounded in the experiences and perspectives of both the participants and the researchers, fostering rich, nuanced interpretations that go beyond surface-level descriptions. RTA embraces the researcher's active role in meaning making. Braun and Clarke (2022) argue that RTA is not merely a technique but a fully qualitative methodology that recognises the constructed nature of knowledge. In this view, themes do not simply "emerge" from data; rather, they are actively developed by researchers through deep engagement with the data, shaped by their theoretical assumptions, socio-cultural positioning, and scholarly insights (Braun et al., 2019a, 2019b). Thus, as explicated throughout this section, Braun and Clarke's RTA (2006, 2013, 2019, 2021), which allows for both deductive (theory-driven) and inductive (data-driven) coding and theme development, was employed. In alignment, the structure and content of the interview protocol employed (Appendix 1) demonstrate that both approaches were used. Thus, the interview protocol contains deductive questions directly shaped by the theoretical frameworks employed (Sections 1.6, 2.4, and 2.5) alongside open, exploratory (inductive) questions that encourage participants to introduce novel meanings, interpretations, and their experiences.

However, the use of Braun and Clarke's RTA is not without challenges. Braun and Clarke (2019) highlighted persistent issues in reporting quality, prompting the development of the Reflexive Thematic Analysis Reporting Guidelines (RTARG) (Braun and Clarke, 2024) to enhance rigour and transparency. A key challenge is the misconception of RTA as a singular, fixed method rather than a flexible, reflexive approach. This can lead to rigid applications that undermine their interpretive depth. RTARG addresses this by encouraging researchers to critically engage with both their data and positionality, ensuring that themes are meaningfully constructed rather than reduced to superficial topics. Another concern is the

use of RTA without a connection to theory, which weakens the analytical depth and risks misrepresenting participants' realities. The RTARG advocates for a clear theoretical grounding to guide theme development and contextual interpretation. Thus, integrating RTARG into RTA practice strengthens methodological integrity, supports nuanced analysis, and enhances the credibility of the findings. Braun and Clarke's six-step RTA (Figure 4) was employed to analyse data, while overlapping and working cyclically, as detailed in stages 1-6 below.

Figure 4: Braun and Clarke's Six-Stage Reflexive Thematic Analysis (Braun and Clarke, 2019)

Stage 1: Data transcription, familiarisation, and writing familiarisation notes.

Data familiarisation, the foundational stage of Braun and Clarke's RTA (2006; 2019, 2024; Braun et al., 2019a, 2019b), involved deep iterative engagement with the dataset through transcription, repeated listening, and close reading of interview transcripts and notes. NVivo 14 supported this process by enabling the use of visual aids such as the 'Word Frequency Query' function to generate word clouds from frequent terms (Appendices 11A–C), thus offering visual insights into dominant concepts, such as "science" and "capital", to aid the identification of initial patterns. Familiarisation was reflexive and cyclical, involving back-and-forth movements between data collection, transcription, and interpretation (Braun et al., 2019a, 2019b; Bloomberg, 2022). Although time-intensive and laborious, requiring revisiting over and over, this stage was crucial to a thorough understanding of the depth, breadth, and nuances of participants' responses; hence, it was well worth the time spent. In addition, NVivo's '*annotation*' and '*memo*' functions were employed to document in situ reflections and summary notes, capturing emotional cues, body language, and evolving analytic impressions. This stage embraced my subjectivity, recognising positionality as a

resource rather than a bias, and laid the groundwork for rigorous, contextually grounded coding and theme development.

Data transcription, which marked the start of data familiarisation, involved converting participants' Zoom audio responses into Microsoft Word documents for analysis (McLellan, MacQueen and Neidig, 2003). The auto-generated transcripts were manually reviewed and corrected line-by-line to ensure accuracy, addressing misinterpretations linked to grammar, phonetics, and accents. The final transcripts were pseudonymised for confidentiality (Appendix 9) and, along with additional participant notes (Appendix 10), imported into NVivo 14 for analysis. This meticulous process ensured data integrity and supported a rigorous thematic exploration.

Running a word frequency contributed to analytical rigour by highlighting the key concepts and recurring themes in participants' transcripts and notes, thus, supporting deeper engagement with the data by highlighting semantically rich terms, guiding initial coding decisions and ensuring that the analysis remains grounded in participants' language. The word cloud (Figure 4) reveals that "science" and "capital" are central themes, affirming the study's grounding in science capital. Prominent terms such as "engagement", "identity", "ethnicity", "language", "barriers", and "STEM" may indicate a strong focus on equity, inclusivity, and access. The presence of "teacher", "career", and "pathways" suggests that the framework encompasses both student and educator experiences, particularly in relation to professional development and SC acquisition. The diversity of terms may reflect an intersectional approach, highlighting how linguistic, cultural, and socioeconomic factors shape science engagement. These findings reinforce the study's contribution to exploring SC in a contextually diverse educational setting, such as an FE college. Building on the familiarisation process, Stage 2 involved generating initial codes to systematically identify and organise meaningful links across the dataset.

Figure 5: Word Cloud of Dominant Words

Stage 2: Generating Initial Codes

Following the initial familiarisation and reflexive notetaking, Stage 2 involved systematically generating initial codes to begin organising the data into meaningful analytical units. Codes are the smallest meaningful units of analysis that identify and capture noteworthy features in the data. This stage involved detailed iterative coding to identify meaningful data segments using concise interpretive labels (Braun and Clarke, 2006, 2019). This was done by systematically identifying notable features across the entire dataset by coding sections relevant to the research questions (RQs). As detailed below in Stage 3, coding was data-driven and generated both deductively and inductively, beginning with semantic (surface-level) coding and progressing to latent coding, which involved deeper engagement with the participants' language and underlying meanings (Braun et al., 2019a).

NVivo 14 supported the line-by-line coding of the pseudonymised transcripts, with recurring ideas grouped into *Initial Codes 1* (Appendix 12A), which were later refined into second-level codes, *Initial Codes 2* (Appendix 12B). This flexible, reflexive process allowed the codes to evolve, with excerpts being reallocated or uncoded as the understanding deepened. Descriptive coding (Saldana, 2021) was selected for its suitability in summarising key topics, supporting data reduction, and laying the foundation for theme development in Stage 3. Analytic rigour and transparency were upheld through iterative systematic coding, detailed documentation of analytic decisions, and ongoing reflexive engagement with the data. (Given 2008; Saldana and Omasta 2018; Richards 2021). With initial codes systematically generated

and organised, the next stage focused on identifying patterns across the dataset to begin constructing Initial *Themes* from the coded and collated data.

Stage 3: Generating Initial Themes from Coded and Collated Data

Following the systematic coding of the dataset, Stage 3 involved identifying patterns and relationships across the coded extracts to construct initial themes. This process was guided by Braun and Clarke's (2006, 2020, 2022, 2024) RTA framework, which emphasises the researcher's active role in interpreting meaning rather than simply categorising data. Hence, theme development involved actively constructing patterns of shared meaning from related codes rather than passively identifying topics (Given, 2008; Saldana and Omasta, 2018; Braun et al., 2019a). The themes were shaped through iterative engagement with both the codes and the broader context of participants' narratives, while reflexive notes were employed to inform the analytic process, supporting transparency and theoretical sensitivity.

A blended inductive–deductive thematic analysis was used to develop the themes, drawing on NVivo 14 and guided by Braun and Clarke's reflexive thematic analysis (RTA), which supports flexible, mixed analytic strategies within theoretically informed qualitative research (Patton, 1990, 2015; Hayes, 1997; Boyatzis, 1998; Frith and Gleeson, 2004; Braun and Clarke, 2006, 2020, 2022, 2024). RTA enabled me to move between inductive, data-driven coding ("bottom up") and deductive, theory-driven coding ("top down") (Braun and Clarke, 2006, pp. 83–84), and this dual movement was central to the analytic logic of the study. As explained in Section 4.4.4 (a), the SC framework (Archer et al., 2015) provided an initial sensitising structure, offering concepts such as scientific literacy, dispositions, practices, and social capital as provisional analytic anchors. At the same time, inductive coding allowed the participants' responses to interact with these concepts, thereby highlighting [un]anticipated patterns, contradictions, and context-specific insights that could not be captured by the SC framework alone.

This means that theory was treated as a starting point rather than a boundary, and the analysis remained open to insights that challenged or extended the existing conceptual insights. This blended approach was reinforced by the abductive design of the interview protocol (Section 4.4.4(a)), which intentionally invited participants to shape, contest, or re-interpret the theoretical categories. Early questions (RQ1, Q1–Q3) elicited participants' own definitions and interpretations before the framework was introduced, while later questions (Q4–Q6) encouraged critique, contextualisation, and re-framing. In other words, the protocol itself created the conditions for abductive analysis by ensuring that participants' meanings were not overshadowed by the theoretical lens. As a result, the analytic process moved iteratively between what participants said and what the framework suggested, allowing each to inform and re-shape the other (Braun and Clarke, 2019, 2020; Timmermans and Tavory, 2012).

Coding and theme development therefore unfolded through continuous comparison. Initial inductive codes were examined alongside the theoretical dimensions of SC; where data aligned with theory, codes were elaborated, and where data diverged, themes were adapted, split, or newly constructed. This means that the final thematic structure was neither imposed by theory nor wholly emergent from the data, but produced through an ongoing negotiation between the two. For instance, this study's context-specific insights that emerged, such as the salience of English language proficiency (see Section 5.4), illustrate how inductive patterns prompted theoretical extension rather than simple confirmation. Hence, the analysis did not treat theory and data as competing sources but as mutually generative. In other words, participants were positioned as co-constructors of meaning, and the final themes were hybrid constructions, which were theoretically informed yet re-shaped, extended, and sometimes challenged by participants' lived realities of teaching and learning within this study's FE context.

After subjectively and reflexively generating and refining the Initial Codes to capture semantic (surface-level) meanings in *Initial Codes* 1 (Appendix 12A) and latent (deep, interpretive) meanings in *Initial Codes* 2 (Appendix 12B), the next step was to organise them into broader patterns, that is, *Initial Themes 1*. This was done by clustering related codes (*Initial Codes* 2) into overarching themes and subthemes (Figures 6 and 8). This thematic development, which reflects key insights from the data, was conducted using NVivo. The

themes were treated as analytical outputs that were actively created rather than being allowed to passively emerge from the data. This flexibility allowed for adaptive changes to be made as new meanings emerged, ensuring comprehensive and responsive analysis (Saldana, 2021; Bloomberg, 2022). The *Initial Themes* were then exported from NVivo, printed, and manually sorted to further explore conceptual groupings and regroup them into *Final Themes* (Appendix 14). This hands-on process supported a deeper interpretive engagement. The *Final Themes* were then mapped against the RQs, showing their layered connections to the initial codes and early thematic ideas (Appendix 15A), ensuring analytic coherence and transparency. Stage 3 focused on fragmenting the data into individual codes that iteratively captured the key ideas. Stage 4 moved beyond this by grouping the codes into meaningful themes, much like assembling bricks into a structured building that reveals the overall shape and purpose of the analysis. Thus, Stage 3 helped identify and label key features within the data through systematic coding, while Stage 4 built on this by organising those codes into meaningful themes, constructing a coherent analytical framework that revealed deeper patterns and insights.

Stage 4: Developing and Reviewing Themes

Stage 4 involved critically reviewing and refining the *Initial Themes* to ensure coherence within each theme and clear distinctions between them (Braun and Clarke, 2006, 2019a). This was done by initially assessing the fit of each *Initial Theme* with its coded data extracts and then evaluating its alignment with other themes. This process was both iterative and interpretive, requiring me to assess whether the themes meaningfully captured the coded data and the dataset as a whole, and whether they answered the RQs convincingly (Braun et al., 2019a). Themes were split, merged, or discarded as needed, with continuous revision of *Initial Codes 1* and *2* to uncover deeper patterns (Appendices 15A and 15B). Stage 4 concluded with the construction of provisional thematic structures that began to articulate the analytical architecture of the data, which seamlessly transitioned into Stage 5, where the themes were rigorously refined, clearly defined, and precisely named to ensure conceptual clarity, analytical depth, and alignment with the overarching research aims (Appendix 14).

Stage 5: Refining, Defining and Naming Themes

Here, each *Initial Theme* was refined to clarify its core meaning and contribution to the overall narrative by defining its specific focus and developing a clear, concise name that accurately reflected the theme. This interpretive process required repeated refinement to ensure that the theme names were concise, analytically coherent, and aligned with the research questions (Appendices 15A). As shown in the *Final Themes (*Figure 7), each representing a distinct narrative thread, were developed through this cyclical process and mapped against the RQs to ensure analytic clarity and depth. Figures 6 and 8 show the final themes and subthemes and how they are interrelated. Appendix 15B summarises the final themes, sub-themes, initial themes, codes, and indicative quotes from participants that exemplify their responses.

Figure 6: Table of Final Themes and Sub-Themes

Final Themes	**Sub-Themes**
Theme 5.2: Perceptions and Impacts on Science Capital	5.2.1: Students' and Teachers' Experiences of Science Capital 5.2.2: Students' and Teachers' First Time of Hearing about Science Capital 5.2.3: Students' and Teachers' Interest and Motivation to Study Science 5.2.4: Relevance of Science (Students and Teachers) 5.2.5: Relevance of Science Capital (Students and Teachers) 5.2.6: Informal Science Learning Environments 5.2.7: Science Media Consumption and Science Capital 5.2.8: Scientific Literacy and Science Capital 5.2.9: Progression and Science Capital
Theme 5.3: Influences of Intersectionality on Science Capital	5.3.1: Ethnocultural background and Science Capital 5.3.2: Gender and Science Capital 5.3.3: Habitus and Science Capital 5.3.4: Socioeconomic Background and Science Capital 5.3.5: English Language Proficiency and Science Capital
Theme 5.4: Unexpected Findings	5.4.1: English Language Proficiency Recommendations 5.4.2: Insufficient Focus on Equality, Diversity and Inclusion 5.4.3: Tendency Towards Deterministic Science Capital Conception

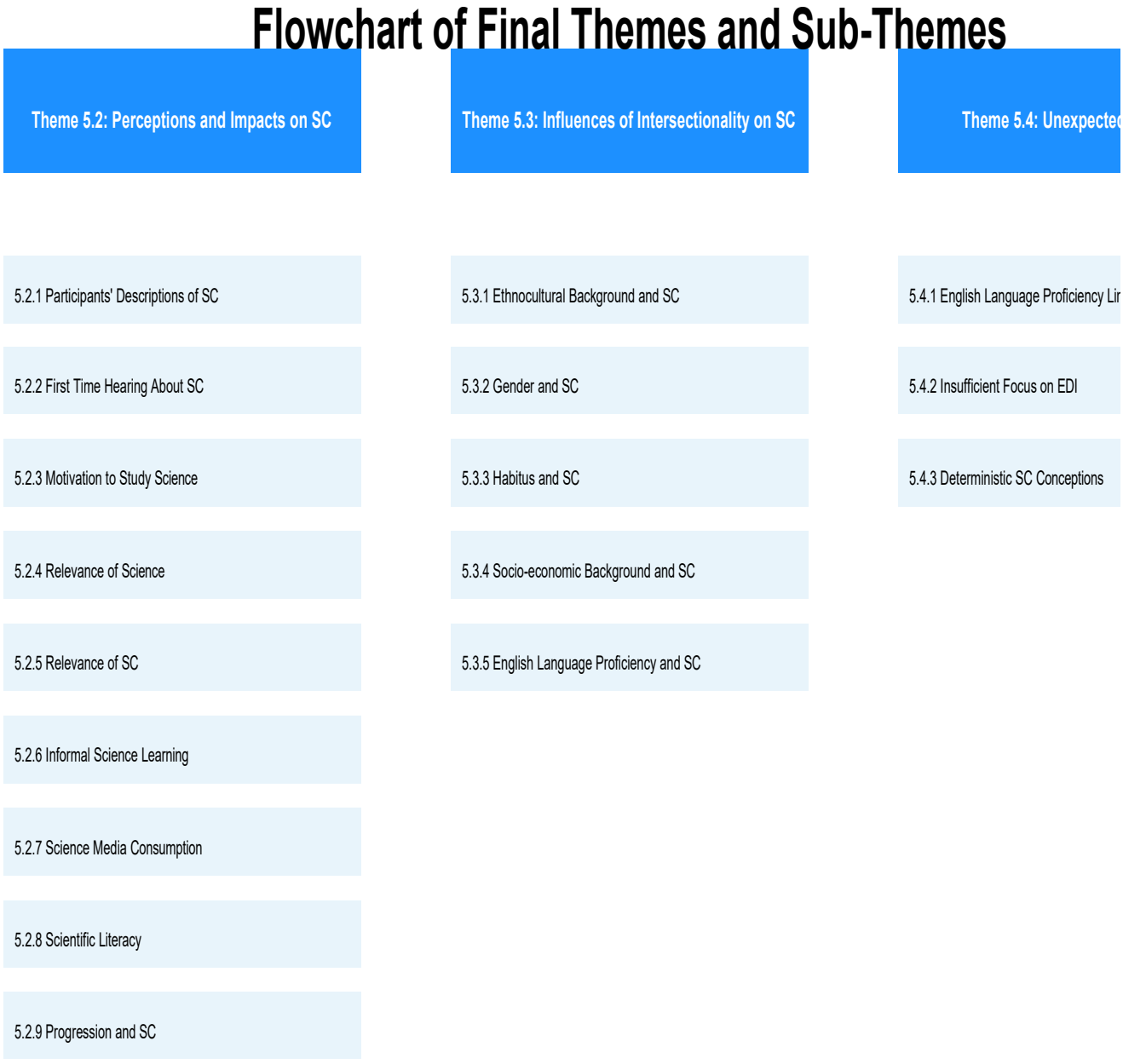
Figure 7: Final Themes

5.2: Perceptions and Impacts on Science Capital

5.3: **Influences of Intersectionality on Science Capital**

5.4: Unexpected Findings

Figure 8: Flow chart of Final Themes and Sub-themes



4.6 Ethical considerations

Ethical integrity was embedded throughout the study, guided by multiple frameworks that prioritised inclusivity, reflexivity, and equity. Central to this was the principle of the informed consent. Prior to data collection, ethical approval for the study was secured through the University of Glasgow's College of Social Sciences Research Ethics Committee (Appendices 5E and 5G), alongside institutional permissions from my college (Appendices 5 J and 5 K) to ensure participant autonomy and confidentiality (Iranmanesh, Yazdi-Feyzabadi and Mehrolhassani, 2020; Fatima and Mahmood, 2024). Participants were fully briefed on their rights, including the right to withdraw at any time, through a series of documents that were discussed and agreed upon prior to obtaining written consent. These included the Participant Information Sheet, Privacy Notices, Participant Consent Form, and Parent/Guardian Consent Form (Appendices 5A–5D, respectively). These materials ensured transparency, clearly outlining the study's aims and procedures and reinforcing voluntary participation and ethical accountability.

Confidentiality was rigorously maintained using pseudonyms and secure data protocols (Appendices 5F and 5H), with written consent obtained for data access and use of quotations; no consent was assumed. The ethical framework also aimed to maximise participant comfort (Addissie et al., 2014; Potthoff et al., 2023). This was supported by a comprehensive Data Management Plan (Appendices 5F and 5H), which detailed the types of data collected, Zoom audio and video recordings, and outlined secure storage via the UofG Cloud and password-protected devices. In line with institutional policy, data will be retained for ten years, with access controls and open-access provisions ensuring both security and transparency. This approach aligns with virtue ethics, highlighting the integrity and trustworthiness of the study.

Power dynamics were managed using relational and culturally responsive methods. Interviews were conducted in familiar classroom settings using a conversational tone to foster trust and openness. The participants appeared relaxed and willingly shared personal anecdotes, illustrating the ethics of care and the importance of relational engagement (Martani et al., 2024). The study also drew on Foucauldian ethics to interrogate dominant discourses and validate non-Western scientific knowledge (Mattioni et al., 2021). For example, Participant E

noted how science qualifications are often seen as markers of intelligence, marginalising those who struggle with traditional assessments: Similarly, Participant P advocated for recognising alternative pathways into science, such as apprenticeships, challenging elitist, university-centric narratives. These insights informed the study's critique of dominant discourses and its call for more inclusive representations of science capital in literature. Additionally, ethics were treated as an iterative process (Stevenson et al., 2015) requiring ongoing reflection and responsiveness.

4.7 Positionality, Reflexivity and Power Dynamics

4.7.1 Introduction

As outlined in this section, recognising my positionalities, reflexivity, subjectivity, and power relations helped contextualise my role as the "researcher-as-an-instrument" (Morrow, 2005, p.250). This meant examining my 'self' and actively reflecting on how my identity might shape this study. Positionality is fluid, layered, and context-dependent (Holmes, 2020), what May and Perry (2017, p.173) call "the multiple selves that we inhabit and exhibit." Holmes, drawing on the Johari Window (Esposito, Mcadoo, and Scher (1978), highlights how our open self is easier to articulate than our blind, hidden, or unknown selves, each of which may subtly shape the research. Reflexivity involves consciously addressing or accepting the biases that stem from these positionalities (Basit, 2013; Berger, 2013; Holmes, 2020), acknowledging that who I am influences the research direction (Rose, 1997; Hopkins, 2007; Rowe, 2014; Creswell and Creswell, 2018).

Reflexivity, which is core to audit trails (Tobin and Begley, 2004), required ongoing self-critique of how my similarities, differences, and "betweenness" (Hopkins, 2007, p.388) with participants could influence the study (Cohen, Manion and Morrison, 2018; May and Perry, 2017). This helped surface assumptions, mine and theirs, and contributed towards ethical rigour and trustworthiness (Sultana, 2007; Shepherd, Noble and Parkin, 2022). As Shepherd et al. (2022, p.1) put it, reflexivity is "the ongoing examination of how the researcher's identity potentially impacts research design, methods, analysis, ontology and

epistemology." Declaring my positionalities enabled me to reflect on and challenge my assumptions, acknowledge blind spots (Hopkins, 2007; Holmes, 2020; Hopkins et al., 2022), and avoid producing "antiseptic accounts" devoid of subjectivity (May and Perry, 2017, p.175). This meant recognising the strengths and limits of my multiple selves, my shifting 'selfhood' (for instance, perspectives, power relations) and fixed 'sameness' (May and Perry, 2017, p.178) (for instance, age, gender, ethnicity), which positioned me variably as an insider, outsider, or somewhere in between. I also worked to mitigate hierarchical dynamics (Foote and Bartell, 2011), aware that my control over the questions and structure could skew power relations. As the study progressed, I remained open to uncovering unconscious biases and blind spots, treating reflexivity as a continuous and critical practice.

4.7.2 My Personal and Professional identities

I identify as a Black ethnic minority, middle-aged, middle-class female who completed primary and secondary education outside the UK before relocating from Nigeria to the UK. I consider myself a Londoner, classified under the Black, Black British, Caribbean or African ethnic group according to the England and Wales 2021 Census and socioeconomically positioned within the "L3 Higher professional occupations" category of the UK 2021 NS-SEC, which includes roles requiring advanced qualifications and professional expertise. These positionalities, particularly my science background, afforded me an 'insider' status with the four science teacher participants, all of whom were middle-aged immigrants from Africa, Western Europe, and South Asia, with over a decade of experience in London's FE sector and holding at least a Master's degree in STEM. However, gender marked a point of difference, as all the teacher participants were male. In contrast, the student participants presented a more complex demographic profile (Appendix 1). The majority of their demographic characteristics positioned me as an 'outsider' in relation to them, apart from some who had an ethnic background commonality with me.

Professionally, I am an experienced science educator with over two decades of teaching and curriculum management experience within London's FE sector. My work has been driven by a commitment to widening equitable access to STEM education and careers, particularly for

young women and those from socio-economically or culturally marginalised backgrounds who may not be traditionally drawn to science. Over the years, my experience in both FE and research has challenged prevailing narratives and earlier studies that suggest limited science uptake among ethnic minority students in England. In practice, I have observed the opposite, with a growing disengagement from science among young White students, particularly males, a trend that underscores the urgency of studies like this one to promote post-compulsory science participation across all demographics. As an EdD student, I occupy a unique academic position as a science educator conducting research within the social sciences. This dual identity presents an ongoing challenge, resisting the pull of positivist interpretations and scientific objectivism in exploring social phenomena. Mitigating against lapsing into scientific, positivist interpretations of social phenomena is an ongoing challenge; for instance, the interpretive methodology chosen and the framing of the interview questions are aimed at preventing scientific objectivism.

4.7.3 Researcher Positionality: Ontology, Epistemology, and Axiology

My paradigmatic stance in this study is rooted in the interpretivist-constructivist paradigm, which views reality as socially constructed and shaped by individual meaning making (Gormally and Coburn, 2014). This aligns with a relativist ontology that acknowledges multiple realities. Each participant, including myself as the researcher, constructed their own understanding while also contributing to a shared meaning (Morrow, 2007; Pervin and Mokhtar, 2022). This study rejects the positivist paradigm and its realist ontology, which assumes a singular, objective truth and positions the researcher as a passive observer of value-free realities (Denzin and Lincoln, 2023; Wilson, 2014). Such assumptions are incompatible with the interpretivist-constructivist approach, which recognises the researcher's active role in shaping knowledge. In addition, my ontological stance reflects a rejection of essentialist ideologies that perpetuate inequality in science education based on race, class, or gender. Epistemologically, I embrace the idea that knowledge is co-constructed through interaction, shaped by context and informed by values. Axiologically, this study is guided by ethical values that prioritise equity, inclusivity, and reflexivity. Together, these philosophical foundations inform the study's methodology and reinforce its

commitment to ethical, meaningful and socially responsive research (Guba and Lincoln, 1994; Braun and Clarke, 2013; Morrow, 2007; Wilson, 2014; Pervin and Mokhtar, 2022).

4.7.4 Philosophical Positionality: Pragmatism

My philosophical orientation is rooted in pragmatism, which contrasts sharply with idealism in epistemological and ontological terms. Idealism seeks universal truths beyond empirical observation, whereas pragmatism prioritises context-sensitive enquiry and actionable knowledge (Morgan, 2007). This pragmatic worldview has long shaped my educational and professional journey, particularly my affinity for scientific disciplines grounded in real-world applications. Even in my formative years, I gravitated toward subjects that emphasised utility and experimentation. For example, despite excelling in A-Level geography, I chose not to pursue it at university because of its theoretical orientation and its location within the social sciences, fields I then perceived as lacking practical relevance. This disposition initially posed challenges during the early stages of my EdD, where I struggled to reconcile my scientific mindset with the interpretive and often ambiguous nature of the social science research. However, over time, I came to appreciate the value of multiple perspectives and the interpretivist-constructivist paradigm's capacity to explore complex social realities. My commitment to pragmatism continues to guide my research, aiming to generate knowledge that is both meaningful and applicable to science education.

Furthermore, practical pragmatism, the applied dimension of philosophical pragmatism, underpins my methodological choice. It supports flexibility and outcome-oriented strategies for addressing real-world problems (Saunders et al., 2012). In this study, semi-structured interviews were used, allowing participants to express their experiences in their own terms while enabling depth and contextual nuance. My longstanding engagement with science education has reinforced my commitment to producing findings that are not only theoretically grounded but also practically relevant to educators, policymakers, and learners. Pragmatism served as a methodological compass, ensuring that the research remained anchored in practice while critically engaging with broader theoretical and social questions.

4.7.5 My reflexivity

My reflexivity was shaped by the complex interplay of my personal, professional, and philosophical positionalities. As a Black ethnic minority woman from an African background, I bring a culturally attuned perspective to issues of diversity in science education. This identity positioned me as an 'insider' to many of the minority student participants, enhancing my sensitivity to their experiences. However, my middle-aged, middle-class status also made me an 'outsider', particularly in relation to students from lower socioeconomic backgrounds. Professionally, with over two decades in London's FE science education sector, I possess insider knowledge of the institutional landscape, which informs my understanding of the barriers and opportunities surrounding SC accumulation. My motivation to promote equitable access, especially for young women and marginalised groups, closely aligned with the study's focus, driving a critical exploration of inclusive strategies.

Philosophically, my alignment with the interpretivist-constructivist paradigm and relativist ontology was central to the study's approach. This perspective, which recognises multiple socially constructed realities, enables a nuanced understanding of how participants conceptualise science and its relevance in their lives. My strong stance against essentialist ideologies that reinforce inequality, particularly those rooted in race, class, or gender, shaped the study's critical lens. For example, my commitment to gender equity in science education is deeply personal and influenced by my father's advocacy for educating his daughters in science against prevailing cultural norms. My pragmatic philosophical inclination further guided the study's methodological choices, favouring practical, actionable strategies for enhancing SC. This was reflected in the use of semi-structured interviews, which allowed participants to express their experiences in their own terms, while enabling depth and contextual nuance. The aim was to produce findings that were theoretically informed and relevant to educators, policymakers, and learners.

While my diverse background enriched the study and facilitated rapport with the participants, it also introduced potential biases. My strong investment in equity could risk overemphasising certain aspects of inclusion, and my middle-class status might limit my understanding of the challenges faced by students from more disadvantaged backgrounds. Recognising these

limitations was essential for maintaining reflexivity and ensuring the study's trustworthiness. Thus, reflexivity in this study involved continuous, critical engagement with how my positionality shaped the research process and outcomes. Balancing insider insight with outsider awareness and personal conviction with methodological rigour ensured that the study remained ethically grounded, culturally sensitive, and analytically robust.

4.8 Trustworthiness and Authenticity

Lincoln and Guba (1986, p.74) introduced "trustworthiness" and "authenticity" to reflect the distinct nature of qualitative enquiry, which does not seek universal objectivity but rather contextual depth and meaning. Trustworthiness reflects the rigour and integrity needed to ensure findings are credible, meaningful, and relevant (Guba, 1981; Lincoln and Guba, 1985, 1986; Tobin and Begley, 2004; Morse et al., 2015; Nowell et al., 2017). As Tobin and Begley (2004, p.390) put it, "rigour is the means by which we show integrity and competence: it is about ethics and politics, regardless of the paradigm." Qualitative research's inherent subjectivity and the researcher's active role complicate how such rigour is demonstrated (Denzin and Lincoln, 2023). This study draws on Lincoln and Guba's widely accepted framework, which replaces the quantitative criteria of validity and reliability with four qualitative benchmarks: credibility, dependability, confirmability, and transferability (Lincoln and Guba, 1986). These principles, which are detailed below, embedded throughout the research, offer a robust foundation for evaluating qualitative rigour (Nowell et al., 2017; Ahmed, 2024; Novak and Jen, 2024).

Dependability refers to the consistency and replicability of the findings within similar contexts, conditions, and populations (Tobin and Begley, 2004; Haq et al., 2023). Achieving this requires transparent, well-documented, and logically structured processes that allow others to trace and scrutinise each stage of the research (Tobin and Begley, 2004; Guba and Lincoln, 1994; Nowell et al., 2017; Ahmed, 2024). In this study, dependability was ensured through detailed audit trails that captured the rationale, purpose, data collection, and analysis procedures of the study. For example, the changes made to the interview questions following the pilot study, original Zoom recordings, auto-generated transcripts, edited and

pseudonymised versions, researcher notes, NVivo annotations and memos, and the documented stages of reflexive thematic analysis were all systematically recorded, providing a clear and traceable account of the research process, supporting transparency, reproducibility, and methodological rigour.

Transferability refers to the extent to which the findings can be meaningfully applied to other contexts, settings, or populations. Unlike the positivist notion of generalisability, which seeks universal applicability through statistical inference, transferability is rooted in the interpretivist-constructivist paradigm that recognises multiple realities and context-bound knowledge (Lincoln and Guba, 1985; Tobin and Begley, 2004; Given, 2008). It is not the researcher's responsibility to claim applicability, but rather the reader's responsibility to assess relevance based on contextual similarities (Roulston and Choi, 2018; Drisko, 2025). In this study, transferability was supported by rich and thick descriptions of the research context, participants, and processes. Detailed accounts of the participants' demographic characteristics (Guba and Lincoln, 1994), the study's rationale and methodology, and the use of direct participants' quotations (Amin et al., 2020) should enable readers to evaluate the relevance of the findings to their own settings. As Denzin (2011, p.3) explains, "in interpretive studies, thick descriptions and inscriptions are deep, dense, detailed accounts… [that] often state the intentions and meanings that organise actions," in contrast to thin descriptions that merely report facts. Potential limitations were addressed by attending to my positionality and reflexivity, ensuring transparency in data collection, and avoiding confirmation bias through careful participant verification. Additionally, care was taken to preserve the study's contextual nuances when considering the applicability of the findings to other settings.

Credibility refers to the accuracy, depth, and believability of the findings and methods, which is similar to internal validity in quantitative studies (Guba, 1981; Lincoln and Guba, 1985, 1986; Tobin and Begley, 2004; Nowell et al., 2017; Haq et al., 2023; McKim, 2023; Ahmed, 2024). This ensures that the researcher's representation aligns with participants' perspectives, what Nowell et al. (2017, p.3) describe as the "fit" between respondents' views and the researcher's interpretation. This study employed Lincoln and Guba's (1986) credibility strategies, including prolonged engagement and persistent observation. Verbatim

quotations were used to authentically capture participants' voices and the complexity of their experiences, enhancing the depth and trustworthiness of the findings (McKim, 2023). Thick conceptual descriptions, reflexivity, transparency, and detailed audit trails further support credibility (Amin et al., 2020). Prolonged engagement was achieved through sustained interaction with the participants, from initial recruitment and ethical briefings to interviews and post-interview discussions. This extended involvement helped build trust and allowed for a deeper understanding of the study's multifaceted dimensions (Bush and Amechi, 2019).

Although prolonged engagement can risk over-familiarity, potentially leading participants to tailor responses to perceived expectations, the constructivist paradigm, which recognises both researcher and participant subjectivities, helped to mitigate this concern. Additionally, persistent observation involved ongoing reflexivity, recognition of bias, and triangulation, allowing for a careful analysis of the most relevant aspects of the data. This helped avoid premature conclusions and ensured that the interpretations remained grounded in the participants' responses (Bush and Amechi, 2019; Ahmed, 2024). Furthermore, data triangulation was used to improve accuracy and depth. This was achieved through the purposive recruitment of a heterogeneous sample, including science students of diverse ages, genders, and socioeconomic backgrounds, as well as teachers. The varied contexts enriched the data and ensured inclusivity. Importantly, triangulation did not overshadow the study's constructivist-interpretivist paradigm, which prioritised the socially constructed nature of knowledge and the multiplicity of meanings. Thus, both dominant and marginal interpretations were treated as valuable and explored further. Although combining one-to-one semi-structured interviews with focus groups might have strengthened methodological triangulation, this option was not employed, which is a possible area for improvement. Similarly, while investigator triangulation could have added demographic reflexivity, professional diversity, and multidimensional insights, it was not feasible within the constraints of an EdD that requires independent research. However, this remains a consideration for future studies.

Confirmability, a cornerstone of trustworthiness, ensures that the findings are firmly rooted in the participants' data rather than shaped by researcher bias or assumptions (Tobin and Begley, 2004; Nowell et al., 2017). This reflects the extent to which interpretations are

traceable and supported by a transparent audit trail (Lincoln and Guba, 1985; Riege, 2003). In this study, confirmability was not treated in isolation but was interwoven with credibility, dependability, and transferability, which together reinforced the findings' authenticity (Lincoln and Guba, 1985). To enhance confirmability, I made my positionalities explicit, including my dual role as a lecturer and manager and my relationship with the participants. This transparency, as Holmes (2020) suggests, allows others to assess how my background may have shaped this research. In addition, rich, thick descriptions of participants, methods, and the interview process provided contextual depth, enabling readers to understand how interpretations emerged from specific data (Lincoln and Guba, 1985). The interview process was designed to support the confirmability. A conversational, participant-led approach allowed the narratives to unfold naturally, reducing the risk of researcher-imposed framing. Reflexive practices also enabled an ongoing critical awareness of how my positionality might influence interpretation (Roulston, 2021). Supervisors' debriefings (Guba and Lincoln, 1994), as an example of 'member checking' (p.3080, also provided critical spaces to challenge my assumptions and refine my interpretations. Together, these strategies ensured that the study's findings were anchored in the participants' experiences.

4.9 Conclusion

This chapter outlines a coherent interpretivist-constructivist framework for exploring participants' experiences in science education. Semi-structured interviews guided by a refined protocol and pilot process enabled rich, context-sensitive data collection. Braun and Clarke's RTA offers a flexible yet rigorous method for theme development grounded in participants' narratives. Reflexivity, awareness of my positionalities, and potential power shaped both the design and interpretation, with the aim of enhancing authenticity. Trustworthiness was reinforced through transparent documentation and analyses. While acknowledging the limitations, the study's ethical considerations and reflexive practice aimed to provide a foundation for the interpretation of the findings.

Chapter 5 – Findings

5.1 Introduction

This chapter presents the study's findings, structured around the two research questions (Section 1.4) and the emergent themes identified through Braun and Clarke's reflexive thematic analysis (Section 4.5; Figures 6, 7, and 8). Section 5.2 examines participants' perceptions and experiences of science capital, including their initial encounters with the concept (5.2.1, 5.2.2), its perceived relevance (5.2.4, 5.2.5), and its influence on motivation (5.2.3), engagement, and progression in science education (5.2.9). It also considers the contribution of informal learning environments (5.2.6), media consumption (5.2.7), and scientific literacy (5.2.8) to developing science capital. Section 5.3 explores how intersectional factors–ethnocultural background (5.3.1), gender (5.3.2), habitus (5.3.3), socioeconomic status (5.3.4), and language proficiency (5.3.5)–mediate access to and engagement with science capital. Sections 5.4 and 5.5 address unexpected findings and participants' recommendations, offering insights beyond the original scope of the study and informing future practices and policies. The implications for practice and policy are examined in the Discussion section (6.8).

5.2 Perceptions and Impact on Science Capital

This section reports the findings related to the first research question (Section 1.4): RQ1: *How do students and teachers perceive science capital, and how do these perceptions influence their science engagement?* Drawing on participants' accounts, it examines their initial encounters with science capital (5.2.1 and 5.2.2), motivations and interests in science (5.2.3), and the perceived relevance of science and science capital to their personal and professional lives (5.2.4 and 5.2.5). It also explores how informal science learning environments (5.2.6), media consumption (5.2.7), and scientific literacy (5.2.8) shape science capital, illustrating how these factors intersect with the participants' educational trajectories. The findings reveal nuanced perceptions and differential impacts on science capital, informing recommendations for how it may be more effectively constructed, accessed, and mobilised within everyday educational contexts (6.9). Figure 9 presents the

EDI-informed pseudonyms used for participants' coded references in this chapter and the subsequent sections.

Figure 9: EDI-Informed Pseudonyms for Participants' Coded References

Coded Reference	**Pseudonym**
12345	Zainab
A	Kai
B	Amina
C	Diego
D	Mei
E	Fatima
F	Noah
G	Priya
H	Jamal
J	Lina
K	Thabo
L	Yara
M	Ravi
N	Sofia
P (Teacher)	Mr. Chen
Q (Teacher)	Mr. Adeyemi
R1 (Teacher)	Dr. Patel
S (Teacher)	Mr. Morgan

5.2.1 Definitions and Descriptions of Science Capital

This section examines how students and teachers defined and described SC, drawing on their accounts to identify the meanings they associated with the concept. Archer et al.'s (2015) framework was used as a sensitising reference point rather than a prescriptive model, enabling attention to both alignment and divergence. The analysis shows that while participants' definitions broadly reflected established dimensions of SC, they frequently re-framed these through lived experience, professional responsibilities, and identity-based understandings. In other words, SC was articulated as something done, felt, and built rather than as a fixed sociological resource. Across students' accounts, SC was most commonly framed as knowledge, understanding, and familiarity with science, often described as enabling participation and progression.

Several students referred to a combination of knowledge, attitude, and experience when defining SC (Zainab, Mei, Noah, Ravi, Sofia, Lina), collectively positioning knowledge as an active resource rather than abstract information. For instance, Zainab described SC as "the depth of one's engagement with scientific concepts… it is about interaction with the ideas and principles of scientific knowledge," while Mei similarly defined it as "an individual's knowledge and attitude and experience related to science… high science capital means they have high understanding of science." This framing positioned understanding as something that enables confidence, decision making, and future aspiration. This suggests that students understood SC as a practical form of capability that allows science engagement to become actionable. In other words, knowledge was not valued for its own sake, but for what it made possible within education and beyond.

Alongside knowledge, several students described SC in affective and identity-based terms, emphasising curiosity, interest, and ways of thinking. Jamal offered the most expansive account, describing SC as "having knowledge, curiosity to engage science… having [the] superpower of understanding science in all its forms," framing science as wonder, agency, and empowerment. Yara echoed this perspective, describing SC as "bringing out the science inside us by learning more, exploring and experiencing more." These descriptions highlight that, for some students, SC was less about formal achievement and more about how science

was internalised and made personally meaningful. This positions SC as a mindset or orientation, reminding us that students often articulate science through experiential meaning-making rather than sociological abstraction.

Reflexively, this required attentiveness to students' language so that their accounts were not over-theorised beyond their intended meaning. Students also consistently described SC as something built through experience, exposure, and everyday interaction across formal and informal contexts. Several accounts highlighted learning through doing and active participation (Fatima, Yara, Thabo, Lina). Fatima described SC as "everything science related and how you come about it… from friends, teachers… volunteering somewhere… anything scientific," while Thabo highlighted agency by stating, "I found out… why some people participate… and why some others not interested… I can improve my science capital by doing more research, asking more questions." This framing presented SC as cumulative and dynamic rather than inherited or static. This suggests that students viewed SC as something they could actively develop over time. In other words, participation itself was seen as a way of building capital, even if its recognition was less certain.

Background, social environment, and future progression also featured prominently in students' definitions. Amina described SC as shaped by background and relationships, explaining that "how someone's background or education can affect how they pursue doing science… how the people around me shaped me… my aunt… my close friend." Sofia similarly cited family, community, and institutions such as museums and libraries, while Noah linked cultural background to educational and career choices. Others explicitly connected SC to progression. Ravi described it as shaping "the probability of… pursuing a science related career," and Sofia positioned her own SC as "medium" because she was "getting to a higher level." These accounts framed SC as developmental and future-oriented, shaped by personal histories and social contexts.

This illustrates how students often narrate structural influences through personal stories rather than explicit references to inequality, a pattern taken forward in later analysis. Taken together, students' accounts showed clear points of alignment with Archer et al.'s (2015)

framework, particularly in relation to scientific literacy, attitudes, informal participation, and family influence. However, SC was frequently individualised and affectively framed, with limited explicit reference to class, race, or structural inequality. Knowing people in science and science media consumption, which are central dimensions of Archer et al.'s model, were rarely highlighted. This suggests that students tended to emphasise agency, curiosity, and self-development over socially stratified resources. In other words, SC was understood as lived and identity-shaping rather than as an unequal form of capital embedded within structural hierarchies. These divergences are significant and inform the later discussion of [mis]recognition (Section 6.4.1).

However, teachers' definitions of SC reflected overlapping but distinct emphases shaped by their professional roles and institutional contexts. Several teachers described SC as multidimensional, but frequently framed it through pedagogical, organisational, and policy lenses rather than through students' lived experience. Mr Adeyemi provided the definition most closely aligned with Archer et al.'s framework, describing SC as "all the science-related things we do… our experiences in science… people we know who are doing science… our knowledge in science… and how we feel about it." This account integrated knowledge, networks, experience, and attitude. In contrast, Mr Chen emphasised teaching and resources, describing SC as "all the knowledge, the ability of the student, commitment of the parent, teachers… equipment… lecturers… parents' contribution at home," positioning SC within material provision and instructional responsibility.

Dr Patel framed SC in terms of outreach and motivation, defining it as "projecting the importance of science to other people and stimulating interest," reflecting STEM recruitment discourse, while Mr Morgan described SC as life-wide experience, likening it to financial capital that "helps someone study or choose science for their future." These accounts show that teachers often interpreted SC through institutional responsibility, vocational practice, and policy pressure. Comparing students' and teachers' accounts reveals both shared ground and important divergence. Both groups understood SC as multidimensional, socially influenced, and developed across formal and informal contexts, aligning broadly with Archer et al.'s (2015) framework. However, students framed SC primarily through identity, curiosity, and lived experience, while teachers framed it through pedagogy, resources, and institutional

outcomes. This difference reflects positionality, with students describing SC from within their learning trajectories, whereas teachers interpreting it through professional and institutional roles.

In other words, students' definitions were experiential and identity-centred, while teachers' definitions were organisational and practice-focused. Overall, SC was understood as a flexible and dynamic construct encompassing knowledge, attitudes, experience, relationships, and future orientation. Archer et al.'s (2015) framework operated as a conceptual anchor, but participants adapted it to their own realities rather than reproducing its sociological emphasis on inequality. This divergence between lived and structural understandings of SC helps explain later tensions around legitimacy and [mis]recognition within the FE science context of this study, as analysed in Section 6.4.1 through the being/doing divide, developed further in Section 6.4.2 through linguistic and intersectional mediation, and theorised in Section 6.5 in relation to institutional [mis]recognition and convertibility of SC.

5.2.2 First Time of Hearing about Science Capital

This section explores when and how students and teachers first encountered the concept of SC, drawing on participants' accounts to examine the contexts through which the term entered their awareness. Rather than mapping exposure as a neutral background detail, the analysis treats these first encounters as analytically important, as they shape how SC was subsequently understood, articulated, and mobilised within the study. In other words, how participants first encountered SC mattered for how they made sense of it. Across student accounts, first awareness of SC was mostly recent and context-specific. Most students reported encountering the term for the first time through this study, rather than through earlier schooling or everyday experience (Mei, Zainab, Diego, Lina, Ravi, Sofia, Noah). As Mei explained, "I heard about science capital in 2024 from my tutor" (the researcher), a view echoed widely across the cohort. Zainab similarly recalled, "I first heard 'science capital' at college… a few weeks ago… I didn't know what it was about before that," while Sofia noted that it was "when you (the researcher) gave the paper to me… that's the first time."

These responses indicate that SC did not form part of students' existing conceptual vocabulary but was introduced primarily within this study's setting. This means that students' engagement with SC began as an act of sense-making rather than as recognition of a familiar idea, likely positioning SC as a sensitising concept rather than a pre-existing one. A smaller number of students encountered SC through formal college learning or targeted academic searching, though even these encounters were closely tied to structured educational contexts. For instance, Jamal recalled hearing about SC "in 2020 when I started college," while Amina linked her first encounter to classroom learning earlier in the academic year. A minority described independent exposure linked to purposeful activity, such as course searches or interview preparation (Lina, Kai, Diego), rather than informal or everyday circulation. For instance, Kai described seeing the term in an online advert related to science belonging, while Lina encountered it when researching university courses. These accounts suggest that SC had limited visibility outside institutional or academic spaces. In other words, students did not encounter SC as part of everyday science discourse, but through mainly through this study.

Teachers' first encounters with SC were more varied, reflecting differences in professional training, institutional positioning, and exposure to policy discourse. Like students, some teachers first encountered the term 'science capital' through this study, highlighting similar sensitisation effects. Dr Patel explained, "Directly from you (the researcher)… when you introduced the subject to me," adding that although related ideas were discussed in STEM training, "I have no idea how this exact, precise term of 'science capital'… was introduced into the thinking of people." Mr Morgan likewise described encountering SC for the first time through reading the study materials, stating, "I didn't have a clue about science capital… I read about it… that was the first time." These indicate that, even among educators, SC was not necessarily embedded within everyday professional language, but mainly surfaced through this research engagement.

By contrast, two of the four teachers described earlier or more independent exposure. Mr Adeyemi recalled first encountering SC during PGCE training, noting that it was mentioned by a lecturer "around 2005," marking the longest period of familiarity among participants. Mr Chen encountered the concept through media coverage connected to national STEM concerns, explaining that "they were writing about encouraging students to continue in science… because the UK government found out students are struggling to continue." These accounts show that teachers' awareness of SC emerged through uneven routes, including professional education, policy-oriented discourse, and media engagement. This suggests that SC circulates more visibly within professional and policy spaces than within students' learning environments.

Comparing students' and teachers' accounts highlights a clear disparity in access to the conceptual language of science capital. Students' exposure was mostly from this study, whereas teachers' exposure, while still mainly from this study, is uneven, including longer-standing engagement through training and policy discourse. This uneven access matters because it shapes how participants articulate their experiences. Students often described science through lived practice and identity, without reference to structural language, while teachers were more likely to frame SC in institutional or policy terms. This difference highlights a gap between students' lived science experiences and the theoretical vocabulary used to describe them.

Taken together, these patterns also show that SC functioned primarily as a sensitising concept within this study rather than as a widely familiar term. Awareness of SC was shaped by educational pathways, professional exposure, and participation in this research, rather than by informal circulation. This required sustained reflexive attention to contextual priming, as outlined in Sections 4.4.4(a)–(b), to ensure that subsequent interpretations did not confuse newly acquired language with established understanding. In other words, understanding when and how participants first encountered SC is crucial for interpreting how they later defined, used, and made sense of the concept, a tension examined specifically through the analysis of recognition, legitimacy, and [mis]recognition in Sections 6.4.1 (the being/doing divide), 6.4.2 (linguistic and intersectional mediation), and 6.5 (theoretical contributions on recognition and [mis]recognition).

5.2.3 Interest and Motivation to Study Science

This section examines how students and teachers described their interest in and motivation to study science, focusing on the influences that shaped their engagement with the subject. Drawing on participants' accounts, the analysis again employs SC as a sensitising concept to explore how motivation emerged through interactions between personal curiosity, social relationships, educational experiences, and recognition. Rather than treating motivation as an individual trait, the findings show it to be relational, context-dependent, and unevenly supported across different groups. Across students' responses, motivation to study science emerged through varied but interconnected influences, most notably practical engagement, relational encouragement, and developing aspirations. In alignment, research indicates that students' interest in STEM varies according to how science is framed within curricular standards, suggesting that engagement is shaped not only by ability or preference but by the forms of science that are institutionally emphasised and valued (May, Wendt and Barthlow, 2022).

Several students described early interest sparked by hands-on experimentation or their learning experiences (Kai, Diego, Lina, Thabo), suggesting that doing science rather than merely learning about it played a central role in sustaining engagement. For instance, Diego explained his preference to "learn more in a practical way," illustrating how applied activity supported identification with science. Family relationships were also important, although unevenly distributed. Some students described strong science-oriented households (Noah), while others drew inspiration from individual family members (Amina, Fatima). Noah's account most clearly illustrated how high family SC supported confidence and sustained interest: "Everyone in our house was super interested in science… we'd mix dyes together and imagine chemical mixtures." This suggests that familial recognition of science engagement functioned as an early and reinforcing source of motivation.

Where family support was limited, school-based encouragement often played a compensatory role. Several students described teachers as pivotal in shaping their motivation, particularly through making science accessible and enjoyable (Jamal, Yara). Jamal recalled a headteacher who "really engaged me to do science," while Yara described primary school science as "like

a game… fun and easy," indicating that recognition by authority figures helped sustain engagement. This means that motivation was not solely generated internally, but was actively shaped by whether students felt encouraged and recognised within educational contexts. In other words, interest grew where students' engagement was affirmed rather than assumed. Students also framed motivation in relation to curiosity and future orientation, although these accounts often co-existed with uncertainty. Mei described science as "pretty open… you can study the universe, space, animals, people, food," framing her motivation around breadth and exploration, while Lina linked science to her aspiration to pursue orthopaedics. Importantly, several students described their interest as developing later rather than being fixed early on. Sofia, for instance, reflected that she "didn't really like it" at first, but grew to enjoy science through recent study. This challenges assumptions that science motivation must be established early and suggests that SC can be built, revived, or re-shaped over time. Taken together, these accounts show that students' motivation was emergent, relational, and often fragile, shaped through intersections of practice, encouragement, and aspiration rather than through stable, inherited [dis]advantage.

However, teachers' accounts of interest and motivation contrasted sharply with students' narratives. Teachers typically described long-standing and stable motivation, shaped by early academic success, sustained family encouragement, and continuous immersion in science-rich environments. Mr Chen recalled childhood fascination with physics through visualisation and wonder, describing how he would look at stars and ask, "how do they form?". Dr Patel framed science as epistemically enriching, reflecting that engagement with scientific ideas showed him that science "would enrich me." Family influence was consistently highlighted. Mr Adeyemi described inter-generational encouragement, noting that science was "constantly discussed" within his family, while Mr Morgan described growing up in an environment where "everybody was encouraging me" to pursue science within a highly competitive system.

In short, teachers' motivation reflected the cumulative reinforcement of SC across family, schooling, and culture, resulting in secure science identities. Teachers also positioned themselves as active cultivators of student motivation. Dr Patel described running science clubs and discussions to make science "as interesting as possible," while Mr Adeyemi discussed promoting science pathways and encouraging persistence. These accounts suggest

that teachers saw themselves not only as beneficiaries of SC, but as agents responsible for reproducing it in others. However, this positioning also reflected professional responsibility and policy discourse, particularly around science recruitment, rather than the lived uncertainties described by students. This contrast highlights how motivation to study science is experienced differently across roles and stages.

Comparing both groups reveals convergence around the importance of early exposure, meaningful encounters, and relational support, but divergence in how motivation is secured and sustained. Students described motivation as shaped by recognition, practice, and opportunity, while teachers described motivation as durable and institutionally reinforced. Students' accounts were rooted in lived experience and identity formation, whereas teachers' accounts reflected long-term accumulation of SC and professional embedding within science cultures. This means that although motivation was widespread, its conversion into confidence, legitimacy, and progression was uneven, a tension analysed through [mis]recognition and the being/doing divide in Sections 6.4.1 and 6.5. Overall, interest and motivation functioned as dynamic expressions of SC, shaped by [mis]recognition rather than by individual disposition alone. In other words, motivation to study science depended not only on curiosity or effort, but on whether engagement was socially and institutionally recognised.

5.2.4 Perspectives on Relevance of Science

This section examines how students and teachers described the relevance of science, focusing on how science was understood in relation to everyday life, personal decision-making, and wider social concerns. The analysis shows that while both groups regarded science as highly relevant, they framed that relevance in distinct ways shaped by lived experience, professional positioning, and access to recognition. In other words, relevance was not a neutral concept but one through which SC was enacted, interpreted, and, in some cases, contested. From students' responses, science was consistently framed as relevant to everyday life and survival, with examples drawn from health, household practices, technology, and the natural environment (Zainab, Amina, Diego, Fatima, Jamal, Thabo, Ravi, Sofia). Many students initially struggled to articulate relevance abstractly but quickly grounded their

responses in practical experience. Amina, for instance, moved from uncertainty to a clear health-based framing, arguing that without science people are “at a disadvantage… because they don’t know what they’re eating or buying.” Fatima captured this everyday orientation most succinctly, stating that “science is always happening everywhere around us,” and describing ignorance of science as “upsetting.”

These accounts positioned science as embedded in routine action, wellbeing, and immediate decision-making. This suggests that students understood relevance as something lived and enacted rather than as a distant academic or policy concern. Several students extended this framing by linking relevance to specialised knowledge and responsibility. For instance, Noah’s account illustrated how subject-specific understanding shaped his sense of relevance, particularly in relation to medicine and ethics. He explained that impurities in pharmaceuticals “would be harmful to my patients,” connecting science directly to professional accountability. Others broadened relevance to cultural or global contexts. Ravi linked traditional burn treatments to scientific reasoning, while Sofia referred to chemical safety in the home and to radioactivity during the Ukraine war, emphasising science as a way of “sharing information… learning new ideas.”

These examples demonstrate that students drew on personal, cultural, and global reference points to make sense of why science matters. This means that relevance was constructed through diverse epistemic resources, not solely through the formal categories highlighted in dominant SC frameworks. Overall, students’ accounts align with Archer et al.’s (2015) argument that recognising science in everyday life reflects mobilised SC. Their references to food, health, electricity, medicine, and environmental processes show SC enacted through daily reasoning and self-management. However, these accounts also extend the framework by highlighting domains such as everyday survival, traditional knowledge, and household risk, areas less visible in Archer et al.’s categorisations. In other words, students articulated relevance through lived necessity rather than through institutional status or future employability. Although science was consistently described as important, this relevance did not automatically translate into institutional recognition or legitimacy, a tension analysed Sections 6.4.2, and 6.5.

Teachers' accounts of relevance were markedly different, reflecting broader, systemic, and future-oriented perspectives shaped by their long-standing engagement with science and professional responsibility. While teachers also described science relevance as extensive, their examples tended to highlight societal progress, technological change, and economic futures. For instance, Mr Chen warned that without scientific competence people may "struggle to get a job in future," particularly in an automated society. Mr Adeyemi similarly argued that "everything" we do, working, eating, exercising, flying, is underpinned by science, insisting that life would be "very, very difficult" without it. Mr Morgan offered the most expansive view, asserting that without science "we cannot imagine… success of anything," linking relevance to global challenges such as carbon neutrality, recycling, and public health. These accounts positioned science as essential to collective survival, innovation, and policy goals rather than to everyday household practice.

Comparing both groups highlights a clear difference in how relevance was understood and valued. Students framed relevance at the micro-level, through personal survival, practice, and immediate decision-making, whereas teachers framed relevance at the macro-level, through societal progress, employability, and future planning. This divergence reflects differences in positionality and access to science capital. Teachers' professional roles and long-term immersion in science-rich environments shaped a policy-aware and abstract orientation to relevance, while students' understandings were grounded in lived experience and practical necessity. This may explain why students often recognised science as relevant but did not always experience that relevance as legitimised or institutionally valued.

Overall, while both students and teachers agreed that science is highly relevant, they constructed that relevance through different lenses, with students emphasising every day and cultural relevance and teachers emphasising systemic and future relevance. This divergence suggests that Archer et al.'s (2015) framework could be extended to account more fully for everyday survival capital, culturally hybrid knowledge, and future-employability capital. In other words, relevance operates as a key site where SC is enacted but not always recognised, underpinning later tensions around legitimacy and misrecognition, as examined in Sections 6.4.1 and 6.5.

5.2.5 Perspectives on Relevance of Science Capital

This section examines how students and teachers understood and articulated the relevance of SC, focusing on how SC was perceived to shape engagement, confidence, identity, learning, and future pathways. Drawing on participants' accounts and using Archer et al.'s (2015) framework as a sensitising reference point, the analysis shows that SC was understood not simply as background advantage, but as an active mechanism through which scientific engagement became meaningful. In other words, relevance was not neutral, it was where SC was experienced, interpreted, and evaluated. SC was most commonly described by students as personally and relationally relevant, shaping how students engaged with science, understood themselves as learners, and navigated confidence and belonging.

Some students framed SC as helping to explain variation in engagement and confidence (Zainab, Mei, Diego). Zainab described SC as "my entire relationship with science, shaped by my upbringing and educational experiences," and argued that recognising SC allowed her to understand how "people from different backgrounds bring unique perspectives and knowledge." Mei similarly linked SC to participation and progression, explaining that it helped explain "why some individuals pursue science post-16 while others may not." These accounts position SC as a lens through which difference is interpreted rather than ignored. This suggests that students understood SC as socially patterned, even when they did not specifically name structural inequality.

Other students emphasised affective and experiential aspects of SC relevance, describing SC as something that made science accessible, enjoyable, and confidence-building (Jamal, Lina, Yara). Jamal described SC as "super important because it gives an opportunity to understand the world… like solving cool mysteries," framing relevance through curiosity and enjoyment. Lina similarly explained that SC helped her "connect with science, making me more confident and capable in my studies," while Yara emphasised daily use, stating that she "utilise[s] science capital literally every day," and highlighting teachers' role in shaping how science is perceived.

This means that students experienced SC as something felt and enacted through practice, not merely understood in abstract terms. Some students also framed SC as practically enabling and identity-shaping. Ravi described SC as “vital and most practical in our lives,” linking it to managing health and future success, while Noah articulated its reflective function, explaining that SC “helps me know myself as a person… how much I know and how much I could improve it,” alongside identifying ways to build it through science media, museums, and discussion. Kai captured the identity dimension most clearly, stating that SC matters because “I see science as a subject for me.” These accounts show that students linked SC to self-evaluation, everyday capability, and identity formation. In other words, SC became relevant when it supported a sense of legitimacy and belonging within science.

Teachers articulated more systemic, pedagogical, and future-oriented interpretations of SC relevance, reflecting their professional roles and higher accumulation of SC. Teachers consistently framed SC as something that could be intentionally cultivated through pedagogy, institutional support, and curriculum design. Mr Chen argued that SC relevance depended on interactions between learners’ attitudes and educators’ practices, explaining that SC enabled him to “simplify topics,” “support theory with practical,” and “relate concepts to industry.” Mr Adeyemi similarly positioned SC as socially mediated, noting that even where family background was limited, interest could be developed “through peers and teachers.” Dr Patel framed SC as enhancing effectiveness for both teachers and students, emphasising the responsibility to “provide the tools” needed for engagement. Mr Morgan adopted the broadest perspective, asserting that “without science, we cannot imagine… success in anything,” from daily life to medicine and global challenges, and linking SC to persistence and progression. These accounts position SC as a pedagogical and structural resource tied to employability, societal futures, and institutional pathways.

Comparing both groups reveals alignment in recognising SC as important, but divergence in how its relevance was understood and valued. Students grounded relevance in lived experience, everyday capability, and identity, whereas teachers framed relevance through pedagogy, institutions, and societal goals. This divergence reflects positionality and differential access to recognition. While students experienced SC through immediate practice and self-meaning, teachers engaged with it as a tool for shaping outcomes within structured

systems. Notably, some students extended Archer et al.'s (2015) framework by combining scientific knowledge with other ways of understanding drawn from every day or cultural experience. For instance, Ravi's integration of traditional health knowledge with scientific reasoning illustrates a culturally hybrid form of SC that sits beyond the SC framework's predominantly Western orientation. Teachers, meanwhile, expanded SC relevance towards automation, carbon neutrality, and employability, extending the framework towards future-employability capital.

Overall, while both students and teachers viewed SC as highly relevant, students prioritised personal development, confidence, and everyday applicability, whereas teachers emphasised pedagogical leverage, structural mediation, and long-term societal outcomes. This suggests that SC operates as a flexible interpretive lens shaped by role, experience, and institutional positioning. Crucially, although SC was widely recognised as relevant, its relevance did not automatically convert into institutional legitimacy or progression. This gap between lived relevance and recognised value underpins later tensions around recognition and [mis]recognition, examined explicitly through the being/doing divide in Section 6.4.1, the linguistic and intersectional mediation of recognition in Section 6.4.2, and the theoretical extension of [mis]recognition and convertibility in Section 6.5.

5.2.6 Perspectives on Informal Science Learning Environments

This section examines how students and teachers understood and experienced informal science learning environments (ISLEs), such as museums, science fairs, workshops, clubs, and industry visits. Using Archer et al.'s (2015) SC framework, the analysis shows that ISLEs were widely perceived as valuable spaces for building curiosity, confidence, and understanding, but their contribution to SC was uneven and often contingent on access, mediation, and institutional recognition. In other words, ISLEs functioned as potential rather than guaranteed sites of SC development. ISLEs were most often described by students as curiosity-generating and memorable spaces that supported early exposure, personal learning, and identification with science.

Many students associated museums and fairs with formative experiences that helped them visualise science beyond the classroom (Zainab, Kai, Mei, Jamal, Lina). Zainab described museum visits as particularly important for younger learners, explaining that they help students “have an actual decision of what they want to do,” while also noting that a university DNA workshop was “quite helpful… it helps me with my assignments.” Kai similarly reflected that seeing dinosaur bones helped “open up a science mindset,” capturing how ISLEs were experienced as developmental rather than instructional. This suggests that students valued ISLEs for sparking interest and confidence rather than for delivering detailed content. In other words, relevance was located in experience and inspiration rather than depth of explanation.

Also, students who preferred visual or hands-on learning emphasised the personal value of ISLEs particularly strongly. Noah argued that “education is not just theoretical,” and that museums and clubs allow learners to “touch it and understand it,” positioning informal environments as spaces where understanding becomes tangible. Ravi similarly highlighted the role of fairs and museums in strengthening “visual memory” and long-term understanding. However, not all students were uncritical. Fatima described museums as “fun… but you’re not really getting information,” calling them “a side thing” for learners seeking deeper scientific explanation. This tension illustrates how ISLEs were seen as engaging but not always sufficient for advanced learning. This means that while ISLEs were valued affectively, their epistemic status was sometimes perceived as limited.

Importantly, constrained access shaped how often students could engage with ISLEs. Several students described wanting to visit museums or fairs but being limited by time, distance, or FE workload rather than lack of interest (Mei, Jamal, Zainab). Jamal described museums as “really important,” yet admitted his last visit was “three or four years ago” because he “hasn’t had enough time.” Mei contrasted frequent museum visits in her country of origin with limited access in the UK, explaining that she had not visited recently because “I don’t have a lot of time… but I’m trying.” These accounts indicate that informal enrichment opportunities were unevenly accessed, shaped by structural and temporal constraints. This means that ISLEs operated as uneven sources of science capital, reinforcing differences in who can convert curiosity into sustained engagement

Teachers' accounts framed ISLEs through more structured and intentional lenses, emphasising pedagogical mediation, curriculum alignment, and future pathways. Teachers consistently argued that ISLEs were most valuable when linked clearly to learning objectives and professional contexts. Mr Chen explained that visits enabled him to "support theoretical concepts with practical" and "relate concepts to industry," positioning ISLEs as tools for translation rather than enrichment alone. Mr Morgan similarly stressed that visits allow learners to "interlink theory and practical side by side," offering access to "real scientific scenarios." Dr Patel emphasised perceptual and skill development, noting that students "see science from a slightly different perspective" and develop communication and teamwork skills, aligning with evidence that informal settings support social and discursive engagement (DeWitt, Nomikou, and Godec, 2018). Teachers also highlighted professional benefits, describing ISLEs as opportunities to refresh subject knowledge and extend industry awareness (Mr Adeyemi). In other words, teachers positioned ISLEs as mediated spaces whose value depended on structure, purpose, and follow-up.

Comparing both groups reveals shared agreement that ISLEs enhance engagement and curiosity, but clear divergence in how their relevance was framed. Students described ISLEs as personally meaningful, enjoyable, and identity-affirming, emphasising curiosity, memory, and the experience of becoming a "science person" (Archer, et al., 2020a, p.3). Teachers, by contrast, framed ISLEs as pedagogical interventions designed to support curriculum delivery, employability, and progression. This divergence reflects positionality and differential access to recognition. Students experienced ISLEs as moments of inspiration that did not always count institutionally, whereas teachers treated them as strategic resources whose value depended on deliberate mediation.

Several accounts also extended Archer et al.'s (2015) framework. For instance students from migrant backgrounds compared ISLE provision across countries (Mei, Diego), highlighting cross-cultural differences in access to informal science learning not fully captured within the framework. Ravi's integration of traditional everyday practices with scientific reasoning pointed to a culturally blended form of SC beyond the framework's largely Western orientation. Teachers, meanwhile, extended relevance towards industry exposure and future employability, suggesting an emergent employability-oriented dimension of SC. Overall, while

ISLEs were widely valued as enriching and motivating, their contribution to SC was unevenly realised. Students experienced ISLEs as exploratory and identity-building, whereas teachers viewed them as structured, mediated mechanisms for enhancing learning and future pathways. This gap likely helps explain why informal engagement does not always translate into institutional recognition or progression. In other words, ISLEs functioned as conditional rather than guaranteed sites of SC accumulation, as examined further in Sections 6.4.1 and 6.5.

5.2.7 Perspectives on Science Media Consumption

This section examines how students and teachers engaged with science-related media and how these practices contributed to the development and enactment of SC. Drawing on participants' accounts, the analysis explores the types of media accessed, the purposes for which they were used, and the meanings attached to these practices, with the findings showing that science media functioned as a key mechanism through which SC was accessed, practised, and interpreted, but not always equitably recognised or converted. Across students' accounts, digital media, particularly YouTube, online searches, and educational websites, emerged as the most prominent and accessible sources of scientific information (Zainab, Kai, Diego, Ravi, Lina).

Many students described using media frequently to support coursework and independent learning. Zainab explained that she used YouTube "a lot… especially when working on assignments… three or four times a week," adding that it improved her "knowledge and understanding of chemistry, physics, or biology." Kai similarly described YouTube as "an education tool," valuing videos that "explain in detail," positioning media as an extension of classroom learning. These accounts align with Archer et al.'s (2015b) identification of media engagement as a form of cultural SC, supporting literacy, familiarity with scientific discourse, and confidence. This suggests that media played an active role in sustaining students' engagement with science beyond formal teaching. Students also framed science media as fostering curiosity, enjoyment, and identity. Several described using media to explore topics of personal interest rather than solely for assessment (Fatima, Jamal, Lina). Fatima noted

that exposure to content on “stars, quarks, [and] black holes” “encourages me to do more science… I want to learn more,” reflecting an emerging exploratory habitus. Lina described checking NASA content “every day” out of interest, while Jamal found scientific websites “really helpful” for accessing up-to-date information.

In other words, students used media not only to learn science, but to become science people, using curiosity-driven engagement to support identification and belonging. For some students, media use extended into broader every day and social understanding. Noah described science media as essential for understanding “the basics of science,” citing misconceptions around menstruation, and reported engaging with books, articles, and medical programmes to broaden his perspective beyond the syllabus. Ravi described using Google, YouTube, and ChatGPT “every day… 80% of my daily life is based on research,” to support assignments and access what he described as “internationally recognised” knowledge, while also acknowledging risks of superficial searching. By contrast, other students reported limited or cautious use. Sofia used YouTube only when struggling with notes and expressed reservations about AI accuracy, while Amina described limited engagement despite recognising media’s potential influence from a young age. Mei highlighted how migration shaped access, explaining that on arriving in the UK “it was really hard to access some resources,” though this improved with library and internet access. This means that media engagement was shaped not only by interest, but by access, time, and digital confidence, reinforcing that science media does not operate as a neutral resource.

However, teachers’ accounts contrasted with students’ exploratory use by framing science media as a structured pedagogical and professional resource. Teachers consistently described media as a means of enriching teaching, linking theory to practice, and maintaining subject expertise. Mr Chen argued that media “makes [students] more aware,” helping them connect classroom knowledge with “what is being obtained in industry”, while Mr Adeyemi encouraged students to engage with documentaries and journals, stating that media “adds another level of information” beyond formal lessons. Teachers also emphasised their own professional learning. Mr Adeyemi described reading journals and watching science channels to keep up with “new ideas coming up all the time,” while Dr Patel used scientific magazines and clinical sources to relate “new developments” to classroom discussions. Mr Morgan

similarly relied on science news and blogs to “enrich myself,” stressing that “science is always developing.” In other words, teachers positioned media consumption as essential professional capital and a means of mediating students’ access to legitimate scientific knowledge.

Furthermore, perspectives on artificial intelligence (AI) further illustrated this student–teacher divergence. Students adopted a pragmatic and exploratory stance, using AI as an accessible learning aid. Ravi used AI “every day” to “widen my scope,” Lina used it when “something [is] confusing,” and Sofia used ChatGPT “sometimes” to compare information, while acknowledging accuracy concerns. Teachers, however, framed AI as a tool requiring careful mediation. Mr Morgan used it selectively for definitions, while Mr Adeyemi emphasised the need for students to “read, understand… analyse,” and Mr Chen warned that over-reliance could “inhibit critical thinking.” This contrast highlights how emerging digital tools may extend access to scientific information without guaranteeing recognition within formal educational norms. These findings align with Archer et al.’s (2015) framework in showing science media as a key dimension of SC, supporting literacy, curiosity, and engagement. At the same time, they extend the SC framework by highlighting digital inequality, geographical variation, AI-mediated learning, and professional identity.

Furthermore, students such as Mei and Diego drew attention to cross-national differences in media access, while Ravi’s blending of traditional knowledge and scientific information suggests culturally hybrid forms of SC beyond the framework’s predominantly Western focus. Teachers further extended relevance towards employability, professional updating, and career navigation, pointing to an emerging future-employability dimension of science capital. Overall, while science media was widely valued and frequently used, its contribution to SC was uneven. Students experienced media as exploratory, identity-building, and practically useful, whereas teachers positioned it as pedagogically purposeful and professionally essential. This gap may help to explain why extensive media engagement does not always translate into institutional recognition or progression. In other words, science media functioned as a conditional rather than guaranteed site of SC accumulation.

5.2.8: Perspectives on Scientific Literacy

Scientific literacy is a central component of SC, shaping access to scientific knowledge, confidence, progression, and recognition (Archer et al., 2013b; Archer et al., 2015). It is socially situated, unevenly distributed, and mediated through learners' backgrounds, experiences, and opportunities to engage with science. This section examines how students and teachers understood and mobilised scientific literacy within the FE science context, showing that literacy functioned not only as knowledge possession but as a key mechanism through which SC was recognised, evaluated, and made legitimate. From the students' accounts, scientific literacy was most commonly framed as functional understanding, confidence, and the ability to navigate scientific tasks and concepts.

Several students linked literacy directly to progression and academic success, positioning it as a gateway rather than an abstract skill (Zainab, Kai, Diego). For instance, Zainab articulated this most clearly, explaining that scientific literacy involved understanding "terminology used in science" and enabled "progress[ion] to higher education" and "better grades," aligning closely with Archer et al.'s (2013b, 2015) emphasis on literacy as shaping post-16 pathways. Kai similarly described literacy as the ability to "analyse science experiments" and "interpret" information rather than merely recall facts, suggesting that literacy supported independence and practical competence. This means that some students positioned scientific literacy as something that enabled them to act with confidence within scientific spaces.

Other students understood scientific literacy as helping them grasp lessons more easily and apply science in everyday situations. For instance, Amina described literacy as something that "made me understand the work… [and] makes the work easier because I know what I'm doing," while Fatima emphasised the importance of foundational knowledge, stating that "if you didn't know the basics, there's no way you'd understand the complex things." Fatima further linked literacy to social understanding, using misconceptions around menstruation as an example of how limited literacy can reinforce stigma. These accounts indicate that scientific literacy was understood not only as academic competence but also as a socially consequential resource. In other words, literacy mattered because it enabled participation, understanding, and communication both inside and outside the classroom.

Students' self-assessments of scientific literacy further reveal how literacy was intertwined with identity and recognition rather than objective measurement. Some students rated themselves as "medium," explaining uneven strengths across disciplines or topics (Mei, Jamal, Thabo, Sofia), while others articulated higher confidence based on experience and exposure (Yara, Lina, Ravi). Noah captured the reflexive dimension of literacy most explicitly, explaining that it "helps me know myself as a person… how much I know and how much I could improve it," framing literacy as a means of self-evaluation and growth. Ravi linked scientific literacy to everyday life, stating that "science is practised in our daily life," and attributed his confidence partly to family exposure, illustrating intergenerational transmission of SC. This suggests that students' self-ratings reflected perceived legitimacy and belonging in science rather than simply assessment accuracy.

Teachers' accounts reframed scientific literacy in more structural, pedagogical, and progression-oriented terms, reflecting their professional roles and accumulated SC. Teachers consistently positioned literacy as foundational to effective teaching, scientific understanding, and future pathways. Mr Chen defined scientific literacy as the ability to "simplify [science] and pass information down to the learner," arguing that higher literacy enables students to "progress into the future and study science more." Mr Adeyemi emphasised application, describing literacy as "having knowledge in science, and then be able to apply this knowledge to our benefit," and highlighting the role of assignments, field trips, and real-world examples. Dr Patel framed literacy as essential for delivering science "successfully, efficiently and effectively," stressing vocabulary development, multiple explanations, and topical discussion as ways to sustain motivation and engagement.

These accounts position scientific literacy as something deliberately cultivated through pedagogy and institutional design rather than as an individual disposition. Comparing student and teacher perspectives reveals alignment in valuing scientific literacy, but divergence in how it was understood and mobilised. Students framed literacy through lived experience, confidence, and everyday competence, whereas teachers framed it as a curricular and institutional requirement linked to progression, employability, and scientific authority. Also, students viewed literacy as evolving and personal, while teachers positioned it as structured and measurable. This divergence reflects differences in role, experience, and access to

recognition, thus, while students used literacy to make sense of the world and their place within science, teachers used it to organise learning, assess readiness, and legitimate progression. Some of these responses also extend Archer et al.'s (2013b, 2015) framework. However, students' concerns about misinformation in online media (Fatima, Sofia) challenge assumptions that informal engagement automatically enhances SC, echoing critiques that literacy without mediation may reproduce inequality (DeWitt and Archer, 2017).

Additionally, migrant students such as Mei and Diego highlighted transnational differences in access to scientific literacy, pointing to geographical and cultural dimensions under-theorised in UK-centric models. Teachers' emphasis on employability and career navigation suggests a future-employability dimension of scientific literacy, while Ravi's use of literacy for everyday self-management indicates an everyday survival form of SC. In other words, scientific literacy operated across academic, cultural, and practical domains in ways that exceed existing theoretical boundaries.

In conclusion, research indicates that access to science tools in the home can support science self-efficacy and confidence, reinforcing engagement for some learners through increased familiarity and practice (Ennes et al., 2022). However, wider research shows that such confidence and resource access do not automatically translate into recognition or advantage within formal education, particularly where learners' experiences fall outside dominant expectations of what counts as legitimate scientific knowledge (Archer et al., 2015). In this study, students similarly described developing scientific understanding through every day and informal engagement, yet these forms of learning were not always acknowledged or valued within FE assessment and classroom practices. This suggests that access to resources contributes to science capital only when it is recognised and legitimised within institutional contexts, rather than simply possessed. In other words, science capital operates not just through availability of tools, but through whether learners' knowledge and confidence are recognised as meaningful within the educational field.

5.2.9 Perspectives on Progression

Progression is a key outcome within the SC framework, shaped by learners' access to resources, dispositions, and institutional support (Archer et al., 2015). Research on science degree completion highlights that progression is strongly shaped by self-efficacy, perceived support, and the extent to which learners feel capable of succeeding within science pathways, rather than by academic ability alone (Larson et al., 2013). Across participants' accounts in this study, progression emerged as a critical point at which SC was expected to convert into confidence, legitimacy, and future opportunity. This section examines how students and teachers conceptualised progression, showing that while aspirations were often strong, their realisation depended on recognition, mediation, and structural conditions. Students commonly framed progression as an expansion of possibilities rather than a narrow pathway, with science perceived as keeping options open across a wide range of futures. Some students emphasised the flexibility of science qualifications and transferable skills, positioning science as a foundation rather than a fixed destination (Noah, Fatima, Diego). Noah captured this most clearly, explaining that science keeps "all doors… open for careers," linking scientific study not only to medicine and engineering but also to non-science fields through "mathematical… data analysis" skills. Fatima similarly described science as something that "would help me in the end goal," even when that goal was not fully defined. This suggests that students associated SC with mobility and choice, aligning with Archer et al.'s (2015) argument that higher SC supports confidence in navigating uncertainty. In other words, progression was experienced as possibility rather than prescription.

Alongside this flexibility, many students articulated specific science-related ambitions closely tied to identity, confidence, and accumulated experience. Aspirations towards nursing, pharmacology, orthopaedics, radiography, midwifery, and engineering were indicated in a sense of belonging to science and familiarity with scientific practice (Amina, Mei, Lina, Ravi, Sofia). Mei's account illustrates the role of inter-generational SC in shaping progression. Although she initially resisted, encouragement from her mother, a surgeon, later supported a turn towards pharmacology and "higher degrees." Ravi similarly described how family members with "advanced knowledge in science" fostered a pro-science habitus that "helped improve the lifestyle of their children." These accounts show how family-based SC can stabilise aspirations and make higher education pathways feel attainable. For some students, progression involved re-engagement rather than continuity, challenging linear models of

science trajectories. Sofia described returning to science through applied pathways after lower confidence, explaining that she was advised science “can take me somewhere.” This reframing positioned progression as reinvention and self-improvement rather than straightforward continuation. This means that progression functioned both as continuity for some learners and as recovery or re-orientation for others, depending on prior confidence, exposure, and recognition.

Teachers’ accounts differed from students’ narratives by framing progression in more structural and pedagogical terms. Teachers consistently emphasised progression as something that must be actively enabled through literacy, exposure, guidance, and institutional support. For instance, Mr Chen linked progression to scientific literacy and communication, arguing that the “right materials, right support, right understanding” enable students to “study science more” in the future. Mr Adeyemi similarly framed progression through application, emphasising that literacy allows students to “apply knowledge to their benefit” and recognise routes into higher education. Teachers also positioned themselves as central mediators. Mr Adeyemi described actively encouraging science pathways, “I impressed upon my students the importance of studying science”, while Mr Chen highlighted differentiation and simplification as key to building confidence and independence. In other words, teachers framed progression as an institutional process shaped by pedagogical design.

Enrichment and exposure were further emphasised as mechanisms supporting progression. Dr Patel described university visits as enabling students to “see science from a slightly different perspective,” build communication skills, and “get a feel of university life,” reinforcing annual engagement as essential. Mr Morgan linked practical, applied qualifications to enhanced experiences, using examples such as Covid-19 vaccine development to demonstrate “how science is affecting and helping our day-to-day life.” Collectively, teachers viewed progression as a long-term developmental process sustained through structured exposure to scientific practices, networks, and professional contexts.

Comparing student and teacher perspectives reveals shared agreement that science supports future opportunity, higher education access, and transferable skills (Archer et al., 2015;

DeWitt and Archer, 2017), but divergence in how progression was understood and enacted. Students narrated progression through identity, aspiration, and lived possibility, drawing on family habitus, personal interest, and emerging confidence (Dawson, 2014; Moote et al., 2020a). Teachers, differed by framing progression through curriculum, qualifications, and institutional navigation, reflecting professional responsibility and systemic constraints. This divergence highlights two complementary but distinct logics, which are progression as personal meaning-making and progression as formal educational design. These accounts also expose limits within Archer et al.'s (2015) SC framework. For instance, students such as Noah and Fatima demonstrated that SC can facilitate mobility into non-STEM careers, a dimension under-theorised in existing models. Also, migrant learners like Mei highlighted transnational forms of SC shaped outside UK educational structures. In addition, Ravi's everyday use of science for self-management points to a practical survival dimension, while identity-driven specialisation (for example, sustained interest in SpaceX or medical fields) suggests personalised interest capital beyond current categories.

Furthermore, meritocratic narratives, such as Diego's belief that opportunity is available regardless of gender, further complicate structural accounts by potentially masking systemic barriers. This means that progression is likely shaped by cultural, structural, and personal factors that extend beyond the original SC framework. Hence, these findings show that while aspirations for progression were often strong, their conversion into recognised pathways was uneven. Students framed progression as identity-driven and aspirational, whereas teachers framed it as structured, scaffolded, and institutionally mediated. This gap may help to explain why motivation and aspiration do not always translate into legitimate progression within this study's context as evaluated in Sections 6.4.1 and 6.5.

5.3 Intersectional Dimensions and Science Capital

This section addresses the second research question- RQ2 (Section 1.4): *How do intersecting dimensions of identity, including gender, ethnocultural background, socioeconomic status, and English language proficiency, shape participants' science capital (SC)?* Drawing on participants' accounts, the analysis examines how these dimensions interact to influence access to, recognition of, and engagement with science. Rather than treating identity categories as separate or additive, this section adopts an intersectional lens to show how multiple dimensions of identity can operate together to shape learners' aspirations, confidence, participation, and progression. Through a thematic analysis of ethnocultural background (Section 5.3.1), gender (5.3.2), habitus (5.3.3), socioeconomic status (5.3.4), and English language proficiency (5.3.5), the findings reveal how SC is differentially recognised and legitimised across learners.

Habitus emerges as a key mediating mechanism, shaping how students perceive science, imagine possible futures, and interpret their place within scientific spaces. In other words, science participation is produced not only through individual interest or effort, but through the interaction of structural conditions and lived identity. By highlighting intersectionality, this section challenges deficit explanations that attribute unequal participation to individual shortcomings. Instead, it highlights how systemic and institutional factors, which are often rendered invisible through meritocratic or colour-blind narratives, may produce uneven opportunities for science engagement. This intersectional analysis therefore deepens understanding of how inequalities in science education are sustained and sets up the recognition-centred discussion of legitimacy, misrecognition, and convertibility developed in Chapter 6.

5.3.1 Ethnocultural Background and Science Capital

This section examines how students and teachers understood the relationship between ethnocultural background and SC. Rather than treating ethnocultural background as a static identity category, this analysis focuses on how it was recognised, minimised, or rendered invisible within participants' accounts. In other words, ethnocultural background emerges

here as a key site of misrecognition, where individual narratives often sit in tension with structural patterns of inequality. Across student accounts, a dominant pattern was the rejection of ethnocultural background as shaping science participation or opportunity. Several students framed science as universally accessible and meritocratic (Diego, Lina, Thabo), positioning success as a function of effort rather than structural location. Diego's assertion that "I'll get anywhere" captures this stance most clearly, while Lina's claim that "everyone can be whatever they want" reflects similar individualist positioning.

These accounts align with research showing that young people tend to resist structural explanations of inequality in science, instead drawing on individualist science identity narratives (Archer et al., 2015; Carlone and Johnson, 2007). This suggests a form of identity-protective or defensive individualism, where acknowledging inequality risks positioning the self as disadvantaged. In this way, students maintained a sense of agency while distancing themselves from structural constraint. In contrast, a smaller group of students explicitly acknowledged ethnocultural or religious mediation in shaping science engagement, aligning more closely with Archer et al.'s (2015) conception of SC as culturally patterned (Yara, Noah, Ravi, Sofia). Yara articulated this most directly, stating that "ethnic or racial background… significantly influences their understanding and access to science," and noting that "differences in our culture and beliefs shape our minds and access to and utilisation of science." This highlights how cultural norms and systemic barriers may operate prior to individual motivation. Noah similarly connected his South Asian background to the valuing of specific science careers, explaining that "people there are more interested in medical fields than any other fields," echoing research on the uneven cultural valuation of scientific pathways, particularly medicine (DeWitt, Nomikou and Godec, 2019; Mezieobi and Ibekwe, 2017). These accounts suggest that ethnocultural expectations can subtly channel aspirations toward particular scientific trajectories, reinforcing culturally patterned forms of SC.

Even where students denied ethnicity as influential, cultural and religious norms still appeared implicitly within their narratives. For instance, Ravi initially linked traditional practices to limits on scientific advancement, describing how things done "in a traditional way… not in an advanced way" might restrict access, although he later resisted framing this

explicitly in racial terms. Sofia similarly noted that participation "depends on your religion… there might be certain things that they can do, or they cannot do," pointing to religiously mediated constraints consistent with findings on science participation and religion (Archer et al., 2015). Family expectations further revealed intersectional effects. Amina stated, "I'm the one who's expected to do science compared to my brother," highlighting gendered cultural expectations embedded within family habitus (Wong, 2016), while Jamal's comment that his family "don't have any background in science" illustrates the uneven inter-generational distribution of SC (Archer et al., 2012; 2015). This means that even when ethnicity was explicitly denied, cultural, religious, and gendered norms continued to shape access and confidence.

Teachers' accounts mirrored similar patterns of denial and recognition, though framed through professional discourse. Several teachers adopted explicitly colour-blind positions, rejecting ethnocultural background as relevant to SC. For instance, Mr Chen stated that "ethnic and racial backgrounds have no influence on science capital," while Mr Adeyemi emphasised interest and motivation over background, insisting that "irrespective of the background… that student might not have interest in science." These positions reflect what Morris and Perry (2017) describe as colour-blind professional discourse, which can obscure the structural conditions shaping opportunity. Although framed as inclusive, such accounts rely on meritocratic narratives that tend to side-step systemic inequalities documented across STEM education (Archer et al., 2015; Ong et al., 2018). In other words, science was positioned as neutral, even as unequal conditions remained implicit. By contrast, Dr Patel explicitly acknowledged ethnocultural and gendered barriers, stating that "ethnicity, cultural, and religious background may preclude people from developing science capital," particularly where cultural practices restrict girls' participation. This account aligns more closely with the SC framework's emphasis on structural mediation and resonates with research on cultural constraints in STEM participation (Ong et al., 2011; Tan et al., 2013). Dr Patel's position highlights how recognising ethnocultural mediation shifts attention from individual explanations towards structural inequality.

Therefore, these findings show partial but uneven alignment with Archer et al.'s (2015) framework. While a minority of participants recognised cultural legitimacy, structural

inequality, and ethnocultural mediation, most defaulted to meritocratic explanations that portrayed science as equally accessible to all. This tension between recognition and denial was evident when students acknowledged cultural or religious norms but simultaneously rejected ethnicity as relevant, illustrating how individualist narratives can coexist with implicit recognition of constraint (Moote et al., 2020a). This suggests that ethnocultural background rarely operates in isolation, instead intersecting with gender, religion, family habitus, and class to shape SC. Overall, ethnocultural background emerged not as a consistently acknowledged influence, but as a contested and often obscured dimension of SC (House of Commons Education Select Committee, 2021). The dominance of meritocratic and colour-blind narratives illustrates how misrecognition may operate within FE science contexts, masking structural inequalities while preserving individual agency. However, research on racialised students in higher education shows that emotions such as anxiety, exclusion, and self-doubt are not individual traits but responses to institutional practices that signal who belongs and whose knowledge is valued (Hu, Moskal and Read, 2024).

5.3.2 Gender and Science Capital

Gender is a significant yet contested dimension of SC, shaping access, encouragement, and legitimacy within science education (Archer et al., 2015). Although science is often framed as gender-neutral and meritocratic, extensive research demonstrates that gendered norms, expectations, and recognition remain unevenly distributed (Archer et al., 2013b; Archer et al., 2015; Carlone and Johnson, 2007; Ong et al., 2011; Ong et al., 2018), a pattern replicated in this study where participants simultaneously asserted gender equality while describing gendered stereotypes, differential parental encouragement, and uneven recognition within science learning (Section 5.3.2). This section examines how students and teachers understood gender in relation to SC, showing that gender operated as both denied and lived. In other words, gendered inequalities were frequently minimised in principle, yet re-surfaced through participants' reflections on experience, confidence, and opportunity. Across student accounts, a dominant pattern was the rejection of gender as influencing science participation or capability.

Many students framed science as a level playing field where effort and ability, rather than gender, determined success (Kai, Amina, Diego, Mei, Fatima, Noah, Jamal, Thabo). Diego's statement, "Any gender can do anything… we're all equals," captures this meritocratic stance most clearly. Such responses align with Archer et al.'s (2015) observation that learners often articulate egalitarian ideals while minimising structural inequality, drawing on individualist science identity narratives. These claims reflect defensive individualism, where denying gendered barriers helps individuals avoid seeing themselves as disadvantaged. As a result, equality narratives protected a sense of personal agency while hiding broader patterns of inequality.

However, deeper reflection often revealed more complex and contradictory accounts. Lina offered the clearest articulation of lived gendered constraint, stating that "society norms make science look like male dominated… this blocks us [females] from being engaged in science," and that "girls' parents… might be less likely to encourage science-related activities." She linked these norms directly to her own confidence, explaining, "I became more quiet in science… it stopped me exploring more," and described increased confidence after moving to England. Lina's account illustrates how gendered norms may shape confidence and participation long before formal choices are made, aligning closely with Archer et al.'s (2015) work on parental recognition and gendered expectations.

However, some students initially denied gender as relevant but later acknowledged its effects implicitly. Ravi first claimed that gender does not influence SC, yet went on to state that "being a male has an advantage… more opportunities," reflecting persistent stereotypes about women's suitability for science. Zainab recognised that "stereotypes" shape perspectives "based on gender," while Yara argued that "society norms and stereotypes… portray science as male-dominated," adding that girls' parents "might be less likely to encourage science-related activities." Sofia similarly suggested that teachers' feedback might be gendered, noting, "Maybe the teacher might say I'm not doing well even if I think I did," while also acknowledging that "every background is different." These responses show that even where gender was publicly denied, it continued to shape recognition, encouragement, and legitimacy beneath the surface. By contrast, Thabo maintained an unequivocal equality stance, "everybody's all the same… we're all equal", thus, highlighting the variability in how students negotiated gendered discourse. Overall, students' responses demonstrate how

gender operates simultaneously as denied ideology and lived experience, re-emerging through talk of stereotypes, parental expectations, and confidence.

Teachers' accounts mirrored this pattern of simultaneous recognition and neutralisation, though articulated through professional discourse. Several teachers adopted colour-blind positions, framing science participation as independent of gender. Mr Adeyemi stated that "the gender shouldn't affect students' science capital… gender doesn't come in at all," and attributed differences instead to interest, background, and teacher support. Mr Chen offered a layered account: when discussing social norms in northern Nigeria, he described clear gendered barriers, noting that "most girls always go to the art or commercial side… not science… they are always scared." Yet when asked directly whether gender affects SC, he reverted to a universalist position, stating, "I don't think gender actually has any effect on science capital." Such accounts reflect what Morris and Perry (2017) describe as colour-blind professional discourse, where inequality is acknowledged contextually but denied abstractly. In other words, gendered barriers were recognised when located elsewhere, but neutralised when discussed in general terms.

By contrast, Dr Patel provided a clear structural framing of gendered inequality. He argued that "the majority of cultures… have shown more interest in helping males develop their interest in science than girls," and stated that "female young people have been neglected to a certain extent in many cultures." He contextualised this historically, noting that there were "many more male scientists than female ones" in his generation, not due to ability, but because of culture and parental encouragement: "parents do not encourage their daughters to engage with science as much as they encourage the boys." Dr Patel's account therefore marks a turning point, showing how recognising gendered and cultural mediation leads to a more structural understanding of inequality. Also, Mr Morgan initially echoed equality narratives, "I don't believe that gender will affect", but then reframed the issue intersectionally, explaining that "South Asian backgrounds encourage boys to study science… [and] African backgrounds… do not encourage girls to study science." This shift illustrates how gender rarely operates alone, intersecting with ethnicity, culture, and family norms to shape science participation.

In conclusion, participants' accounts highlighted that gendered inequalities in science learning were shaped less by ability or interest and more by differential encouragement, recognition, and access to valued forms of participation. Many female students described experiencing lower confidence and reduced legitimacy within science and technology-related spaces, particularly where digital or technical competence was implicitly coded as masculine. Research shows that access to science tools and resources plays a significant role in shaping science self-efficacy and confidence, helping to reinforce early engagement for some learners over others (Ennes et al., 2022).

However, similar patterns have been documented in research showing that gendered norms influence how science aspirations, confidence, and participation are recognised and supported, even among high-achieving learners (Archer et al., 2012; Archer et al., 2020). For instance, research on women of colour in STEM shows that "counterspaces" play a crucial role in sustaining persistence and success by providing affirmation, belonging, and recognition that are often absent in dominant institutional settings (Ong, Smith and Ko, 2018, pp.209-210). In this study, these dynamics shaped the convertibility of SC, as women's science-related engagement was less readily affirmed or rewarded within FE contexts. This suggests that gender likely operates as a mediating factor in SC, influencing not only access but the recognition of who is seen as legitimately scientific. For instance, women of colour in STEM describes a persistent "double bind," where students must navigate simultaneous gendered and racialised expectations that undermine recognition and belonging despite high levels of commitment and achievement (Ong et al., 2011, pp.173-175). Overall, these findings show partial yet uneven alignment with the SC framework. This tension highlights how misrecognition may operate not through overt exclusion, but through the denial of structural influence. Gender thus function as a deeply felt but frequently minimised dimension of SC.

5.3.3 Habitus and Science Capital

This section examines how habitus shapes SC, drawing on students' and teachers' accounts to explore how family educational histories, parental occupations, cultural norms, and everyday practices influence engagement with science. Using Archer et al.'s (2015) framework as a

sensitising lens, the analysis treats habitus not simply as background context, but as a key mechanism through which science becomes familiar, valued, and legitimate. In other words, habitus provides the everyday conditions through which students interpret what science is for, who it is for, and whether participation feels possible. Across students' responses, habitus operated most strongly through family role models, expectations, and routine exposure to science-related talk and practices.

Several students described close relatives working in science or healthcare as shaping aspiration and confidence (Kai, Amina, Mei). Kai's account captures this pattern most clearly: "one of my uncles is currently doing biomedical science… it really opened up being able to take in science with passion," with regular family discussions reinforcing interest and direction. Amina similarly reflected that an aunt trained in medicine "gave me the idea of doing science," adding that "if she did something else, I would have had different interests." These accounts show how family members act as carriers of science-related dispositions, shaping what feels familiar and attainable. This means that habitus influenced not only knowledge, but also imagination and aspiration.

Sustained support also emerged as crucial. Diego described early childhood exposure through the father, "my dad used to teach me how to fix motherboards… I was introduced to a lot of science", but noted that this influence weakened once support was no longer available. This illustrates that habitus-based SC may require ongoing reinforcement rather than one-off exposure. Similarly, Mei described her mother, a surgeon, as pivotal: "if she didn't support me or tell me what to do, probably I wouldn't be here today," later noting the advantage of having "someone next to me who knows everything that I'm doing, supporting me." In these cases, habitus functioned as a stabilising resource that sustained confidence and directed progression over time.

However, first-generation and mixed-habitus experiences introduced some complexities. Yara described being the first in her family to pursue higher education as potentially lowering progression in science, while also highlighting strong parental motivation despite limited educational background. Zainab similarly described internalising unrealised parental

aspirations: “my parents wanted me to do science as well, even though they did not have the opportunity themselves.” Ravi framed science as “prestigious,” explaining that relatives in healthcare “set a higher standard for us,” shaping ambition and persistence. By contrast, Sofia described habitus as both limiting and motivating, noting that while parents without educational backgrounds “can’t help a lot,” they still provide encouragement. This suggests that emotional support can partially compensate for limited technical capital. Peer habitus also mattered, with Diego describing everyday conversations with friends as reinforcing learning, “once you talk about it, it gets recorded”, showing how peer networks can offset limited family SC. In other words, habitus was not fixed but continually produced through family, peers, and everyday practice.

Teachers’ accounts reinforced the importance of habitus but framed it through broader structural and institutional lenses. Teachers consistently described habitus as both a constraint and a resource, one that schools can mediate but not fully replace. For instance, Mr Chen emphasised material and cultural resources, observing that students from wealthier families often have “the right equipment, even tutors,” illustrating how economic and cultural capital intersect. Mr Adeyemi acknowledged family background as influential “from the beginning,” but stressed compensatory potential within education, arguing that “family background is important, but it shouldn’t disadvantage a student.” This school-centred framing positioned institutions as corrective spaces, though it also downplayed the durability of family-based SC.

Dr Patel and Mr Morgan offered more structurally grounded accounts. Dr Patel linked science engagement to family enthusiasm and familiarity, explaining that “if you have a father or mother in the same field, things become easier,” while also recognising the role of ethnocultural background in shaping expectations and encouragement. Mr Morgan described how migration and exposure to better resources in the UK, alongside support from a science-trained uncle, transformed his engagement with science, suggesting that institutional context can re-shape habitus over time. These accounts highlight the cumulative and contextual nature of habitus, extending across family history, migration, and institutional access.

However, even though habitus was widely recognised, ideas about choice and effort remained strong across both groups. Some students described science choice as purely individual. For instance, Jamal stated that “it depends on you”, and Mr Adeyemi similarly suggested that personal interest could overcome background disadvantage. These equality-focused views helped maintain a sense of control and motivation, but they also hid the fact that students begin from very different starting points. As a result, the influence of family background and early exposure was often played down, even when it shaped opportunities.

These findings align closely with Archer et al.’s (2015) conception of SC as personal and socially distributed. Habitus shaped how students related to science by influencing what felt normal, achievable, and worthwhile. At the same time, many participants spoke about science as a matter of personal choice and effort. This focus on individual choice often hid the lasting influence of family support, cultural expectations, and early exposure. In other words, students’ participation was often shaped by background even when they described their decisions as entirely their own. This gap between experience and explanation is explored further in Chapter 6, particularly in the discussion of the being/doing divide (Section 6.4.1) and how opportunities are taken up and recognised (Section 6.5).

5.3.4 Socioeconomic Status and Science Capital

This section examines how students and teachers understood the relationship between socioeconomic status (SES) and SC, with this analysis focusing on how financial resources, stability, and access shape engagement with science, as well as how these influences are recognised or downplayed. While both groups acknowledged inequality, students tended to describe socioeconomic effects through immediate access and personal effort, whereas teachers more often framed them as cumulative and structural. In other words, socioeconomic background mattered, but it was narrated from very different standpoints. From students’ responses, SES was most often described in terms of access to learning resources and support. Several students associated higher income with easier access to textbooks, online materials, and tutoring (Kai, Amina, Diego, Mei). Kai captured this pattern clearly, stating, “I believe that I am able to afford these types of textbooks, and I am able to access online resources, which I am very fortunate for.” Amina similarly noted that

higher-income families can provide “private tutor[s] for them to do science.” These accounts show how financial stability can reduce barriers to learning by making scientific resources readily available. This indicates that students from more advantaged backgrounds likely experienced science engagement as smoother and less constrained.

Also, beyond materials, some students linked socioeconomic hardship to time, stress, and basic security. Noah provided the clearest articulation of this, explaining, “When you’re suffering for food or housing, education feels like a privilege… science needs a lot of time and stability.” This highlights how poverty may shape not only aspiration but capacity, limiting the conditions needed to sustain science engagement. For other students, SES intersected with first-generation status and parental education. Jamal described how students without academically experienced families must “seek external resources,” while Yara described low-income backgrounds as creating limits but also fostering resilience. In these accounts, SES was both constraining and motivating, shaping how students approached science. At the same time, several students emphasised personal effort and resilience, often downplaying structural disadvantage. Fatima argued, “I don’t think it affects me at all… I’ve been a hard worker for a long time,” and Thabo suggested that SES only becomes relevant later, “unless they go to university and have to pay.” These statements illustrate a recurring pattern in which students recognised unequal access in general but distanced themselves from its effects. This means that students often moved between acknowledging inequality and re-asserting individual responsibility, blending awareness with meritocratic beliefs.

Teachers’ accounts offered a more structural reading of socioeconomic influence. Teachers commonly described SES as shaping SC over time through cumulative access to resources, stability, and exposure. Mr Chen stated that students from wealthier families often have “even tutors to support you… all these will help,” highlighting how economic and cultural capital combine. Dr Patel framed SES as highly influential, noting that “whether it is fair or not, the socioeconomic background plays a significant role,” and argued that this was precisely why teachers must support those “who are not that fortunate.” These accounts positioned SES as a long-term condition shaping opportunity rather than an isolated barrier. However, teachers also expressed tension between recognising inequality and emphasising motivation. Mr Adeyemi argued that background “shouldn’t have too much effect” if teachers

and institutions foster interest, reflecting a compensatory view of education. Yet even where teachers emphasised effort, their accounts revealed material constraints. For instance, Mr Chen's reflection on leaving engineering, "they asked us to buy a lot of materials… my parents were not there… I could not cope with the financial demand", illustrates how cost can shape trajectories despite motivation. In other words, structural barriers surfaced most clearly when teachers spoke about lived experience rather than abstract principle.

Comparing both groups shows that students tended to experience socioeconomic inequality as something negotiated in the present, through access, stress, and effort, while teachers described it as historically produced and cumulative. Students often framed inequality through immediate needs and agency; teachers framed it through patterns observed across cohorts and careers. Although both groups recognised that socioeconomic background matters, meritocratic language frequently softened its impact. This suggests that SES shaped science engagement through access, stability, and continuity, while its deeper structural effects were often minimised. Overall, the findings align with Archer et al.'s (2015) argument that SC is unequally distributed through material and social resources. While education can mitigate some disadvantage, unequal starting points remain influential. Equality-focused narratives preserved motivation and agency but often hid these differences. In other words, socioeconomic background tended to shape science engagement even when its influence was played down.

5.3.5 English Language Proficiency and Science Capital

This section examines how students and teachers understood the relationship between English language proficiency (ELP) and SC, focusing on how language shapes access to participation, assessment, and recognition in science education. Drawing on Archer et al.'s (2015) framework as an analytic reference, the analysis treats English proficiency not as science capital itself, but as a key factor that mediates whether scientific knowledge can be expressed, evaluated, and recognised. In other words, language operates as a gatekeeper, shaping how SC is made visible within FE contexts. Across student responses, ELP was described as enabling or constraining science engagement, particularly in relation to

speaking, writing, and assessment. Native English language speakers (NELS) often described English as an advantage that supported easy access to scientific texts and classroom interaction (Zainab, Kai, Fatima). Zainab expressed this most clearly, noting that students with English as an additional language (EALS) "may struggle with expressing the ideas clearly and it may affect the ability to participate in class discussions or ask a question, compared to fluent English speakers." Such accounts illustrate how linguistic fluency is often taken for granted by those who possess it, while simultaneously shaping participation and recognition within science learning environments.

By contrast, the EALS students described ELP as a structural challenge that increased effort without necessarily reflecting lower scientific understanding. Several distinguished between knowing science and being able to show that knowledge in English. Noah explained the extra cognitive labour involved: "Sometimes I find it very hard to understand some things… so, I have to interpret it in my language, and then try to understand it easier." He also described how fear of speaking English publicly limited participation, as classmates avoided asking questions due to "insecurity." Jamal echoed this sense of cumulative strain, stating, "If English was my first language, definitely I would be in better science… I would definitely have more information, more knowledge," even as he emphasised working hard and using compensatory strategies such as peer support, YouTube, and online resources. This means that multilingual students often invested additional time and emotional effort simply to reach the same point of recognition.

Furthermore, assessment contexts intensified these effects. Students repeatedly described situations where linguistic precision, rather than scientific understanding, determined outcomes. Yara captured this distinction plainly: "I knew the answer, but I just couldn't put it in sentence and that was my problem." Lina similarly explained that misusing a single term, such as "increase" instead of "decrease," could "rob out the mark," while Mei described leaving exam questions blank because not understanding one word prevented comprehension of the entire task. These examples show that English-based assessment structures often privilege language accuracy over conceptual understanding. In other words, what students knew was frequently overshadowed by how well they could perform that knowledge in English. Notably, students often located responsibility for overcoming language barriers with

themselves, rather than with the institution. Lina stated, “it is mainly by myself,” while Noah similarly argued, “If I’m bad at something, it’s my duty to try to get better.” Even when colleges offered support, students often described it as limited or secondary. As a result, language difficulties were treated as something students needed to fix themselves, rather than as an issue shaped by how science is taught and assessed (Bourdieu and Passeron, 1990). This meant that unequal language demands were often accepted as normal, making them less visible as equity issues.

Teachers’ accounts broadly supported students’ distinction between scientific understanding and linguistic performance, but differed in how far they viewed ELP as structurally disadvantaging. For instance, Mr Chen stated that limited English “may not remove your ability to think,” but could prevent students from communicating effectively. Mr Morgan likewise argued that difficulty in explanation “may have nothing to do with their scientific knowledge.” However, some teachers downplayed the broader impact of language, framing SC instead as driven by interest and motivation. Mr Adeyemi suggested that English “shouldn’t affect science capital,” positioning effort as the main factor. By contrast, Dr Patel focused on wider social and institutional factors, stating that “English language is the predominant science language internationally… those people who have a good command of the English language will always have the advantage.” This positioned English proficiency as an institutionally valued resource that shapes whose science knowledge is recognised, aligning closely with Archer et al.’s (2015b) argument that some forms of capital are rewarded more highly than others within education systems. Although teachers described support strategies such as peer help, dictionaries, and additional language classes, these approaches generally assumed adaptation to English-dominant norms rather than questioning how those norms structure recognition. Hence, equality was often framed as treating all students the same, rather than addressing unequal starting points.

Comparing student and teacher perspectives highlights a clear gap in emphasis. Students experienced language barriers as emotional and confidence-shaping, often describing fear, silence, extra effort, and lost marks. Teachers, by contrast, tended to frame ELP as a technical issue to be managed through support or remediation, with less attention to emotional impact or identity. This contrast reflects a difference between lived experience

and institutional interpretation. As a result, language proficiency shaped not only what students could say, but how they were seen as science learners. Overall, ELP functioned as a mediating resource rather than SC itself, shaping how science knowledge was communicated and recognised. Students demonstrated strong conceptual understanding alongside difficulty meeting linguistic expectations, highlighting a gap between knowing science and being recognised as knowing it. This gap may help to explain how SC can remain invisible within English-dominant FE contexts. The role of language in shaping recognition and legitimacy is examined further in the discussion of linguistic mediation and misrecognition in Section 6.5.4.

5.4 **Unexpected findings**

Although the study was guided by specific research questions, the interpretivist-constructivist approach and open-ended nature of the interviews allowed for the emergence of unanticipated insights. The unexpected findings narrated in this section (5.4.1-5.4.3) reveal underlying tensions, contradictions, and moments of critical reflection in participants' narratives, offering fresh perspectives on the dynamics of science capital. In particular, they highlighted the fluidity of identity, influence of non-traditional science experiences, and role of emotional and affective dimensions in shaping science engagement. These emergent themes not only enrich the understanding of science capital but also point to areas for further enquiry and practical interventions.

5.4.1 English Language Proficiency Limitation

Some findings challenge Archer et al.'s (2013, 2015) conceptualisation, particularly in terms of its scope, recognition, and applicability across diverse educational and cultural contexts. The participants' responses challenged Archer et al.'s (2013, 2015) commonly accepted SC framework by problematising what some considered as the critical, yet underexplored role of linguistic capital (English language proficiency (ELP)) in shaping students' access to and engagement with science. While Archer et al. (2013, 2015) emphasised access to resources, attitudes, and exposure, the participants' responses (Section C5**)** additionally showed that ELP fundamentally mediates students' ability to comprehend, express, and participate in

science learning and assessment. This is especially significant given the very high percentage (76%) of students who are English as Additional Language Speakers (EALS) in this participant group.

While Archer's framework is multidimensional, it does not fully account for how language functions as both a gatekeeper and enabler within this study population. The findings revealed that many students' limited ELP creates profound barriers to their comprehension, expression, and participation, often resulting in underperformance that is unrelated to scientific capability. In Section 5.3.5, some students (for instance, Mei, Noah, and Lina) described feeling persistently disadvantaged, needing to invest disproportionate effort and time to decode English language, and often avoiding classroom interactions due to fear of miscommunication or judgment. Teachers corroborated these experiences, noting that language difficulties obscure students' actual scientific understanding and hinder their ability to demonstrate scientific knowledge in their assessments. Moreover, the study illustrated that linguistic capital is not static but should be actively cultivated through institutional support, peer collaboration, and adaptive pedagogical strategies. Students' coping mechanisms, such as using translation tools, vocabulary notebooks, and peer assistance, highlight their resilience but also underscore the systemic gaps in language-integrated science instruction. Teachers' recommendations for scaffolding language learning in science contexts further emphasise the need for a more inclusive educational approach.

A poignant example that stays with me is that of my EdD OS2 assignment participant (AQ), who described the general struggles encountered with summative assessments (examinations and coursework assessments) because of having to translate the questions and answers into their own native language first before translating back into English, which was not only time-consuming, but also considered by AQ to have adversely affected the grade achieved.

AQ:

> And during the exams. You may understand the topic, but because of one word and a question, you may not be able to answer the question…. The questions in the exams, I think they are different from the way we think, from the way we express… I'm ……. [AQ stated, Country of origin, which is an Eastern European country], that's me, when I

> express, I express in a different way…. Therefore, when I translated the question, I did so without making ... It does not make a meaning sometimes for me, I think. Though you know, you know, you know the answer, but because of that word that doesn't make sense for you, you can't translate it in your head. You can't answer that question. So also, I find it.

AQ also described the different challenges encountered with the two examination units: Unit 5 (Principles and Applications of Science II) and Unit 7 (Contemporary Issues in Science) (Pearson, 2019). AQ described more difficulties with Unit 7, which requires a high level of ELP (reading, writing, and comprehension), compared with Unit 5 (chemistry-focused), which was referred to as 'easier because it's more schematic', meaning 'You don't have to expand your answer so much. You go up to four or five sentences maximum you have to write, so it's easier in this way…. we could have done it, even using bullet points, make it shorter and be on point'.

For Unit 7, AQ stated,

> I will incline more to unit 7; there you need to relate one question with the other; the sentences, it needs to make sense, you don't just put words there; …Sometimes in my head, in……[AQ mentioned native language], it makes sense, but when I am translating it in English, it's not the same meaning, and also, I have that answer in my language, but I don't have the answer in English. …because even if in my head I can form the sentence, if one word from that sentence is missing and I don't have another... synonym? in my head or something to replace that word, I can't write the sentence anymore.

AQ faced barriers, struggling to find appropriate English words to express known concepts from their native language, which, combined with translation issues, likely wasted their examination time and affected their morale and confidence, thus, their performance in Unit 7. However, AQ described the coping mechanisms developed to navigate the language barriers experienced, one of which is overcompensating when answering questions,

> It's like when you have a task, and it's very simple and [straight]forward…and they ask you just let's say, for an assignment, just for you to do a small paragraph which will contain 4 or 5 sentences, but me, I will not stop there, I don't know when to stop…I will go [on] because I don't understand exactly the question…So, I will try to write more and more and more, I don't know how to give up, for example.

AQ's explanation about writing excessively due to not understanding the question was intriguing as I have seen a similar trend in many students' work. AQ also described their resourceful approach to learning, which included using YouTube and Google for additional information, particularly when searching for multiple definitions of scientific terms such as 'isomerism'. This was viewed positively as an opportunity to deepen their understanding and enrich their ELP. Unfortunately, these experiences are more common than isolated, with some of my students likely suffering through such barriers silently and normalising their struggles, another example of Bourdieu's misrecognition theory (Bourdieu and Passeron, 1990). AQ advocated for extra time in examinations for EALS students, particularly in Unit 7, due to the need for complex structuring of answers, analyses, and evaluations during the back-and-forth translations between languages.

The insider positionality of my colleagues and me as mostly migrants from non-European Union countries, whose formative educational years were outside the UK, informs the response to many students' limited ELP. We are sensitive to students' English language development needs and routinely liaise with them to develop topic-specific dictionaries to enhance their learning; such interventions should be encouraged and formalised in FE settings. However, in my experience, limited ELP remains problematic for many students, especially during examinations. Another helpful way forward is to formally recognise the barriers that limited ELP presents to my students' learning and begin to mitigate them in formal ways, for instance, by advocating for extra time in their examinations and course work assessments.

Hence, in increasingly multi-ethnically diverse classrooms, such as those in my department, where many students are migrants with varied linguistic backgrounds, these reforms should be required, not optional. By valuing linguistic diversity and embedding inclusive pedagogical

strategies, science education can become more equitable, enabling all students to engage meaningfully with scientific discourse and thrive academically in the long run. By highlighting how linguistic limitations can marginalise capable learners and distort assessments of science competence, this study calls for a reconceptualisation of SC that integrates language as a core dimension. This suggests that SC is not only shaped by access to resources and cultural attitudes but is also deeply contingent on students' ability to navigate the linguistic demands of science education. This reconceptualisation has profound implications for curriculum design, teacher training, and equity-focused policy in FE settings.

5.4.2 Insufficient Focus on Equality, Diversity and Inclusion

Archer et al.'s (2015) SC conceptualisation insufficiently addresses equality, diversity, and inclusion (EDI). For instance, Lina recommended including 'more on practical engagement with science and diverse representations'. This observation highlights the need to consider how SC may be conceptualised and operationalised differently across diverse sociocultural contexts. This sentiment resonates with other research, such as that by Archer et al. (2015), who argued for more inclusive pedagogical practices to diversify participation in science education. Also, as discussed extensively in Sections 3.11, 3.12 & 3.13, the mainly Western-centric SC conceptualisation that marginalises non-Western SC epistemologies (Elshakry, 2010; Perera, 2011; Jensen and Wright, 2015; Kalolo, 2015) was alluded to in participants' responses.

Yara argued that "ethnic or racial background… significantly influences understanding and access to science," citing systemic barriers that limit exposure and confidence. Ravi noted that "cultural beliefs and traditional practices can impact one's ability to utilise SC". Dr. Patel asserted that ethnicity, culture, and religion can shape SC, particularly through gender disparities: "In some cultures, only men are helped and promoted… women are even precluded from studying" and argued that enabling all individuals to pursue science benefits society: "Anybody who has the right interest and motivation… that can only benefit society

generally." These perspectives underscore the importance of critically examining how SC can be shaped not only by individual efforts but also by structural and cultural forces that may be invisible to those not directly affected by them.

5.4.3 Tendency Towards Deterministic Science Capital Conception

While some participants saw high SC as predictive of science engagement and career aspirations, others like Mei disagreed that "having high SC guarantees success in pursuing science post-16", highlighting the role of other factors such as "access to resources, quality of education, and personal motivation". This is in alignment with the growing discourse in the literature challenging deterministic interpretations of SC, notably the notion that high SC ensures success in pursuing science post-16 (DeWitt et al., 2016; Essex and Haxton, 2018; Moote et al., 2020). While this may be true in many cases, such a deterministic view of SC is not considered absolute by some critiques. Mei articulated that success also hinges on other variables, such as access to resources and personal motivation, a view supported by Wynne (2014), who criticises this deterministic lens, arguing that science itself is often portrayed as producing fixed societal outcomes, particularly in technological domains. Additionally, Black and Hernandez-Martinez (2016) challenge the rigidity of capital, proposing that SC should be viewed as a flexible resource shaped by context and capable of transformation, and argue that educational interventions can help students reconfigure their trajectories, highlighting the role of agency. Moote et al. (2019) also support this view, suggesting that while SC reveals patterns of inequality, it also offers a lens through which aspirations and participation can be understood and expanded. In agreement, I believe that SC should not be a fixed construct, and recognising its dynamic nature should enhance educational strategies that disrupt deterministic patterns and promote equity.

These unexpected findings revealed nuanced dimensions of science capital that were not initially anticipated, including the influence of non-traditional learning spaces and the fluidity of identity in shaping science engagement. These insights not only deepen the understanding of how science capital operates in lived contexts but also highlight gaps in institutional recognition and support. Building on these emergent themes, the following section presents

the participants' recommendations, offering practical suggestions for enhancing equity, relevance, and accessibility in science education.

5.5 **Participants' Recommendations**

This section analyses the respondents' recommendations; both students and teachers emphasised the importance of making science more engaging, accessible, and relevant to students' lives while also recognising the challenges faced by non-native English speakers. Students generally focused on recommendations related to classroom activities, learning materials, and extracurricular experiences. For example, Yara suggested making science "look more fun and engaging" and organising "science-related trips" to increase student interest. Similarly, Diego recommended adding "more trips and interesting trips about science" to make the course more exciting. Several students also emphasised the need for more interactive and hands-on learning experiences. Fatima suggested taking students outside to conduct experiments rather than just explaining concepts theoretically, stating, instead of just telling them about it, maybe you could go on to physically do it". This aligns with the SC framework's emphasis on practical engagement with science. Language support was another key theme in the students' recommendations. Kai suggested providing learning materials in students' native languages and advising teachers to "speak a bit slower" to accommodate EALSs, while Mei recommended having someone available during exams to translate unfamiliar words for students struggling with English. Some students focused on providing additional academic support to their peers. Thabo suggested implementing "interventions for just 30 minutes, for 30 minutes or one-hour interventions" and creating "more revision materials for students who are unable to understand" and Noah recommended having supervised library time to encourage more studying.

Teachers' recommendations tended to be more systemic and pedagogical in nature, focusing on teaching strategies, resource allocation, and institutional support structures. For instance, Mr. Adeyemi emphasised the need for adequate teaching resources and equipment for practical sessions, stating, "If the resources are there and then everything is at the disposal of the teacher, then everything should be okay." Several teachers highlighted the importance of

making science relevant to students' daily lives. Mr. Adeyemi noted that "If teachers are able to link science to the daily life of individuals, students will see the relevance of science and then be more interested." This aligns closely with the SC concept of seeing science as being relevant to everyday life. Some teachers also focused on providing individualised support to struggling students. Mr. Adeyemi suggested giving extra assignments and providing in-class or outside-class support to help students catch up, and Mr. Chen highlighted the availability of online resources and the use of Microsoft Teams for communication with students who need additional help. Some teachers proposed more innovative approaches to building the SC. Dr. Patel suggested creating a science club where students could discuss current scientific topics, similar to the roundtable discussions in medical schools. They also recommended developing a science dictionary to help students, particularly those with language barriers, understand key scientific terms and concepts, which is currently being done with students. The recommendations offered by the participants reflect a strong desire for more inclusive, responsive, and equitable approaches to science education. Rooted in their experiences, these suggestions emphasise the need to recognise diverse forms of science capital, challenge structural barriers, and foster environments in which all learners can see themselves as legitimate participants in science. These insights not only reinforce the findings of this study but also provide a forward-looking perspective that informs the implications discussed in the next chapter.

In conclusion, this chapter presented an in-depth thematic analysis of students' and teachers' responses, highlighting how SC is narrated, negotiated, and enacted within the post-compulsory FE science context of this study. The findings revealed both expected patterns, consistent with the existing SC literature, and unanticipated dynamics, particularly concerning language, recognition, and resistance to deterministic interpretations of SC. While the analysis in this chapter prioritised participants' voices and experiential accounts, the findings were critically interrogated through known SC theoretical lenses. The next chapter (Chapter 6) interprets, evaluates, and synthesises these findings in relation to the SC framework, Bourdieusian concepts of capital, habitus, and field, and intersectional perspectives on inequality.

The next chapter (Chapter 6) brings together the findings from this study with Archer et al.'s (2012; 2013; 2013b; 2015; 2015b) SC framework and related research to examine how SC operates in the FE context studied. It focuses on how science opportunities are shaped by relationships, recognition, and the specific conditions of the FE study context. By linking the findings across this chapter, the analysis moves beyond description to examine how science participation is enabled, limited, and valued in practice. Chapter 6 addresses both research questions directly and uses the evidence to refine the idea of SC so that it better reflects the language demands, cultural contexts, and structural constraints faced by the FE learners. In short, the chapter rethinks SC using the real experiences of students and teachers in this study, showing how opportunity and inequality may play out in everyday FE contexts.

Chapter 6

Discussion, Implications and Conclusion

6.1 Introduction

This chapter critically synthesises and evaluates the findings presented in Chapter 5, situating them within the wider theoretical, empirical, and policy landscape of SC and specifically within a London FE college science department. Applying an interpretivist–constructivist lens, the participants' responses were employed to examine how SC is conceptualised, experienced, negotiated, and constrained within the socio-culturally diverse contexts of the participants. In other words, this chapter synchronises the empirical and theoretical strands to illuminate how SC operates in practice within this particular FE setting. Thus, this study addresses a significant gap in SC literature by focusing on a post-compulsory FE college vocational science department, a context which is under-represented in SC research that is dominated by compulsory (primary and secondary) education in England. For instance, much existing SC work assumes school-aged learners and therefore overlooks the distinct trajectories, motivations, and constraints shaping FE students' engagement with science. By soliciting some students' and their teachers' voices and applying an intersectional framework, this chapter engages the participants' responses to report a more nuanced understanding of SC as fluid, relational, and context-sensitive.

Hence, the purpose of study is revisited (Section 6.2); the key findings in relation to existing literature are summarised (Section 6.3); the responses to the two research questions are evaluated (Section 6.4), with the unique contributions to knowledge explicated (Section 6.5). Also, this chapter reflects critically on my positionality (Section 6.6); while evaluating this study's strengths and limitations (Section 6.7), with the practice-policy implications and recommendations explored (Section 6.8); recommendations for future research proposed (Section 6.9) and final reflections and conclusion presented (Section 6.10). This means that this chapter not only synthesises the findings but also situates them within broader debates about equity, participation, and recognition in science education.

6.2 Revisiting Purpose of Study

This study investigated how SC is conceptualised, experienced, and mobilised by students and teachers in my vocational applied science department within a North London FE college, informed by the SC framework developed by Archer et al. (2012, 2013, 2013a, 2015, 2020a). By addressing a notable gap in the literature, this study advances SC research into post-compulsory FE contexts in England, emphasising the experiences of highly diverse, multicultural, and historically marginalised learner populations in England. In other words, this study highlights groups whose voices and trajectories are often overlooked in mainstream SC research. With reference to Research Question 1 (RQ1), this study investigated how students and teachers understand and enact SC in practice and how these interpretations inform their engagement with science.

Drawing on the Bourdieusian theories of capital and social reproduction (Bourdieu and Passeron,1990; Bourdieu and Wacquant, 1992), Social Identity Theory (Tajfel, 1978; Tajfel and Turner, 1979), Critical Race Theory (Ledema and Calderón, 2015; Delgado, 2017; Stefancic and Harris, 2017) and, postcolonial theory (Said, 1979; Spivak, 1988), an exploration of how SC functions in practice, whether understood as a coherent framework, tacit resource, or embodied identity, and how it is [re]produced or transformed within every day teaching, learning, and assessment practices was done. For instance, these theoretical perspectives enabled a richer interrogation of how power, identity, and structural inequality may shape the ways SC is accumulated, recognised, or constrained.

Situated within a vocational science setting, this study interrogated how far existing conceptualisations of SC account for the realities of post-16 learners whose educational trajectories, motivations, and forms of participation often differ from those highlighted in the UK's compulsory school-based research. This means that the study some challenges assumptions embedded in dominant SC literature by centring the lived experiences of some FE learners in my department. Furthermore, by addressing RQ2, this study investigated how intersecting identities, particularly ethnicity, gender, socioeconomic status (SES), and English language proficiency (ELP), may shape access to, accumulation of, and recognition of SC (Ong et al., 2017; Seebacher, Hofmann and Reiss, 2021; Seebacher et al., 2021; Ibourk et al., 2022). By capturing the voices of both students and teachers within a multi-ethnic,

socioeconomically diverse urban context, this research examined how science may function simultaneously as a site of empowerment and exclusion, and how structural inequalities may be [re]produced, resisted, or rendered invisible through everyday educational practices. In other words, this study explored how SC is shaped not only by what students know or do, but by how they are positioned within wider social hierarchies.

Underpinning both RQ1 and RQ2 was a strong commitment to equity, diversity, and inclusion (EDI), alongside the premise that science education should contribute to social mobility, civic engagement, and widening participation, rather than reinforcing stratification (Agosto and Roland, 2018; Seebacher, Hofmann and Reiss, 2021). Beyond contributing to theoretical debates, this study aimed to generate practice-facing insights relevant to its context, such as curriculum design, pedagogy, and institutional policy, particularly in sociocultural contexts such as North London, where barriers to the accumulation and recognition of SC are most likely unequally patterned. For instance, the findings highlight how institutional practices may unintentionally privilege certain forms of capital while marginalising others, and this means that this study's FE setting should adopt more culturally and linguistically responsive approaches to science education.

6.3 Summary of Key Findings

RQ1: How do students and teachers conceptualise and experience science capital in a post-compulsory FE context?

The findings indicate that both students and teachers demonstrated nuanced and reflective understandings of SC that broadly aligned with, yet also extended beyond, Archer et al.'s original SC framework (Archer et al., 2013a, 2015). Across both groups, there was strong agreement that SC is multidimensional, encompassing knowledge, attitudes, experiences, identity, and opportunity, rather than being confined to academic attainment alone (Archer et al., 2015; Sheldrake, Mujtaba and Reiss, 2017; Glaze, 2018, 2018b; Du and Wong, 2019; Jones et al., 2020; Archer et al., 2020; Godec et al., 2024; Kontkanen et al., 2024). In other words, participants viewed SC as a broad constellation of resources and dispositions that shape how science becomes meaningful in their lives. Students predominantly conceptualised

SC through personal and experiential lenses, emphasising curiosity, early exposure, informal learning, media engagement, and the relevance of science to everyday life, including health, problem-solving, and future careers. Teachers extended these by articulating broader and more systemic understandings of SC, shaped by their pedagogical knowledge, family influence, institutional structures, and interdisciplinary relevance. For instance, teachers often drew on their professional experience to frame SC as embedded within wider educational and social systems.

Despite these differences, both groups aligned with Archer et al. by positioning SC as central to the formation of science identity and aspirations, with students describing more personally and teachers emphasising its social and cognitive dimensions (Archer et al., 2015, 2020a; DeWitt et al., 2011; Moote et al., 2019). Furthermore, early exposure to science has emerged as a critical catalyst for engagement and aspiration, particularly when mediated through practical activities, experiments, or science-related media. Teachers reinforced the importance of emotional engagement and family encouragement in sustaining interest over time, aligning with wider research on motivation and science identity development (Xu, Coats and Davidson, 2012; Potvin and Hasni, 2014; Iglesia et al., 2023). However, most participants encountered the term "science capital" (Archer et al., 2015, p.928) for the first time in this study, indicating a significant gap in conceptual awareness among post-compulsory FE students and teachers and echoing concerns regarding the under-recognition of SC in FE contexts (DeWitt et al., 2016; Moote et al., 2020). This means that while participants intuitively understood SC, they lacked explicit language to articulate it, reflecting a broader absence of SC discourse in FE.

RQ2: How do intersecting identities shape access to and mobilisation of science capital?

The findings revealed a complex and intersectional landscape in which SC was shaped by interacting socio-cultural factors, including ethnicity, gender, SES, and ELP. These dimensions did not operate additively but compounded in ways that are likely to produce uneven access to opportunities, recognition, and confidence within science education. In other words,

identity shaped SC not through single categories but through overlapping and mutually reinforcing dynamics. A particularly significant and unexpected finding was the central role of ELP. For English as Additional Language Speakers (EALS), linguistic barriers mediated access to scientific knowledge, classroom participation, assessment performance, and institutional recognition, positioning language as a gatekeeping mechanism in the mobilisation of SC. This finding highlights how scientific understanding may be obscured rather than absent, and how language can shape whose SC becomes visible and valued, thus, resulting in Bourdieu's 'misrecognition' (Bourdieu and Passeron, 1990, p.4). For instance, students often possessed strong conceptual understanding but lacked the linguistic capital required for institutional validation.

Additionally, informal science learning environments (ISLEs) and science related media were widely recognised by both students and teachers as important sites for science identity formation and aspiration building. However, access to ISLEs remained uneven as reported in the findings, and their integration with formal science education was understood to require intentional collaboration, curriculum alignment, and sustained professional development. These findings highlight how structural conditions may shape the distribution and conversion of SC beyond individual motivation alone. This means that SC is not simply accumulated through effort but is shaped by access, recognition, and institutional structures. Furthermore, participants critiqued Archer et al.'s model for insufficiently highlighting equality, diversity, and inclusion (EDI), reflecting broader concerns about Western-centric and decontextualised applications of SC that may underplay minoritised experiences (Gonsalves et al., 2021).

Importantly, some students and teachers resisted deterministic interpretations of SC, choosing instead to emphasise agency, quality of instruction, institutional support, and motivation as mediating factors. SC was therefore experienced as dynamic, context-dependent, and potentially transformable rather than fixed or predictive. In other words, participants viewed SC as something that could be built, re-shaped, or strengthened rather than as a static attribute. Overall, these findings tend to position SC in the studied post-compulsory FE context as fluid, relational, and deeply shaped by identity and context. The following section (Section 6.4) builds on this synthesis to evaluate RQ1 and RQ2 in depth, placing the empirical findings in dialogue with the theoretical frameworks introduced in

Chapters 2 and 3, and advancing a reconceptualisation of SC responsive to the realities of the vocational science FE context studied. For instance, Section 6.4 examines how SC may operate as a recognition-dependent and context-specific construct within the FE context studied.

6.4 Responding to Research Questions

This section evaluates the findings relating to students' and teachers' perceptions and experiences of SC, examining the extent to which these align with (Section 6.4.1 (b)), extend, or diverge from (Sections 6.5.1–6.5.5) Archer et al.'s SC framework (Archer et al., 2015). In doing so, it highlights the context-specific nuances of this study, particularly those associated with its FE settings and London demographics. The evaluation further considers SC operationalisation by addressing responses to the RQ1 questions (Table 6) concerning informal science learning environments (Section 6.5.1), science media consumption (Section 6.4.2(f)), scientific literacy (Section 6.4.1(c)), and progression routes (Section 6.8.1). In parallel, Section 6.4.2 examines the intersectional implications of the findings (Theme 5.3, Figure 6) through an evaluation of the following intersectionalities: participants' demographic characteristics (Section 6.4.2(a)); ethnicity, culture, and language (Section 6.4.2(b)); gender, ethnicity, and socioeconomic status (Section 6.4.2(c)); habitus and socioeconomic status (Section 6.4.2(d)); English language proficiency, ethnicity, and socioeconomic status (Section 6.4.2(e)); and science media consumption and scientific literacy (Section 6.4.2(f)). Overall, this section synthesises how the findings respond to both research questions by conceptualising SC as both an analytical framework and a lived experience.

6.4.1 (RQ1) Perceptions and Impacts of Science Capital

This section critically evaluates the findings in relation to Archer et al.'s science capital framework, situating participants' perceptions and experiences of SC within broader theoretical and empirical debates. It examines the extent to which the findings align with established conceptualisations of SC, while also identifying key ways in which they extend the framework through attention to context, identity, and structure. Drawing on students' and

teachers' accounts, this section highlights the likely roles of its FE study context and London-specific conditions in shaping how SC is produced, recognised, and constrained. Bourdieu's concept of habitus is also integrated to illuminate how dispositions and institutional norms may mediate access to, and valuation of science. In doing so, it establishes a foundation for understanding SC as a culturally embedded and relational construct, as evaluated for the different SC domains below .

(i) Alignment with Archer's multidimensional science capital framework (knowledge, attitudes, practices, resources).

Consistent with Archer et al.'s (2013, 2013a, 2015, 2015b, 2020a) SC conceptualisation, the findings affirm SC as a multidimensional construct encompassing scientific literacy, attitudes, behaviours, and access to resources, echoing prior studies (Jenkin and Nelson, 2005; Sheldrake, Mujtaba and Reiss, 2017; Glaze, 2018, 2018b; Du and Wong, 2019; Jones et al., 2020; Zhang, 2021; Godec et al., 2024; Kontkanen et al., 2024). Participants' accounts broadly align with this framework while also exposing its limits, particularly critiques of its Western-centric orientation and potentially deterministic dispositions (Sections 3.11–3.13). In other words, the findings largely corroborate the established SC model but point to the need for greater cultural and contextual sensitivity in the study's FE and urban settings.

(ii) Cognitive and affective dimensions of SC (scientific literacy, attitudes, dispositions).

Students and teachers conceptualised SC as extending beyond formal knowledge to include curiosity, relevance, and meaning-making (Sections 5.2.1–5.2.5), aligning with Archer et al.'s (2015) cognitive and affective domains. For instance, Jamal described SC as "having knowledge, curiosity to engage science… having superpower of understanding science in all its forms" (Section 5.2.1(a)), while Zainab emphasised "interaction with the ideas and principles of scientific knowledge" (Section 5.2.1(a)). This means that students intuitively framed SC as both intellectual and motivational, reinforcing claims that science engagement is

sustained when learners perceive personal and everyday relevance (Osborne, Simon and Collins, 2003; Godec et al., 2024).

(iii) Behavioural and experiential dimensions (informal engagement, practices, trajectories).

Consistent with Archer et al.'s emphasis on science-related practices and experiences, informal science engagement featured prominently (Section 5.2.6), with students drawing on everyday encounters to inform classroom learning. Teachers similarly recognised the value of out-of-school knowledge, even when it lay beyond the formal curriculum, supporting DeWitt et al.'s (2016, 2017) findings. For instance, students' aspirations towards medicine, radiography, pharmacy, or midwifery (Section 5.2.9) illustrate how SC may connect present engagement to their aspirations. In other words, some perceived SC functioning as a bridge between identity, aspiration, and progression, rather than merely as accumulated knowledge.

(iv) Identity and relational dimensions of SC (recognition, belonging, science identity).

While Archer's framework highlights identity, the findings extend this by integrating Social Identity Theory (Tajfel, 1978; Tajfel and Turner, 1979) to explain how belonging and recognition may mediate SC mobilisation (Section 2.5.2(c); Section 5.2.3). For instance, Zainab's aspiration to be "the first one" in her family to study science, influenced by "science-related series" (Section 5.2.3(a)), highlights how identification as a "science person" can shape confidence and persistence. This means that SC was experienced as relational and symbolic, contingent on recognition and group alignment, not solely on access to resources.

(v) Extending the framework: habitus, intersectionality, and exclusion.

By combining SIT with Bourdieu's habitus (Bourdieu and Passeron, 1990), the analysis extends Archer et al.'s framework to capture emotional and inter-personal dynamics of inclusion and exclusion, particularly in this study's FE context that is marked by ethnic, linguistic, and socioeconomic diversity. Teachers' accounts

demonstrated how classroom norms and pedagogical practices can [un]intentionally reinforce exclusionary identities. For instance, gendered perceptions of science as elite or male-dominated were shown to empower some learners while marginalising others, as articulated by Dr Patel, who linked female under-representation to cultural practice rather than ability (Section 5.3.2(b)). In other words, identity alignment can simultaneously motivate individuals and constrain collective inclusivity, necessitating pedagogies that actively challenge reductive group norms.

(vi) Cultural embeddedness and structural constraint: extending science capital beyond Western hierarchies.

Most clearly, this study extends Archer et al.'s framework by demonstrating that SC is culturally embedded, negotiated, and shaped by structural conditions rather than uniformly accumulated. Participants also highlighted the marginalisation of non-Western epistemologies and culturally situated practices, reinforcing critiques of dominant science education (Elshakry, 2010; Gonsalves et al., 2021). For instance, Noah's observation that certain communities prioritise "medical fields" legitimised specific scientific pathways, while Yara emphasised that "ethnic or racial background… significantly influences access to science," citing systemic barriers. This means that students often oscillated between recognising structural constraints and re-affirming meritocratic ideals, revealing tensions in how SC may be understood and claimed.

Overall, this section extends Archer et al.'s (2015) SC framework by evidencing SC as fluid, contextually negotiated, and relational, shaped by identity, aspiration, and lived experience as much as by formal literacy. Dr Patel's reflections that cultural and socioeconomic contexts may "preclude some people from developing and increasing their science capital" (Section 5.3.2 (b)) highlight the cumulative and unequal nature of SC. In other words, recognising community-based literacies and culturally grounded aspirations as legitimate forms of SC broadens participation and challenges deficit framings. This extended framing provides the foundation for Section 6.4.2, which examines how intersecting social positions (RQ2) mediate access to, recognition of, and engagement with science, and for Section 6.8, which considers practice and policy implications.

6.4.2 (RQ2) Intersectionality and Science Capital

In addressing RQ2, this section examines how intersecting identities shape access to, recognition of, and engagement with science capital (SC). Drawing on Crenshaw's (1989, 1991, 1998) intersectional framework, the findings demonstrate that [dis]advantages in science education are compounded rather than additive. Students' experiences of SC were shaped through the compounded effects of ethnicity, gender, socioeconomic status (SES), English language proficiency (ELP), migration history, and family background, which acted relationally and contextually rather than independently. For instance, female students from ethnic minority backgrounds who were also EALS and from lower SES backgrounds experienced cumulative barriers affecting confidence, participation, and access to enrichment. This means that SC cannot be understood through single-category explanations, but should be conceptualised as institutionally-mediated and relational. Accordingly, this section evaluates how intersecting dimensions structure whose SC is recognised, whose remains obscured, and how this may operate within the FE study contexts.

(i) Demographic positioning and intersectional starting points

Participants' demographic characteristics provided essential context for interpreting intersectional patterns in SC. As shown in Appendix 2, the cohort comprised 13 students and 4 teachers, offering both students' and teachers' perspectives shaped by distinct positionalities. High ethnic diversity (Black n=7; Asian n=4; White n=2), widespread EALS status (n=14), and varied SES backgrounds created uneven starting points for SC mobilisation. For instance, the fact that only five participants completed GCSEs in England highlights how prior educational systems may intersect with language and class to shape confidence and scientific literacy. This means that SC accumulation in the study's context is conditioned by historically situated biographies rather than uniform access.

(ii) Ethnicity, culture, and language

Participants' accounts illustrated that SC is compounded through the intersection of ethnicity, culture, and language, rather than any single dimension. Consistent with Gonsalves (2018), students drew on transnational and culturally situated science norms that shaped aspiration and meaning-making. For instance, Noah noted that "people [in my country] are more interested in medical fields," while Yara reflected that "our culture and beliefs shape our minds and access to and utilisation of science." These accounts demonstrate how culturally embedded forms of SC are present but often weakly recognised within English FE science. This means that multilingualism and transnational experience are likely to function as epistemic resources that are misrecognised as deficits rather than strengths.

(iii) Gender, ethnicity, and socioeconomic status

The intersection of gender with ethnicity and SES further shaped science participation and identity. Although many participants asserted that gender should not affect SC, persistent disparities remained evident, particularly for ethnic minority girls. This aligns with research indicating that STEM fields are culturally coded as masculine (Francis et al., 2017) and often positioned as incompatible with communal values (Diekman et al., 2017). For example, students' narratives revealed how racialised and gendered stereotypes constrained confidence and belonging, echoing Archer et al.'s (2020a, p.3) findings on "science debt." In other words, gendered experiences of SC were inseparable from racialised and classed positioning.

(iv) Habitus and socioeconomic status

Family habitus intersected with SES to shape early exposure to science-related resources and dispositions, reflecting Bourdieu's (1986; Bourdieu and Passeron, 1990) theory of capital reproduction. Students from higher SES backgrounds often described greater familiarity with science and confidence in progression, while others perceived science pathways as risky or

inaccessible (Archer and Hutchings, 2000). However, several participants also articulated resilience and agency, challenging deterministic interpretations. For instance, students emphasised motivation and institutional support as enabling upward trajectories, aligning with Wynne's (2014) and Black and Hernandez-Martinez's (2016) critiques of fixed capital. This likely means that SC is structured by habitus but remains open to transformation.

(v) English language proficiency, ethnicity, and SES

ELP emerged as a key intersecting dimension shaping SC recognition and mobilisation. EALS students reported expending greater cognitive and emotional labour to access scientific discourse, often feeling disadvantaged despite comparable understanding. This linguistic burden intersected with ethnicity and SES to shape participation, confidence, and assessment outcomes. Drawing on Bourdieu's concept of linguistic capital (Bourdieu and Passeron, 1990), these findings demonstrate that language operates as a gatekeeping mechanism within this study's context. In other words, ELP is not peripheral to SC but central to how scientific competence is recognised and valued.

(vi) Science media consumption and scientific literacy

Science media consumption functioned as a mediating resource intersecting with SES, language, and cultural capital. While students engaged with digital platforms such as YouTube and apps, teachers privileged traditional academic sources, reproducing distinctions between legitimate and marginalised knowledge practices. For instance, students who used media to supplement learning reported increased confidence, but only when supported by critical interpretation. This aligns with Kontkanen et al. (2024), who argue that media-based SC remains under-theorised and weakly integrated into curricula. This means that media access alone is insufficient without pedagogical mediation.

(vii) Transnational media, misrecognition, and extended science capital

Finally, transnational and culturally embedded media practices revealed how SC is often enacted but not convertible within dominant institutional fields. Consistent with Bourdieu's concept of misrecognition, students' global reference points, such as Noah's culturally valued medical pathways or Yara's culturally situated epistemologies, were not consistently recognised as legitimate SC. This aligns with Kontkanen et al. (2024) and Wilson-Lopez et al. (2017), who highlight how community-based and digital literacies remain marginalised. In other words, students possessed rich forms of SC that remained institutionally invisible.

Collectively, this section demonstrates that SC is unevenly distributed and differentially recognised across intersecting dimensions of gender, ethnicity, class, language, and migration history. Students occupying multiple marginalised positions will likely face compounded barriers, while those whose habitus aligned with dominant norms will likely benefit from recognition. In line with Bourdieu's theory of misrecognition (Bourdieu and Passeron, 1990), these findings extend Archer et al.'s SC framework by highlighting intersectionality as central to understanding how science participation is enabled or constrained. This provides the foundation for the recommendations developed in Section 6.8.

6.5 Study's Contributions to Knowledge

This study makes an original contribution to knowledge by extending and re-theorising science capital (SC) through an empirically grounded analysis of vocational science education in a North London FE college. While Archer et al.'s (2015) SC framework remains foundational in demonstrating the socially patterned nature of science participation, the findings show that its explanatory power is limited when applied to the post-compulsory, multilingual, migrant-rich, and socioeconomically diverse FE context of this study without conceptual expansion. By integrating Bourdieusian theory, science identity, and intersectionality, this study advances SC as an institutionally-contingent, linguistically-mediated, and epistemologically inclusive construct. In other words, SC should be re-imagined to reflect the lived realities of FE science learners in this study's context, whose identities and trajectories diverge from those assumed in mainstream SC research.

6.5.1 Being/doing science and institutional recognition (RQ1)

A core theoretical contribution is the identification and theorisation of a persistent *being/doing* divide. Drawing on Carlone and Johnson's (2007) science identity framework, the findings demonstrate that students could competently *do* science through applied coursework, investigations, and reasoning, yet often struggled to *be* recognised as legitimate science participants. For instance, students demonstrated strong conceptual understanding but felt excluded from the category of "science person" (Carlone and Johnson, 2007, p. 1194), a key dimension of science identity and capital (Carlone and Johnson, 2007; Archer et al., 2015), due to linguistic or cultural misrecognition. While Archer et al. (2015) highlight participation and aspiration, this study identifies recognition as a critical mediating mechanism through which SC becomes meaningful or constrained. This means that accumulation of SC does not necessarily translate into legitimacy, confidence, or progression unless institutions actively recognise and value students' scientific practices. Research shows that trust in science and support for evidence-based policy are shaped by political and social context rather than by scientific merit alone, reinforcing the argument that science capital operates through recognition and legitimacy as much as through knowledge or skill (Gauchat, 2015). Furthermore, analyses of the politicisation of science show that acceptance of scientific knowledge is often shaped by ideological and cultural frames rather than evidence alone, reinforcing the argument that scientific legitimacy depends on recognition as much as competence (Goldberg, 2017).

6.5.2 Science capital enacted within FE as an institutional field (RQ1)

This study extends SC theory by conceptualising its FE context as a distinct institutional field (Bourdieu, 1986; Bourdieu and Passeron, 1990), characterised by particular material, symbolic, and evaluative conditions, within which students' habiti are differentially aligned with dominant expectations and in which the accumulation of SC does not guarantee its recognition. In this field, forms of SC developed through applied and vocational learning are particularly vulnerable to misrecognition, limiting their convertibility into legitimacy, confidence, and progression. This means that many participants described their science engagement in FE as shaped by institutional marginalisation, constrained resources, and low symbolic status (Augar, 2019). For instance, Kai described being able to "afford textbooks" as

“very fortunate,” while Mr Morgan noted that practical science was often delivered “as group practical sessions because of the cost.” This means that in this study’s context, some FE conditions likely directly shape not only access to science but also the symbolic value of the SC students acquire. Applied and vocational forms of science learning were thus meaningful yet institutionally under-valued, extending Archer et al.’s (2013a, 2020a) argument that SC is unevenly recognised as well as unevenly distributed.

6.5.3 English language proficiency as linguistic science capital (RQ2)

A major empirical and conceptual contribution of this study is the theorisation of English Language Proficiency (ELP) as *linguistic science capital*. The findings challenge assumptions of linguistic neutrality within existing SC frameworks (Archer et al., 2015), demonstrating that ELP operates as a powerful gatekeeping mechanism shaping recognition, confidence, and assessment outcomes. For instance, Yara stated, “I knew the answer, but I just couldn’t put it in sentence,” while Lina noted that a single linguistic error could “rob out the mark.” These accounts illustrate symbolic misrecognition (Bourdieu and Passeron, 1990), where scientific understanding exists but is not institutionally recognised unless expressed fluently in English. This means that language proficiency determines not only expression but legitimacy, requiring SC theory to integrate linguistic capital explicitly. Hence, drawing on Bourdieu’s theorisation formulation of linguistic capital in relation to education and symbolic power (Bourdieu and Passeron, 1990), this study conceptualises English Language Proficiency as a structurally valued form of science capital.

6.5.4 Digital and informal science as context-dependent capital (RQ1)

This study also extends SC by evidencing how students mobilise digital and informal science learning practices, possibly to compensate for restricted access to legitimised institutional resources. As digital technologies increasingly shape scientific work and employment, the value attached to digital science skills has intensified; however, analyses of technological

change show that these benefits are unevenly distributed, with access and recognition favouring those already positioned to convert digital engagement into reward (Dong and McIntyre, 2014). In alignment, participants described digital tools as both helpful and limiting for science learning, reflecting wider commentary that technology can support engagement but may also create barriers depending on access and skills (Dong and McIntyre, 2014; Mokyr, 2018; Asaram, 2023). For instance, students described learning through YouTube, WhatsApp groups, and AI tools, with Kai describing YouTube as "an education tool" used "daily." However, such practices were rarely legitimised within formal science education. In other words, students' digital and everyday science engagement functioned as parallel learning spaces but remained weakly convertible into recognised SC. This finding challenges assumptions in SC literature that informal engagement is universally accessible and highlights how digital capital can only become valuable when institutionally recognised (DeWitt and Archer, 2017).

6.5.5 Intersectionality as a structuring principle of science capital (RQ2)

Furthermore, this study advances SC theory by re-positioning intersectionality (Crenshaw, 1989, 1991) as a core structuring principle rather than an add-on analytic lens. Participants' experiences showed that gender, ethnicity, SES, language proficiency, and migration history interacted dynamically to shape science participation and recognition. For instance, Noah described science as inaccessible during periods of housing and food insecurity, while Yara highlighted how gendered and cultural expectations shaped her confidence in science. This means that SC is structured through compounded rather than additive forms of [dis]advantage, challenging linear models within existing SC frameworks and extending Archer et al.'s (2015, 2020a) relational conceptualisation.

In alignment, scholarship on intersectionality, educational inequality, and institutional recognition collectively strengthens this study's argument that inequalities in science education are produced less by individual ability than by the ways institutions value, legitimise, and respond to learners' diverse social dimensions. For instance, large-scale spatial and survey research demonstrates how gender, ethnicity, socioeconomic status, and

geography interact to compound educational disadvantage, offering data-driven approaches that are readily transferable to FE science for identifying under-represented learners and informing inclusive curriculum design (Lido, Osborne and Reid, 2020). Related work on "lifewide literacies" further challenges narrow definitions of learning by arguing that educational systems must recognise knowledge developed beyond formal settings, which supports this study's claim that FE science should value students' cultural, community-based, and experiential knowledge as legitimate forms of science capital rather than treating them as informal or supplementary (Lido, Reid and Osborne, 2019, p. 282). Qualitative studies deepen this insight by showing how institutional "comfort zones" and identification shape who feels entitled to participate and seek support, with minority ethnic and working-class students often demonstrating strong academic commitment while experiencing weaker recognition and peer affirmation (Stuart, Lido and Morgan, 2009; 2011).

Pedagogical research aligned with these findings shows how such inequities can be disrupted in practice. For instance, Morrison-Love's Adaptive Subject Pedagogy Model encourages teachers to adapt learning to students' social, cultural, and educational contexts, while culturally grounded approaches to design and technology education challenge Eurocentric knowledge hierarchies and promote humanising, reflective teaching (McLain et al., 2019; Morrison-Love and Patrick, 2025). At the level of knowledge production, critical analyses of gender equity further reveal how "gendered discourses, precarity, and far-right politics" marginalise women and racialised scholars, demonstrating how "power and politics converge to undermine equity" within academic institutions (Read, 2024, p. 1). This means that exclusion operates not only in classrooms but across the wider systems that determine what knowledge counts and who is recognised as legitimate. Overall, these studies reinforce the central contribution of this study, which is that SC is not simply accumulated through participation or access, but is made meaningful through institutional recognition and responsiveness. To advance equity in FE science education, intersectionality should therefore move beyond theory to inform inclusive, data-driven, and culturally responsive practices that address how gender, ethnicity, language, class, and other axes of identity interact to shape learners' SC trajectories.

6.5.6 Decolonising science capital through a postcolonial lens (RQ1 & RQ2)

A further original contribution is the application of postcolonial theory (Said, 1979; Spivak, 1988) to critique Western-centric epistemologies embedded within dominant SC frameworks. Participants frequently mobilised culturally embedded, community-based, and transnational forms of scientific knowledge that were institutionally undervalued. For instance, Ravi described "traditional ways of curing illnesses" as related to science, while Noah recalled home-based experimentation with dyes. These practices demonstrate epistemological misrecognition rather than absence of SC whereby the nature of science should engage with issues of power, inequality, and social justice, rather than presenting science as neutral or value-free knowledge (Hansson and Yacoubian, 2020). In other words, students possessed rich forms of SC that remained invisible within Eurocentric institutional norms, extending Archer et al.'s notion of "science debt" (2020a, p.3) to include institutional constraints in which students' forms of digital knowledge may not be recognised and legitimised, thus, epistemically excluded. For instance, critical histories of digital colonialism demonstrate how contemporary digital infrastructures reproduce long-standing power asymmetries, shaping whose knowledge is visible, authoritative, and institutionally recognised within global knowledge systems (Nothias, 2025).

6.5.7 Wider relevance for Further Education contexts

Although grounded in a single London FE college, this study offers insights with relevance beyond its immediate context. The misrecognition of applied science, linguistic mediation of legitimacy, and fragile science identities identified here likely reflect wider structural features of FE science provision in England. This means that FE should not be treated as peripheral to science education research but as a critical site where SC is negotiated and transformed. By re-positioning SC as recognition-centred rather than participation-centred, this study contributes a theoretically enriched and contextually grounded account of science capital in vocational and applied settings, with implications for research, policy, and pedagogy, as developed in Section 6.8.

6.6 Critical Reflexivity on the Influence of My Positionalities on Interpretation

As outlined in Section 4.7, this study is grounded in critical reflexivity, recognising that knowledge production within an interpretivist-constructivist paradigm is shaped by my researcher positionality, power relations, and interpretive judgement. My positionalities as a Black ethnic minority woman, migrant, curriculum manager, and long-standing FE science educator influenced the research process in layered and sometimes contradictory ways. Over two decades of experience in London's FE science sector provided deep insider knowledge of institutional structures, pedagogical practices, and systemic constraints shaping SC, enabling trust with teacher participants and nuanced interpretation. However, this proximity also required vigilance against over-familiarity and taken-for-granted assumptions. At the same time, my middle-class positioning and advanced academic qualifications differentiated my experiences from those of many student participants. While I shared experiences of linguistic and cultural marginalisation with some students, my educational privilege limited access to the full depth of their material constraints.

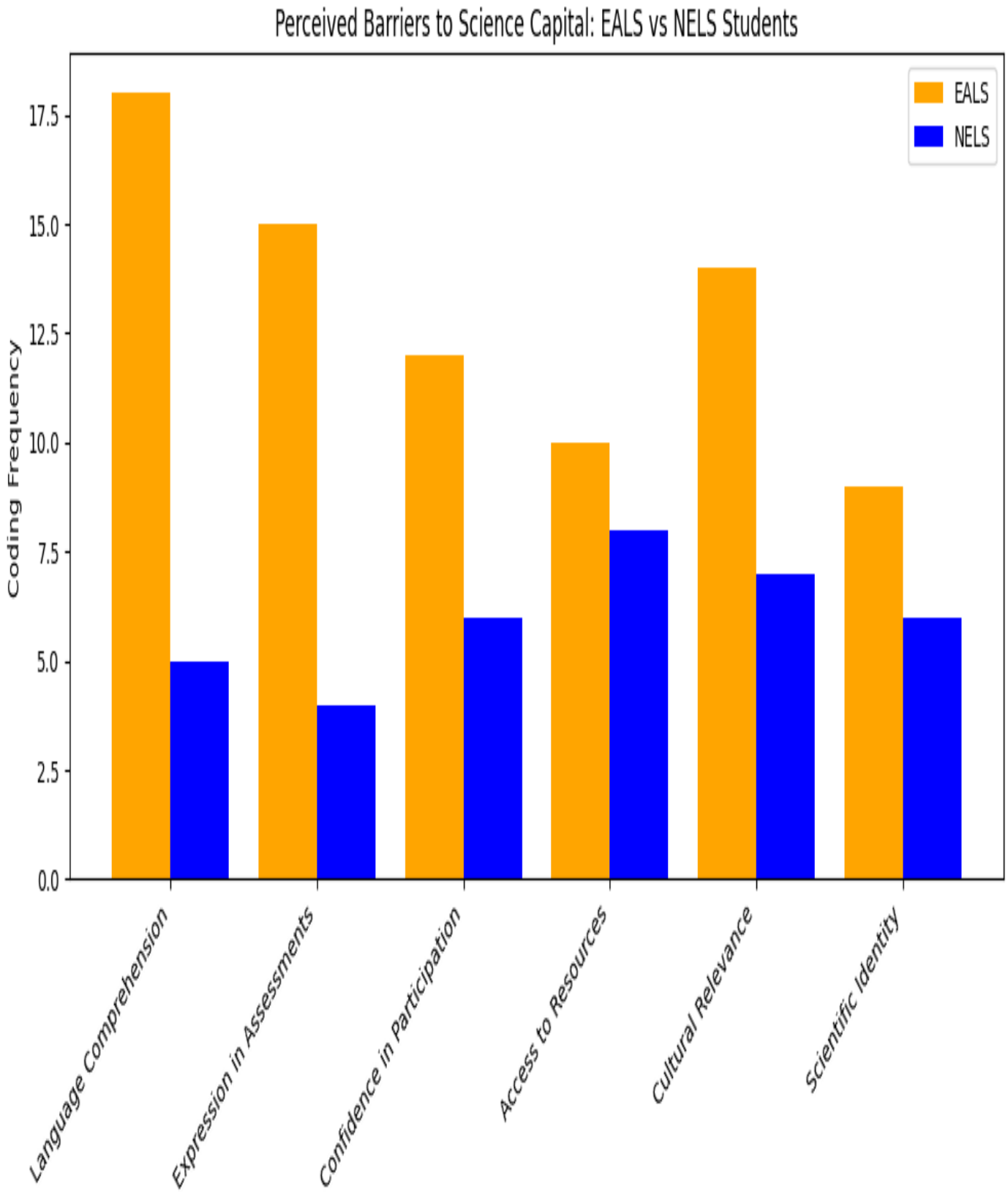
Reflexivity therefore required continual interrogation of both proximity and distance. For example, my commitment to equity in science education risked foregrounding structural inequality at the expense of students' expressions of agency or strategic resistance, necessitating reflexive critique to maintain analytic balance. Consistent with the epistemological stance outlined in Section 4.7, reflexivity operated as an ongoing analytic practice rather than a simple acknowledgement of bias. Drawing on Critical Race Theory's emphasis on counter-narratives (Delgado et al., 2017), this study rejects claims of neutrality within racially, linguistically, and classed contexts. Participants' accounts of navigating language, cultural expectations, and caring responsibilities resonated with my professional knowledge of FE science education. Inclusive practices valued by students, such as multilingual resources or flexible pacing, remained marginal within high-stakes accountability regimes, reinforcing Bourdieu's argument that treating unequal learners equally reproduces inequality (Bourdieu and Passeron, 1990). Reflexivity was therefore central to identifying how symbolic violence operates through seemingly neutral institutional practices.

Reflexivity also shaped data generation and interpretation through researcher–participant interaction. Interviews were approached as dialogic spaces, with meaning co-constructed rather than simply elicited. Participants such as Fatima and Sofia appeared to articulate their

understandings of SC during the interviews themselves, aligning with an interpretivist view of knowledge production (Wellington and Osborne, 2001). Reflexive re-reading of the data led to analytic shifts, such as re-interpreting students' hesitation not as low aspiration but as linguistic or epistemic misrecognition. This reframing informed the study's central theoretical contribution: identifying recognition, rather than possession, as the mechanism through which SC becomes meaningful. Finally, reflexivity informed the interpretation of analytical outputs, including the expanded SC framework (Figure 10) and NVivo coding frequencies (Figure 11). These visualisations foreground under-theorised dimensions, particularly linguistic capital and culturally embedded knowledge, while highlighting the disproportionate epistemic labour borne by English as an Additional Language (EALS) students. Reflexive interpretation situated these patterns within broader structural contexts, reinforcing reflexivity as a continuous methodological practice underpinning analytic judgement, theoretical development, and ethical accountability. Across this study, reflexivity was therefore not an appendix, but a necessary condition for theorising SC as relational, linguistically mediated, and institutionally recognised (Archer et al., 2015).

Figure 10: A Proposed Expanded Science Capital Model From The Findings

Figure 11: The NVivo14 Coding Frequency Chart of Participants' Responses



6.7 Study's Methodological and Contextual Strengths and Limitations

The methodological and contextual design of this study is central to its contributions. Hence, rather than treating the strengths and limitations as technical features to be itemised, this section demonstrates how specific design choices actively shaped what the study was able to reveal, theorise, and contribute. In line with interpretivist-constructivist approaches to knowledge production (Finlay and Gough, 2008; Lincoln and Guba, 2000), this study prioritises analytic depth, contextual specificity, and reflexive transparency over claims of generalisability. This means that this study's significance lies in how its design enabled new theoretical and methodological insights SC, rather than in the breadth of its empirical reach. Accordingly, the strengths and limitations discussed below are treated as productive conditions that shape, rather than weaken, the scope and significance of the contributions outlined in Section 6.5.

A key strength of this study is the clear alignment between its interpretivist-constructivist approach, qualitative design, and abductive approach (Sections 4.1–4.3). This alignment made it possible to understand SC as relational and institutionally shaped, rather than as a fixed set of individual resources. For instance, abductive reasoning allowed participants' narratives to actively re-shape theoretical interpretation, revealing forms of linguistic and epistemic misrecognition that dominant SC frameworks conceal. Hence, this design choice directly enabled the study's main theoretical contribution by making issues of recognition within science capital clear and visible.

The Further Education context constitutes a second strength that underpins the study's empirical contribution. SC research has largely centred on compulsory schooling in England (Archer et al., 2013a, 2020a), leaving post-compulsory contexts under-theorised. By situating this study within a large, urban London FE college, the research renders visible how science participation is shaped within a structurally marginalised institutional field characterised by linguistic diversity, vocational curricula, and complex migration trajectories. This context exposed forms of SC accumulation and misrecognition that are unlikely to be captured in school-based research. In other words, the FE setting did more than provide a research site; it actively generated insights that extend how SC is understood.

A further methodological strength arises from the use of SC as a sensitising rather than prescriptive framework (Section 4.4.3). By holding Archer et al.'s (2015) SC framework provisionally and inviting critique, participants' experiences were not forced to fit existing SC frameworks (Ong et al., 2011), thus, making it possible for gaps, tensions, and exclusions in those frameworks to become visible. For instance, participants' criticisms of assessment language directly informed the re-conceptualisation of SC as linguistically mediated. This openness was not incidental but central to the study's ability to move beyond reproduction of existing theory toward its re-theorisation.

The interview design further strengthened the methodological contribution. Semi-structured interviews, refined through piloting (Sections 4.4.2 and 4.4.5) and supported by reflexive interviewing practices (Section 4.4.7), enabled depth, responsiveness, and ethical engagement. Combined with maximum-variation purposive sampling and triangulation across student and teacher perspectives (Sections 4.4.4.1–4.4.4.2), this design highlighted intersectional complexity rather than statistical representativeness (Denzin and Lincoln, 2005). For instance, Zoom-based interviews reduced hierarchical pressure for some participants, enabling more open discussion of linguistic and cultural barriers. This means that the methodological decisions made actively enhanced both analytic insight and participant responses.

However, these strengths must be interpreted alongside limitations to this study's contribution. First, volunteer purposive sampling (Section 4.4.4.3) introduces the possibility of self-selection bias, potentially privileging more confident or linguistically secure participants (Silverman, 2024). While this may limit insight into the experiences of students most disengaged from science, it strengthens the study's capacity to analyse how SC is articulated, negotiated, and defended by those navigating institutional expectations. Second, the use of pre-interview SC materials carries a residual risk of priming despite careful mitigation (Section 4.4.3). Rather than undermining the study, these limitations are addressed (Section 4.4.3 (b)) to propose methodological refinements, such as two-phase interview designs that separate exploration from theorisation. This means that limitations function as a basis for methodological contribution rather than as analytic deficits.

Finally, the insider-researcher position presents a contextual limitation that both enabled and constrained the study. While access and rapport were improved, participants may still have shaped their responses to present themselves in a favourable light or to align with what they perceived the researcher expected (Section 4.4.7). The findings are therefore presented as reflexively situated knowledge rather than neutral representation, consistent with arguments that transparency, rather than detachment, underpins qualitative rigour (Finlay and Gough, 2008; Roulston, 2021). In closing, this study's strengths and limitations work together to define the conditions under which its contributions are made.

6.8 Study's Practice-Policy Implications and Recommendations

This study has significant implications for practice and policy within my department and offers insights relevant to other FE colleges seeking to improve learner engagement, progression, and equity in science provision. Although students across the study demonstrated strong commitment, competence, and motivation to do science, the findings show that institutional structures and norms do not consistently enable this competence to be recognised or converted into confidence, legitimacy, and progression. As a result, opportunity and recognition are unevenly distributed despite comparable levels of engagement. This means that widening participation strategies centred on access or engagement alone are likely insufficient. From a SC perspective, institutions should also address how SC is recognised, legitimised, and made convertible through every day practices. In other words, participation has limited impact unless institutions recognise students' existing science engagement and enable it to count towards confidence and progression.

6.8.1 Institutional Recognition of Science Capital

The findings show that applied scientific competence in FE is frequently under-recognised as a result of institutional status, resource constraints, and vocational habitus, which together weaken the symbolic value of FE science pathways. Students demonstrated strong practical expertise and scientific reasoning, yet many expressed uncertainty about their legitimacy as "science people" (Archer et al., 2020a, p.3) and the credibility of their qualifications for progression. For instance, students who excelled in practical investigations questioned whether universities would value their achievements. This reveals a persistent being/doing divide, where science is actively practised but unevenly recognised within progression, assessment, and guidance structures. From a practical perspective, FE science provision should embed recognition-focused practices within curriculum design, tutorial systems, assessment feedback, and progression guidance, explicitly validating applied and vocational science as legitimate scientific participation. This means that every day institutional messaging should consistently affirm that vocational science is real science. At policy level, participation-led strategies that fail to address funding inequities, accountability pressures, and the low symbolic status of FE risk reproducing misrecognition. In other words, policy should address the institutional conditions that determine whether SC can be activated and valued.

6.8.2 Linguistic Recognition Beyond English Language Proficiency

This study demonstrates that English Language Proficiency (ELP) operates as a gatekeeping form of linguistic SC, shaping whose scientific understanding is recognised and rewarded. Many multilingual and EALS students showed strong conceptual understanding but were unable to fully demonstrate this within English-dominant assessment formats, leading to the misrecognition of their SC. This highlights ELP as a structural issue embedded within curriculum, assessment, and institutional norms rather than an individual deficit. In other words, language is a central mechanism through which scientific legitimacy is granted or withheld. In practice, FE science teaching should embed language-aware pedagogies as core practice rather than optional support. For instance, enabling oral explanation, diagrammatic reasoning, or scaffolded responses can reduce linguistic load without lowering scientific

rigour. This means assessment should distinguish scientific understanding from English accuracy. At policy level, treating English-dominant assessment as neutral obscures how it privileges native speakers. Recognising linguistic diversity as a structural feature of FE is therefore essential for equitable recognition of SC.

6.8.3 Pedagogical Alignment with Learner Strengths

The findings show that when students feel constrained or misrecognised by institutional and linguistic forms of SC, they increasingly look for ways to compensate by relying on informal learning resources to sustain engagement. For instance, some students described using YouTube, peer networks, messaging platforms, and AI tools, yet these practices are usually unevenly valued and weakly convertible into recognised advantage. This challenges assumptions that informal learning functions as neutral enrichment. In other words, informal learning is often structured by unequal access to time, resources, and recognition. Pedagogically, FE science provision should integrate informal and digital learning into core teaching and assessment rather than treating it as peripheral. For instance, students could critically compare a digital explanation with a textbook account, demonstrating scientific evaluation rather than passive consumption. This alignment reduces the symbolic gap between institutional science and students' lived informal science practices. At policy level, legitimising digitally mediated learning, particularly where access to physical enrichment is constrained, is necessary if informal SC is to be recognised rather than marginalised.

6.8.4 Intersectionality as a Structuring Principle of Science Capital

The findings show that students' science trajectories are shaped by the interaction of ethnicity, gender, socioeconomic status, ELP, and migration history, producing compounded rather than additive forms of [dis]advantage. Addressing any single dimension in isolation fails to account for these lived realities. For instance, a female EALS student experiencing financial insecurity encounters qualitatively different barriers from those addressed by gender-only interventions. This repositions intersectionality as a structuring principle of SC rather than an optional analytic lens. In practice, FE science provision should adopt

intersectionally-informed approaches to pedagogy, tutoring, and progression guidance that recognise how multiple factors interact. This means support should be responsive to lived experience rather than abstract categories. At policy level, widening participation frameworks focused on single markers of disadvantage risk reproducing misrecognition at points of intersection. In other words, intersectionality should inform both classroom practice and institutional policy if SC is to be recognised equitably.

6.8.5 Epistemological Recognition and Decolonising Science Capital

The postcolonial analysis demonstrates that dominant SC frameworks privilege Western, English-mediated, and institutionally sanctioned forms of knowledge, leading to likely epistemic exclusion of culturally embedded and community-based science practices. Many students possessed rich scientific understanding that remained invisible because it did not align with dominant epistemic norms. In other words, inequity is reproduced through what counts as knowledge, not only through access. In practice, FE science teaching should recognise students' every day, community-based, informal, and transnational science experiences as valid ways of doing science, rather than treating them as separate from or inferior to formal scientific knowledge. For instance, encouraging students to connect scientific concepts to community practices can support recognition without lowering academic expectations. At policy level, inclusion strategies that focus only on formal measures, such as qualifications or test results, risk reinforcing narrow ideas about what counts as scientific knowledge. Recognising different ways of knowing is therefore essential if diverse learners are to be acknowledged as legitimate science knowers.

6.8.6 Wider FE Practice–Policy Implications

Although grounded in a London FE college, the findings have relevance for the wider FE sector, particularly in similar linguistically and socioeconomically diverse FE science contexts. This is because issues such as the limited recognition of vocational science routes, the strong influence of English language on who is seen as capable, and students'

uncertainty about their science identity likely reflect wider structural problems across FE science provision in England. This study shows that the FE context is a key place where students' scientific identities, confidence, and future pathways are formed, rather than a minor or temporary step on the way to 'real' science routes. Hence, FE providers should strengthen recognition of applied and vocational science through curriculum design, induction, assessment, and progression guidance. At policy level, moving beyond participation-centred models towards recognition-centred SC frameworks is essential. In other words, equity in FE science should focus on transforming how science is valued and recognised, not simply how it is accessed.

6.9 Future Research: Extending Recognition-Centred Science Capital in Further Education

While this study advances understanding of SC, recognition, and equity within its FE science education context (Sections 6.5–6.8), it also raises a set of questions that extend beyond the empirical and methodological boundaries of a single-site study. The future research directions outlined here are extensions of the study's findings, context, and reflexive design. Taken together, they identify where SC research in FE should move if persistent issues of recognition, legitimacy, and inequity are to be addressed more fully. For instance, several findings point to structural features of FE science provision that require broader empirical investigation across institutions, time, and policy settings.

One unresolved issue emerging from this study concerns the extent to which the recognition-based *being/doing* divide identified here is shaped by local institutional conditions, which likely reflects a broader structural feature of FE science education. Comparative research across multiple FE colleges in England would allow this question to be examined more systematically. As shown in this study, students may competently *do* science while receiving limited recognition for it, yet the mechanisms through which this occurs are likely to vary across colleges with different organisational missions, employer partnerships, curriculum models, and progression routes. In other words, comparative research can show whether misrecognition of applied science pathways is systemic or context-specific. Such

work would also extend SC research, which has largely focused on compulsory schooling (Archer et al., 2013a; 2020a), and help identify how accountability regimes, assessment cultures, and funding structures shape which forms of SC are recognised, converted, or marginalised. For instance, comparing FE colleges oriented towards higher education progression with those embedded in employer-led apprenticeships may reveal different recognition regimes operating within science pathways.

A second key direction arises from the study's cross-sectional design and the resulting limitation in understanding how SC develops and is recognised over time. Most SC studies capture a single moment in learners' trajectories, offering limited insight into how confidence, legitimacy, and science identity evolve across educational transitions (Section 2.5.2). This means that we currently lack evidence about how SC unfolds across the critical post-16 period. Longitudinal research tracking FE students from entry through progression into higher education, apprenticeships, or science-related employment would provide a more dynamic account of SC as cumulative, fragile, and context dependent. For instance, following EALS students over time could reveal how shifts in linguistic confidence intersect with changing recognition of their scientific competence. Such approaches would respond directly to Ong et al.'s (2011) call to examine persistence, interruption, and exit within STEM pathways, rather than assuming linear progression.

Closely connected to this is the need for more sustained research into the role of language and multilingualism in shaping scientific recognition. This study demonstrates that English language proficiency operates as a key mediator of assessment, legitimacy, and confidence, yet language remains under-theorised within SC research (Sections 6.4.2(e) and 6.5.2). Future research should therefore focus on how multilingual learners reason scientifically across different modes and contexts, with the aim of disentangling linguistic fluency from scientific understanding. Methodologically, this opens space for research into multimodal assessment approaches, such as oral reasoning, visual explanation, or collaborative problem-solving, which may capture scientific competence more accurately than written English alone (Lee, 2005; Fang, 2006; Estrella et al., 2018). In other words, language should be examined as a dynamic, context-dependent resource rather than a fixed barrier. Comparative research across secondary, FE, and higher education contexts would further

illuminate how shifting linguistic norms across transitions shape science trajectories and recognition practices.

Another gap highlighted by this study relates to educators, professional development, and institutional change. While this research triangulated student and teacher perspectives, it did not examine how recognition-focused practices are developed, embedded, or sustained within the department over time. Future research could therefore explore how educators negotiate recognition-based approaches within curriculum design, assessment practices, and marking cultures, particularly under performative and accountability pressures. For instance, design-based or longitudinal studies could examine how teachers adapt assessment when encouraged to separate scientific reasoning from linguistic accuracy, or how inclusive practices are supported or constrained at departmental level. This means that future research should move beyond identifying what *should* change to understanding how change is enacted, resisted, or sustained within FE institutions.

This study also points to the need for continued expansion of the theoretical and epistemic frameworks used within science capital research. Participants' accounts consistently challenged deficit-oriented interpretations of SC, particularly where culturally embedded, community-based, or transnational knowledge was rendered invisible (Sections 6.5.5 and 6.8.5). Future research should therefore engage more specifically with non-Western, indigenous, and diasporic epistemologies and examine how such knowledge is recognised or marginalised within formal science education. In addition, more detailed intersectional research is required to explore how gender, ethnicity, class, migration history, and language proficiency interact to shape recognition and legitimacy (Crenshaw, 1989, 1991, 1998). While this study adopted an intersectional lens, larger samples or mixed-method designs could further illuminate patterned inequalities without reducing complex experiences to single variables. In other words, future research should continue to challenge narrow definitions of what counts as science and whose knowledge is valued.

Finally, future research should engage more directly with policy and system-level influences on science capital in FE. This study has shown that [mis]recognition is not only institutional

but structurally produced. Studies examining how national qualification frameworks, funding models, and inspection regimes shape recognition practices would therefore complement the institution-level focus of this research. For instance, analysing how Ofsted criteria implicitly privilege certain forms of scientific engagement could make visible policy-level mechanisms of [mis]recognition. Taken together, these future research directions signal the need for a shift from measuring science participation towards examining how [mis]recognition, legitimacy, and epistemic value are produced within and across FE contexts. In other words, advancing equity in post-16 science education requires research that attends to both the structural and epistemic conditions under which science capital is recognised as legitimate.

6.10 Final Reflections and Study Conclusion

In concluding this study, I argue that its contributions converge around a central and necessary shift , which is that inclusive FE science education in the study's context depends not only on learners' participation but on their recognition as legitimate science knowers. The findings showed that many students engaged meaningfully and competently with scientific practices, yet their science capital was not always recognised within institutional norms shaped by language, identity, and assumptions about who "belongs" in science (Archer et al., 2015, p. 12). As Archer et al. (2015, p. 11) emphasise, being seen as a "science person" is not a neutral descriptor but a socially-mediated judgement about legitimacy. This means that doing science is insufficient unless institutions also recognise learners as rightful participants. This study therefore advances a recognition-centred, intersectionally grounded reconceptualisation of science capital that highlights the structural conditions shaping legitimacy in FE science education.

While Archer et al.'s (2012, 2013, 2013a, 2015, 2020a) framework provided a vital foundation, this study demonstrated that its compulsory school-centred assumptions do not fully capture the multilingual, transnational, and intersectionally positioned realities of FE learners in this study's context. Through a Bourdieusian lens, this highlights the need to understand science capital not only as something accumulated but as something that must

be made legitimate and institutionally convertible to matter. By centring student and teacher voices in an under-researched FE context, the study challenges narratives that equate scientific legitimacy with elite linguistic norms or traditional academic pathways. This means that the findings expose the ethical and political implications of treating science capital as a neutral analytic tool, rather than a normative lens that shapes who is imagined as belonging in science.

My positionality as a Black ethnic minority, migrant, EAL academic sharpened my awareness of how misrecognition operates, particularly when students' accounts echoed some of my own negotiations of legitimacy in educational spaces. This reflexive stance raised awareness of how knowledge about equity in science education is produced and why more plural, inclusive ways of knowing are needed. Although the single-site, insider-researcher design limits generalisability, it also enabled a depth of insight that would have been inaccessible through more distanced approaches. This means that the study's methodological constraints also functioned as epistemic strengths, allowing the analysis to remain closely attuned to the lived realities of the FE learners studied.

Overall, this study argues that equitable science pathways require moving decisively beyond deficit or access-only models towards deliberate institutional transformation. Recognition must be actively structured through curriculum design, assessment practices, language policies, and progression guidance. Re-framing science capital as something that must be recognised to matter shifts responsibility away from individual learners and towards the systems that define value, competence, and legitimacy. This means that equity becomes a structural responsibility, not an individual burden.

Ultimately, this thesis offers a recognition-centred, intersectionally grounded reconceptualisation of science capital and calls for a more socially just vision of FE science education, one in which multilingualism, applied knowledge, relational labour, and lived experience are treated as integral components of scientific participation rather than peripheral to it. As FE colleges continue to serve increasingly diverse and intersectionally

positioned learners, the ethical imperative is not simply to widen participation but to ensure that participation is rendered meaningful through recognition.

In other words, the future of equitable FE science education depends on transforming recognition itself. This means that equity cannot be achieved simply by widening access, increasing participation, or encouraging students to engage with science. Instead, institutions should rethink the criteria through which they judge who counts as a legitimate science learner. Recognition should shift from privileging narrow, school-centric, monolingual, and middle-class forms of science capital to valuing the multilingual, applied, relational, and lived forms of knowledge that the FE learners in this study bring. Hence, transforming recognition means re-designing structures, such as, curriculum, assessment, language policies, progression routes, and everyday pedagogical interactions, which determine whose capital is legitimised and whose is overlooked. It requires moving from a model where students must adapt to existing norms to one where institutions adapt to the realities of their learners. Put simply, equitable FE science education will only become possible when recognition is no longer an [un]spoken gatekeeping mechanism but an intentional, inclusive, and structurally embedded practice.

References

Adamuti-Trache, M. and Andres, L. (2008). Embarking on and persisting in scientific fields of study: Cultural capital, gender, and curriculum along the science pipeline. *International journal of science education*, 30(12), 1557–1584. https://doi.org/10.1080/09500690701344966

Addissie, A., Davey, G., Newport, M.J., Addissie, T., MacGregor, H., Feleke, Y. and Farsides, B. (2014). A mixed-methods study on perceptions towards use of Rapid Ethical Assessment to improve informed consent processes for health research in a low-income setting. *BMC medical ethics*, 15(1), 35–46. https://doi.org/10.1186/1472-6939-15-35

Ahmed, S.K. (2024). The pillars of trustworthiness in qualitative research. *Journal of medicine, surgery, and public health*, 2, Article 100051. https://doi.org/10.1016/j.glmedi.2024.100051

Alghamdi, N.A.A. (2024). *Gender and intersectionality: Understanding and addressing women's mental health within the cultural context of Saudi Arabia*. PhD thesis. University of Glasgow.

Amin, M.E.K., Nørgaard, L.S., Cavaco, A.M., Witry, M., Hillman, L., Cernasev, A. and Desselle, S.P. (2020). Establishing trustworthiness and authenticity in qualitative pharmacy research. *Research in social and administrative pharmacy*, 16(10), 1472–1482. https://doi.org/10.1016/j.sapharm.2020.02.005

Archer, L. and Hutchings, M. (2000) 'Bettering yourself'? Discourses of risk, cost and benefit in ethnically diverse, young working-class non-participants' constructions of higher education. British Journal of Sociology of Education, 21(4), pp. 555–574. https://doi.org/10.1080/713655373

Archer, L., DeWitt, J., Osborne, J., Dillon, J., Willis, B. and Wong, B. (2010) Doing science versus being a scientist: Examining 10/11-year-old schoolchildren's constructions of science. Science Education, 94(4), pp. 617–639. https://doi.org/10.1002/sce.20399

Archer, L., DeWitt, J., Osborne, J., Dillon, J., Willis, B. and Wong, B. (2012) Science aspirations, capital, and family habitus: How families shape children's engagement and

identification with science. American Educational Research Journal, 49(5), pp. 881–908. https://doi.org/10.3102/0002831211433290

Archer, L., DeWitt, J., Osborne, J., Dillon, J., Wong, B. and Willis, B. (2013) ASPIRES report: Young people's science and career aspirations, age 10–14. London: King's College London.

Archer, L. and DeWitt, J. (2014a) Science aspirations and gender identity: Lessons from the ASPIRES project. In: Henriksen, E.K., Dillon, J. and Ryder, J. (eds.) Understanding student participation and choice in science and technology education. Dordrecht: Springer, pp. 89–102. https://doi.org/10.1007/978-94-007-7793-4_6

Archer, L., DeWitt, J. and Willis, B. (2014b) Adolescent boys' science aspirations: Masculinity, capital, and power. Journal of Research in Science Teaching, 51(1), pp. 1–30. https://doi.org/10.1002/tea.21122

Archer, L., Dawson, E., DeWitt, J., Seakins, A. and Wong, B. (2015a) Science capital: A conceptual, methodological, and empirical argument for extending Bourdieusian notions of capital beyond the arts. Journal of Research in Science Teaching, 52(7), pp. 922–948. https://doi.org/10.1002/tea.21227

Archer, L., DeWitt, J. and Osborne, J. (2015b) Is science for us? Black students' and parents' views of science and science careers. Science Education, 99(2), pp. 199–237. https://doi.org/10.1002/sce.21146

Archer, L. and DeWitt, J. (2016a) Understanding young people's science aspirations: How students form ideas about 'becoming a scientist'. 1st edn. London: Routledge. https://doi.org/10.4324/9781315761077

Archer, L., Dawson, E., DeWitt, J., Seakins, A. and Wong, B. (2016b) Science Capital Made Clear. London: King's College London.

Archer, L., Dawson, E., DeWitt, J., Godec, S., King, H., Mau, A., Nomikou, E. and Seakins, A. (2017) Killing curiosity? An analysis of celebrated identity performances among teachers and students in nine London secondary science classrooms. Science Education, 101(5), pp. 741–764. https://doi.org/10.1002/sce.21291

Archer, L., Francis, B., Miller, S., Taylor, B., Tereshchenko, A., Mazenod, A., Pepper, D. and Travers, M. (2018) The symbolic violence of setting: A Bourdieusian analysis of mixed methods data on secondary students' views about setting. British Educational Research Journal, 44(1), pp. 119–140. https://doi.org/10.1002/berj.3321

Archer, L., Moote, J. and MacLeod, E. (2020a) Learning that physics is 'not for me': Pedagogic work and the cultivation of habits among advanced level physics students. Journal of the Learning Sciences, 29(3), pp. 347–384. https://doi.org/10.1080/10508406.2020.1723759

Archer, L., Moote, J., MacLeod, E., Francis, B. and DeWitt, J. (2020b) ASPIRES 2: Young people's science and career aspirations, age 10–19. London: UCL Institute of Education.

Archer, L., Dawson, E., DeWitt, J. and Wong, B. (2020c) Equity in science education: The case for a science capital approach. In: Milne, C. et al. (eds.) Equity and science education reform. Cham: Springer. https://doi.org/10.1007/978-3-030-62703-6_2

Archer, L., Moote, J., Francis, B., DeWitt, J. and Yeomans, L. (2020d) The exceptional physics girl: A sociological analysis of multimethod data from young women aged 10–16 to explore gendered patterns of post-16 participation. American Educational Research Journal, 57(1), pp. 168–203. https://doi.org/10.3102/0002831219860519

Archer, L., Moote, J., Francis, B., DeWitt, J. and MacLeod, E. (2020e) The Science Capital Teaching Approach. London: University College London.

Archer, L., Godec, S., Calabrese Barton, A., Dawson, E., Mau, A. and Patel, U. (2021) Changing the field: A Bourdieusian analysis of educational practices that support equitable outcomes among minoritized youth on two informal science learning programs. Science Education, 105(1), pp. 166–203. https://doi.org/10.1002/sce.21606

Archibald, M.M., Ambagtsheer, R.C., Casey, M.G. and Lawless, M. (2019). Using Zoom for qualitative data collection. *International journal of qualitative methods*, 18, 1–8. https://doi.org/10.1177/1609406919874596

Asaram, L.S. (2023). Technology advancements: The pros and cons. *Engineering Institute of Technology*. Available at: https://www.eit.edu.au/technology-advancements-the-pros-and-cons/ [Accessed 22 February 2025].

Association of Colleges (2019). *College key facts 2019/20*. Available at: https://www.aoc.co.uk/sites/default/files/AoC%20College%20Key%20Facts%202019-20.pdf [Accessed 10 June 2025].

Augar, P. (2019) Independent panel report to the Review of Post-18 Education and Funding. London: HM Government.

Balta, N., Japashov, N., Mansurova, A., Tzafilkou, K., Oliveira, A.W. and Lathrop, R. (2023). Middle- and secondary-school students' STEM career interest and its relationship to gender, grades, and family size in Kazakhstan. *Science education*, 107, 401–426. https://doi.org/10.1002/sce.21763

Bang, M. and Medin, D. (2010). Cultural processes in science education: Supporting the navigation of multiple epistemologies. *Science education*, 94(6), 1008–1026. https://doi.org/10.1002/sce.20392

Basit, T.N. (2013). Ethics, reflexivity, and access in educational research: Issues in intergenerational investigation. *Research papers in education*, 28(4), 506–517. https://doi.org/10.1080/02671522.2012.762585

Basu, S.J. and Barton, A.C. (2007). Developing a sustained interest in science among urban minority youth. *Journal of research in science teaching*, 44(3), 466–489. https://doi.org/10.1002/tea.20143

Berger, R. (2013). Now I see it, now I don't: Researcher's position and reflexivity in qualitative research. *Qualitative research*, 15(2), 219–234. https://doi.org/10.1177/1468794112468475

Berner-Rodoreda, A., Bärnighausen, T., Kennedy, C., Brinkmann, S., Sarker, M., Wikler, D., Eyal, N. and McMahon, S.A. (2020). From doxastic to epistemic: A typology and critique of qualitative interview styles. *Qualitative inquiry*, 26(3–4), 291–305. https://doi.org/10.1177/1077800419868507

Bielinis, E. (2019). Gender, diversity and intersectionality in adult education: A critical review. *Studies in the education of adults*, 51(2), 213–229. https://doi.org/10.1080/02660830.2019.1616332

Bilen, S. (2024). *Faith, gender and science identity: An ethnographic study of Muslim students in London FE colleges*. Doctoral thesis. UCL Institute of Education.

Black, L. and Hernandez-Martinez, P. (2016). Re-thinking science capital: The role of 'capital' and 'identity' in mediating students' engagement with mathematically demanding programmes at university. *Teaching mathematics and its applications*, 35(3), 131–143. https://doi.org/10.1093/teamat/hrw016

Bloomberg, L.D. (2022).*Completing your qualitative dissertation*. 5th ed. Thousand Oaks, CA: SAGE Publications.

Blumer, H. (1954). What is wrong with social theory? *American sociological review*, 19(1), 3–10. https://doi.org/10.2307/2088165

Blumer, H. (2006). What is wrong with social theory? In: *Sociological methods*. London: Routledge, 84–95.

Boliver, V. and Capsada-Munsech, Q. (2024). Intergenerational inequality in education. In: Kilpi-Jakonen, E., Blanden, J., Erola, J. and Macmillan, L. (eds.) *Research handbook on intergenerational inequality*. Cheltenham: Edward Elgar Publishing, 13–26. https://doi.org/10.4337/9781800888265.00009

Bourdieu, P. (1977). *Outline of a theory of practice*. Translated by R. Nice. Cambridge: Cambridge University Press.

Bourdieu, P. (1977a). Frontmatter. In: Nice, R. (trans.) *Outline of a theory of practice*. Cambridge: Cambridge University Press, i–iv.

Bourdieu, P. (1977b). Structures and the habitus. In: Nice, R. (trans.) *Outline of a theory of practice*. Cambridge: Cambridge University Press, 72–95.

Bourdieu, P. (1977c). Structures, habitus, power: Basis for a theory of symbolic power. In: Nice, R. (trans.) *Outline of a theory of practice*. Cambridge: Cambridge University Press, 159–197.

Bourdieu, P. (1977d). Cultural reproduction and social reproduction. In: Karabel, J. and Halsey, A.H. (eds.) *Power and ideology in education*. New York: Oxford University Press, 487–511.

Bourdieu, P. (1984). *Distinction: A social critique of the judgement of taste*. Cambridge, MA: Harvard University Press.

Bourdieu, P. (1986) 'The forms of capital', in Richardson, J.G. (ed.) Handbook of Theory and Research for the Sociology of Education. New York: Greenwood, pp. 241–258.

Bourdieu, P. (1989). Social space and symbolic power. *Sociological theory*, 7(1), 14–25. https://doi.org/10.2307/202060

Bourdieu, P. (1990). Structures, habitus, practices. In: *The logic of practice*. Cambridge: Polity Press, 52–65.

Bourdieu, P. (1995). *Outline of a theory of practice*. Translated by R. Nice. Cambridge: Cambridge University Press.

Bourdieu, P. and Passeron, J. (1990). *Reproduction in education, society and culture*. 2nd ed. Thousand Oaks, CA: SAGE Publications.

Bourdieu, P. and Wacquant, L. (1992). *An invitation to reflexive sociology*. Cambridge: Polity Press.

Boyatzis, R. (1998). *Transforming qualitative information: Thematic analysis and code development*. Thousand Oaks, CA: SAGE Publications.

Bowen, G.A. (2006). Grounded theory and sensitising concepts. *International journal of qualitative methods*, 5, 12–23. https://doi.org/10.1177/160940690600500304

Bowen, G.A. (2019). Sensitising concepts. In: *SAGE research methods foundations*. London: SAGE Publications. https://doi.org/10.4135/9781526421036

Braun, V. and Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology*, 3(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Braun, V. and Clarke, V. (2013). *Successful qualitative research: A practical guide for beginners*. London: SAGE Publications.

Braun, V. and Clarke, V. (2016). (Mis)conceptualising themes, thematic analysis, and other problems with Fugard and Potts' (2015) sample-size tool for thematic analysis. *International journal of social research methodology*, 19(6), 739–743. https://doi.org/10.1080/13645579.2016.1195588

Braun, V. and Clarke, V. (2019). Reflecting on reflexive thematic analysis. *Qualitative research in sport, exercise and health*, 11(4), 589–597. https://doi.org/10.1080/2159676X.2019.1628806

Braun, V. and Clarke, V. (2021) Thematic Analysis: A Practical Guide. London: Sage.

Braun, V. and Clarke, V. (2020). One size fits all? What counts as quality practice in (reflexive) thematic analysis? *Qualitative research in psychology*, 18(3), 328–352. https://doi.org/10.1080/14780887.2020.1769238

Braun, V. and Clarke, V. (2022). Conceptual and design thinking for thematic analysis. *Qualitative psychology*, 9(1), 3–26. https://doi.org/10.1037/qup0000196

Braun, V., Clarke, V., Hayfield, N. and Terry, G. (2019a). Answers to frequently asked questions about thematic analysis. Available at: https://cdn.auckland.ac.nz/assets/psych/about/ourresearch/documents/Answers%20to%20frequently%20asked%20questions%20about%20thematic%20analysis%20April%202019.pdf [Accessed 8 September 2025].

Braun, V., Clarke, V., Hayfield, N. and Terry, G. (2019b). Thematic analysis. In: Liamputtong, P. (ed.) *Handbook of research methods in health social sciences*. Singapore: Springer, 843–860. https://doi.org/10.1007/978-981-10-5251-4_103

Braun, V. and Clarke, V. (2024) Conceptual and reflexive thematic analysis: Expanding the scope of qualitative analysis. Qualitative Research in Psychology, 21(1), pp. 1–17. Brauhttps://doi.org/10.1080/14780887.2023.2265785

Bright, L.K., Malinsky, D. and Thompson, M. (2016). Causally interpreting intersectionality theory. *Philosophy of science*, 83(1), 60–81. https://doi.org/10.1086/684173

Brinkmann, S. (2014). Unstructured and semi-structured interviews. In: Leavy, P. (ed.) *The Oxford handbook of qualitative research*. Oxford: Oxford University Press, 277–299.

Brinkmann, S. and Kvale, S. (2018). Planning an interview study. In: *Doing interviews*. London: SAGE Publications, 39–56.

Brinkmann, S. and Kvale, S. (2018b). Epistemological issues of interviewing. In: *Epistemological issues of interviewing*. 2nd ed. London: SAGE Publications, 13–26. https://doi.org/10.4135/9781529716665.n2

Broady, D. (2014). Capital: Cultural, symbolic and social. In: *Encyclopaedia of educational theory and philosophy*, 99–102. Available at: http://ai-makurdi.org/wp-

content/uploads/2020/05/98.-Encyclopedia-of-Educational-Theory-and-Philosophy-by-D.-Denis-C.-Phillips-2.pdf [Accessed 30 June 2023].

Burge, A., Maxwell, E. and Tait, A.J. (2018). Intersectionality. In: Robertson, J., Williams, A., Jones, D., Isbel, L. and Loads, D. (eds.) *Equality: Gender equality in higher education*. Leiden: Brill, 85–88.

Bush, A.A. and Amechi, M.H. (2019). Conducting and presenting qualitative research in pharmacy education. *Currents in pharmacy teaching and learning*, 11(6), 638–650. https://doi.org/10.1016/j.cptl.2019.02.030

Cabinet Office (2024). *Civil service equality, diversity and inclusion expenditure guidance*. Available at: https://www.gov.uk/government/publications/civil-service-equality-diversity-and-inclusion-expenditure-guidance/civil-service-equality-diversity-and-inclusion-expenditure-guidance [Accessed 3 August 2025].

Cabinet Office (2025). Socioeconomic status. *Ethnicity facts and figures*. Available at: https://www.ethnicity-facts-figures.service.gov.uk/uk-population-by-ethnicity/demographics/socioeconomic-status/latest [Accessed 3 August 2025].

Carlone, H.B. (2006). Science education for everyday life: Evidence-based practice. *Science education*, 90, 1144–1146. https://doi.org/10.1002/sce.20179

Carlone, H.B. and Johnson, A. (2007). Understanding the science experiences of successful women of colour. *Journal of research in science teaching*, 44, 1187–1218. https://doi.org/10.1002/tea.20237

Carlone, H.B., Johnson, A. and Scott, C.M. (2014). Agency amidst formidable structures: How girls perform gender in science class. *Journal of research in science teaching*, 51(7), 835–861. https://doi.org/10.1002/tea.21150

Cartwright, A. (2022). A theory of racialised cultural capital. *Sociological inquiry*, 92, 317–340. https://doi.org/10.1111/soin.12468

Ceglie, R. (2021). Science faculty's support for underrepresented students: Building science capital. *International journal of science and mathematics education*, 19(4), 661–679. https://doi.org/10.1007/s10763-020-10090-1

Chan, R.C. (2022). A social cognitive perspective on gender disparities in self-efficacy, interest, and aspirations in STEM: The influence of cultural and gender norms. *International journal of STEM education*, 9(1), 1–13. https://doi.org/10.1186/s40594-022-00353-0

Charmaz, K. (2014). *Constructing grounded theory*. London: SAGE Publications.

Chauca, A., Ortiz, C. and López, J. (2023). Implementation of content and language integrated learning methodological guide to improve learning of science in English. *Ciencia Latina revista científica multidisciplinar*, 7(5), 6837–6860. https://doi.org/10.37811/cl_rcm.v7i5.1761

Chigeza, P. (2011). Cultural resources of minority and marginalised students should be included in the school science curriculum. *Cultural studies of science education*, 6(2), 401–412. https://doi.org/10.1007/s11422-010-9286-0

Chng, E.H.S. and Tan, T.T.M. (2024). Informal learning of science at science centres and museums: Perspectives, influences, and issues. In: Ong, Y.S., Tan, T.T.M. and Lee, Y.J. (eds.) *A diversity of pathways through science education*. Singapore: Springer. https://doi.org/10.1007/978-981-97-2607-3_13

Cho, S., Crenshaw, K.W. and McCall, L. (2013). Towards a field of intersectionality studies: Theory, applications, and praxis. *Signs*, 38(4), 785–810. https://doi.org/10.1086/669608

Christiansen, C.C. (2004). News consumption among immigrants in Europe: The relevance of ethnic media. *European journal of communication*, 19(3), 291–314. https://doi.org/10.1177/0267323104019003002

Christidou, D., Papavlasopoulou, S. and Giannakos, M. (2021). Using the lens of science capital to capture and explore children's attitudes towards science in an informal making-based space. *Information and learning sciences*, 122(5–6), 317–340. https://doi.org/10.1108/ILS-08-2020-0185

Clarke, V. and Braun, V. (2019). Guidelines for reviewers and editors evaluating thematic analysis manuscripts. Available at: https://cdn.auckland.ac.nz/assets/psych/about/ourresearch/documents/TA%20website%20update%2010.8.17%20review%20checklist.pdf [Accessed 8 September 2025].

Claussen, S. and Osborne, J. (2013). Bourdieu's notion of cultural capital and its implications for the science curriculum. *Science education*, 97(1), 58–79. https://doi.org/10.1002/sce.21040

Cobian, K.P., Hurtado, S., Romero, A.L. and Gutzwa, J.A. (2024). Enacting inclusive science: Culturally responsive higher education practices in STEMM. *PLOS ONE*, 19(1), e0293953, 1–27. https://doi.org/10.1371/journal.pone.0293953

Codiroli McMaster, N. (2017). Who studies STEM subjects at A level and degree in England? An investigation into the intersections between students' family background, gender and ethnicity in determining choice. *British educational research journal*, 43(3), 528–553.

Cohen, L., Manion, L. and Morrison, K.R.B. (2017). *Research methods in education*. 8th ed. London: Routledge.

Cohen, L., Manion, L. and Morrison, K.R.B. (2018). *Research methods in education*. 9th ed. London: Routledge.

College Ofsted Reports (2011; 2020; 2022) Further Education inspection reports. [Internal reports]. London: Office for Standards in Education, Children's Services and Skills (Ofsted).

College Self-Assessment Report (SAR). College Self-Assessment Report (2024/25) Self-Assessment Report. [Internal institutional document]. London: Further Education College.

Collins, P.H. (2015). Intersectionality's definitional dilemmas. *Annual review of sociology*, 41, 1–20. https://doi.org/10.1146/annurev-soc-073014-112142

Confraria, H., Mira Godinho, M. and Wang, L. (2016). Determinants of citation impact: A comparative analysis of the Global South versus the Global North. *UNU-MERIT working papers*, No. 029. Maastricht: UNU-MERIT.

Crenshaw, K. (1989). Demarginalizing the intersection of race and sex: A Black feminist critique of antidiscrimination doctrine, feminist theory and antiracist politics. *University of Chicago legal forum*, 1989(1), 139–167. Available at: https://chicagounbound.uchicago.edu/uclf/vol1989/iss1/8

Crenshaw, K. (1991). Mapping the margins: Intersectionality, identity politics, and violence against women of colour. *Stanford law review*, 43(6), 1241–1299. https://doi.org/10.2307/1229039

Crenshaw, K. (1998). Demarginalising the intersection of race and sex: A Black feminist critique of antidiscrimination doctrine, feminist theory, and antiracist politics. In: Phillips, A. (ed.) *Feminism and politics*. Oxford: Oxford University Press. https://doi.org/10.1093/oso/9780198782063.003.0016 [Accessed 17 February 2024].

Creswell, J.W. and Creswell, J.D. (2018). *Research design: Qualitative, quantitative and mixed methods approaches*. London: SAGE Publications.

Creswell, J.W. and Poth, C.N. (2018). *Qualitative inquiry and research design: Choosing among five approaches*. 4th ed. Thousand Oaks, CA: SAGE Publications.

Crozier, G., Reay, D. and Clayton, J. (2019). Working the borderlands: Working-class students constructing hybrid identities and asserting their place in higher education. *British journal of sociology of education*, 40(7), 922–937. https://doi.org/10.1080/01425692.2019.1604208

Cuádraz, G.H. and Uttal, L. (1999). Intersectionality and in-depth interviews: Methodological strategies for analysing race, class, and gender. *Race, gender & class*, 6(3), 156–186.

Dale, R. and Robertson, S.L. (2004a). Interview with Boaventura de Sousa Santos. *Globalisation, societies and education*, 2(2), 147–160. https://doi.org/10.1080/1476772042000224662

Dale, R. and Robertson, S.L. (2004b). The globalisation agenda and the politics of education. In: Phillips, R. and Schweisfurth, J. (eds.) *Comparative and international education: An introduction to theory, method and practice*. London: Continuum, 43–66.

Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B. and Osher, D. (2020). Implications for educational practice of the science of learning and development. *Applied developmental science*, 24(2), 97–140. https://doi.org/10.1080/10888691.2018.1537791

Dawson M. and Hughes, N. (2014). *Doing a successful research project*. Basingstoke: Palgrave Macmillan.

Davies, S. and Rizk, J. (2017). The three generations of cultural capital research: A narrative review. *Review of educational research*, 88(3), 331–365. https://doi.org/10.3102/0034654317748423

Dawson, E. (2014). Not designed for us: How science museums and science centres socially exclude low-income minority ethnic groups. *Science education*, 98(6), 981–1008. https://doi.org/10.1002/sce.21133

Delaney, J.M. and Devereux, P.J. (2019). Understanding gender differences in STEM: Evidence from college applications. *Economics of education review*, 72, 219–238. https://doi.org/10.1016/j.econedurev.2019.07.002

Delgado, R., Stefancic, J. and Harris, A. (2017). Introduction. In: *Critical race theory: An introduction*. 3rd ed. New York: NYU Press, 1–18.

Denzin, N.K. (2011). The discipline and practice of qualitative research. In: Denzin, N.K. and Lincoln, Y.S. (eds.) *The SAGE handbook of qualitative research*. 4th ed. Thousand Oaks, CA: SAGE Publications, 1–20.

Denzin, N.K. and Lincoln, Y.S. (2005). Introduction: The discipline and practice of qualitative research. In: Denzin, N.K. and Lincoln, Y.S. (eds.) *The SAGE handbook of qualitative research*. Thousand Oaks, CA: SAGE Publications, 1–32.

Denzin, N.K. and Lincoln, Y.S. (2023). *The SAGE handbook of qualitative research*. 6th ed. Thousand Oaks, CA: SAGE Publications.

Department for Education (DfE) (2014). *SEND: Guide for further education providers*. Available at: https://www.gov.uk/government/publications/send-guide-for-further-education-providers [Accessed 9 September 2025].

Department for Education (DfE) (2016). *Participation of young people in education, employment or training: Statutory guidance for local authorities*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/561546/Participation-of-young-people-in-education-employment-or-training.pdf [Accessed 8 June 2025].

Department for Education (DfE) (2016a). *Post-16 skills plan and independent report on technical education*. Available at: https://www.gov.uk/government/publications/post-16-skills-plan-and-independent-report-on-technical-education [Accessed 11 July 2025].

Department for Education (DfE) (2016b). Growing support for Government's Post-16 Skills Plan for technical education reform. *The Education Hub*. Available at: https://educationhub.blog.gov.uk/2016/07/growing-support-for-governments-post-16-skills-plan-for-technical-education-reform [Accessed 11 July 2025].

Department for Education (DfE) (2018). *Barriers to learning for disadvantaged groups: Report of qualitative findings*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/735453/Barriers_to_learning_-_Qualitative_report.pdf [Accessed 25 June 2021].

Department for Education (DfE) (2019a). *Realising the potential of technology in education*. Available at: https://www.gov.uk/government/publications/realising-the-potential-of-technology-in-education [Accessed 12 July 2025].

Department for Education (DfE) (2019b). *Teacher recruitment and retention strategy*. Available at: https://www.gov.uk/government/publications/teacher-recruitment-and-retention-strategy [Accessed 12 July 2025].

Department for Education (DfE) (2023). *Sustainability and climate change: A strategy for the education and children's services systems*. Available at: https://www.gov.uk/government/publications/sustainability-and-climate-change-strategy/sustainability-and-climate-change-a-strategy-for-the-education-and-childrens-services-systems [Accessed 12 July 2025].

Department for Education (DfE) (2023a). *Post-16 skills plan and technical education reform*. Available at: https://www.gov.uk/government/publications/post-16-skills-plan-and-independent-report-on-technical-education [Accessed 10 July 2025].

Department for Education (DfE) (2023b). *Introduction of T Levels*. Available at: https://www.gov.uk/government/publications/introduction-of-t-levels/introduction-of-t-levels [Accessed 11 July 2025].

Department for Education (DfE) (2024a). *The Advanced British Standard: A new approach to 16–19 education*. Available at: https://www.gov.uk/government/publications/a-world-class-education-system-the-advanced-british-standard [Accessed 10 July 2025].

Department for Education (DfE) (2024b). *Local skills improvement plans (LSIPs) and strategic development funding (SDF)*. Available at: https://www.gov.uk/government/publications/identifying-and-meeting-local-skills-needs-to-support-growth/local-skills-improvement-plans-lsips-and-strategic-development-funding-sdf [Accessed 12 July 2025].

Department for Education (2025a). *Lifelong Learning Entitlement (LLE): Overview*. Available at: https://www.gov.uk/government/publications/lifelong-learning-entitlement-lle-overview [Accessed 10 July 2025].

Department for Education (DfE) (2025b). *DfE update: Further education, 30 April 2025*. Available at: https://www.gov.uk/government/publications/dfe-update-30-april-2025/dfe-update-further-education-30-april-2025 [Accessed 9 September 2025].

Department for Education (2025c). *Apprenticeship funding rules 2025 to 2026: Summary of changes*. Available at: https://assets.publishing.service.gov.uk/media/682479dc7293a87b6c75ebf9/Apprenticeship_funding_rules_2025_to_2026_-_summary_of_changes.pdf [Accessed 12 July 2025].

Department for Education (DfE) (2025d). *Widening participation in higher education: Academic year 2023/24*. Available at: https://explore-education-statistics.service.gov.uk/find-statistics/widening-participation-in-higher-education/2023-24 [Accessed 14 September 2025].

Department for Science, Innovation and Technology (DSIT) (2024). Government backs UK R&D with record £20.4 billion investment at Autumn Budget. Available at: https://www.gov.uk/government/news/government-backs-uk-rd-with-record-204-billion-investment-at-autumn-budget [Accessed 12 July 2025].

Department for Science, Innovation and Technology, HM Treasury, Reeves, R. and Kyle, P. (2025a). Transformative £86 billion boost to science and tech to turbocharge economy. Available at: https://www.gov.uk/government/news/transformative-86-billion-boost-to-

science-and-tech-to-turbocharge-economy-with-regions-backed-to-take-cutting-edge-research-into-own-hands [Accessed 12 July 2025].

Department for Science, Innovation and Technology (DSIT) (2025b). *Science and technology framework*. Available at: https://www.gov.uk/government/publications/science-and-technology-framework/science-and-technology-framework [Accessed 11 July 2025].

Deuze, M. (2006). Ethnic media, community media and participatory culture. *Journalism*, 7(3), 262–280. https://doi.org/10.1177/1464884906065512

DeWitt, J. and Archer, L. (2015). Who aspires to a science career? A comparison of survey responses from primary and secondary school students. *International journal of science education*, 37(13), 2170–2192. https://doi.org/10.1080/09500693.2015.1077225

DeWitt, J. and Archer, L. (2017). Participation in informal science learning experiences: The rich get richer? *International journal of science education, part B*, 7(4), 356–373. https://doi.org/10.1080/21548455.2017.1360531

DeWitt, J., Archer, L. and Mau, A. (2016). Dimensions of science capital: Exploring its potential for understanding students' science participation. *International journal of science education*, 38(16), 2431–2449. https://doi.org/10.1080/09500693.2016.1248520

DeWitt, J., Archer, L. and Osborne, J. (2014). Science-related aspirations across the primary–secondary divide: Evidence from two surveys in England. *International journal of science education*, 36(10), 1609–1629. https://doi.org/10.1080/09500693.2013.871659

DeWitt, J., Archer, L., Osborne, J., Dillon, J., Willis, B. and Wong, B. (2010). High aspirations but low progression: The science aspirations–careers paradox amongst minority ethnic students. *International journal of science and mathematics education*, 9(2), 243–271. https://doi.org/10.1007/s10763-010-9245-0

DeWitt, J., Nomikou, E. and Godec, S. (2019). Recognising and valuing student engagement in science museums. *Museum management and curatorship*, 34(2), 183–200. https://doi.org/10.1080/09647775.2018.1514276

DeWitt, J., Osborne, J., Archer, L., Dillon, J., Willis, B. and Wong, B. (2013). Young children's aspirations in science: The unequivocal, the uncertain and the unthinkable. *International journal of science education*, 35(6), 1037–1063.

Diekman, A.B., Steinberg, M., Brown, E.R., Belanger, A.L. and Clark, E.K. (2017). A goal congruity model of role entry, engagement, and exit: Understanding communal goal processes in STEM gender gaps. *Personality and social psychology review*, 21(2), 142–175. https://doi.org/10.1177/1088868316642141

Dixon, T.L. and Azocar, C.L. (2006). The representation of juvenile offenders by race on television news. *Journal of broadcasting and electronic media*, 50(4), 646–663. https://doi.org/10.1207/s15506878jobem5004_2

Dong, X. and McIntyre, S.H. (2014). The second machine age: Work, progress, and prosperity in a time of brilliant technologies. *Quantitative finance*, 14(11), 1895–1896. https://doi.org/10.1080/14697688.2014.968356

Drisko, J.W. (2025). Transferability and generalisation in qualitative research. *Research on social work practice*, 35(1), 102–110. https://doi.org/10.1177/10497315241234567

Du, X. and Wong, B. (2019). Science career aspiration and science capital in China and UK: A comparative study using PISA data. *International journal of science education*, 41(15), 2136–2155. https://doi.org/10.1080/09500693.2019.1655214

Dunne, M., Pryor, J. and Yates, P. (2005). *Becoming a researcher: A research companion for the social sciences*. Maidenhead: Open University Press.

Education Council (2015). *National STEM school education strategy 2016–2026*. Australia: Education Council.

Elshakry, M. (2010). When science became Western: Historiographical reflections. *Isis*, 101(1), 98–109. https://doi.org/10.1086/652689

Ennes, M.E., Jones, M.G., Childers, G.M., Cayton, E.M. and Chesnutt, K.M. (2022). Children and parents' perceptions of access to science tools at home and their role in science self-efficacy. *Research in science education*, 54, 1–17. https://doi.org/10.1007/s11165-021-10017-4

Essex, J. and Haxton, K. (2018). Characterising patterns of engagement of different participants in a public STEM-based analysis project. *International journal of science education, part B*, 8(4), 1–15. https://doi.org/10.1080/21548455.2018.1506185

Esposito, R.P., McAdoo, H. and Scher, L. (1978). The Johari Window Test: A research note. *Journal of humanistic psychology*, 18(1), 79–81. https://doi.org/10.1177/002216787801800108

Estrella, G., Au, J., Jaeggi, S.M. and Collins, P. (2018). Is inquiry science instruction effective for English language learners? A meta-analytic review. *AERA open*, 4(2), 1–23. https://doi.org/10.1177/2332858418767689

EU STEM Coalition (2020). In-depth interview with Commissioner Mariya Gabriel on the participation of women in STEM and ICT. Available at: https://www.stemcoalition.eu/publications/depth-interview-commissioner-mariya-gabriel-participation-women-stem-and-ict/ [Accessed 12 July 2025].

Evagorou, M., Puig, B., Bayram, D. and Janeckova, H. (2024). Addressing the gender gap in STEM education across educational levels. *NESET report*. Luxembourg: Publications Office of the European Union. https://doi.org/10.2766/260477

Fang, Z. (2006). The language demands of science reading in middle school. *International journal of science education*, 28(5), 491–520. https://doi.org/10.1080/09500690500339092

Farrell, K. (2023). *Navigating intersectionality in STEM: University of Glasgow EDI reflections*. Available at: University of Glasgow – College of Science and Engineering – Equality, Diversity and Inclusion – News – Katie Farrell. [Accessed 12 July 2025].

Fatima, Z. and Mahmood, A. (2024). Striking a balance: Navigating ethical complexity in healthcare: A reply to Mandal, Jhana; Ponnambath, Dinoop Korol; Parija, Subhash Chandra. *MEJAST*, 7(02), 1–3. https://doi.org/10.46431/mejast.2024.7201

Finlay, L. and Gough, B. (2008). *Reflexivity: A practical guide for researchers in health and social sciences*. Oxford: Blackwell Publishing.

Financial Conduct Authority (FCA) (2021). *Review of research literature that provides evidence of the impact of diversity and inclusion in the workplace*. [Accessed 3 August 2025].

Flick, U. (2022). *An introduction to qualitative research*. 7th ed. London: SAGE Publications Ltd.

Fischer, A., Havu-Nuutinen, S., Kontkanen, S. and Suortti, E. (2024). Investigating sustainability education in the science capital teaching approach: Competence development and pillar considerations. *Interdisciplinary journal of environmental and science education*, 20(4), 1–118. https://doi.org/10.29333/ijese/xxxx

Foucault, M. (2003). Truth and power. In: Read, B. (2024). Gender equity in academic knowledge production: The influence of politics, power and precarity. *European educational research journal*, 24(3), 394–407.

Foote, M. and Bartell, T. (2011). Pathways to equity in mathematics education: How life experiences impact researcher positionality. *Educational studies in mathematics*, 78(1), 45–68. https://doi.org/10.1007/s10649-011-9309-2

Francis, B., Archer, L., Moote, J., DeWitt, J., MacLeod, E. and Yeomans, L. (2017). The construction of physics as a quintessentially masculine subject: Young people's perceptions of gender issues in access to physics. *Sex roles*, 76(3–4), 156–174. https://doi.org/10.1007/s11199-016-0669-z

Frith, H. and Gleeson, K. (2004). Clothing and embodiment: Men managing body image and appearance. *Psychology of men and masculinity*, 5, 40–48. https://doi.org/10.1037/1524-9220.5.1.40

Galatians 3:28. Holy Bible. New International Version. Available at: https://www.biblegateway.com/passage/?search=galatians%203:28&version=NIV/ [Accessed 8 September 2025].

Gauchat, G. (2015). The political context of science in the United States: Public acceptance of evidence-based policy and science funding. *Social forces*, 94(2), 723–746. https://doi.org/10.1093/sf/sov046

Giroux, H. (1983). Theories of reproduction and resistance in the new sociology of education: A critical analysis. *Harvard educational review*, 53(3), 257–293. https://doi.org/10.17763/haer.53.3.a67x1p5h1t2p2w3w

Glaze, A.L. (2018). Building science capital in the classroom. *School science review*, 100(371), 45–52.

Glaze, A.L. (2018b). Science capital: A new perspective for science education. *Canadian journal of science, mathematics and technology education*, 18(3), 204–216. https://doi.org/10.1080/14926156.2018.1481809

Given, L.M. (2008). *The SAGE encyclopaedia of qualitative research methods*. Vol. 1. Thousand Oaks, CA: SAGE Publications, Inc. Available at: https://doi.org/10.4135/9781412963909 [Accessed 12 June 2025].

Godec, S., King, H.C. and Archer, L. (2017). *The science capital teaching approach: Engaging students with science, promoting social justice*. London: University College London Press.

Godec, S., King, H.C. and Archer, L. (2018). The science aspirations–capital gap: What's to be done? *Science education*, 102(1), 73–105. https://doi.org/10.1002/sce.21320

Godec, S., King, H. and Archer, L. (2024). Science capital and STEM identity: Exploring the relationship in university participation. *British journal of sociology of education*, 45(2), 215–233. https://doi.org/10.1080/01425692.2023.2261234

Godec, S., Archer, L., Moote, J., Watson, E., DeWitt, J., Henderson, M. and Francis, B. (2024). A missing piece of the puzzle? Exploring whether science capital and STEM identity are associated with STEM study at university. *International journal of science and mathematics education*, 22, 1615–1636. https://doi.org/10.1007/s10763-023-10394-2

Godec, S., King, H., Archer, L., Dawson, E. and Seakins, A. (2018). Examining student engagement with science through a Bourdieusian notion of field. *Science and education*, 27, 501–521. https://doi.org/10.1007/s11191-018-9991-8

GOV.UK (2015). 2010 to 2015 government policy: Public understanding of science and engineering. Available at: https://www.gov.uk/government/publications/2010-to-2015-government-policy-public-understanding-of-science-and-engineering/ [Accessed 09 July 2025].

GOV.UK (2021a) Further education funding. London: UK Government. Available at:

https://www.gov.uk/guidance/further-education-funding [Accessed: 12 July 2025].

GOV.UK (2021b). *Early years foundation stage (EYFS) statutory framework*. Available at: https://www.gov.uk/government/publications/early-years-foundation-stage-framework--2/ [Accessed 06 September 2025].

GOV.UK (2025) Further education. London: UK Government. Available at: https://www.gov.uk/further-education-courses [Accessed: 12 July 2024].

Goldberg, J. (2017). The politicisation of scientific issues: Looking through Galileo's lens or through the imaginary looking glass. *Skeptical inquirer*, 41(5), 34–39.

Gonsalves, A.J. (2018). Gender, culture, and science identity: Indian and Indian-origin women choosing STEM in college. *Journal of women and minorities in science and engineering*, 24(1), 1–24.

Gonsalves, A.J., Cavalcante, A.S., Sprowls, E.D. and Iacono, H. (2021)."Anybody can do science if they're brave enough": Understanding the role of science capital in science majors' identity trajectories into and through postsecondary science. *Journal of research in science teaching*, 58(8), 1117–1151.

Gormally, S. and Coburn, A. (2014). Finding nexus: Connecting youth work and research practices. *British educational research journal*, 40, 869–885.

Gray, L.M., Wong-Wylie, G., Rempel, G.R. and Cook, K. (2020). Expanding qualitative research interviewing strategies: Zoom Video Communications. *The qualitative report*, 25(5), 1292–1301.

Grenfell, M. (2009). Applying Bourdieu's field theory: The case of social capital and education. *Education, knowledge and economy*, 3(1), 17–34.

Greenhow, C., Gibbins, T. and Menzer, M.M. (2015). Re-thinking scientific literacy out-of-school: Arguing science issues in a niche Facebook application. *Computers in human behaviour*, 53, 593–604.

Grimalt-Álvaro, C., Couso, D., Boixadera-Planas, E. and Godec, S. (2022). "I see myself as a STEM person": Exploring high school students' self-identification with STEM. *Journal of research in science teaching*, 59(5), 720–745.

Guba, E.G. (1981). Criteria for assessing the trustworthiness of naturalistic inquiries. *Educational technology research and development*, 29, 75–91.

Guba, E.G. and Lincoln, Y.S. (1994). Competing paradigms in qualitative research. In: Denzin, N.K. and Lincoln, Y.S. (eds.) *Handbook of qualitative research*. Thousand Oaks, CA: SAGE, 105–117.

Gumbo, M., Nnadi, F. and Anamezie, R. (2021). Amalgamating Western science and African Indigenous Knowledge Systems in the measurement of gravitational acceleration. *Journal of Baltic science education*, 20(5), 729–739.

Habig, B., Gupta, P. and Adams, J.D. (2021). Disrupting deficit narratives in informal science education: Applying community cultural wealth theory to youth learning and engagement. *Cultural studies of science education*, 16, 509–548.

Hang, Y. and Zhang, X. (2024). A systematic review of students' habitus in the higher education field: Challenge and resilience. *Studies in higher education*, 50(4), 790–807.

Hansson, L. and Yacoubian, H.A. (2020). Nature of science for social justice: Why, what and how? In: Haq, H.A. and Hansson, L. (eds.) *Nature of science for social justice*. Science: Philosophy, History and Education. Cham: Springer, 1–18.

Haq, Z., Rasheed, R., Rashid, A. and Akhter, S. (2023). Criteria for assessing and ensuring the trustworthiness in qualitative research. *International journal of business reflections*, 4(2), 150–173.

Hayes, N. (1997). Theory-led thematic analysis: Social identification in small companies. In: Hayes, N. (ed.) *Doing qualitative analysis in psychology*. Hove: Psychology Press.

Hazari, Z., Sadler, P.M. and Sonnert, G. (2013). The science identity of college students: Exploring the intersection of gender, race, and ethnicity. *Journal of college science teaching*, 42(5), 82–91.

Hecht, M. (2021). Creating cultural refugia to transform the boundaries of science. *Cultural studies of science education*, 16, 549–556.

Henriksen, E.K., Dillon, J. and Ryder, J. (2015). *Understanding student participation and choice in science and technology education*. Dordrecht: Springer.

Holmes, A.G. (2020). Researcher positionality – A consideration of its influence and place in qualitative research – A new researcher guide. *Shanlax international journal of education*, 8(4), 1–10.

Hopkins, P. (2007). Positionalities and knowledge: Negotiating ethics in practice. *ACME: An international journal for critical geographies*, 6(3), 386–394.

Hopkins, P., Pande, R., Ali, N., Chambers, C. and Phillips, R. (2022). Working with community interviewers in social and cultural research. *Area*, 00, 1–8.

House of Commons Education Select Committee (2021). *The forgotten: How White working-class pupils have been let down, and how to change it – First Report of Session 2021–22*. Available at: https://committees.parliament.uk/publications/6364/documents/69838/default/ [Accessed 06 September 2025].

Hu, M., Moskal, M. and Read, B. (2024). Mapping the emotions of racialised international students and the politics of exclusion in higher education. *Higher education*, 1–15.

Hudson, L. and Ozanne, J. (1988). Alternative ways of seeking knowledge in consumer research. *Journal of consumer research*, 14(4), 508–521.

Hwang, K. (2010). Way to capture theory of indigenous psychology. *Psychological studies*, 55(2), 96–100.

Ignatow, G. and Robinson, L. (2017). Pierre Bourdieu: Theorising the digital. *Information, communication and society*, 20(7), 950–966.

Iranmanesh, M., Yazdi-Feyzabadi, V. and Mehrolhassani, M. (2020). The challenges of ethical behaviours for drug supply in the Iran pharmacies by deontological approach. Available at: https://doi.org/10.21203/rs.3.rs-15713/v1

James, D. (2015). How Bourdieu bites back: Recognising misrecognition in education and educational research. *Cambridge journal of education*, 45(1), 97–112.

Janghorban, R., Latifnejad Roudsari, R. and Taghipour, A. (2014). Skype interviewing: The new generation of online synchronous interview in qualitative research. *International journal of qualitative studies on health and well-being*, 9(1), 1–3.

Jarmouni, M., Bellaihou, M., Labdouti, Z. and Arectout, A. (2024). A study on the impact of instruction language on academic achievement in higher education. *Forum for linguistic studies*, 6(5), 471–482.

Jensen, E. and Wright, D. (2015). Critical response to Archer et al. (2015) "Science capital": A conceptual, methodological, and empirical argument for extending Bourdieusian notions of capital beyond the arts. *Science education*, 99(6), 1143–1146.

Johnson, T., Burgoyne, A., Mix, K., Young, C. and Levine, S. (2022). Spatial and mathematics skills: Similarities and differences related to age, SES, and gender. *Cognition*, 218, 1–15.

Jones, M.G., Ennes, M., Weedfall, D., Chesnutt, K. and Cayton, E. (2021). The development and validation of a measure of science capital, habitus, and future science interests. *Research in science education*, 51, 1549–1565.

Kalliomäki, H., Nieminen, M. and Ylönen, D. (2024). Inclusion as a science, technology, and innovation policy objective in high-income countries: The decoupling dilemma. *Science and public policy*, 51(1), 1–13.

Kalolo, J. (2015). Towards contextual and culturally relevant science education in non-Western countries: The African experience. *Journal of studies in education*, 5(3), 38–56.

Kelly, R., Lehane, L., McGarr, O. and Erduran, S. (2019). STEM and gender at university: Focusing on Irish undergraduate female students' perceptions. *Journal of applied research in higher education*, 11(4), 770–787.

Kerkhoven, A.H., Russo, P., Land-Zandstra, A.M., Saxena, A., Rodenburg, F.J. and Dalby, A.R. (2016). Gender stereotypes in science education resources: A visual content analysis. *PLOS ONE*, 11(11), 1–9.

King, H., Nomikou, E., Archer, L. and Regan, E. (2015). Teachers' understanding and operationalisation of 'science capital'. *International journal of science education*, 37(18), 2987–3014.

Kontkanen, S., Koskela, T., Kanerva, O., Kärkkäinen, S., Waltzer, K., Mikkilä-Erdmann, M. and Havu-Nuutinen, S. (2024). Science capital as a lens for studying science aspirations – A systematic review. *Studies in science education*, 61(1), 89–115.

Korstjens, I. and Moser, A. (2017). Series: Practical guidance to qualitative research. Part 2: Context, research questions and designs. *European journal of general practice*, 23(1), 274–279.

Kvale, S. (1996). *Interviews: An introduction to qualitative research interviewing*. London: SAGE Publications.

Kvale, S. (2007) Doing Interviews. London: Sage.

Kvale, S. and Brinkmann, S. (2015) InterViews: Learning the Craft of Qualitative Research Interviewing. 3rd edn. London: Sage.

Larson, L.M., Pesch, K.M., Bonitz, V.S., Wu, T. and Werbel, J.D. (2013). Graduating with a science major. *Journal of career assessment*, 22(3), 479–488.

Lauder, H., Brown, P., Dillabough, J.A. and Halsey, A.H. (2006). Introduction: The prospects for education: Individualization, globalization, and social change. In: Lauder, H., Brown, P., Dillabough, J.A. and Halsey, A.H. (eds.) *Education, globalization, and social change*. Oxford: Oxford University Press, 1–70.

Laugksch, R.C. (2000). Scientific literacy: A conceptual overview. *Science education*, 84(1), 71–94.

Lederman, N.G. (2007). Nature of science: Past, present, and future. In: Abell, S.K. and Lederman, N.G. (eds.) *Handbook of research on science education*. New Jersey: Lawrence Erlbaum Associates, 845–894.

Ledesma, M.C. and Calderón, D. (2015). Critical race theory in education: A review of past literature and a look to the future. *Qualitative inquiry*, 21(3), 206–222.

Lee, O. (2005). Science education with English language learners: Synthesis and research agenda. *Review of educational research*, 75, 491–530.

Lent, R.W., Miller, M.J., Smith, P.E., Watford, B.A., Lim, R.H., Hui, K., Morrison, M.A., Wilkins, G. and Williams, K. (2013). Social cognitive predictors of adjustment to engineering majors across gender and race/ethnicity. *Journal of vocational behaviour*, 83(1), 22–30.

Lewis, J., Bolton, P. and Hubble, S. (2021). *Further education funding in England*. Available at: https://commonslibrary.parliament.uk/research-briefings/cbp-9194/ [Accessed 03 September 2025].

Li, Y. and Guo, M. (2021). Scientific literacy in communicating science and socio-scientific issues: Prospects and challenges. *Frontiers in psychology*, 12, 1–15.

Lido, C., Reid, K. and Osborne, M. (2019). Lifewide learning in the city: Novel big data approaches to exploring learning with large-scale surveys, GPS, and social media. *Oxford review of education*, 45(2), 279–295.

Lido, C., Osborne, M. and Reid, K. (2020). *Big data, lifelong learning and learning cities: A briefing paper*. Glasgow: Urban Big Data Centre, University of Glasgow.

Lincoln, Y.S. and Guba, E.G. (1985). *Naturalistic inquiry*. Beverly Hills, CA: SAGE Publications.

Lincoln, Y.S. and Guba, E.G. (1986). But is it rigorous? Trustworthiness and authenticity in naturalistic evaluation. *New directions for programme evaluation*, 1986, 73–84.

Lincoln, Y.S. and Guba, E.G. (2000). Paradigmatic controversies, contradictions and emerging confluences. In: Denzin, N. and Lincoln, Y. (eds.) *Handbook of qualitative research*. 2nd ed. Thousand Oaks, CA: SAGE, 163–188.

Lo Iacono, V., Symonds, P. and Brown, D.H.K. (2016). Skype as a tool for qualitative research interviews. *Sociological research online*, 21(2), 1–15.

Lumivero (2023). *NVivo (Version 14)*. Lumivero. Available at: https://www.lumivero.com/ [Accessed 13 August 2025].

Luo, T., So, W.W.M., Wan, Z.H. and Li, W.C. (2021). STEM stereotypes predict students' STEM career interest via self-efficacy and outcome expectations. *International journal of STEM education*, 8(1), 1–13.

Macdonald, A. (2014). "Not for people like me?" Under-represented groups in science, technology and engineering. Wise Campaign. Available at: https://www.equalityanddiversity.net/docs/not_for_people_like_me.pdf

Makarova, E., Aeschlimann, B. and Herzog, W. (2019). The gender gap in STEM fields: The impact of the gender stereotype of math and science on secondary students' career aspirations. *Frontiers in education*, 4, 1–11.

Mamlok-Naaman, R. (2024). Diversity and inclusion in science education: Why? A literature review. *Centre for educational policy studies journal*, 14(1), 9–28.

Martani, A., Tian, Y., Felber, N. and Wangmo, T. (2024). Gerontechnologies, ethics, and care phases: Secondary analysis of qualitative interviews. *Nursing ethics*, 32(1), 141–155.

Mattioni, F., Nakata, P., Dresh, L., Rollo, R., Brochier, L. and Rocha, C. (2021). Health promotion practices and Michel Foucault: A scoping review. *American journal of health promotion*, 35(6), 845–852.

Maxwell, J.A. (2005). *Qualitative research design: An interactive approach*. 2nd ed. Thousand Oaks, CA: SAGE Publications.

May, T. and Perry, B. (2017). *Reflexivity: The essential guide*. London: SAGE Publications Ltd., 1–69.

May, B.K., Wendt, J.L. and Barthlow, M.J. (2022). A comparison of students' interest in STEM across science standard types. *Social sciences & humanities open*, 6(1), 100287.

McLain, M., Irving-Bell, D., Wooff, D. and Morrison-Love, D. (2019). *Design and technology education: An international journal*, 24(2), 8–19.

McLellan, E., MacQueen, K.M. and Neidig, J.L. (2003). Beyond the qualitative interview: Data preparation and transcription. *Field methods*, 15(1), 63–84.

Moll, F., Grecu, A. and Hadjar, A. (2023). Students' academic habits and its relation to family capital: A latent class approach to inequalities among secondary school students. *Sociological inquiry*, 94(1), 190–220.

McKim, C. (2023). Meaningful member-checking: A structured approach to member-checking. *American journal of qualitative research*, 7(2), 41–52.

Mellén, J. and Angervall, P. (2021). Gender and choice: Differentiating options in Swedish upper secondary STEM programmes. *Journal of education policy*, 36(3), 417–435.

Mezieobi, S.A. and Ibekwe, P. (2017). Contemporary family choice: Areas of Nigerian families' change lag. *European journal of research and reflection in educational sciences*, 5(1), 66–70.

Miles, M.B., Huberman, A.M. and Saldaña, J. (2014). *Qualitative data analysis: A methods sourcebook*. 3rd ed. Thousand Oaks, CA: SAGE.

Mokyr, J. (2018). The impact of science and technology on global economic growth. *IMF Finance & Development Magazine*, June. Available at: https://www.imf.org/en/Publications/fandd/issues/2018/06/impact-of-science-and-technology-on-global-economic-growth-mokyr [Accessed 22 February 2025].

Moote, J., Archer, L., DeWitt, J. and MacLeod, E. (2019). Who has high science capital? An exploration of emerging patterns of science capital among students aged 17/18 in England. *Research papers in education*, 36(4), 402–422.

Moote, J., Archer, L. and DeWitt, J. (2020a). The science identity of low-income, minority ethnic students: A systematic review. *Studies in science education*, 56(2), 205–243.

Moote, J., Archer, L., DeWitt, J. and MacLeod, E. (2020). Science capital or STEM capital? Exploring relationships between science capital and technology, engineering, and maths aspirations and attitudes among young people aged 17/18. *Journal of research in science teaching*, 57(8), 1228–1250.

Morgan, D. (2007). Paradigms lost and pragmatism regained: Methodological implications of combining qualitative and quantitative methods. *Journal of mixed methods research*, 1(1), 48–76.

Morris, A. (2015). *A practical introduction to in-depth interviewing*. London: SAGE Publications Ltd.

Morris, E.W. and Perry, B.L. (2017). Girls behaving badly? Race, gender, and subjective evaluation in the discipline of African American girls. *Sociology of education*, 90(2), 127–148.

Morrison-Love, D. and Patrick, F. (2025). Understanding the challenge of developing pedagogical reasoning in initial teacher education: Theorising as practice-focused research. *British educational research journal*, 51, 1904–1926.

Morrow, S.L. (2005). Quality and trustworthiness in qualitative research in counselling psychology. *Journal of counselling psychology*, 52, 250–260.

Morrow, S.L. (2007). Qualitative research in counselling psychology: Conceptual foundations. *The counselling psychologist*, 35(2), 209–235.

Morse, J.M. (2015). Critical analysis of strategies for determining rigour in qualitative inquiry. *Qualitative health research*, 25(9), 1212–1222.

Mujtaba, T., Sheldrake, R., Reiss, M.J. and Simon, S. (2018). Students' science attitudes, beliefs, and context: Associations with science and chemistry aspirations. *International journal of science education*, 40(6), 644–667.

Nag, C.M., King, H. and Archer, L. (2021). *The Primary Science Capital Teaching Approach: Teacher handbook*. London: UCL Institute of Education.

Nairz-Wirth, E., Feldmann, K. and Spiegl, J. (2017). Habitus conflicts and experiences of symbolic violence as obstacles for non-traditional students. *European educational research journal*, 16(1), 12–29.

Nash, J.C. (2008). Re-thinking intersectionality. *Feminist review*, 89, 1–15.

Naukkarinen, J.K. and Bairoh, S. (2020). STEM: A help or a hindrance in attracting more girls to engineering? *Journal of engineering education*, 109(2), 177–193.

Newhart, M. and Patten, M.L. (2023). *Understanding research methods: An overview of the essentials*. 11th ed. New York: Routledge.

Nothias, T. (2025). An intellectual history of digital colonialism. *Journal of communication*, jqaf003.

Novak, A. and Jen, E. (2024). The editorial word: Trustworthiness. *Journal of advanced academics*, 35(4), 718–728.

Nowell, L.S., Norris, J.M., White, D.E. and Moules, N.J. (2017). Thematic analysis: Striving to meet the trustworthiness criteria. *International journal of qualitative methods*, 16(1), 1–13.

OECD (2021). *Education at a glance 2021: OECD indicators*. Available at: https://doi.org/10.1787/b35a14e5-en/ [Accessed 10 July 2025].

OECD (2023a). *Equity and inclusion in education: Intersectional approaches*. Paris: OECD Publishing.

OECD (2023b). *Intersectionality in education: Policy approaches for equity and inclusion*. OECD Education Working Papers, No. 269.

OECD (2025a). *PISA 2025 science framework*. Paris: OECD Publishing.

OECD (2025b). *PISA: Programme for International Student Assessment*. Available at: https://www.oecd.org/en/about/programmes/pisa.html/ [Accessed 10 July 2025].

OECD (2025c). *About the OECD: Better policies for better lives*. Available at: https://www.oecd.org/en/about.html [Accessed 28 February 2025].

OECD (2025d). *About the OECD: Members and partners*. Available at: https://www.oecd.org/en/about/members-partners.html [Accessed 28 February 2025].

Office for Students (2020a). *A new approach to fair access, participation and success*. Available at: https://www.officeforstudents.org.uk/annual-review-2019/a-new-approach-to-fair-access-participation-and-success/ [Accessed 06 September 2025].

Office for National Statistics (2022). *Ethnic group, England and Wales: Census 2021*. Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/culturalidentity/ethnicity/bulletins/ethnicgroupenglandandwales/census2021/ [Accessed 16 February 2025].

Ofsted (2021). *Ofsted annual report 2020/21*. Available at: https://files.ofsted.gov.uk/v1/file/50147709/ [Accessed 03 September 2025].

Ofsted (2023). *Finding the optimum: The science subject report*. Available at: https://www.gov.uk/government/publications/subject-report-series-science/finding-the-optimum-the-science-subject-report—2/ [Accessed 06 September 2025].

Ofsted (n.d.). *Ofsted inspection reports*. Available at: https://reports.ofsted.gov.uk/ [Accessed 7 September 2025].

Ong, M., Smith, J. and Ko, L. (2018). Counterspaces for women of colour in STEM higher education: Marginal and central spaces for persistence and success. *Journal of research in science teaching*, 55, 206–245.

Ong, M., Wright, C., Espinosa, L.L. and Orfield, G. (2011). Inside the double bind: A synthesis of empirical research on undergraduate and graduate women of color in science, technology, engineering, and mathematics. *Harvard educational review*, 81(2), 172–208.

Osborne, J. (2002). Science without literacy: A ship without a sail? *Cambridge journal of education*, 32(2), 203–218.

Osborne, M. (2003). Policy and practice in widening participation: A six-country comparative study of access as flexibility. *International journal of lifelong education*, 22(1), 43–58.

Osborne, J., Simon, S. and Collins, S. (2003). Attitudes towards science: A review of literature and its implications. *International journal of science education*, 25(9), 1049–1079.

Osborne, J. and Dillon, J. (2008). *Science education in Europe: Critical reflections*. London: The Nuffield Foundation.

Palinkas, L.A., Horwitz, S.M., Green, C.A., Wisdom, J.P., Duan, N. and Hoagwood, K. (2013). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and policy in mental health and mental health services research*, 42(5), 533–544.

Patterson, E. and Schneider, E. (2024). Are WIDA test results appropriately reflecting multilingual learners' language skills according to ESOL teachers' experiences? *GATESOL journal*, 33(1), 3–14.

Patton, M.Q. (1990). *Qualitative evaluation and research methods*. 2nd ed. Thousand Oaks, CA: SAGE.

Patton, M.Q. (2015). *Qualitative research and evaluation methods*. 4th ed. Thousand Oaks, CA: SAGE Publications.

Pearson Edexcel (2019). *Pearson BTEC Level 3 National Extended Diploma in Applied Science Specification (Issue 9)*. Available at: https://qualifications.pearson.com/content/dam/pdf/BTEC-Nationals/Applied-Science/2016/specification-and-sample assessments/9781446938195_BTECNat_AppSci_ExtDips_Spec.pdf [Accessed 20 June 2023].

Perera, S. (2011). Science teachers from non-Western backgrounds challenged by (Western) science: A whole other ball game. *The international journal of science and society*, 2(2), 11–22.

Pervin, N. and Mokhtar, M. (2022). The interpretivist research paradigm: A subjective notion of a social context. *International journal of academic research in progressive education and development*, 11(2), 419–428.

Potthoff, S., Hempeler, C., Gather, J., Gieselmann, A., Vollmann, J. and Scholten, M. (2023). Research ethics in practice: An analysis of ethical issues encountered in qualitative health research with mental health service users and relatives. *Medicine, health care and philosophy*, 26(4), 517–527.

Potvin, P. and Hasni, A. (2014). Analysis of the decline in interest towards school science and technology from grades 5 through 11. *Journal of science education and technology*, 23(6), 784–802.

Prieur, A. and Savage, M. (2013). Emerging forms of cultural capital. *European societies*, 15(2), 246–267.

Quan, L. (2024). How new media affect cultural identity: Case studies from Malaysia. *Asian journal of communication*, 34(2), 134–152.

Quaye, J. and Pomeroy, D. (2022). Social class inequalities in attitudes towards mathematics and achievement in mathematics cross generations: A quantitative Bourdieusian analysis. *Educational studies in mathematics*, 109, 155–175.

Rapley, T. (2022). Developing research questions: The social lives of ideas, interests and questions. In: Flick, U. (ed.) *Developing research questions: The social lives of ideas, interests and questions*. Vol. 2. London: SAGE Publications Ltd, 257–272.

Read, B. (2024). Gender equity in academic knowledge production: The influence of politics, power and precarity. *European educational research journal*, 24(3), 394–407.

Reay, D. (2004). "It's all becoming a habitus": Beyond the habitual use of habitus in educational research. *British journal of sociology of education*, 25(4), 431–444.

Reay, D. (2021). 'Alienation and celebration: Working-class students, educational spaces and the limits of diversity', British Journal of Sociology of Education, 42(2), pp. 179–190. https://doi.org/10.1080/01425692.2021.1877990

Reay, D., Hollingworth, S., Williams, K., Crozier, G., Jamieson, F., James, D. and Beedell, P. (2007). "A darker shade of pale?" Whiteness, the middle classes and multi-ethnic inner-city schooling. *Sociology*, 41(6), 1041–1060.

Riege, A.M. (2003). Validity and reliability tests in case study research: A literature review with "hands-on" applications for each research phase. *Qualitative market research: An international journal*, 6(2), 75–86.

Relyea, J. and Hwang, H. (2025). Transactional development of science and mathematics knowledge and reading proficiency for multilingual students across languages of instruction. *Developmental psychology*, 61(3), 495–512.

Rey, F. (2022). New frontiers for the deliberative wave. In: *Resisting colonisation, avoiding tropicalisation: Deliberative wave in the Global South*.

Reznik, G., Massarani, L. and Calabrese Barton, A. (2023). Informal science learning experiences for gender equity, inclusion and belonging in STEM through a feminist intersectional lens. *Cultural studies of science education*, 18(3), 959–984.

Richards, L. (2021). *Handling qualitative data: A practical guide*. 4th ed. London: SAGE Publications Ltd.

Roberts, D.A. (2007). Scientific literacy/science literacy. In: Abell, S.K. and Lederman, N.G. (eds.) *Handbook of research on science education*. Mahwah, NJ: Lawrence Erlbaum Associates, 729–780.

Roberts, D.A. and Bybee, R.W. (2014). Scientific literacy, science literacy, and science education. In: Lederman, N.G. and Abell, S.K. (eds.) *Handbook of research on science education*. Vol. 2. New York: Routledge, 559–572.

Rose, G. (1997). Situating knowledges: Positionality, reflexivities and other tactics. *Progress in human geography*, 21(3), 305–320.

Roulston, K. (2021). *Interviewing: A guide to theory and practice*. Thousand Oaks, CA: SAGE Publications.

Roulston, K. and Choi, M. (2018). Qualitative interviews. In: Roulston, K. and Choi, M. (eds.) *The SAGE handbook of qualitative data collection*. London: SAGE Publications Ltd, 233–249.

Rowe, W. (2014). Positionality. In: Coghlan, D. and Brydon-Miller, M. (eds.) *The SAGE encyclopaedia of action research*. London: SAGE Publications Ltd, 628.

Royal Society (2017). *New economic growth: The role of science, technology, innovation and infrastructure*. Available at: https://royalsociety.org/~/media/about-us/international/g-science-statements/2017-may-3-new-economic-growth.pdf [Accessed 22 February 2025].

Royal Society (2024). *Equity in STEM education: Strategies for inclusive practice in further education*. London: The Royal Society. Available at: https://royalsociety.org [Accessed 10 July 2025].

Rubin, H.J. and Rubin, I.S. (2005). *Qualitative interviewing: The art of hearing data*. 2nd ed. Thousand Oaks, CA: SAGE Publications, Inc.

Rüschenpöhler, L. and Markic, S. (2020a). How the home environment shapes students' perceptions of their abilities: The relation between chemistry capital at home and students' chemistry self-concept. *International journal of science education*, 42(12), 2075–2094.

Rüschenpöhler, L. and Markic, S. (2020b). Secondary school students' acquisition of science capital in the field of chemistry. *Chemistry education research and practice*, 21(1), 220–236.

Said, E.W. (1979). *Orientalism*. First Vintage Books edition. New York: Vintage Books. Available at: https://search.ebscohost.com/login.aspx?direct=true&scope=site&db=nlebk&db=nlabk&AN=842875

Saldana, J. (2021). *The coding manual for qualitative researchers*. 4th ed. London: SAGE Publications Ltd.

Saldana, J. and Omasta, M. (2018). Introduction: Analysing life. In: *Qualitative research: Analysing life*, 26–54. Available at: https://b-ok.cc/book/5011259/535bb1/ [Accessed 07 June 2023].

Salehjee, S. and Watts, D.M. (2022). Intersectionality as personal: The science identity of two young immigrant Muslim women. *International journal of science education*, 44(6), 921–938.

Sassen, S. (2001). Global cities: Postindustrial production sites. In: *The global city: New York, London, Tokyo*. Rev. ed. Princeton: Princeton University Press, 127–170.

Saulo, B.M. (2024). Why is science important? (21 reasons). *Enlightio*. Available at: https://enlightio.com/reasons-why-science-is-important [Accessed 22 February 2025].

Savin-Baden, M. and Major, C.H. (2023). *Qualitative research: The essential guide to theory and practice*. 2nd ed. London: Routledge.

Schwarz, N. and Bohner, G. (2001). The construction of attitudes. In: Tesser, A. and Schwarz, N. (eds.) *Blackwell handbook of social psychology: Intraindividual processes*. Oxford: Blackwell.

Scottish Government (2022). *Using intersectionality to understand structural inequality in Scotland: Evidence synthesis*. Edinburgh: Scottish Government.

Seddon, E., Lido, C., Read, B., Umutoni, J., Cyulinyana, M.C., Slade, B., Maitra, S., Chatterjee, S., Maitra, S. and Thakur, M. (2021). *Gendered journeys: The trajectories of STEM students and graduates through higher education and into employment in India and Rwanda*. CR&DALL Briefing Paper, September 2021. University of Glasgow.

Seebacher, L.M., Hofmann, F. and Reiss, K. (2021). Intersectionality in science education: A European perspective on gender, socio-economic status, and science attitudes. *European journal of science education*, 43(4), 567–589.

Seebacher, L.M., Vana, I., Voigt, C. and Tschank, J. (2021). Is science for everyone? Exploring intersectional inequalities in connecting with science. *Frontiers in education*, 6, 1–14.

Seitz, S. (2016). Pixilated partnerships: Overcoming obstacles in qualitative interviews via Skype. *Qualitative research*, 16(2), 229–235.

Seloma, P. and Ramaila, S. (2021). Pedagogical practices adopted by teachers when teaching learners taking English as first additional language in life sciences classrooms, 93–96.

Shahjahan, R.A. (2011). Decolonising the evidence-based education and policy movement: Revealing the colonial vestiges in educational policy, research, and neoliberal reform. *Journal of education policy*, 26(2), 181–206.

Shahjahan, R.A. (2016). International organisations, epistemic tools of influence, and the colonial geopolitics of knowledge production in higher education policy. *Journal of education policy*, 31(6), 694–710.

Sheldrake, R., Mujtaba, T. and Reiss, M.J. (2017). Science teaching and students' attitudes and aspirations: The importance of conveying the applications and relevance of science. *International journal of educational research*, 85, 167–183.

Shepherd, J., Noble, E. and Parkin, J. (2022). *Positionality and reflexivity for early career researchers and postgraduate researchers*. Available at: https://www.cardiff.ac.uk/research/our-research-environment/supporting-researchers/early-career-researchers [Accessed 13 July 2025].

Showunmi, V. (2020). The intersection of race, gender and leadership: (Re)framing the experiences of Black female academics in higher education. *Gender and education*, 32(7), 935–951.

Silverman, D. (2024). *Interpreting qualitative data*. 7th ed. London: SAGE Publications Ltd.

Sixth Form Colleges Association (SFCA) (2021). *Our members – Sixth Form Colleges Association*. Available at: https://www.sixthformcolleges.org/379/our-members/region/all [Accessed 03 September 2025].

Spivak, G.C. (1988). Can the subaltern speak? In: Nelson, C. and Grossberg, L. (eds.) *Marxism and the interpretation of culture*. Urbana/Chicago: University of Illinois Press.

Stahl, G., Scholes, L., McDonald, S. and Lunn, J. (2021). Middle years students' engagement with science in rural and urban communities in Australia: Exploring science capital, place-based knowledges and familial relationships. *Pedagogy, culture and society*, 29(1), 43–60.

Stevenson, F., Gibson, W., Pelletier, C. et al. (2015). Reconsidering "ethics" and "quality" in healthcare research: The case for an iterative ethical paradigm. *BMC medical ethics*, 16(1), 1–8.

Stoet, G. and Geary, D.C. (2018). The gender-equality paradox in science, technology, engineering, and mathematics education. *Psychological science*, 29(4), 581–593.

Stuart, M., Lido, C. and Morgan, J. (2009). *The impact of social identity and cultural capital on different ethnic student groups at university*. ESRC End of Award Report, RES-000-22-2485, 1–27.

Stuart, M., Lido, C. and Morgan, J. (2011).Personal stories: How students' social and cultural life histories interact with the field of higher education. *International journal of lifelong education*, 30(4), 489–508.

Suhay, E. (2017).*The politics of scientific knowledge*. Oxford Research Encyclopaedia of Communication. Retrieved 15 March 2025.

Sultana, F. (2007). Reflexivity, positionality and participatory ethics: Negotiating fieldwork dilemmas in international research. *An international e-journal for critical geographies*, 6(3), 374–385.

T Levels Official Website (n.d.). *T Levels: The next level qualification*. Available at: https://www.tlevels.gov.uk/ [Accessed 12 July 2025].

Tajfel, H. (1978). Differentiation between social groups: Studies in the social psychology of intergroup relations. London: Academic Press.

Tajfel, H. and Turner, J.C. (1979). An integrative theory of inter-group conflict. In: Austin, W.G. and Worchel, S. (eds.) *The social psychology of inter-group relations*. Monterey, CA: Brooks/Cole, 33–47.

Takeuchi, M., Sengupta, P., Shanahan, M., Adams, J. and Hachem, M. (2020). Transdisciplinarity in STEM education: A critical review. *Studies in science education*, 56(2), 213–253.

Tan, E., Calabrese Barton, A., Kang, H. and O'Neill, T. (2013). Desiring a career in STEM-related fields: How middle school girls articulate and negotiate identities-in-practice in science. *Journal of research in science teaching*, 50(10), 1143–1179.

Teo, T.W., Goh, J.W., Aye, K.M. and Yeo, L.W. (2018). Re-thinking teaching and learning of science inference competencies of lower track students in Singapore: A Rasch investigation. *Asia Pacific journal of education*, 38(3), 279–302.

Timmermans, S. and Tavory, I. (2012). Theory construction in qualitative research: From grounded theory to abductive analysis. *Sociological theory*, 30(3), 167–186.

Thomas, D.R. (2006). A general inductive approach for analysing qualitative evaluation data. *American journal of evaluation*, 27(2), 237–246.

Thomas, G. (2013). *How to do your research project: A guide for students in education and applied social sciences*. 2nd ed. London: SAGE Publications.

Tobin, G. and Begley, C. (2004). Methodological rigour within a qualitative framework. *Journal of advanced nursing*, 48(4), 388–396.

Torche, F. (2021). Educational mobility in the developing world. In: Iversen, V., Krishna, A. and Sen, K. (eds.) *Social mobility in developing countries: Concepts, methods, and determinants*. Oxford: Oxford University Press, 139–171.

Tourangeau, R., Rips, L.J. and Rasinski, K. (2000). An introduction and a point of view. In: *The psychology of survey response*. Cambridge: Cambridge University Press, 1–22.

Trust for London (2021a). *London's poverty profile – Latest poverty & inequality data for London*. Available at: https://www.trustforlondon.org.uk/data/ [Accessed 06 September 2025].

Trust for London (2021b). *Poverty rates by London borough*. Available at: https://www.trustforlondon.org.uk/data/poverty-borough/ [Accessed 06 September 2025].

Trust for London (2025).*Trust for London*. Available at: https://trustforlondon.org.uk/ [Accessed 03 September 2025].

Turnbull, S., Vanholsbeeck, F., Locke, K. and O'Neale, D. (2019). Bourdieu, networks, and movements: Using the concepts of habitus, field and capital to understand a network analysis of gender differences in undergraduate physics. *PLOS ONE*, 14(9), 1–29.

Turnbull, S., Meissel, K., Locke, K. and O'Neale, D. (2020). The impact of science capital on self-concept in science: A study of university students in New Zealand. *Frontiers in education*, 5, 1–16.

UCL Institute of Education (2024). *The Science Capital Teaching Approach*. [Online resource and teacher pack]. Available at: UCL IOE Science Capital Teaching Approach.

Uflewska, A., Lido, C. and Dey, S. (2021). Innovative, interactive and individualised (i3) teaching and learning practice in higher and lifelong education. *Widening participation and lifelong learning*, 23(2), 55–69.

UK ethnicities (2021 Census). Available at: https://www.ethnicity-facts-figures.service.gov.uk/style-guide/ethnic-groups/

UNESCO (2017a). *Cracking the code: Girls' and women's education in STEM*. Paris: UNESCO. Available at: https://unesdoc.unesco.org/ark:/48223/pf0000253479/ [Accessed 29 July 2025].

UNESCO Institute for Statistics (2017b). *Fact Sheet number 46*. UIS/FS/2017/ED/46. Available at: http://uis.unesco.org/sites/default/files/documents/fs46-more-than-half-children-not-learning-en-2017.pdf [Accessed 29 July 2025].

van der Weide, R., Lakner, C., Mahler, D.G., Narayan, A. and Rama Subbaiah, R. (2021). *Intergenerational mobility around the world*. Policy Research Working Paper 9707. World Bank Group. Available at:https://openknowledge.worldbank.org/bitstream/handle/10986/35827/Intergenerational-Mobility-around-the-World.pdf [Accessed 29 July 2025].

Vasileiou, K., Barnett, J., Thorpe, S.J. and Young, T. (2018). Characterising and justifying sample size sufficiency in interview-based studies: Systematic analysis of qualitative health research over a 15-year period. *BMC medical research methodology*, 18(1), 148–165.

Verger, A., Novelli, M. and Altinyelken, H.K. (2018). Global education policy and international development: A revisited introduction. In: Verger, A., Novelli, M. and Altinyelken, H.K. (eds.) *Global education policy and international development: New agendas, issues and policies*. 2nd ed. London: Bloomsbury, 1–34.

Wade-Jaimes, K., King, N.S.S. and Schwartz, R. (2021). "You could like science and not be a science person": Black girls' negotiation of space and identity in science. *Science education*, 105(4), 855–887.

Weaver, K. and Olson, J.K. (2006). Understanding paradigms used for nursing research. *Journal of advanced nursing*, 53, 459–469.

Wellington, J. and Osborne, J. (2001). *Language and literacy in science education*. Buckingham: Open University Press.

WEF (2020). *Global gender gap report 2020*. World Economic Forum. Available at: https://www.weforum.org/reports/gender-gap-2020-report-100-years-pay-equality/ [Accessed 27 July 2025].

Willig, C., Rogers, W., Terry, G., Hayfield, N., Clarke, V. and Braun, V. (2017). Thematic analysis. In: *The SAGE handbook of qualitative research in psychology*. London: SAGE Publications Ltd, 17–36.

Wilson, J. (2014). *Essentials of business research: A guide to doing your research project*. 2nd ed. London: SAGE Publications, 30–42. Available at: https://www.academia.edu/39919079/essentials-of-business-research-pdf/ [Accessed 02 June 2025].

Wilson-Lopez, A., Sias, C., Hasbún, I.M. and Smithee, A. (2017). Forms of science capital mobilised in adolescents' engineering projects. *Journal of research in science teaching*, 55(2), 246–270.

Wong, B. (2012). Identifying with science: A case study of two 13-year-old "high achieving working class" British Asian girls. *International journal of science education*, 34(1), 43–65.

Wong, B. (2015). Minority ethnic students and science participation: A qualitative mapping of achievement, aspiration, interest and capital. *Research in science education*, 46(1), 113–127.

Wong, B. (2016). Introduction. In: *Science education, career aspirations and minority ethnic students*. London: Palgrave Macmillan.

Wong, Y. and Qing, L. (2022). Cultural capital and habitus in the field of higher education: Academic and social adaptation of rural students in four elite universities in Shanghai, China. *Cambridge journal of education*, 52(6), 775–793.

Xu, J., Coats, L.T. and Davidson, M.L. (2012). Promoting student interest in science: The perspectives of exemplary African American teachers. *American educational research journal*, 49(1), 124–154.

Yonas, A., Sleeth, M. and Cotner, S. (2020). In a "scientist spotlight" intervention, diverse student identities matter. *Journal of microbiology and biology education*, 21(1), 1–12.

APPENDICES

Appendix 1 Interview Protocol

Appendix 1B 'Science Capital Made Clear' (Archer et al., 2016b)

Appendix 1C Participants' Responses to RQ1.1: '…what does science capital mean to you?'

Appendix 1D Participants' Responses to RQ1.3: Science Capital Definition

Appendix 1E Table of Acquiescence Bias Cases Across Participants

Appendix 1F Table of Negative & Contradictory Cases Across Participants

Appendix 1G Re-design of Interview Protocol: (Two Phase Design)

Appendix 2: Demographics of Participants

Appendix 2A Participants' Demographic Characteristics

Appendix 3A Sampling - Course Groups, Ages and Genders

Appendix 3B Sampling – Ethnicity, Age, Gender, Compulsory Education and Language

Appendix 3C Sampling – Intersectional Dimensions

Appendix 4A 'Invitation to Participate in My Research Study' - Email

Appendix 4B 'Invitation to Participate in My Research Study' – Letter Content

Appendix 5A The Participant Information Sheet

Appendix 5B Privacy Notices

Appendix 5C Participant Consent Form

Appendix 5D Parent/Guardian Informed Consent Form

Appendix 5E Ethics Application Approval Letter

Appendix 5F Data Management Plan template for PGR students

Appendix 5G Staff, Postgraduate Research Students: Application…..for Ethical Approval

Appendix 5H Data Protection Impact Assessment: List of Requirements

Appendix 5J Request for…to Recruit Vocational Science Students and their Teachers…

Appendix 5K Final …to Recruit Vocational Science Students and Teachers as Participants

Appendix 6A Zoom Invite for the Pilot Interview

Appendix 6B Zoom Cloud Recording of the Pilot Interview

Appendix 7A Zoom Interview Invitation to a Student Participant

Appendix 7B Zoom Interview Invitation to a Teacher Participant

Appendix 8 Demonstration of Reflexivity to Improve Interview Skills

Appendix 9 Interview Transcripts File in NVivo 14

Appendix 10 Additional Interview Notes File in NVivo 14

Appendix 11A Interview Transcripts: Word Frequency (10 Words)

Appendix 11B Interview Transcripts: Word Frequency (20 Words)

Appendix 11C Interview Transcripts: Word Frequency (30 Words)

Appendix 12A NVivo 14 List of Initial Codes 1

Appendix 12B NVivo 14 List of Initial Codes 2

Appendix 13A Initial Codes 1: Word Frequency (30 Words)

Appendix 13B Initial Codes 2: Word Frequency (30 Words)

Appendix 14 Manual Formulation and Reviews of Initial Themes

Appendix 15A Development of Initial Themes from Initial Codes

Appendix 15B Final Themes, Sub-themes, Themes and Initial Codes

Appendix 16 NVivo Glossary of key terms

Appendix 1: The Interview Protocol

The Interview Protocol

Title: Exploring Science Capital in a London-Based Further Education College: Science Teachers' and their Students' [Mis]conceptualisations; Diversity, and Inclusive Strategies.

Introduction.

Thank you for agreeing to participate in this study. The following indicative questions are on 'science capital' (SC), which is a theoretical conceptualisation that refers to science-specific forms of social and cultural capitals. The following SC definition by Archer et al. (2015) is employed in this study:

> Scientific forms of cultural capital (scientific literacy; science dispositions, symbolic forms of knowledge about the transferability of science qualifications), science-related behaviours and practices (e.g., science media consumption; visiting informal science learning environments, such as science museums), science-related forms of social capital (e.g., parental scientific knowledge; talking to others about science) (Archer et al., 2015, p.929).

Please, read the attached booklet, 'Science Capital Made Clear' (Enterprising Science KCL Project, nd) (Archer et al., 2016b) prior to our interview session for a summary of Archer et al.'s research findings on SC among mainly primary and secondary pupils in the UK. Other resources that you may also find useful are:

- *The Science Capital Teaching Approach: engaging students with science, promoting social justice - UCL Discovery* (Godec, King and Archer, 2017)
- *The Primary Science Capital Teaching Approach: teacher handbook - UCL Discovery* (Nag, King and Archer, 2021).

Indicative Interview questions

RQ 1: Perceptions and Impact of Science Capital

1. In your own words, what does "science capital" (SC) mean to you? How does this definition come about?

2. When and where did you first hear about "science capital"?

   (I will now re-share Archer et al.'s (2015) SC definition with you).

3. What are your opinions about the descriptions and explanations of SC given by this definition?
   - Do you think some components of SC should be removed or anything added?

4. What do you think the relevance of SC is to you as a science teacher/student?

5. Let's now go through the booklet, '*Science Capital Made Clear'* (Enterprising Science KCL Project, nd) that was given to you. What do you agree or disagree with about the contents of this booklet and why? Did you check the links of SC provided? If yes, what is your opinion on them?
6. What, in your opinion is the relevance of SC to science education generally?

RQ 2: Perspectives on The Influences of Interconnected Diversities (Intersectionality) and Inclusivity Strategies on Science Capital Educational Background:

1. How might having parents with high educational achievement affect a learner's SC? How might being the first in a person's family to go to further or higher education affect their SC?

2. How might not being the first in a person's family to go to further or higher education affect their SC?

3. How do you think your parents' educational background may have impacted your SC access and utilisation?

Socioeconomic Backgrounds:

1. How might individuals from higher, compared to lower (working class or poor), socioeconomic backgrounds access and utilise SC in educational settings?
    - What might be the advantages/disadvantages in SC for higher income families?
    - What might be the advantages/disadvantages in SC for higher income families?

2. Which of the following UK NS-SEC (The National Statistics Socio-economic classification) occupation-based socio-economic classes do you think best describes you and your family? (Rose and Pevalin, 2003; Office of National Statistics, 2020; 2023b; 2023c)
    (i) Managerial, administrative, and professional occupations.
    (ii) Intermediate occupations.
    (iii) Small employers and own account workers.
    (iv) Lower supervisory and technical operations.
    (v) Semi-routine occupations.
    (vi) (viii) Never worked and long-term unemployed.
    (vii) Prefer not to say.
3. What is(are) the occupation(s) of the breadwinner(s) in your family?
    - How do you think breadwinner(s) occupation(s) in your family affect your SC access and utilisation?

4. What impact do you think your socioeconomic classification have on your access to and utilisation of SC?

Gender Identities:

1. How do you think a person's gender can influence one's access to SC?

2. How might a person's gender influence one's SC utilisation in the classroom?
    - At home/ outside the classroom?

3. How would you describe your gender?

4. How has your gender influenced your SC in terms of your access to and utilisation of SC?

Ethnic and Racial Backgrounds:

1. How do you think a person's ethnic or racial background can influence one's understanding of, and/or access to SC?
2. Which of the following ethnic groups as adapted from UK '*ethnic group classifications: census 2021'* (Office of National Statistics, 2023a) best describes you?
    - Asian, Asian British or Asian Welsh (Bangladeshi; Chinese; Indian; Pakistani; Other Asian – please, specify).
    - Black, Black British, Black Welsh, Caribbean or African (African; Caribbean; Other Black – please, specify).
    - Mixed or Multiple ethnic group (White and Asian; White and Black African; White and Black Caribbean; Other Mixed or Multiple ethnic groups - please, specify).
    - White (English, Welsh, Scottish, Northern Irish or British; Irish; Gypsy or Irish Traveller; Roma; Other White - please, specify).
    - Other ethnic group (Arab; Any other ethnic group - please, specify).

- Does not apply (please, specify your ethnic group).
- Prefer not to say.

3. How do you think your ethnic or racial background influenced/continues to influence your access to and utilisation of SC?
4. What ethnicity-related challenges privileges/challenges have you encountered/are encountering with respect to accessing and utilising SC?
   - Any personal examples?

Cultural and Linguistic Backgrounds:

(i) How might having English as a second language at home affect a learner's SC?
(ii) How might having English as a second language at home affect a learner's SC?
(iii) How might having parents from a different culture, who were the first in their families to have immigrated to the UK, affect a learner's SC?
(iv) What languages do you speak?
(v) What languages do your parents speak?
(vi) Were you or your parents born outside the UK?
(vii) How might your cultural and linguistic backgrounds impact upon your utilisation of SC?

Intersectionally Inclusive Strategies

(i) If you oversaw the re-designing science curriculum, what strategies would you suggest to be more inclusive and to level the playing field of SC?
(ii) What recommendations would you make in classrooms to make sure everyone feels valued and included in science?

References

1. Archer, L., Dawson, E., DeWitt, J., Seakins, A. and Wong, B., (2015). "Science capital": a conceptual, methodological, and empirical argument for extending bourdieusian notions of capital beyond the arts. Journal of Research in Science Teaching, 52 (7), pp.922-948.
2. Enterprising Science KCL Project (no date) *Science capital made clear*, *Stem.org.uk*. Available at: https://www.stem.org.uk/sites/default/files/pages/downloads/Science-Capital-Made-Clear.pdf (Accessed: 14 December 2023).
3. Godec, S., King, H., and Archer, L., (2017). The Science Capital Teaching Approach: engaging students with science, promoting social justice. UCL Institute of Education: London, UK.
4. Nag Chowdhuri, M., King, H., and Archer, L., (2021). The Primary Science Capital Teaching Approach: teacher handbook. [Book]. UCL Institute of Education: London, UK.
5. Office of National Statistics, (2020). *Soc 2020 volume 3: The National Statistics Socio-Economic Classification (NS-SEC rebased on the SOC 2020)*. Available at: https://www.ons.gov.uk/methodology/classificationsandstandards/standardoccupationalclassificationsoc/soc2020/soc2020volume3thenationalstatisticssocioeconomicclassificationnssecrebasedonthesoc2020 (Accessed: 16 December 2023).
6. Office of National Statistics, (2023a). Ethnic group classifications: Census 2021. Available at: https://www.ons.gov.uk/census/census2021dictionary/variablesbytopic/ethnicgroupnationalidentitylanguageandreligionvariablescensus2021/ethnicgroup/classifications (Accessed: 16 December 2023).
7. Office of National Statistics, (2023b). Approximated social grade, England and Wales: Census 2021. Available at: https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/bulletins/approximatedsocialgradeenglandandwales/census2021#comparing-approximated-social-grade-asg-with-national-statistics-socio-economic-classification-ns-sec (Accessed: 16 December 2023).
8. Office of National Statistics, (2023c). *The National Statistics Socio-economic classification (NS-SEC)*. Available at: https://www.ons.gov.uk/methodology/classificationsandstandards/otherclassifications/thenationalstatisticssocioeconomicclassificationnssecrebasedonsoc2010#toc (Accessed: 16 December 2023).
9. Rose, D. and Pevalin, D. J. eds., (2003). *A Researcher's Guide to the National Statistics Socio-economic Classification*. London: SAGE Publications, Ltd. Available at: <https://doi.org/10.4135/9780857024725> [Accessed 16 Dec 2023].

Appendix 1B removed due to copyright.

Appendix 1C: Participants' Responses to RQ1.1: '…what does science capital mean to you?'

Teachers' Responses:

<Files\\INTERVIEW TRANSCRIPTS\\Participant P (Teacher)> - § 1 reference coded [1.92% Coverage]

Reference 1 - 1.92% Coverage
ANN O
What does science capital mean to you?

Participant P 00:58
Well, I think it encompasses all the knowledge, the ability of the student, commitment of the parent, teachers, all variables that make science interesting.

ANN O 01:20
When you say 'variables', what do you mean?

Participant P 01:23
Variables like cultural social norms, equipment, lecturers, capabilities of lecturers, being able to simplify the work for the students, and the parents, also their contributions at home also, not just teachers. The parents also have inputs. So, these are the variables I'm talking about.

<Files\\INTERVIEW TRANSCRIPTS\\Participant Q (Teacher)> - § 1 reference coded [2.43% Coverage]

Reference 1 - 2.43% Coverage
ANN O
In your own words, what does science capital mean to you?

Participant Q 01:17
Well, science capital is a concept that embraces many aspects of everyday life more or less, and then all the science-related things. We know, all the science related things we do, right, they are all part of science capital, our experiences in science. and then even the people we know who are doing science; they all form part of science capital. Our knowledge in science. When we go to school or college or university, what we learn in science, they are part of science capital, and then how we do, we feel about it. Our attitude towards its part of science capital.

<Files\\INTERVIEW TRANSCRIPTS\\Participant R1 (Teacher)> - § 1 reference coded [0.50% Coverage]

Reference 1 - 0.50% Coverage

ANN O 00:01:12
What does 'science capital' mean to you?

Participant R1 00:01:17
I think it means projecting the importance of science to other people and to stimulate interest in as many people as possible.

<Files\\INTERVIEW TRANSCRIPTS\\Participant S (Teacher)> - § 1 reference coded [3.43% Coverage]

Reference 1 - 3.43% Coverage
ANN O
'In your own words, what do you understand by science capital'?

Participant S 00:01:49
Okay, to me, science capital can be referred to as an experience, but that experience can come from different sides or prospect of lives. For example, it can come from the family; it can come from someone's own experience, could be by studying, could be by observing some of the events from their surroundings. So, it's just in a summary, it is a total experience from different parts of life.

ANN O 00:02:48
Hmm, okay, thank you. And how would you think that was science capital?

Participant S 00:02:56
….because, capital always refers to money. So, I believe the concept of this capital. So, for example, if anyone wants to invest in a certain business, they need a capital, so that refers to money for science. Capital could be referred to as an experience or other experiences of life which could help someone to study or choose science as the future of their life in respect of their education.

Students' Responses:

<Files\\INTERVIEW TRANSCRIPTS\\Participant 12345> - § 2 references coded [2.80% Coverage]

Reference 1 - 0.69% Coverage
Participant 12345

To me, science capital signifies the depth of one's engagement or scientific concepts, methods and culture.

Reference 2 - 2.11% Coverage
So, when you say one's engagement, what do you mean?

Participant 12345 03:59
When they're engaged with scientific concept.

ANN O 04:05
Hmm! As we're thinking of scientific concepts. Would you have anything in mind?

Participant 12345 04:22
I'll say, like, the interaction with the ideas and principles of scientific knowledge, maybe?

<Files\\INTERVIEW TRANSCRIPTS\\Participant A> - § 2 references coded [4.61% Coverage]

Reference 1 - 3.60% Coverage

ANN O 00:03:24
So, if somebody says that they have high cultural capital, what do you think that would mean?

Participant A 00:03:31
I believe that would mean that the person is more.., is more engaged in their culture. It's more culture-orientated, meaning, they're more into their culture than other cultures.

ANN O 00:03:46
Thank you, and if somebody says that they have high social capital, what do you think they will mean?

Participant A 00:03:53
In my opinion, I believe that is someone who's able to express, who is confident, who's able to like, express how they think and their personal opinions to others.

ANN O 00:04:14
Okay, thank you. So, now we come to 'science capital'; what do you think that would mean in your own word?

Participant A 00:04:26
I think science capital is, for example, having…,is like having experiences and having, like a specific behavioural attitude towards like, for example, the practices in science.

ANN O 00:04:54
So, if somebody says they have high science capital, what would that mean to you?

Participant A 00:05:01
That would mean that they are more engaged within the science industry; that they are willing to take part in more practices. Low science capital to me, that means that they're not very…they're not very engaged within the science industry.

ANN O 00:05:44
When you say, 'science industry', they are still students, they are not working. Would you mean science industries, like in working or what do you mean?

Participant A 00:05:52
Like in terms of science studies.

<Files\\INTERVIEW TRANSCRIPTS\\Participant B> - § 4 references coded [4.33% Coverage]

Reference 1 - 0.71% Coverage
ANN O
What does science capital mean to you?

Participant B 02:43
It means to me how someone's background or education can affect how they pursue doing science.

Reference 4 - 1.89% Coverage
So, if somebody asks you to give a summary of science capital in terms of all that we have discussed, what will you say?

Participant B 22:10
Well, I will say that science capital is how the people around me shaped me, how I'm going to like…, how other people doing science influence me to do science, like my aunt doing science, or my friend, my close friend, doing science that made me interest[ed] on [sic} doing science.

<Files\\INTERVIEW TRANSCRIPTS\\Participant C> - § 4 references coded [3.01% Coverage]

Reference 1 - 0.77% Coverage
ANN O
So, in your own words, what does science capital mean to you?

Participant C 02:47
[Science capital] The *difference between who's more likely to join in science in terms of ethnicity-wise.*

Reference 2 - 0.65% Coverage
If somebody says you have high social capital, what would they mean?

Participant C 05:16
[High social capital] *Maybe, high influence with people?*

Reference 3 - 1.26% Coverage
[high cultural capital] *if you have high cultural capital, what would that mean to you?*

Participant C 05:29
[high cultural capital] *Maybe, a high knowledge of what, the what I am.*

ANN O 05:42
When you say, the high knowledge of what you are, is that high knowledge of self?

Participant C 05:49
Yes.

<Files\\INTERVIEW TRANSCRIPTS\\Participant D> - § 4 references coded [3.60% Coverage]

Reference 1 - 0.81% Coverage
ANN O
So now, the first thing I'm going to ask you is that, in your own words, what does science capital mean to you?

Participant D 02:59
I think it's an individuals' knowledge and attitude and experience related to science. So just anything about science, anything related to science, I would say.

ANN O
Reference 2 - 0.47% Coverage
So, if I may ask you, what do you think cultural capital means?

Participant D 06:30
I think it means how the individual's culture affects their access to science capital.

Reference 3 - 0.65% Coverage
ANN O
Now, in terms of social capital; what do you think about social capital? What does that mean to you?

Participant D 08:22
I'm not sure about that one, just a second. I don't know what is social capital right now. I literally forgot.

Reference 4 - 1.67% Coverage
ANN O
If you say that somebody has a high science capital, what will that mean to you?

Participant D: 31:34
It will mean to me that they have high understanding of science. They have experiences, I don't know, they have knowledge, and they have a good attitude towards science things. Yeah. first thing, I will think that will be they are really, really experienced. That's that I will think, yeah.

ANN O: 31:59
Okay? And if they have low science capital, what would that mean?

Participant D: 32:04
Not pretty good understanding of science, I will say, yeah, or maybe not a lot of experience as much as the high ones.

<Files\\INTERVIEW TRANSCRIPTS\\Participant E> - § 4 references coded [4.73% Coverage]

Reference 1 - 1.69% Coverage
ANN O
We're talking about science capital and social capital. So, in your own words, what does science capital mean to you?

Participant E
Science capital means to me like, everything like science-related and how you come about, it so like you might get it from like your friends, teachers, just everyone in general. Like in schools, maybe, like you might go to for, maybe volunteering somewhere, you might get from there. So, just anything scientific, like how you come about it.

Reference 2 - 1.33% Coverage
ANN O
So, if you say somebody has high science capital, what would that mean to you?

Participant E
They have like, because of a lot of things they have now like a lot of scientific, you could say experience, maybe, like they know a lot about science. They like lots of things about science come to them like through other means, like teachers, schools, friends, parents, family.

Reference 3 - 1.49% Coverage
ANN O
Hmm, okay, alright, and on the other hand, if somebody has low science capital?

Participant E
It means like, science isn't being encouraged upon them a lot, so like they might like…In schools, it might be like the teachers on, like, really, like, putting science on top of their heads. And then like, maybe their parents don't talk it about at home. They don't have no friends talking about science to them, things like this.

Reference 4 - 0.22% Coverage
ANN O
Whereas science capital is just science coming from everywhere.

<Files\\INTERVIEW TRANSCRIPTS\\Participant F> - § 2 references coded [2.58% Coverage]

Reference 1 - 0.93% Coverage
ANN O
So, in that case, in your own words, what does science capital mean to you?

Participant F 04:42
Science capital is basically how familiar a person is or how good a person's understanding is with scientific concepts, experiences, skills or attitude. This could be influenced by cultural factors or educational level or family backgrounds, etc.

Reference 2 - 1.65% Coverage
ANN O 33:35
So, in your opinion, how do you think a student can build on their science capital? How can a student improve their science capital?

Participant F 33:54
As we said before, Miss, I think science media help them understand more topics in an entertaining way. They can indulge in books. They can indulge in museums, clubs, as we said before. Moreover, I think having intellectual scientific conversations with your peers, teachers, going to places for research, such as universities for a research meeting and things like that. I think all those would greatly improve a learners' science capital.

<Files\\ADDITIONAL INTERVIEW NOTES\\Participant H> - § 1 reference coded [11.09% Coverage]

Reference 1 - 11.09% Coverage
Participant H
To me, science capital means having knowledge, curiosity to engage science, it is having science in everyday life, having superpower of understanding science in all its forms and learn about the amazing world we live in.

<Files\\INTERVIEW TRANSCRIPTS\\Participant H> - § 1 reference coded [2.13% Coverage]

Reference 1 - 2.13% Coverage
ANN O 01:17
I'll start the questions; what does science capital mean to you?

Participant H 01:26
Okay. So basically, to me, science capital is having knowledge and curiosity to engage science in everyday life; it's having a super power of understanding science in all its forms, and learning about the amazing world we live in.

<Files\\INTERVIEW TRANSCRIPTS\\Participant J> - § 2 references coded [1.31% Coverage]

Reference 1 - 1.00% Coverage
ANN O
What does science capital mean to you?

Participant J 00:24
It refers, like more likely to knowledge attitude and more like gaining experiences different experiences mostly experiments that we usually do in our course.

<Files\\INTERVIEW TRANSCRIPTS\\Participant K> - § 3 references coded [4.72% Coverage]

Reference 1 - 2.69% Coverage
ANN O 03:35
Okay, and what did you find out about it, if I may ask?

Participant K 03:40
I found out the key points about it like, why some people participate in post-secondary science and some others not interested in it. Also, I learnt about how science capital can make people think, what do they actually know about it.

ANN O
Reference 2 - 1.34% Coverage
So, how do you think you can improve your science capital?

Participant K 12:39
I can improve my science capital by doing more like research, asking more questions.

<Files\\INTERVIEW TRANSCRIPTS\\Participant L> - § 1 reference coded [0.95% Coverage]

Participant L 01:22
So for me, science capital means exploring more in science and bringing up the science inside us by learning, more exploring and experiencing more.

<Files\\INTERVIEW TRANSCRIPTS\\Participant M> - § 1 reference coded [0.67% Coverage]

Reference 1 - 0.67% Coverage
Participant M
I believe science capital explains why an individual is likely to engage or succeed in science, and then the probability of the person pursuing a science related career in future.
<Files\\INTERVIEW TRANSCRIPTS\\Participant N> - § 2 references coded [2.99% Coverage]

Reference 1 - 1.17% Coverage
Participant N 01:37
In my own words, science capital to me is a skill, often individual, or the skills or experience or knowledge that the individual has which enable them to take part in science related to activity or discussion in science.

Reference 2 - 1.81% Coverage
ANN O
How would you describe your own science capital; will you say it is high, medium or low?

Participant N 06:34
I think, by just getting used to it; medium

ANN O 06:40
What does 'medium' mean to you?

Participant N 06:43
'Medium' is that I'm getting to the higher level by knowing how you go about doing things and learning about what is happening around you as well.

Appendix 1D: Participants' Responses to RQ1.3: Science Capital Definition

Teachers' Response:

<Files\\ADDITIONAL INTERVIEW NOTES\\Participant P> - § 1 reference coded [5.52% Coverage]

Reference 1 - 5.52% Coverage
"All the components of science capital should be retained, but learners' self-motivation/dedication should be added".

Students' Responses:

<Files\\INTERVIEW TRANSCRIPTS\\Participant C> - § 1 reference coded [1.33% Coverage]

Reference 1 - 1.33% Coverage
"So, I think it's a clear vision to see who's more likely to pick science. But I believe that science capital can be wrong because I don't join in the capital ethnicity group, because I'm a Latino, and I don't have any parents that have introduced me to science other than school or STEM projects that we used to do in school as well".

<Files\\ADDITIONAL INTERVIEW NOTES\\Participant D> - § 2 references coded [23.87% Coverage]

Reference 1 - 11.97% Coverage
ANN O
What are your opinions about the descriptions and explanations of science capital given by the definition? Do you think some components should be removed?

Participant D
I suggest removing the emphasis on parental scientific knowledge as a component of science capital; it may not always be directly within one's individual control. Instead, adding focus on in community involvement in science-related activities could enrich the definition better.

Reference 2 - 12.60% Coverage
However, I do not agree that having high SC guarantees success in pursuing science post-16. While science capital is beneficial and increases the likelihood of continued interest in science, other factors such as, access to resources, quality of education, and personal motivation play significant roles in determining one's path in science.

<Files\\ADDITIONAL INTERVIEW NOTES\\Participant H> - § 1 reference coded [7.68% Coverage]

Reference 1 - 7.68% Coverage
"Enhancing hands-on practical experiences could make course even more interesting".

<Files\\ADDITIONAL INTERVIEW NOTES\\Participant J> - § 1 reference coded [9.95% Coverage]

Reference 1 - 9.95% Coverage
My opinion about the definition of science capital given/some components that can be added or removed - It is comprehensive, but it could maintain more on practical engagement with science and diverse representations.

<Files\\ADDITIONAL INTERVIEW NOTES\\Participant L> - § 1 reference coded [2.86% Coverage]

Reference 1 - 2.86% Coverage
"I disagree with the complex content of the framework that have a comprehensive nature, which might make the implementations complicated and resources-intensive".

Appendix 1E: Table of Acquiescence Bias Cases Across Participants

Participant	Examples of Acquiescence Bias Cases	Relevant Quote
Participant 12345	Adopts interviewer's prompt instead of generating own ideas	*"Maybe."* (responding to a suggestion about working in non-science jobs)
	Agrees to interviewer interpretation instead of giving own rationale	*"Yeah, at home."* (following interviewer's suggestion)
Participant A	Adopts interviewer's framing about language advantage	*"I will have an advantage."*
Participant B	Provides minimal answer aligning with interviewer framing	*"No, the second."*
Participant C	Aligns with interviewer's assumption of interest as main reason	*"Yes, yes."* (confirming interest is deciding factor)
Participant E	Soft compliance when uncertain	*"I guess so."* (on usefulness of informal learning)
	Agrees even when contradicting earlier claims	*"Not really, no."* (gender influence)
Participant L	Accepts advantages/disadvantages dichotomy without reflection	*"No."*

Appendix 1F: Table of Negative & Contradictory Cases Across Participants

Participant	Examples of Negative / Contradictory Cases	Relevant Quotes
Participant H	Recognises being first-generation HE student as limiting, contradicting dominant narratives of aspiration and upward mobility	*"It might be a bit challenging to build up science capital. It could mean less exposure to science-related opportunities and experiences."*
Participant L	Contradiction: low parental education perceived as both limiting and motivating	*"My parents had a poor educational background; their effort for science education made me more motivated and engaged to learn even though I didn't witness proper science skills from them."*
	Negative case: breadwinner's occupation not influential, contrary to SC theory	*"My family breadwinner's occupation did not significantly affect my access/utilisation of science."*
Participant 12345	Negative case: family science role-models important, yet personally has none	*"I think that's quite important… [but] No."*
	Negative case: socioeconomic disadvantage framed as limiting access	*"Maybe… they might not have like good resources, maybe due to the economic background."*
Participant A	Negative case: English language proficiency provides clear advantage	*"For a person who doesn't understand English fully… I will have an advantage."*
Participant B	Contradiction: denies gender influence despite wider structural evidence	*"Oh, no! Really no! Doing science doesn't specify what gender you are."*
	Contradiction: denies ethnicity influence with no justification	*"No, no, no, not."*

Participant	Examples of Negative / Contradictory Cases	Relevant Quotes
Participant C	Contradiction: describes family as "not science" yet father taught electronics	*"They don't have any science knowledge"* vs *"My dad used to teach me how to fix motherboards…"*
	Contradiction: says ethnicity affects SC, then denies personal effect	*"I don't join in the capital ethnicity group…"* vs *"No, no."*
	Contradiction: gender "no effect" yet acknowledges stereotypes	*"I don't really think so… everything is equal"* vs *"Some people… think women can't become scientists."*
	Negative case: low family science capital but strong personal science interest	*"I think… not very good at science, but… I've been very interested in [it]."*
	Contradiction: strong challenges in English but also claims understanding	*"Sometimes it does [affect me]… I don't understand 1 or 2 words"*
Participant D	Contradiction: high-SES background but experienced low-SES barriers after migration	*"Even though you come from a high socio-economic background… when I moved to UK… I was by myself… did that change your socio-economic background? – Yes, of course."*
	Negative case: argues that high SC does not guarantee success	*"I do not agree that having high SC guarantees success… other factors such as access to resources… motivation… play significant roles."*
Participant E	Contradiction: science museums inspire engagement yet offer limited learning	*"You can show them science isn't boring… It's fun"* vs *"You won't learn as much as… in lesson."*
	Negative case: gender perceived as irrelevant despite broader literature	*"I don't think gender really matters… Not really, no."*
Participant F	Contradiction: sees informal environments as important but never attends	*"I think it's important"* vs *"I don't think I do [visit]."*
Participant K	Negative case: family higher education not perceived as advantage	*"I wouldn't really say advantage… everybody's off on the same level."*
Participant M	Contradiction: sees media as helpful but causing mediocre work	*"Advantages outweigh… but it makes students give mediocre work."*
	Negative case: strong ethnic influence but denies racial disadvantage	*"I don't think race [affects], but background… ethics… might."*
Participant N	Negative case: denies family education effect despite strong SC literature	*"I don't think so… science is like every day."*

Appendix 1G: Re-design of Interview Protocol : (Two-Phase Design)

Purpose: To elicit participant-led understandings of science participation before introducing the SC framework for reflective dialogue.

General Guidance

- Obtain informed consent; remind participants there are no right/wrong answers.
- Phase A must occur before any exposure to SC materials. Do not mention 'science capital'.
- Use prompts sparingly; privilege participants' own words (in vivo).
- Audio-record with permission. Capture time stamps and notable non-verbal cues where relevant.

Phase A (Emic-first): FE Teachers

Warm-up & Context

A1. Could you tell me about your role and the learners you teach (routes, levels, typical pathways)?
A2. Thinking about your teaching this term, can you describe a moment when science felt especially accessible for your learners, and a moment when it did not?

Free Narrative & Free List

A3. In your own words, what helps someone in your context to 'get on' in science? (Probe: people, places, habits, resources, qualifications, workplaces.)
A4. Free list: Please list as many factors as you can that support science participation and progression in FE.

Mapping & Relationships

A5. Could you sketch or describe a map of people, places, and practices that support (or hinder) learners' engagement with science, inside and outside college? (If on paper, collect artefact.)

Vignettes (Teachers)

Present one at a time; ask for spontaneous explanations and actions.
V1. Adult returner, evenings: A 32-year-old learner works 30 hours/week, has two young children, and is a Level 3 Applied Science course. Attendance has dipped. What factors matter most here, and how might you respond?
V2. Vocational placement: A Level 3 Applied Science learner struggles to secure a relevant placement. What enables or blocks access to opportunities, and how do you navigate this?
V3. Language: A Level 3 Applied Science learner with high practical ability finds written evaluations challenging. What support exists locally? What else would help?

Barriers & Enablers

A6. What gets in the way, practically, culturally, financially, or institutionally, for your learners? Which barriers are most amenable to change?
A7. Where (outside formal lessons) do learners pick up science-related know-how or confidence? (Probe: family, community, online, museums, workplaces, social media.)

Language & Local Terms

A8. What words or phrases do you and your colleagues/learners use when talking about who does well in science and why? (Capture in vivo terms verbatim.)

Phase A (Emic-first): FE Students

Warm-up

S1. Tell me a bit about yourself and your course. What are you aiming for next?

Experiences & Stories

S2. Can you tell me about a time when science felt easy to connect with, and a time when it felt out of reach?
S3. Free list: What things (people, places, apps, videos, clubs, jobs) help you learn or stay interested in science?

Vignettes (Students)

SV1. Caring & commute: You've got a long commute and help with siblings at home. What makes it easier or harder to keep up with science? What would help most?
SV2. Work shift clash: Your lab practical clashes with a work shift you depend on. How would you handle this? Who could help at college or outside?
SV3. Confidence & language: You enjoy experiments but feel less confident with scientific writing. Where could you get support? What have you tried?

Networks & Places

S4. Who do you talk to about science or science-related jobs? Where do you come across science outside lessons?
S5. What gets in the way for you or your friends (money, time, travel, confidence, equipment)? Which of these could the college realistically change?

Phase B (Etic Member-Dialogue): FE Teachers

Neutral Introduction to Science Capital

Read a short neutral summary of the SC framework (avoid evaluative language). Make it clear that this is optional and provisional.

Resonance, Dissonance, Translation

B1. Thinking back to what you described earlier, which parts of this framework agree with your context? Which parts feel missing for FE?
B2. If you were to rename or re-organise elements for FE, what would you change? (Invite creation of new categories, e.g., placement capital, timetable/time capital.)

Card Sort & Prioritisation

B3. Sort these cards into 'central here', 'sometimes relevant', 'not really us'. Add your own cards if needed. Talk through your choices.
B4. Of the items you placed as 'central', which are most actionable by teachers/college, and which require external partnerships?

Application & Practice

B5. What practical strategies have you used or would you try to strengthen the elements you rated as central?

Phase B (Etic Member-Dialogue): FE Students

Brief Framework Reflection

SB1. Looking at this short summary, which parts feel true for your experience? Which parts don't fit?
SB2. If you could add items that matter for students like you (e.g., travel costs, shift work, placements), what would they be?

Card Sort & Supports

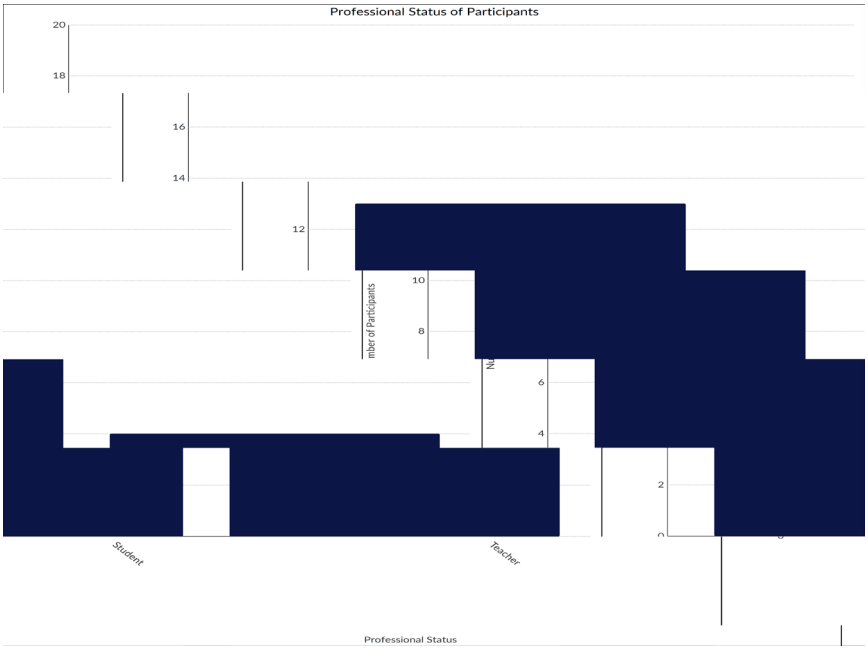
SB3. Sort the cards into 'matters a lot', 'sometimes', 'not really'. Add your own if needed.
SB4. For the top 2–3 items that matter a lot, what support from college, family, work, or community would help most?

Appendix 2: Demographics of Participants

Name	Age	Gende	Ethnicity	langu	Status	Socio-economic status	UK compulsory education & GCSEs (UK GCSEs)
Participant 12345	19+	Female	Any other White background	EALS	Student	Small employers and own account workers	UK compulsory education & GCSEs (UK GCSEs)
Participant A	16-18	Male	Black,Blk British,Caribbean, African	NELS	Student	Small employers and own account workers	UK compulsory education & GCSEs (UK GCSEs)
Participant B	19+	Female	Black,Blk British,Caribbean, African	EALS	Student	Small employers and own account workers	UK compulsory education & GCSEs (UK GCSEs)
Participant C	16-18	Female	Mixed or multiple ethnic groups	EALS	Student	Small employers and own account workers	Non- UK compulsory education & GCSEs (No UK GCSEs)
Participant D	19+	Female	Any other White background	EALS	Student	Managerial, administrative, professional	Non- UK compulsory education & GCSEs (No UK GCSEs)
Participant E	19+	Male	Asian/Asian British	NELS	Student	Intermediate occupations	UK compulsory education & GCSEs (UK GCSEs)
Participant F	16-18	Female	Asian/Asian British	EALS	Student	Intermediate occupations	Non- UK compulsory education & GCSEs (No UK GCSEs)
Participant H	19+	Female	Asian/Asian British	EALS	Student	Small employers and own account workers	Non- UK compulsory education & GCSEs (No UK GCSEs)
Participant J	19+	Male	Asian/Asian British	EALS	Student	Intermediate occupations	Non- UK compulsory education & GCSEs (No UK GCSEs)
Participant K	16-18	Female	Black,Blk British,Caribbean, African	EALS	Student	Small employers and own account workers	UK compulsory education & GCSEs (UK GCSEs)
Participant L	16-18	Female	Any other White background	EALS	Student	Small employers and own account workers	Non- UK compulsory education & GCSEs (No UK GCSEs)
Participant M	19+	Female	Black,Blk British,Caribbean, African	EALS	Student	Managerial, administrative, professional	Non- UK compulsory education & GCSEs (No UK GCSEs)
Participant N	19+	Female	Black,Blk British,Caribbean, African	EALS	Student	Small employers and own account workers	Non- UK compulsory education & GCSEs (No UK GCSEs)
Participant P (Teacher)	19+	Male	Black,Blk British,Caribbean, African	EALS	Teacher	Managerial, administrative, professional	Non- UK compulsory education & GCSEs (No UK GCSEs)
Participant Q (Teacher)	19+	Male	Black,Blk British,Caribbean, African	EALS	Teacher	Managerial, administrative, professional	Non- UK compulsory education & GCSEs (No UK GCSEs)
Participant R (Teacher)	19+	Male	Any other White background	NELS	Teacher	Managerial, administrative, professional	Non- UK compulsory education & GCSEs (No UK GCSEs)
Participant S (Teacher)	19+	Male	Asian/Asian British	EALS	Teacher	Managerial, administrative, professional	Non- UK compulsory education & GCSEs (No UK GCSEs)

Appendix 2A: Participants' Demographic Characteristics

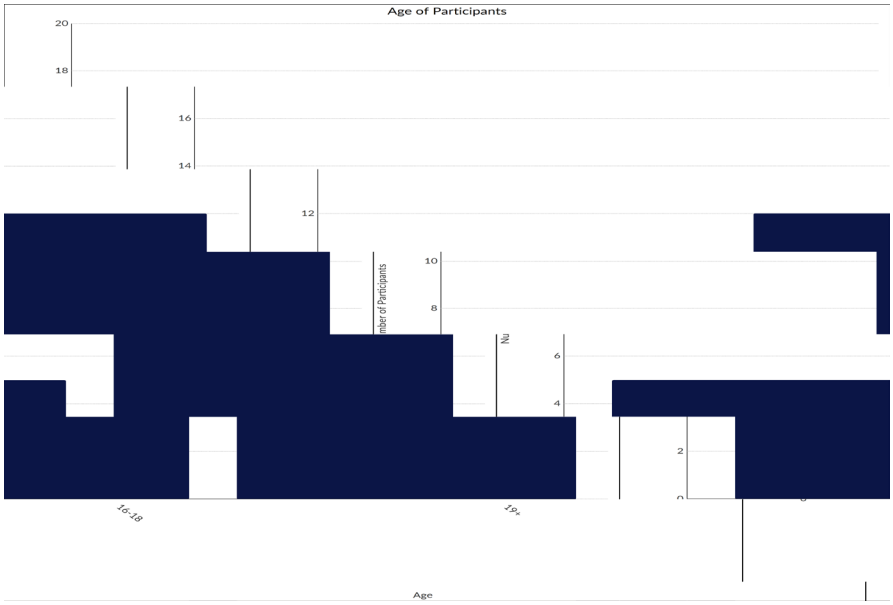
Professional Status of Participants



Professional Status: The Student and Teacher Participants.

The inclusion of both student (n=13) and teacher (n=4) participants provides a dual perspective that enriches the study's findings by capturing both the learners' and their teachers' insights.

Ages of Participants

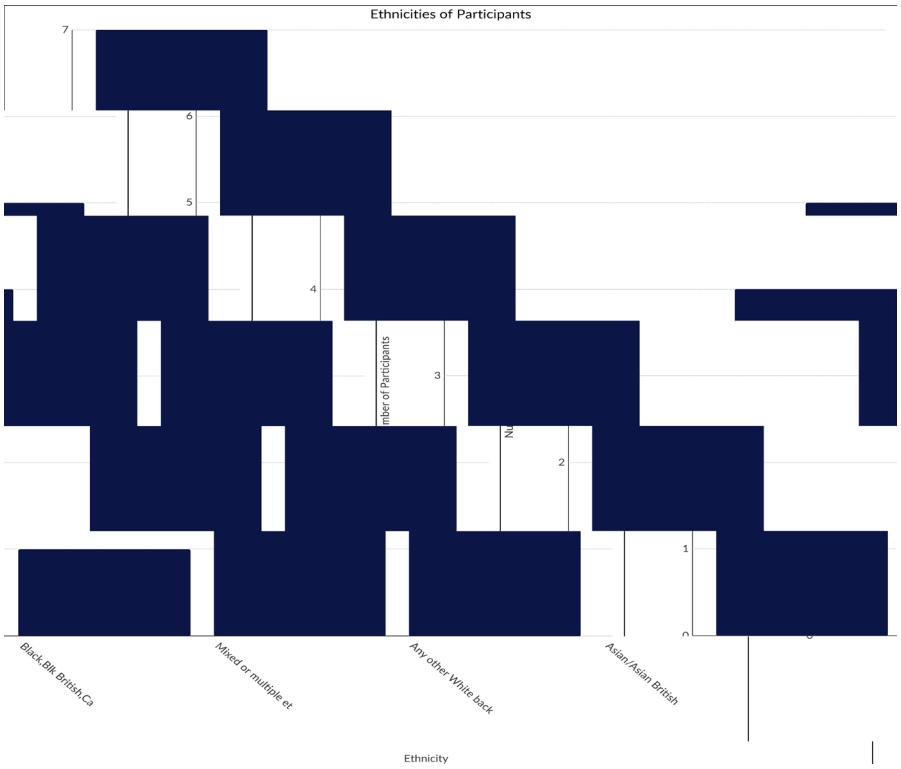


Age Group: Shows most participants (12) are aged 19+, with a smaller group (5) aged 16–18.

The predominance of student participants aged 19+ (n=8) compared to those aged 16–18 (n=5) carries important implications for the interpretation of students' findings.

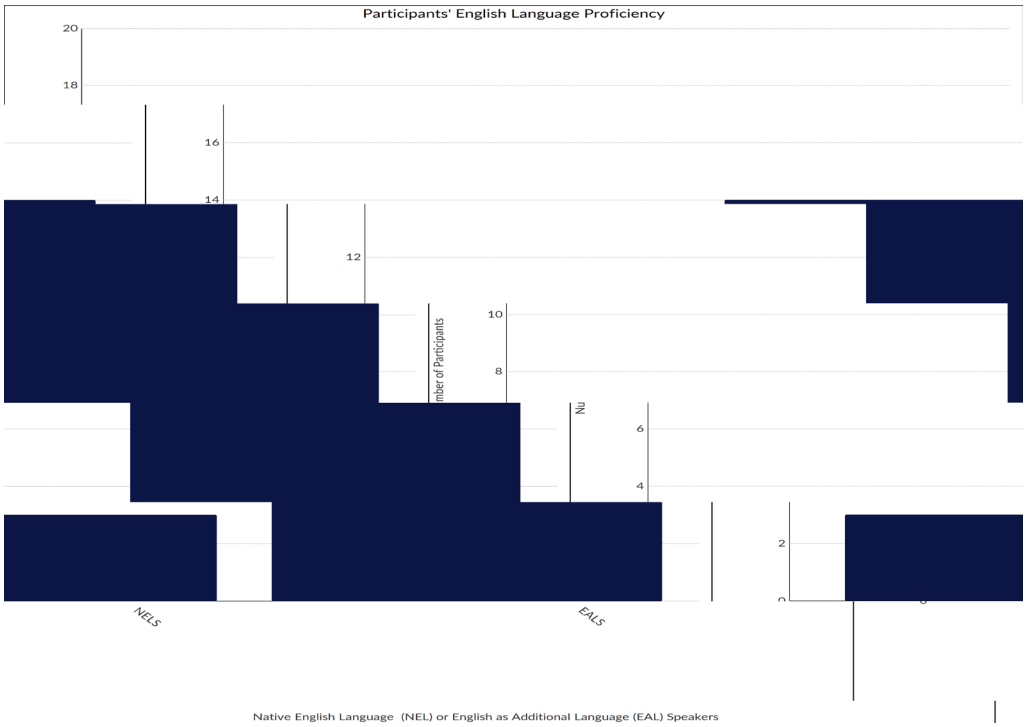
Ethnicities of Participants

Ethnicity: Highlights the ethnic diversity among participants, with strong representation from Black, Asian, and White backgrounds.



The strong representation of Black (n=7), Asian (n=5), and White (n=4) participants confirm the multiethnicity of this study population.

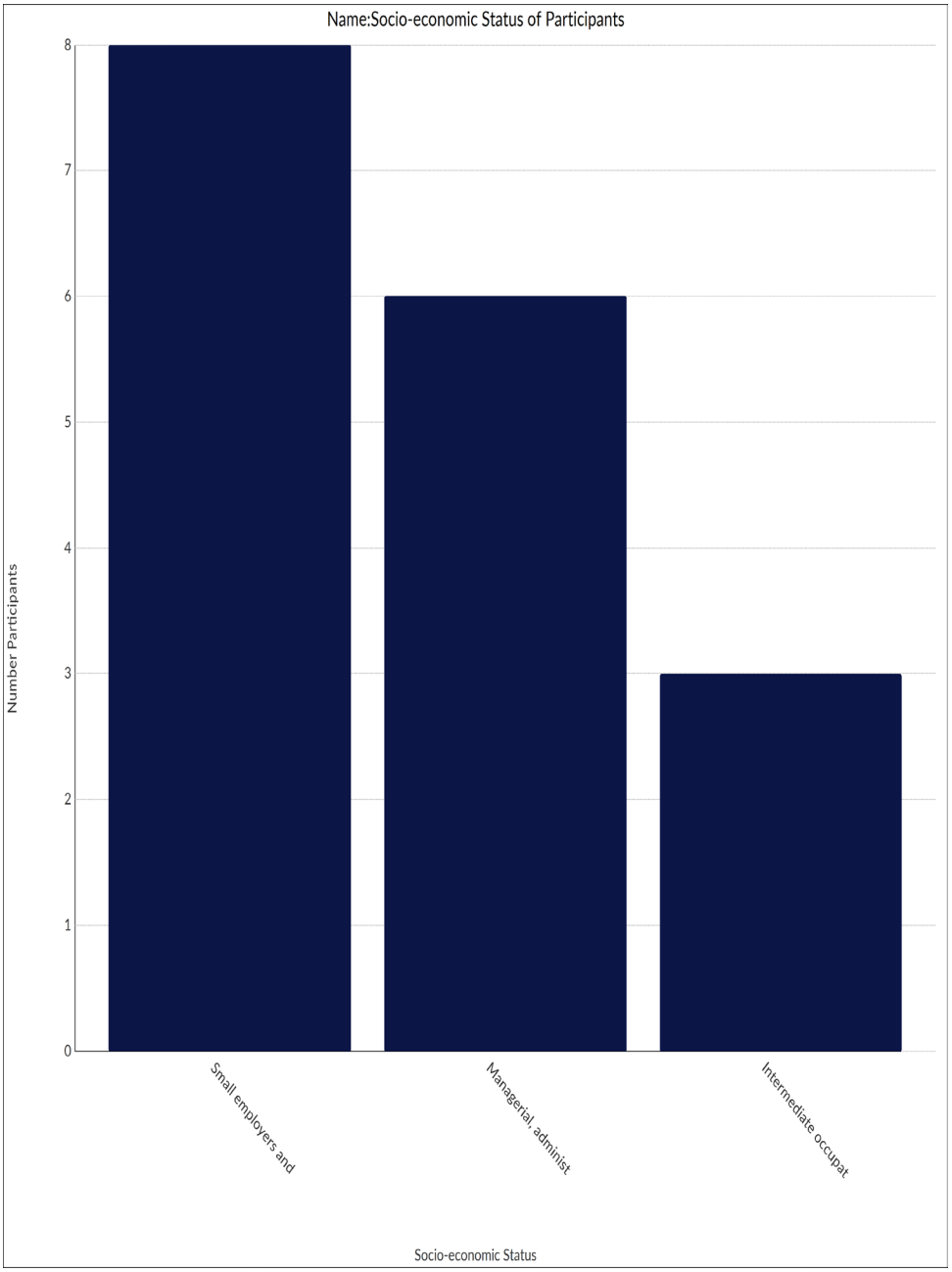
Participants' English Language Proficiency



Language Status: Most participants are EALS (English as an Additional Language), which is particularly relevant for exploring science capital in multilingual contexts.

The predominance of EAL participants (n=14), NEL (n=3), is relevant for interpreting science capital in multilingual contexts.

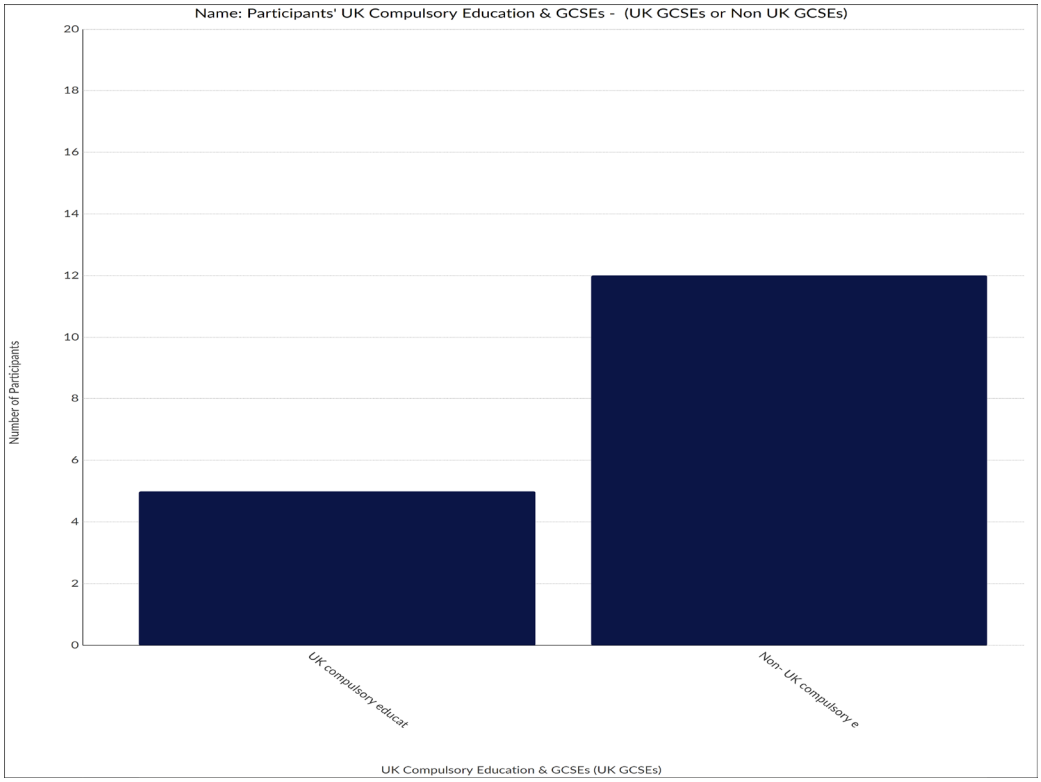
Socioeconomic Status of Participants



Socio-Economic Status: Displays a mix of occupational backgrounds, with notable representation from small employers, intermediate occupations, and managerial/professional roles.

According to the UK 2021 Census, socio-economic status is closely linked to ethnicity, with notable disparities across occupational categories (Cabinet Office, 2025).

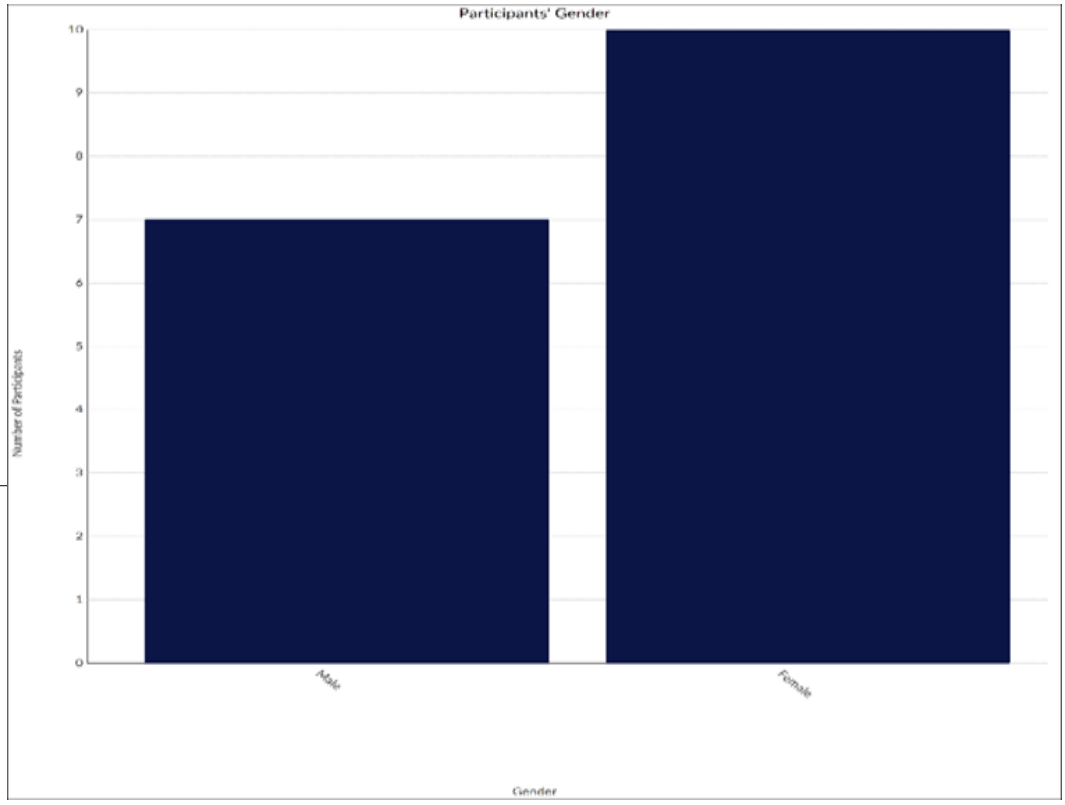
Participants' Compulsory Education & [non]GCSEs



Participants' England Compulsory Education & GCSEs - (GCSEs or Non-GCSEs)- this is whether or not participants did their secondary school education, including taking the GCSE qualification in England.

The distinction between participants who completed their secondary education and GCSEs (n=5) in England and those who did not (n= 12) has important implications for interpreting the study's findings

Participants' Gender



Participants' Gender

The gender imbalance, 10 female students and 3 male students, with all 5 teachers in the department being male, (except myself) has important implications for the study

Appendix 3A Sampling – Students' Course Groups, Ages and Genders (Participants are bracketed)

Category	Group 1	Group 2	Group 3	Total
Age (16–18) Females	HC; (L); JS	MB; (K); (F); (C); TM; SS; PS	AD; IQM	12
Age (16–18) Males		(A)		1
Age (19+) Females	MH; SJ; (M); (D)	FL; BD; AD; (N); AG; AM; HS	(B); SK; (12345); MPD; SYD	16
Age (19+) Males	(E); AH; AI; (H); MK; GN; (J)		SMM; IE; IK; MOP; BDT	12

Appendix 3B Sampling - Students' Ethnicity, Age, Gender, Compulsory Education and Language

(Participants are bracketed)

Category	16-18 years old		19+ years old	
	Female	Male	Female	Male
Asian or Asian British (Indian; Pakistani; Bangladeshi; Chinese; Any other Asian background)	HC; (F); PS		SJ; (H)	(E); MK; (J); SMM
Black, Black British, Caribbean or African (Caribbean; African; Any other Black, Black British, or Caribbean background)	(K); MD; SS; AD; IQM	(A); AM	MH; (M); (N); BD; AD; (B); MPD; SYD	AI; IE; MOP; AH
Mixed or multiple ethnic groups (White and Black Caribbean; White and Black African; White and Asian; Any other Mixed or multiple ethnic background)				
White (English, Welsh, Scottish, Northern Irish or British; Irish; Gypsy or Irish Traveller; Roma; Any other White background)	(L); (C)		(D); SK; (12345)	GN; BDT; IK
Primary, Secondary schools & GCSEs in UK	MB; (K); (C); SS; PS; HC; IQM	(A)	MH; AD; (B); (12345); MPD	(E); AH; GN; AI; BDT
No Primary, Secondary schools & GCSEs in UK	(F); (L); JS; AD		(H); (M); (D); BD; (N); SK; SYD	MK; (J); FL; AM; SMM
English as additional language Speakers (EALS)	(L); JS; HC; MD; (K); (F); (C)		MH; (H); (D); (M); BD; AD; (N); (B); SK	MK; GN; (J); FL; AM; (SMM); BDT
Native English Language Speakers - (NELS)	SS; PS; AD; IQM	(A)	(12345); MPD; SYD	(E); AH; AI
High/Medium Socioeconomic Status	(D); (E); (F); (J); (M)			
Low Socioeconomic Status	(A); (B); (C); (12345); (H); (K); (L); (N)			

Appendix 3C Sampling – Participants' Intersectional Dimensions (Teachers are in **)

Category	16-18 years old		19+ years old	
	Female	**Male**	**Female**	**Male**
Asian or Asian British (Indian; Pakistani; Bangladeshi; Chinese; Any other Asian background)	(F)		(H)	(E); (J) (S**)
Black, Black British, Caribbean or African (Caribbean; African; Any other Black, Black British, or Caribbean background)	(K)	(A)	(M); (N); (B)	(P**); (Q**)
Mixed or multiple ethnic groups (White and Black Caribbean; White and Black African; White and Asian; Any other Mixed or multiple ethnic background)				
White (English, Welsh, Scottish, Northern Irish or British; Irish; Gypsy or Irish Traveller; Roma; Any other White background)	(L); (C)		(D); (12345)	(R**)
Primary, Secondary schools & GCSEs in UK	(K); (C)	(A)	(B); (12345)	(E)
No Primary, Secondary schools & GCSEs in UK	(F); (L)		(H); (M); (D); (N)	(J) (P**); (Q**); (R**); (S**)
English as additional language Speakers (EALS)	(L); (K); (F); (C)		(H); (D); (M); (N); (B)	(J) (P**); (Q**); (R**); (S**)
Native English Language Speakers – (NELS)		(A)	(12345)	(E)
High/Medium Socioeconomic Status	(D); (E); (F); (J); (M)			(P**); (Q**); (R**); (S**)
Low Socioeconomic Status	(A); (B); (C); (12345); (H); (K); (L); (N)			

Appendix 4A removed due to confidentiality.

Appendix 4B: 'Invitation to Participate in My Research Study' – Letter Content

Invitation to participate in my research study.

▫

ANN OBATOMI (PGR)

ANN OBATOMI (PGR)

Invitation to participate in my research study.

I am inviting you to participate in a research study that I am undertaking at the College of Social Sciences at the University of Glasgow, titled:

Exploring Science Capital in a London-Based Further Education College: Science Teachers' and their Students' [Mis]conceptualisations, Diversity, and Inclusive Strategies'

Please, find attached the documents (Private Notice; Participation Information Sheet, Parental Consent (for 16-18-year-olds only), and your Consent form) that explain the purpose of the research, and what your participation will entail. The Research Ethics Committee of my School at the University of Glasgow has reviewed and approved the ethical considerations of the study. Also, I have obtained permission from our college through our Head of School to carry out this study and recruit the intended participants.

I thank you for your consideration.

If you have any questions about any of the documents, I am available to answer them.

Kind regards,
Ann B-T Obatomi

Appendix 5A: The Participant Information Sheet

University of Glasgow

College of Social Sciences

Participant Information Sheet

Title of project: Exploring Science Capital in a London-Based Further Education College: Science Teachers' and their Students' [Mis]conceptualisations; Diversity, and Inclusive Strategies.

Researcher: Ann Bosede-Toluhi Obatomi
Contact details: xxxxxxx@student.gla.ac.uk
Degree being undertaken for this research: Doctor in Education

Invitation to participate in this study.

I am inviting you to take part in my research study. Before you decide to take part, it is important for you to understand why the research is being done and what it will involve. Please, take some time to read the following information carefully and ask me if there is anything that is not clear or if you would like more information. When you are ready, I will appreciate it if you let me know whether you wish to take part in the study.
Thank you for reading this.

The purpose of this study

The principal aim of this study is to investigate the nuanced [mis]conceptualisations of science capital (SC) among a socially diverse and multi-ethnic participant group, considering the possible impacts of contributing intersectional and inclusivity factors. My research aims to explore both the commonalities and differences in the SC [mis]conceptualisations of teachers and students, examining how these diverse perspectives may potentially impact teaching and learning strategies and outcomes for students.

What your participation involves

I am inviting you to take part in this study because you fit into the group of the participants on whom I am carrying out this research. Your participation involves taking part in a 1-1 interview session with me.

- The interview will be on Zoom, and it will be for a maximum of 1 hour; no one else will be involved as it will be confidential. The interview will take place in one of the classrooms in the college.
- During the interview, I will ask you some questions about your perceptions of science capital.
- You do not have to answer all or any of the questions asked and you can withdraw any answer you give up to the moment of publication. Please, be assured that neither the findings from this study will be traceable to any individual nor will any special characteristics at individual level be revealed.

- With your permission, all your verbal responses to the questions asked will be recorded using my university's (University of Glasgow) Zoom audio recorder; your audio responses will be transcribed into a written version later.
- I will give you a written copy of your verbal responses (the transcript) later to check that it is accurate and that I can use it for my study; you are free to remove anything that you are not happy with or ask for the whole interview record not to be used.
- If you agree the use of any or all your responses, they will form part of the data source for my study and will be analysed.

Your participation/withdrawal is entirely voluntary.

Your participation in this study is entirely voluntary. You are free to withdraw at any time without giving a reason. Your participation or withdrawal will not have advantageous or disadvantageous effects on my professional relationship with you. If you choose to withdraw, the data collected from you will be destroyed. However, if you plan to withdraw from this study, please, plan to do so by July 31, 2024, after which your responses may form part of the data analysis. If you are unhappy with this, please, consider withdrawing your participation.

The possible benefits of this study to you

I think that being able to explore your science capital may likely help you to identify your strengths and areas of improvement in your science pursuits and education.

The possible risks of this study to you

- A Zoom interview session with you is planned, hence, I consider the Covid-19 risk to be little. This is because precautions that include social distancing and hygiene measures (the use of hand sanitiser) will be taken. No interview will be held if you or I become unwell. You will be requested to verbally confirm that you are happy with the anti-Covid-19 arrangements in place before the interview commences; if you still feel uncomfortable, the interview will not be held unless modifications have been made to suit you.
- Also, the interview will be held in a pre-booked classroom on the college premises which I consider a safe venue.
- I do not envisage any other risk, however, if you are concerned about anything else, please, let me know.

Confidentiality of your personal details and the data you provide.

- Your participation is entirely confidential.
- Only the data that are required for the study will be requested from you and any data collected will be used for the purposes of this study only. For instance, the study requires your personal data and special characteristics (such as name, socio-economic status, gender and ethnicity).
- The secure University of Glasgow Zoom Client will be employed to record your verbal responses to interview questions; these will then be deleted when downloaded and encrypted.

- Your name and all references that can identify you will not be used in any data analysis; a pseudonym (an imaginary name or letters) will be used to identify you in all data and publications arising from this study.
- The use of direct quote(s) from you will be done with this specific written consent from you.
- All the data collected from you will be de-identified (this means that any information that can identify you will be replaced by a code, to which I will retain the key in a secure location).
- Paper copies of data will be stored securely locked in my home. Once processed, paper documents that contain data will be securely shredded.
- All your personal data will be destroyed immediately after the completion of this research; however, any pseudonymised research data will be retained for 10 years in the University of Glasgow One Drive.
- Electronic data will be encrypted and processed on a laptop that is protected by a complex password to which only I have access; electronic data will be permanently deleted from the laptop once processed.
- No other electronic device (such as a mobile phone, USB stick, or social media platform) will be used to process, transfer or store data.
- With your permission, data collected may be shared in accordance with the University of Glasgow's Data Sharing Guidance. For this study, this means that I will share data from the study with my supervisor, examiners, and any other authorised university staff member on my programme.
- I can share my findings from this study with you in the form of a written summary. Please, let me know if you would like me to do this.
- My findings will be submitted as an assessment of my programme in the university.
- My findings are also likely to be shared publicly in journal articles, conferences, and conference papers.
- The University of Glasgow One Drive will be used to store all research data, which includes the interviews and transcriptions. The University of Glasgow guidelines require that these research data are retained for 10 years following the completion of the project.
- With your permission, data collected may be used in future publications (print and online).
- Other authenticated researchers will be permitted access to this data only if they agree to preserve the confidentiality of the information as requested in this form. They are also permitted to use materials in this study in publications, reports, web pages, and other research outputs if they agree to preserve the confidentiality of the information as requested in the consent form that you signed.

Support groups

Please, find below a list of support groups that you can contact should you require additional help with any of the issues we discussed that have adversely affected you; further help is available from relevant organisational websites:

- UofG open self-help counselling resources - https://www.gla.ac.uk/myglasgow/counselling/
- Covid-19: guidance and support-GOV.UK. - https://www.gov.uk/coronavirus
- NHS 111 24-hour phone line- for right advice and treatment for physical and mental health
- 24 Hour Online Counselling - https://www.findresultsquickly.com/reliable/results
- Anxiety Care UK. https://www.anxietycare.org.uk. (Helpline: 03444775774)

- Mental health crisis helplines. Mind- https://www.mind.org.uk/information-support/guides-to-support-and-services/crisis-services/helplines-listening-services/

Essential statement on confidentiality.

Please note that confidentiality will be maintained as far as possible unless during our conversation I hear anything which makes me worried that someone might be in danger of harm, I might have to inform relevant agencies of this.

This project has received approval from UofG's College of Social Sciences Research Ethics Committee.

To pursue any complaint about the conduct of the research: contact the College of Social Sciences Lead for Ethical Review: socsci-ethics-lead@glasgow.ac.uk.

Appendix 5B: Privacy Notices

Privacy Notices

What is a Privacy Notice?

A Privacy Notice describes to individuals (Data Subjects) when, why and where their information (personal data and sensitive personal data/special categories data) is being used by the University. In order for the processing of personal information to be demonstrably fair and transparent, individuals must be provided with a Privacy Notice. Further guidance on Privacy Notices is available from the Information Commissioner's Office (ICO).

When do I need one?

The University will produce separate Privacy Notices to Students and Staff which will set out in detail the uses made of their personal data. You should first check whether the use of the information within your project/initiative is already included in these Privacy Notices.

If not, then you will need to provide a specific Privacy Notice to data subjects whose personal information you are processing. It is also important that consideration is given to the legal basis for processing personal information. For further information, please refer to ICO guidance on lawful basis for processing and the interactive tool.

What should I include?

There are defined criteria for what must be inclusion in Privacy Notices:

- Identity and contact details of the Data Controller (which will be the University of Glasgow) and the Data Protection Officer.
- Details of the information being processed, the purpose and the legal basis for processing.
- Details of any other organisation or person who may access the data.
- Details of transfers to countries outside the European Economic Area (EEA) and the safeguards in place (e.g. whether a data sharing agreement is in place).
- Information on the retention period or criteria used to determine how long the information will be held.
- Details of applicable data subject rights.
- Where relevant, the existence of automated decision making, including profiling and guidance on how decisions are made, the significance and resultant consequences.
- Where consent is being relied upon as the legal basis for processing, the right to withdraw this consent any time.
- Right to complain to the Information Commissioner's Office.

Further information

https://www.gla.ac.uk/myglasgow/dpfoioffice/gdpr/

Please note all text highlighted in yellow and square brackets should be amended or removed before Privacy Notice is finalised.

Privacy Notice for Participation in Research Project:

Exploring Science Capital in a London-Based Further Education College: Science Teachers' and their Students' [Mis]conceptualisations; Diversity, and Inclusive Strategies.

We only collect data that we need for the research project, and we will de-identify your personal data from interview transcripts through pseudonymisation. Please, note that confidentiality will be maintained as far as it possible, unless during our conversation I hear anything which makes me worried that someone might be in danger of harm, I might have to inform relevant agencies of this. Please, refer to the accompanying **Participant Information Sheet** for more details.

Lawful basis for processing your data.

We must have a lawful basis for processing all personal data. In this instance, the lawful basis is public task/official authority – this covers activities undertaken as part of the core functions of the University, which is appropriate for this academic research. Special categories/sensitive personal information are being processed; hence, the additional lawful basis required is your explicit consent.

What we do with it and who we share it with

All the personal and special categories data you submit are processed by: Ann Bosede-Toluhi Obatomi, at the University of Glasgow in the United Kingdom and can be accessed by my supervisor, Professor Catherine Lido. In addition, security measures are in place to ensure that your personal data remain safe: all files will be encrypted and stored on the secure University of Glasgow OneDrive. Where you might be identifiable in research outcomes (e.g., a quote), we will seek your explicit consent. Please consult the **Consent form** and **Participant Information Sheet** which accompanies this notice.

Due to the nature of this research, it is very likely that other researchers may find the data collected to be useful in answering future research questions. We will ask for your explicit consent for your data to be shared in this way. Upon completion of the report, you will be contacted to ask if you wish to receive a copy of a summary of the research findings. We will also contact you with details of any subsequent publications or outputs (e.g., presentations, academic publications).

What are your rights?*

The UK GDPR (General Data Protection Regulation) provides that individuals have certain rights including: to request access to, copies of and rectification or erasure of personal and special categories data and to object to processing. In addition, data subjects may also have the right to restrict the processing of the personal and special categories data and to data portability. You can request access to the information we process about you at any time.

If at any point you believe that the information we process relating to you is incorrect, you can request to see this information and may in some instances request to have it restricted, corrected, or erased. You may also have the right to object to the processing of data and the right to data portability.

Please note that as we are processing your personal and special categories data for research purposes, the ability to exercise these rights may vary as there are potentially applicable research exemptions under the GDPR and the Data Protection Act 2018. For more information on these exemptions, please see UofG Research with personal and special categories of data.

If you wish to exercise any of these rights, please submit your request via the webform or contact dp@gla.ac.uk

Complaints

If you wish to raise a complaint on how we have handled your personal data, you can contact the University Data Protection Officer who will investigate the matter.

Our Data Protection Officer can be contacted at dataprotectionofficer@glasgow.ac.uk

If you are not satisfied with our response or believe we are not processing your personal data in accordance with the law, you can complain to the Information Commissioner's Office (ICO) https://ico.org.uk/

Who has ethically reviewed the project?

This project has been ethically approved via the College of Social Sciences Research Ethics Committee or relevant School Ethics Forum in the College.

How long do we keep it for?

Your personal and special categories data will be retained by the University only for as long as is necessary for processing and no longer than the expected end of this research (December 31, 2025). After this time, personal and special categories data will be securely deleted.

Your **research** data will be retained for a period of ten years in line with the University of Glasgow Guidelines. Specific details in relation to research data storage are provided on the **Participant Information Sheet** and **Consent Form** which accompany this notice.

End of Privacy Notice _____

University of Glasgow

College of Social Sciences

Appendix 5C: Participant Consent Form

Consent Form

Title of Project: Understanding Science Capital in a London-Based Further Education College: An Exploration of Science Teachers' and Students' [Mis]conceptualisations through the Lens of Intersectionality and Inclusivity.

Name of Researcher: Ann Bosede-Toluhi Obatomi

Name of Supervisor: Professor Catherine Lido

Please tick as appropriate

Yes ☐ No ☐	I confirm that I have read and understood **the Participant Information Sheet** for the above study and have had the opportunity to ask questions.
Yes ☐ No ☐	I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason. If I plan to withdraw from this study, I will do so by July 31, 2024, after which I understand that my responses may form part of the data analysis.
Yes ☐ No ☐	I consent to interviews being audio- and video-recorded.
Yes ☐ No ☐	I acknowledge that copies of transcripts will be returned to participants for verification.
Yes ☐ No ☐	I acknowledge that participants will be referred to by a pseudonym.
Yes ☐ No ☐	I acknowledge that there will be no effect on my grades arising from my participation or non-participation in this research (for student participants only).

I agree that:

Yes ☐ No ☐	All names and other material likely to identify individuals will be pseudonymised.
Yes ☐ No ☐	The personal and pseudonymised material will be treated as confidential and always kept in secure storage.
Yes ☐ No ☐	The pseudonymised material will be retained in secure storage for 10 years for use in future academic research. However, all personal material will be destroyed immediately after the completion of the research.
Yes ☐ No ☐	The pseudonymised material may be used in future publications; both print and online.
Yes ☐ No ☐	I waive my copyright to any pseudonymised data collected as part of this project.
Yes ☐ No ☐	Other authenticated researchers will have access to the pseudonymised data only if they agree to preserve the confidentiality of the information as requested in this form.
Yes ☐ No ☐	Other authenticated researchers may use my words in publications, reports, web pages, and other research outputs, only if they agree to preserve the confidentiality of the information as requested in this form.
Yes ☐ No ☐	I acknowledge the provision of a Privacy Notice in relation to this research project.

I agree to take part in this research study ☐

I do not agree to take part in this research study ☐

Name of Participant …… Signature ……

Date ……

Name of Researcher Ann Bosede-Toluhi Obatomi Signature ……

Date ……

…… End of consent form ……

Appendix 5D: Parent/Guardian Informed Consent Form

Date_____

Parent/Guardian Informed Consent Form

Dear Parent/Guardian of_____

Your permission is requested for your child, _____, to participate in research with me at the College of Haringey, Enfield and North East London (Enfield Centre), EN3 5HA, where they are currently doing their science course. The research is part of a Doctor of Education programme that I am currently doing with University of Glasgow, and it is titled:

> 'Exploring Science Capital in a London-Based Further Education College: Science Teachers' and their Students' [Mis]conceptualisations; Diversity, and Inclusive Strategies'.

The research aims to investigate the participants' understanding of their science capital. The research is considered as a low risk when assessed against the University of Glasgow Information Risk Classifications Document. The participants' personal data (information that makes them identifiable, such as names, gender, email addresses, opinions, audio, and video recordings on Zoom) will be obtained. I assure you that the research will be conducted in accordance with the UK GDPR (General Data Protection Regulation) (The Data Protection Act 2018) ethical standards and should not pose any significant risks to the participants; risks that may arise have been considered and mitigated. This means that any information obtained will be kept confidential except if an ethical responsibility limits confidentiality. You will be notified under the following circumstances:

1. The students reveal information about hurting themselves or another person.
2. The student or another person may be in physical danger.

Your child's participation will be based on a trusting relationship between me as the researcher and your child as a participant. This means that participants will take part voluntarily, remain anonymous, maintain the right to withdraw up until the point of data analysis and will not be classed as vulnerable according to the ethical guidelines for research with human participants. I do not envisage any potential harm to the participants by the interview method chosen or the sample questions indicated in the interview protocol.

With your permission, I would like to contact your child by email to invite them to participate in the study. Furthermore, the guidelines on how to seek further help should participants be unintentionally exposed to psychological stress, will be provided; this includes the University of Glasgow's open self-help counselling resources at https://www.gla.ac.uk/myglasgow/counselling/ . All data collected will only be used for research purposes.

To ensure that all ethical considerations are made, the University of Glasgow's College of Social Sciences Research Ethics Committee will ensure a very detailed ethical review in accordance with GDPR guidelines by granting ethical approval for the study. I would also be glad to answer any questions or concerns that you may have. Please, feel free to contact me at xxxxxxxx@student.gla.ac.uk if you have questions or comments.

I would be grateful if you could tick the appropriate box below to grant/not grant your consent.

I agree for my child to take part in this research study ☐
I do not agree for my child to take part in this research study ☐
Parent/Guardian Name …… Signature ……
Date ……
Name of Researcher Ann Obatomi Signature ……
Date ……

…… End of consent form ……

Appendix 5E: Ethics Application Approval Letter

College of Social Sciences

06 April 2024

Dear Ann Bosede-Toluhi Obatomi

College of Social Sciences Research Ethics Committee

Project Title: **Exploring Science Capital in a London-Based Further Education College: Science Teachers' and their Students' [Mis]conceptualisations; Diversity, and Inclusive Strategies.**

Application Number: 400230130

The College Research Ethics Committee has reviewed your application and has agreed that there is no objection on ethical grounds to the proposed study. It is happy therefore to approve the project, subject to the following conditions:

- Start date of ethical approval: 31/05/2024
- Project end date: 30/12/2025
- Any outstanding permissions needed from third parties in order to recruit research participants or to access facilities or venues for research purposes must be obtained in writing and submitted to the CoSS Research Ethics Administrator before research commences: socsci- ethics@glasgow.ac.uk
- The research should be carried out only on the sites, and/or with the groups and using the methods defined in the application.
- The data should be held securely for a period of ten years after the completion of the research project, or for longer if specified by the research funder or sponsor, in accordance with the University's Code of Good Practice in Research: (https://www.gla.ac.uk/media/media_490311_en.pdf)
- Any proposed changes in the protocol should be submitted for reassessment as an amendment to the original application. The Request for Amendments to an Approved Application form should be used: https://www.gla.ac.uk/colleges/socialsciences/students/ethics/forms/staffandpostgraduateresea richstudents/

Provided on behalf of: College of Social Sciences Research Ethics Committee The University of Glasgow
socsci-ethics-lead@glasgow.ac.uk
College of Social Sciences
University of Glasgow,
Glasgow G12 8QF

Appendix 5F - Data Management Plan template for PGR students

University of Glasgow

Data Management Plan template for PGR students

1. Overview	
Student name	Ann Bosede-Toluhi Obatomi
Supervisor name	Professor Catherine Lido
Project title	Exploring Science Capital in a London-Based Further Education College: Science Teachers' and their Students' [Mis]conceptualisations; Diversity, and Inclusive Strategies.
Funder & award number	Not applicable
Project Summary	This exploratory qualitative study adopts the interpretive-constructivist paradigm (Gormally and Coburn, 2014) to comprehend the intricate dynamics of the science capital (SC) concept, delving into the roles of intersectionality and inclusivity through a small set of online interviews with science teachers and students in a department at a further education college in London. The principal aim is to investigate the nuanced [mis]conceptualisations of SC among a socially diverse and multi-ethnic participant group, considering the possible impacts of contributing intersectional and inclusivity factors. My research aims to explore both the commonalities and differences in the SC [mis]conceptualisations of teachers and students, examining how these diverse perspectives may potentially impact teaching and learning strategies and outcomes for students. Reference Gormally, S., and Coburn, A., (2014). Finding Nexus: Connecting Youth Work and Research Practices. British Educational Research Journal, 40, pp.869-885.

2. Data
What types of data will be collected or created?
Qualitative, collected via semi-structured interview audio and video (combined) recording on UofG Zoom platform.
What formats will you use?
Interview audio and video recordings will be done and stored on the UofG Zoom platform. • Interview recordings will be in MPG-4 format. • Transcripts and notes will be in the .rtf format or .pdf • All passworded and securely held
How much data will you collect?
Each interview data (audio and visual) will be approximately 260 MB from up to 4 teacher and 12 student interviews online.
3. Documentation
How will the data be documented and described?
DDI (Data Documentation Initiatives) standards for social, behavioural and economic data.
Are there any standards for this in your field of research?
DDI (Data Documentation Initiatives) standards for social, behavioural and economic data.
4. Ethics and Intellectual Property
Who owns the data in your project?

I will own the Intellectual Property

Detail any ethical, legal or commercial considerations relating to your research data

My project will collect data relating to human participants

How will these concerns be dealt with?

- Ethical approval for this research will be sought from the Social Sciences ethics committee and data will be processed in line with legal requirements (e.g. data protection/GDPR).
- Transcripts of original recordings will be used for archiving and sharing purposes to reduce the possibility of identification of participants.
- All data will be held securely, password protected and destroyed as described below.

5. Storage and organisation

How will the data be named, organised and structured?

- The file-naming convention will be done in this order: 'Dissertation', Researcher's name, Topic, date (YYYYMMDD), version number, and 'Draft' or 'Final' (e.g. Dissertation_ OBATOMI_Participant 1 Interview_20231204_v1_Final.
- The files will be organised and structured in named folders and sub-folders as follows: UofG > DISSERATION > INTERVIEWS > ….
- Further detailed information will be included with the project documentation, and all passworded, securely held, anonymised and destroyed as per below.

How will the data be stored for the duration of the project?

- The University of Glasgow OwnCloud (https://www.gla.ac.uk/myglasgow/it/filesharing/owncloud/) will be used to back up all research data, which include the audio-recorded interviews, transcriptions and analysed data.
- A laptop that is protected by a complex password that only I have access to will be employed for the processing of data. The laptop to be used will be configured in accordance with UofG's system recommendations, including those relating to antivirus software, keeping the operating system and applications up to date and full disk encryption. Laptop's screen will be locked when I am away from my laptop; laptop will be securely stored in locked drawers and rooms. Folder structuring and file naming will not reveal participants' personal information.
- Once anonymised transcript processing is completed, data will be permanently deleted from the laptop.
- Mobile phones or any other portable device will not be employed to process, transfer or store data.
- Paper documents that contain data will be stored securely locked in my home at ... Road, London. E....

How will the data be backed up during the project?

- The UofG automatic backup services will be employed (https://www.gla.ac.uk/myglasgow/it/informationsecurity/backups/)

Does access to the data need to be controlled for the duration of the project?

- Yes – all the participants' data that include personal information, interview records, transcripts and analysed data will be controlled.
- A laptop that is protected by a complex password that only I have access to will be employed for the processing and transfer of data. The laptop to be used will be configured in accordance with UofG's system recommendations, including those relating to antivirus software, keeping the operating system and applications up to date and full disk encryption. Laptop's screen will be locked when I am away from my laptop; laptop will be securely stored in locked drawers and rooms. Folder structuring and file naming will not reveal participants' personal information.

- Files containing confidential information are not likely to be transferred, however, if required, the UofG file transfer service (https://transfer.gla.ac.uk) and/or shared network drives or OneDrive (https://www.gla.ac.uk/myglasgow/it/informationsecurity/confidentialdata/) will be employed.

Who has the right to access the data during the project?

- Professor Catherine Lido – Supervisor
- Professor Nikki Hedge- EdD Programme Manager
- UofG Research Information Management Service
- UofG IT Services

6. Deposit and long-term preservation

Which data should be retained long-term?

The University of Glasgow guidelines require that the research data are retained for a minimum of 10 years following the completion of the project.

How long will data be retained for?

Maximum of 10 years (but primary videos destroyed upon complete processing and analysis of transcripts).

Where will the data be archived at the end of the project?

Anonymised primary data will be deposited via Enlighten: Research Data, the UofG's institutional data repository.

What formats will the data be archived in?

- Transcripts and notes will be in the .rtf format or .pdf (transcribed from the MPG files)

7. Data sharing

Is any of the data suitable for sharing?

Participants' pseudonymised data

How will the data be shared?

- Primary Data will be shared via the UofG repository deposit.
- Aggregate Data will be published in a journal or as supplementary information to an article

Who should be able to access and use the shared data?

Suitable for access upon request/ application to UofG archive

8. Implementation

Who is responsible for implementing this plan?

Me as the researcher, with supervisor oversight.

How will this plan be kept up to date?

The data will be reviewed on approximately a monthly basis with my supervisor

What actions are necessary to implement this plan?

Contact UofG IT Systems to ensure storage provision is adequate.

What training or further information are needed to implement this plan?

Contact UofG IT Systems for guidance if required.

Appendix 5G: Staff and Postgraduate Research Students: Application Form for Ethical approval

University of Glasgow

College of Social Sciences

College Research Ethics Committee for Non-Clinical Research involving Human Participants/Data

Staff and Postgraduate Research Students: Application Form for ethical approval

Before completing this form, refer to the guidance notes available at College ethics information and Ethics Information for Applicants.

Completed, typed forms (with supporting documents) should be submitted electronically via the Research Ethics System.

Submit applications **at least 6 weeks in advance** of the intended data collection start date, allowing time for applications to be reviewed, and any recommended amendments to be made.

Applications requiring PVG Clearance/permissions to access participants will not be approved until evidence of this is received by Ethics Administrator. Guidance is available at PVG Guidance.

Applicant Details

Staff Research Project ☐ **Staff Scholarship of Teaching and Learning Project** ☐

Postgraduate Student Research Project ☒

Name of Applicant Ann Bosede-Toluhi Obatomi

Student ID/Staff Number xxxxxxxx

School & Subject (Cluster/RKT group) Education

PGR Programme Title (Where applicable) EdD

Application Details

Project Title: Exploring Science Capital in a London-Based Further Education College: Science Teachers' and their Students' [Mis]conceptualisations; Diversity, and Inclusive Strategies.

Data Collection Start Date 19/02/2024

Proposed Project End Date e.g. date of PhD award, article submission, end of funding 30/12/2025

Is this application being submitted to another ethics committee, or has it been previously submitted to another ethics committee? **Yes** ☐

No ☒

If YES provide details Enter text here

the research subject to external funding? (i.e. a sponsor or funding body) **Yes ☐** **No ☒**

If YES provide details Enter text here

Does the research involve using networked or electronic data such as internet platforms, apps, social media, secondary data, Big Data?

Yes ☐ **No ☒**

If YES you must complete and submit the 'Protocol for research dealing with non-standard human data' This can be downloaded from the College ethics website.

---

1 Description of project Give a brief description of the project.

This exploratory study adopts the interpretive-constructivist paradigm (Gormally and Coburn, 2014) to comprehend the intricate dynamics of the science capital (SC) concept, delving into the roles of intersectionality and inclusivity among science teachers and students in a further education college in London. The principal aim is to investigate the nuanced [mis]conceptualisations of SC among a socially diverse and multi-ethnic participant group, considering the possible impacts of contributing intersectional and inclusivity factors. My research aims to explore both the commonalities and differences in the SC [mis]conceptualisations of teachers and students. The exploratory nature of this study means that no universally applicable conclusions can be made, however, the study aims to contribute to the little that is known (Moote et al., 2019, 2020, 2021) of how SC is perceived and utilised by multiculturally and socio-economically diverse further education students and their teachers in England and the potential impacts on teaching and learning strategies and outcomes for students.

My research method consists of 1-1 semi-structured interviews on Zoom, with audio recordings for subsequent transcription. The data analysis will employ Braun and Clarke's reflexive thematic analysis (Braun and Clarke, 2019, 2021, 2022). In exploring participants' perceptions of their SC, Bourdieu's theory of practice (Bourdieu, 1977a, 1977b, 1984, 1986, 1990), as conceptualised by Archer et al. (2014, 2015, 2020a), will be applied; this theory will interrelate Bourdieu's key tripartite concepts of field, capital, and habitus to explore the participants' perceptions of their SC.

! Application will be returned if Ethical Risks section is incomplete!

For PGR student applications - Supervisors should complete this section on the possible risks associated with the project.

For staff applications - all submitting applicants should complete this section on the possible risks associated with the project.

You should complete this comments section and sign electronically/type your name, and date this section. **This section must be fully completed**, demonstrating that the student/supervisor/staff researcher has considered any potential risks to participants and/or researcher, and giving evidence of how these are to be mitigated. Refer to Risk Guidance Document on the College ethics website for detailed guidance on what are considered to be risk areas.

Remember to sign and date this section as the application will be returned if this is not done**,** if scanned signature is not available, typed names or GUID are acceptable. Applicants are confirming that they have considered any potential ethical issues and if supervisors are completing this section, they are affirming that they approve and support the application for ethical approval.

PGR Applications – **Supervisors** must complete and sign this section, approving submission for ethical review.

Staff Applications – **Applicant** must complete and sign this section, confirming submission for ethical review.

2 Ethical Risks Comment on any potential research ethics risks involved in the project, and any steps taken to mitigate these risks. Risk Guidance Document is available at Ethics Forms

I consider the proposed research to be a low risk when assessed against the University of Glasgow Information Risk Classifications Document. The teachers and students' participants will be at least 16 years old of different racial or ethnicity and gender backgrounds and ages. Hence, their personal data (information that makes them identifiable, such as names, gender, and pseudonymised data that include their email addresses, opinions, audio, and video recordings on Zoom) will be obtained. The lawful basis for processing participants' personal information is in accordance with GDPR (General Data Protection Regulation) Article 6(1)(a) (the consent of the data subjects) and Article 6(1)(e) (for the performance of public task).

Also, the only special category data (sensitive personal data) that will be collected are the participants' ethnicities. The special category data will be collected in accordance with GDPR Article 9(2). The lawful basis for processing special categories of data is in accordance with GDPR Article 9(2)(a), which is, the explicit consent of the data subjects. Hence, the following conditions will be ensured: participants will be informed that the processing of their special

category data is for research purposes only; explicit consent will be obtained from each participant and no information that has not been made public by a participant will be collected. Parental consent will be obtained for the 16-18-year-old participants, who are designated as 'children' for educational purposes. Participants will take part voluntarily, remain anonymous, maintain the right to withdraw up until the point of publication and will not be classed as vulnerable according to the ethical guidelines for research with human participants. In addition, all participants will be assured of data minimisation, pseudonymisation and secure data storage.

- Ann has taken into consideration the importance of ensuring that the participants will not be unduly stressed by the interviews by planning to work around their personal and professional commitments as teachers and students. Qualifying teachers and students will be approached informally and requested to participate in the study. They will also be assured that confidentiality will be maintained, and that permission will be sought from them to quote them directly in any written report; the college's consent will be obtained for all the participants and additional parental consent will be ensured for the 16-18-year-olds who are officially designated as 'children'.
- We do not envisage any potential harm to the participants by the interview method chosen or the sample questions indicated in the interview protocol. Ann has considered the ethical implications of the teacher-student-dependent and the staff-line manager relationships with all the potential participants and the potential power dynamics in her favour. For instance, participants may feel uneasy and result to telling her what they think she would like to hear, rather than saying what they really think or feel. To mitigate this, The Participant Information Sheet will inform them that their participation/non-participation is entirely voluntary and will not have advantageous or disadvantageous effects on their course, progression, and outcomes, and their professional relationship with Ann. In addition, assurance that they can withdraw their participation at any time during the study with no consequence will be given. They will be requested to take their time to consider whether they want to participate and give their response by a mutually agreed date. Also, the interviews will be carried out on the UofG Zoom Client platform to reduce the skewing of the power dynamics in Ann's favour.

X Enter Signature or GUID xxxxx Signature or GUID or typed name should be given here

X 16/01/2024 Click here and calendar will appear, then select date.

---

3 NAMES of Researchers/Supervisors

3.1 All Researchers including research assistants and transcribers where appropriate

Title	**First and Surname**	**Telephone**	**Email** (usually UofG)
Mrs	Ann Bosede-Toluhi Obatomi		xxxxxxxx@student.gla.ac.uk
Enter text here	Enter text here	Enter text here	Enter text here
Enter text here	Enter text here	Enter text here	Enter text here
Enter text here	Enter text here	Enter text here	Enter text here
Enter text here	Enter text here	Enter text here	Enter text here

3.2 All Supervisors *Principal Supervisor first where applicable*

Title	**First and Surname**	**Telephone**	**Email** (usually UofG)
Professor	Catherine Lido		Catherine.Lido@glasgow.ac.uk
Enter text here	Enter text here	Enter text here	Enter text here
Enter text here	Enter text here	Enter text here	Enter text here

4 JUSTIFICATION for the research

Why is this research **significant** to the wider community? What might be the **impact** on your practice or on the practice of others? How will the *possible* ***benefits*** *to researchers, participants, and others, realised from the project justify any risks or discomfort involved?*

Science capital (SC) is Archer et al.'s (2015) theoretical conceptualisation that refers to the science-specific forms of the Bourdieusian habitus, social and cultural capitals. Archer's team defines SC as:

> Scientific forms of cultural capital (scientific literacy; science dispositions, symbolic forms of knowledge about the transferability of science qualifications), science-related behaviours and practices (e.g., science media consumption; visiting informal science learning environments, such as science museums), science-related forms of social capital (e.g., parental scientific knowledge; talking to others about science) (Archer et al. 2015, p.929).

The SC concept and its potential roles in science learning and outcomes have been extensively studied, mostly by Archer's team (Archer et al., 2015, 2020; Regan and DeWitt, 2015) among young pupils in compulsory (primary and secondary) education in England, with SC studies also carried out in other countries (Kelly et al., 2019**;** Turnbull et al., 2020; Avraamidou, 2021). The SC concept is increasingly emerging as a pivotal construct in science pedagogical practices (Godec, King and Archer, 2017; Archer et al., 2020b; Nag, King and Archer, 2021); student engagement (Archer et al., 2012; 2016); academic achievements (Archer et al., 2020); gendered outcomes (Kelly et al., 2019; Archer et al., 2020b); ethnicity (Archer et al., 2015b) and science career outcomes (Archer et al., 2013; 2020). An example is the development, dissemination, and promotion of SC-based learning resources such as '*The Science Capital Teaching Approach'* (Godec, King and Archer, 2017) and '*The Primary Science Capital Teaching Approach: teacher handbook'* (Nag, King and Archer, 2021) in primary and secondary schools in England.

Despite the efforts made to promote SC in English primary and secondary schools, the extensive literature review carried out by me indicates a paucity of research in SC conceptualisation in post-secondary, post-compulsory (further and higher) education generally (Kelly et al., 2019) and specifically in England (Moote et al., 2019, 2020, 2021). Thus, this research aims to explore SC in a multi-ethnic and socially diverse London-based further education (FE) college, with a view to progressing an understanding of how science teachers and students' [mis]conceptualisations of SC and the possible impacts of intersectionality and inclusivity might shape teaching, learning and students' outcomes. In my opinion, an in-depth exploration of the multifaceted dynamics of SC conceptualisation among post-compulsory further education students in England should contribute to enhancing our understanding of SC's influence on teaching and learning and its potential utilisation beyond compulsory education. This study seeks a better understanding of the significance of SC in a FE sector in England, with potential broader implications for enhancing science education practices, fostering inclusivity, and exploring potential disparities among students that this study may/may not allude to.

5 Research Methodology and Data Collection

5.1 Method of data collection You are **required to provide** *indicative themes/questions in separate documents, in sufficient detail to present a clear view of the project and its ethical implications.*

If you intend to conduct face-to-face research in the community, in participants' homes or in any overseas territories you must comply with all relevant Scottish Government or relevant local government social distancing measures in place at the time of the proposed research.

Select all that apply

Method	**Selected**
5.1a Face to face or telephone interview	☐
5.1b Online interview, for example using Teams or Zoom	☒
5.1c Focus group	☐
5.1d Questionnaire	☐
5.1e Online questionnaire Provide indicative *electronic copy with application pending online version*	☐

5.1f Participant observation *Provide an observation proforma*	☐
5.1g Audio or video-recording interviewees, focus groups or events Provide evidence of p*ermission* on the consent form. Details should be provided, either in theme/question information or separately.	☒
5.1h Other methodology	☐
If **Other** selected above, provide details here: Enter text here	

5.2 Research Methods

Explain the reasons for the chosen method/s, the estimated time commitment required of participants and how the data will be analysed. Include reference to methods of providing confidentiality as indicated below.

This study is exploratory; hence, generalised conclusions are not planned. The research paradigm is interpretive-constructivist – this means that the research questions will aim to decipher the participants' socially constructed realities of their science capital [mis]conceptualisations (Gormally and Coburn, 2014). The chosen method is 1-1 semi-structured interviews on Zoom, because these are considered more suitable to the open-ended questions that will be employed to explore the participants' conceptualisations of their science capital. This method of data collection should not have significant adverse effects on the participants; however, the risks associated with Covid-19 are possibilities because of expected contacts with the participants during data collection; these will be mitigated as detailed in section 17. Other factors that may cause discomfort to the participants include the timing of the interviews; the venues and the questions asked. Any of these may evoke unpleasant emotional or psychological responses if participants had or are having intersectionality-related bad experiences; thus, sections 18.3 and 18.4 contain details of how these will be addressed if any of them occurs. The 1-1 interview session/participant is aimed for 45 minutes to 1-hour maximum. This time frame is considered suitable for the interview to enable the information required to be obtained without wasting the participants' time (Rubin and Rubin, 2005).

The nature and scope of the study, the time and the depth of participants' responses are the factors guiding the choice of the 16 participants (Hennink et al., 2017) that will consist of up to 4 teachers and 12 students. The number of participants is considered suitable because the study is purposive and exploratory. Hence, all the 4 science teachers and 12 student volunteers will be initially recruited, with a plan to recruit more students if required, to make allowance for dropouts. The recruitment of the student volunteers will be purposive to take cognisance of intersectional and inclusivity factors as designated by their college's enrolment records); thus, students' age, gender, ethnicity, and socio-economic status will be considered; the teachers' recruitment will not be purposive, but their intersectional factors will still be considered.

Also, student volunteers in the first or second year of their 2-year advanced level vocational (Level 3) science programme who have completed at least 1 year of post-compulsory science education in will be approached to volunteer, while students who have done less than a year of post-compulsory science education will not be recruited because they will not be deemed to have sufficient post-compulsory experience in England. The rationale for choosing the cohort of students indicated is that each student has not only committed to and completed a post-compulsory science course for at least 1 year, but they have also chosen to progress to another science course, thus, indicating their choice of studying science beyond the compulsory secondary school level. All the participants will be invited to participate in the 1-1 semi-structured interview sessions without prejudice to their right to decline any or both. The research questions are:

(i) Perceptions and Impact of Science Capital

How do teachers and learners define and perceive the concept of science capital and what are the implications of these perspectives on teaching and learning outcomes?

(ii) *Perspectives on The Influences of Diversities (Intersectionality) and Inclusivity Strategies on Science Capital*

How do the participants' backgrounds affect their understanding and applications of science capital and what inclusive strategies can be recommended?

A Participation Information Sheet that introduces me as the researcher; the purpose of the study and the ethical considerations will be given to the volunteers prior to interviews, to enable their familiarisation and preparation. Indicative, pre-determined and open-ended main questions that cover the research questions on science capital (SC) will be developed and shared with the participants in the *interview protocol*. The main questions will be combined with follow-up questions (additional questions that seek further explanations of interviewees' responses) and probes (that seek clarification, depth, vividness,

richness, nuances, and examples) (Rubin and Rubin, 2005). The use of the main and follow-up questions, in addition to the probes, should enable the participants to offer balanced responses and express their points of view. The *interview protocol* will be printed and given to each participant when they are invited to participate and prior their 1-1 interview session; this, in my opinion, will enable familiarisation with the questions.

Rubin and Rubin (2005) recommend a maximum of six and a minimum of three predetermined main questions to ensure a sufficient depth of responses; this will be adopted. They will be requested to read the booklet, '*Science Capital Made Clear'* (Enterprising Science KCL Project, nd) prior to their interview session for a summary of Archer et al.'s research findings on SC among mainly primary and secondary pupils in the UK. This is because some of the main questions will relate to the ideas raised in the booklet. They will also be offered the following links for further information on SC:

(i) *The Science Capital Teaching Approach: engaging students with science, promoting social justice - UCL Discovery*

(ii) *The Primary Science Capital Teaching Approach: teacher handbook - UCL Discovery*

The interviews will take place in our college premises at The College of Haringey, Enfield and North East London (Enfield Centre), London. EN3 5HA. Two dedicated rooms will be booked for each interview session (one for me and another for the participant) to avoid noise interference between our devices, giving that the interview will be held on Zoom. A notice of 'confidential meeting in progress, do not disturb' will be displayed on the doors of the interview rooms. Participants will be informed that in the event of an incident that requires an interruption to the interviews, for example, a fire alarm, the interview will be stopped and the appropriate guidelines and/or actions will be communicated.

Audio-recording of the interview responses on UofG's Zoom Client platform will be done. This will enable the simultaneous collection and verbatim recording of responses that will be transcribed. All the transcribed data will be de-identified and pseudonymisation will be employed in reports and publications, to maintain participants' confidentiality. Secure storage, labelling, tracking, and confidential handling of audiotaped responses on UofG's One Drive will be ensured as required by the UofG ethical and data management regulations. Transcribing of the responses, coding, and themes development using Braun and Clarke's reflexive thematic analysis (Braun and Clarke, 2022) will be done

6 Confidentiality and Data Handling

6.1 Will the research involve: (Click to right of ***Select method*** *at top of column to indicate method and* ***select all that apply****)*

	Select method	Select method	Select method	Select method	Select method
Degree of Anonymity					
6.1a De-identified samples or data (i.e. a **reversible** process whereby identifiers are replaced by a code, to which the researcher retains the key, in a secure location?	☒	☐	☐	☐	☐
6.1b Anonymised samples or data (i.e. an **irreversible** process whereby identifiers are removed from data and replaced by a code, with no record retained of how the code relates to the identifiers. It is then impossible to identify the individual to whom the sample of information relates)?	☐	☐	☐	☐	☐
6.1c Complete anonymity of participants (i.e. researchers will not meet, or know the identity of participants, as participants are part of a random sample and are required to return responses with no form of personal identification)?	☐	☐	☐	☐	☐
Use of Names					
6.1d Subject being referred to by pseudonym in any publication arising from the research?	☒	☐	☐	☐	☐
6.1e Participants consent to being named?	☐	☐	☐	☐	☐

6.1g Participants being made aware that confidentiality may be impossible to guarantee; for example, in the event of **disclosure of harm or danger** to participants or others	☐	☐	☐	☐	☐
6.1h Participants being made aware that confidentiality may be impossible to guarantee; for example, due to **size of sample, particular locations** etc.?	☐	☐	☐	☐	☐
6.1i Participants being made aware that data may be shared/archived or re-used in accordance with Data Sharing Guidance provided on Participant Information Sheet?	☒	☐	☐	☐	☐
6.1f Any other methods of protecting the privacy of participants? (e.g. use of direct quotes with specific, written permission only; use of real name with specific, written permission only):	☒	☐	☐	☐	☐
If you have selected **Other** above provide details here Participants will be requested to give written consent to the use of direct quotes. All references that may identify participants' identities will be deleted; data will be anonymised and pseudonymisation of the participants will be done in all reports and publications. The Participation Information Sheet contains the contact's name and email address of the College of Social Sciences Lead for Ethical Review that the participant can report to if they have a reason to believe that any possible harm or wrongdoing to has been committed in the research.					

6.2 The following methods of assuring confidentiality of data will be implemented:

	Select all that apply
6.2a Data will be stored at University of Glasgow * **Paper (**kept secure in locked facility/cabinet) * **Electronic (**files to be available by password only **and** data encrypted; see UofG/IT/InformationSecurity/ConfidentialData for guidance)	☐ ☒
6.2b Data will be stored at another site provide details/address below * **Paper (**kept secure in locked facility/cabinet) * **Electronic (**files to be available by password only **and** data encrypted; see UofG/IT/InformationSecurity/ConfidentialData for guidance) **(Provide details/address below)** **Paper** All paper documents generated will be stored securely locked in my home at ...London. .... **Electronic** The laptop to be used is protected by a complex password.	☒ ☒
6.2c Other (other methods of securing confidentiality of data in transmission, access, and storage) (e.g. data to be encrypted for transmission/security measures if data sent outside UK; cloud storage and access) See UofG Data management support and link given above.	☐
If you have selected **Other** above provide details here: Storage in the UofG One Drive Cloud	

7 Access to data

7.1 Will anyone other than those named above (researchers, supervisors, examiners, research assistants, Heads of Department, transcribers) **access the research data? Yes** ☐ **No** ☒

If YES, please provide details below. If e.g. transcribers or research assistants are not known at this time, please forward details to Ethics Administrator when available.

7.2 Retention and disposal of PERSONAL data

Explain/justify your proposals for retention and disposal of any PERSONAL data to be collected. The definition of personal data is available at UofG GDPR Changes. Further information on GDPR is available at UofG GDPR Guidance)

Only the data that are required for the study will be requested from participants. All personal data will be handled, stored and disposed of confidentially on completion of the study in accordance with the UofG guidelines. Paper notes that contain personal data will be shredded and the files used to electronically store personal data will be permanently deleted.

7.3 Retention and disposal of RESEARCH data

Explain/justify your proposals for retention and disposal of RESEARCH data to be collected. PGR/Staff research data is expected to be retained for 10 years. Further guidance is available in Code of Good Practice in Research. For Data Management Support, visit Data Management

The secure University of Glasgow Zoom Client will be employed to store the audio recordings initially and these will be deleted when they are downloaded and encrypted. The UofG One Drive will be used to store all research data, which include the interviews and transcriptions. The UofG guidelines require that these research data are retained for 10 years following the completion of the project.

8 Dissemination of results:

(select all that apply)

Method	To Participants	To Peers/Colleagues
8.1a Dissertation	☐	☒
8.1b Thesis (e.g. PhD)	☐	☐
8.1c Journal Articles	☐	☒
8.1d Conference Papers	☐	☒
8.1e Written summary of results to all if requested	☒	☐
8.1f Other or none of the above	☒	☒
If you have selected **Other** above provide details here: Enter text here		

9 Datasets suitable for future re-use will be:

9.1a Openly available via data repository (UKDA, Enlighten, Research Data)	☐
9.1b Available via a data repository but with restricted access	☒
9.1c Available from researchers by personal request	☒
9.1d None of the data will be suitable for future access/reuse	☐
9.1e Other or none of the above	☐
If you have selected **Other** above provide details here: Enter text here	

10 Participants

10.1 How do you intend to recruit participants? Provide as much detail as you can, including what age/type of group will be used for each research activity involved, e.g. interviews.

The participants will be science teachers and some of the vocational science students in the courses that I teach and manage as the curriculum manager. The 16 participants that will consist of up to 4 teachers and 12 students of mixed (young and adult) ages; genders, ethnicities, and socio-economic statuses. The number of participants is considered suitable because the study is purposive and exploratory. Hence, all the 4 science teachers in and 12 student volunteers will be contacted; allowance will be made for dropouts, with the possibility of recruiting more students if required.

10.2 Target Participant Group Guidance on the age of legal capacity available on Age of Legal Capacity (Scotland) and also Principles of Consent (England, Wales and Northern Ireland)

Select all options that apply by ticking appropriate box.

	Select all that apply
10.2a Students * or Staff of the University of Glasgow (* See Working with Glasgow University Students)	☐
10.2b Adults (over 18 years old **and competent** to give consent)	☒
10.2c Adults (over 18 years old who **may not** be competent to give consent)	☐
10.2d Young people ages 16-17 years old	☒
10.2e Children under 16 years old	☐

10.3 Will financial inducements/incentives, other than reasonable expenses and compensation for time, be offered to participants? **Yes** ☐

No ☒

If YES provide details

Enter text here

10.4 Number of participants G*ive details of different age groups/activities involved* ***for each method of data collection***

All the 4 science teachers will be approached to participate in the study in addition to 12 student volunteers.

10.5 Are any of the participants in a dependent relationship with any of the investigators, particularly those involved in recruiting for or conducting the project? i.e. student/teacher, employee/employer, patient/doctor, student/supervisor etc.

Yes ☒ **No** ☐ Click on box to select

If YES provide details

I have teacher-student-dependent and line-manager-managee relationships with the student and teacher participants, respectively. Ethical considerations will take cognisance of the likelihood of skewed power dynamics in my favour. Hence, to make the recruitment process open and comfortable, I plan to approach all the participants informally in the first instance to inform them of my study and their potential role as participants. The Participation Information Street will assure them that their participation is entirely voluntary and that their (non)participation will not have (dis)advantageous effects on their courses, their progression, and outcomes (for the students) and my professional relationship with them (for the teachers). They will also be assured that confidentiality will be maintained, and that permission will be sought from them to quote them directly in any written report. In addition, assurance that they can withdraw their participation at any time during the study with no consequence will be given. They will be requested to take their time to consider whether they want to participate and give me their response by a mutually agreed date.

Students and teachers who indicate their intention to participate will be sent an email using my UofG email address to thank them for their participation; to confirm to them that I am undertaking this study as a student of UofG (and not in my professional relationship with them); to request them to contact me through this email for further information and that this email address is only for the purposes of the study. The Participant Information Sheet and the consent form will also be sent to the participants and returned using

11 Location of research participants

11a University of Glasgow	☐
11b Outside location/s provide details/address below The interviews will take place in our college premises at The College of Haringey, Enfield and North East London (Enfield Centre), London. EN3 5HA.	☒

12 Permissions to access participants

12.1 Do you require permission to gain access to research participants within an organisation? e.g. Academic institution, **including University of Glasgow**, Private Company; school; Local Authority; Voluntary Organisation; Overseas institution.

Yes ☒ **No** ☐ **12.2 If YES**

is evidence of this permission provided with this application? Yes ☒ **No** ☐

NB: S*eparate permission to survey students must be obtained, usually from the appropriate authority, prior to any such survey being undertaken once ethical approval has been granted. Once obtained, proof of permission must be forwarded to the Ethics Administrator. More details available on* Information for Applicants. See Working with Glasgow University Students

12.3 If applicable, list the University of Glasgow students that you intend to contact e.g. 30 students from X course. Information for Applicants has guidance.

Enter text here

12.4 If NO

to either of the above questions, explain why permission is NOT required, or why evidence is not provided with this application:

According to the UofG guidelines, an outline permission to carry out the study with some science teachers and students in will be sort from the college and the parents of the 16-18-year-olds; evidence will be submitted with the ethics application form. However, full permission will not be obtained until after the ethical approval when fully approved information including information sheet, research instruments etc. will be available.

13 Informed Consent Consult the guidance on Ethics Forms page to understand what you are required to provide in the Participant Information Sheet (a written 'plain language' statement that explains your project and invites participation)

Participant Information	**YES**	**NO**
13a Have you attached your Participant Information Sheet?	☒	☐
13b Will a copy of the Participant Information Sheet be offered to participants to keep?	☒	☐
If NO to 13a or 13b above, please give details here: Enter text here		
13c Are any participants likely to require special consideration in the preparation of the Participant Information Sheet, to ensure informed consent? e.g. use of child friendly language, English as a second language	☐	☒
If **YES to 13c** above, please give details here: Enter text here		

14 How will informed consent by individual participants or guardians be evidenced?

Written evidence of informed consent is normally obtained and retained using a formal consent form, with copies provided for review.

select all that apply

Participant Consent	
14a Signed consent form	☒
14b Recorded verbal consent	☐
14c Confirmed by return of survey (evidence of clear agreement of consent to use participant data must be provided at start of survey e.g. by use of tick box)	☐
14d Other	☐
If you have selected **Other** above provide details here: Enter text here	

15 Justification, if **written** evidence of informed consent will **NOT** be obtained and retained:

Enter text here

16 Monitoring

16 How will the project be monitored to ensure that the research is being carried out as approved *e.g. give details of regular meetings/skype/email contact.*

I will be in regular contact with my EdD supervisor by email and/or Zoom.

17 Health and Safety/Risk

17 Will the project have any personal safety implications for you, all other researchers and participants involved in the research? (This should include risks associated with COVID-19 but **other** than lone fieldwork – refer to Section 18 for this)

Yes ☒ **No** ☐

If **YES,** please explain the potential issues and how you intend to manage them:

Risks associated with Covid-19 are possibilities because contact will still be made with the participants even though Zoom interviews are planned. Although, Covid-19 risks are now significantly reduced and classified as 'low' in UK, precautions that will include the use of hand sanitiser will be taken. No interview will be held if anyone (researcher or participant) is unwell. Participants will be requested to verbally confirm that they are happy with the health and safety arrangements; if anyone still feels uncomfortable, the interview will not be held unless modifications have been made to suit the participant. No further safety concern is envisaged because each interview will be held in a pre-booked classroom in the college premises which is a safe venue.

18 Risk

18.1 Does the activity Involve Lone Field Work, lone working, or travel to unfamiliar places? See Information for Applicants, Lone Working

Yes ☐ **No** ☒

If YES, please explain

Enter text here

18.2 Does this research include any sensitive topics or vulnerable groups? Risk guidance is available at Ethics Forms

Yes ☐ **No** ☒

If YES, please explain the reason for including these and how the sensitivity will be managed

Enter text here

18.3 How will you ensure that you minimise any possible **distress** caused to any **participants** by the research process? Consider potential disruption or negative consequences that could cause emotional, social or economic distress.

All known possible causes of distress will be carefully considered to avoid or minimise any distress caused to any participant by the research process. Participants will be requested to choose the date and time most convenient for their interviews, with the assurance that they can reschedule or cancel at the last minute; this is in appreciation of likely busy time and schedules. Participants will be reminded of their freedom to avoid answering any question, take a break, change a topic, or withdraw from the interview without any explanation; assurance will be given that if they choose to withdraw, any information given will be destroyed immediately. However, they will be informed that their responses cannot be destroyed once data analysis has commenced, if they are unhappy with this, they can consider withdrawing prior to the stage.

The classrooms to be used for the interviews will be in one of the relatively quiet areas of the college that they are familiar with; also, steps will be taken to ensure confidentiality and prevent disruptions by posting a message of 'meeting in progress, do not disturb' on the door. The prior permission given for the audio recording of their responses will be re-confirmed before the start of the interviews, to avoid distressful surprises; their right to stop the interviews at any time and not to respond to any question asked will also be reinstated.

The subject matter of this study, which is to explore the participants' science capital [mis]conceptualisations, with related diversity and inclusivity strategies, may evoke adverse emotional and psychological effects on some participants who may have had unfavourable intersectionality-related experiences in the past or are experiencing such now. If a participant shows any sign of distress at any time during the interviews (for instance, visible or audible discomfort that may include hyperventilating, anger, crying), the interview will be paused, and the participant will be encouraged to take a break to calm down; discuss their feelings if they desire or do whatever else they consider appropriate. They will be offered further help that may include contacting their GP, a counsellor, a mental health support group or other relevant organisations (with contact addresses provided by me).

It is not envisaged that the interviews will likely have adverse, physical, social, or economic effects, however, contingency plans will also be made to cater for these by me helping them to find the contact details of relevant organisation(s) for help. If after all these interventions, they continue to be distressed, I will stop the interview request them to seek help as needed; further contact will be made to confirm if they wish to continue.

18.4 What procedures are in place for the appropriate referral of a study **participant** who discloses an **emotional, psychological, health, education**, or **other issue** during the course of the research or is identified by the researcher to have such a need?

In addition to the procedures that are indicated above in section 18.3, an offer to refer participants to the appropriate support group(s) will be made. Participants will be offered support that may include contacting their GP, a counsellor, a mental health support group or other relevant organisations; I have provided the contact addresses of some free support groups in the Participant Information Sheet, with further advice on how to access other support groups; such groups include,

- Covid-19: guidance and support-GOV.UK.- https://www.gov.uk/coronavirus
- NHS 111 24-hour phone line- for right advice and treatment for physical and mental health
- 24 Hour Online Counselling - https://www.findresultsquickly.com/reliable/results
- Anxiety Care UK. https://www.anxietycare.org.uk. (Helpline: 03444775774)
- Mental health crisis helplines . Mind- https://www.mind.org.uk/information-support/guides-to-support-and-services/crisis-services/helplines-listening-services/

18.5 Does this project require Protection of Vulnerable Groups (PVG) clearance? Guidance available at UofG Protection of Vulnerable Groups and additionally at: MyGov Types of Disclosure)

Yes ☐ **No** ☒

If YES, please provide confirmation of certification held or being sought

Enter text here

19 Please provide additional details if the proposed research involves:

- Work involving the use of research participants outside GB, NI, the Channel Islands, or the Isle of Man
- The use of hazardous materials
- Non CE marked medical devices
- Molecules or compounds developed and manufactured at the UofG
- Number of participants in excess of 5000
- Work involving research participants known to be pregnant at the time of the project

Activity involving any of the above may require additional insurance cover to be put in place

See Insurance Guidance

Please contact debra.stuart@glasgow.ac.uk for further information regarding additional insurance requirements

If applicable, please provide details

Enter text here

20 Government Legislation further information available at Information for Applicants

Click on box to select

20.1 Have you made yourself familiar with the requirements of the following legislation?	**YES**	**NO**
General Data Protection Regulation (GDPR) (May 2018)	☒	☐
Freedom of Information (Scotland) Act 2002	☒	☐

20.2 If NO to either of the above questions, explain why the legislation is not relevant.

21 Declaration by Researchers And Supervisors

! Application will be returned if declaration is not signed and dated!

- The information contained herein is, to the best of my knowledge and belief, accurate.
- I have read the University's current human ethics guidelines, and accept responsibility for the conduct of the procedures set out in the attached application in accordance with the guidelines, the University's Code of Conduct for Research and any other condition laid down by the University of Glasgow Ethics Committee and the College of Social Sciences Research Ethics Committee.
- I and my co-researcher/s or supporting staff have the appropriate qualifications, experience, and facilities to conduct the research set out in the attached application and to deal effectively with any emergencies and contingencies related to the research that may arise.
- I understand that **no** research work involving human participants or data collection can commence until I have been granted full ethical approval by the College of Social Sciences Research Ethics Committee.

Applicant/Researcher/s

X Enter Signature or GUID xxxxxxxxx

X 18/12/2023

Supervisor/s

(Where Applicant Is Student)

X Enter Signature or GUID xxxxxx Where applicable, at least one supervisor must sign in some form.

X 16/01/2024 Click and calendar will appear, then select date

For Supervisors – Please note that by submitting this application the supervisor confirms that:

- The student is aware of the College ethics requirements.
- The topic merits further research.
- The student has the relevant skills to begin research.
- If interviewing, the student has produced an appropriate information sheet for participants.
- The procedures for recruitment and obtaining informed consent are appropriate.

References

Archer, L., DeWitt, J., Osborne, J., Dillon, J., Willis, B. and Wong, B., (2012). Science Aspirations, Capital, and Family Habitus: How Families Shape Children's Engagement and Identification with Science. *American Educational Research Journal*, 49 (5), pp. 881-908.

Archer, L., DeWitt, J., Osborne, J. F., Dillon, J. S., Wong, B., and Willis, B., (2013). *ASPIRES Report: Young people's science and career aspirations, age 10 –14*. King's College London.

Archer, L., Dewitt, J., and Willis, B., (2014). Adolescent boys' science aspirations: Masculinity, capital, and power. Journal of Research in Science Teaching, 51(1), pp.1–30.

Archer, L., Dawson, E., DeWitt, J., Seakins, A. and Wong, B., (2015). "Science capital": a conceptual, methodological, and empirical argument for extending Bourdieusian notions of capital beyond the arts. Journal of Research in Science Teaching, 52 (7), pp.922-948.

Archer, L., DeWitt, J. and Osborne, J., (2015a). Is science for us? Black students' and parents' views of science and science careers. *Science Education*, 99 (2), pp.199-237. Doi: 10.1002/sce.21146.

Archer, L. and DeWitt, J., (2016). Understanding Young People's Science Aspirations: How students form ideas about 'becoming a scientist'. London, Routledge. Doi: 10.4324/9781315761077.

Archer, L., Moote, J., MacLeod, E., Francis, B., and DeWitt, J. (2020). ASPIRES 2: Young people's science and career aspirations, age 10-19. London: UCL Institute of Education.

Archer, L., Moote, J., and MacLeod, E., (2020b). Learning that physics is 'not for me': Pedagogic work and the cultivation of habitus among advanced level physics students. *Journal of the Learning Sciences*, 29(3), pp.347–384. https://doi.org/10.1080/10508406.2019.1707679.

Avraamidou, L., (2021). Identities in/out of physics and the politics of recognition. *Journal of Research in Science Teaching*, 59(1), pp.58– 94.

Bourdieu, P., [1972] (1977a). Outline of a Theory of Practice. Translation. Richard Nice. Cambridge University Press. Google Scholar.

Bourdieu, P., (1977b). "Cultural Reproduction and Social Reproduction." pp. 487–511 in Power and Ideology in Education, edited by Jerome Karabel and Albert H. Halsey. New York: Oxford University Press.

Bourdieu, P., (1984). *Distinction: A Social Critique of the Judgement of Taste*. Harvard. University Press.

Bourdieu, P., (1986). The forms of capital. In: Richardson, J., Handbook of Theory and Research for the Sociology of Education. Westport, CT: Greenwood, pp. 241–258 (pp.15-29). | socialcapitalgateway.org.

Bourdieu, P., (1990). Structures, Habitus, Practices. *The Logic of Practice.* Cambridge, England. Polity Press, pp.52-65. [Online] Available at: <https://monoskop.org/images/8/88/Bourdieu_Pierre_The_Logic_of_Practice_1990.pdf/> [Accessed 28 October 23].

Braun, V. and Clarke, V., (2019). Reflecting on reflexive thematic analysis. *Qualitative Research in Sport Exercise and Health,* 11(4), pp.589–597, https:// Doi. org/ 10. 1080/ 21596 76X. 2019.16288 06.

Braun, V. and Clarke, V., (2021). One size fits all? What counts as quality practice in (reflexive) thematic analysis? *Qualitative Research in Psychology,* 18(3), pp.328-35, https:// Doi. org/ 10. 1080/ 14780 887. 2020. 17692 38.

Braun, V. and Clarke, V., (2022). Conceptual and design thinking for thematic analysis. *Qualitative Psychology, 9*(1), pp.3–26, https://doi.org/10.1037/qup0000196.

Enterprising Science KCL Project (no date) *Science capital made clear*, *Stem.org.uk*. Available at: https://www.stem.org.uk/sites/default/files/pages/downloads/Science-Capital-Made-Clear.pdf (Accessed: 14 December 2023).

Godec, S., King, H., and Archer, L., (2017). The Science Capital Teaching Approach: engaging students with science, promoting social justice. UCL Institute of Education: London, UK.

Gormally, S., and Coburn, A., (2014). Finding Nexus: Connecting Youth Work and Research Practices. *British Educational Research Journal, 40*, pp.869-885.

Hennink, M. M., Kaiser, B. N. and Marconi, V. C., (2017). Code Saturation Versus Meaning Saturation: How Many Interviews Are Enough? *Qualitative Health Research*, 27(4), pp. 591–608. Doi: 10.1177/1049732316665344.

Kelly, R., McGarr, O., Lehane, L., and Erduran, S., (2019). Stem and gender at university: focusing on Irish undergraduate female students' perceptions. *Journal of Applied Research in Higher Education*, 11(4), pp.770-787.

Regan, E. and DeWitt, J., (2015). Attitudes, interest, and factors influencing STEM enrolment behaviour: An overview of relevant literature. In E.K. Henriksen, J. Dillon and J. Ryder (Eds.), Understanding student participation and choice in science and technology education, pp. 63-88. Dordrecht: Springer.

Rubin, H. J. and Rubin, I. S., (2005). Structuring the interview. In *Qualitative interviewing (2nd ed.): The art of hearing data* (pp. 129-151). SAGE Publications, Inc., https://dx.doi.org/10.4135/978145222665.

Moote, J., Archer, L., DeWitt, J., and MacLeod, E., (2019). Who has high science capital? An exploration of emerging patterns of science capital among students aged 17/18 in England. *Research Papers in Education*, pp.1-21.

Moote, J., Archer, L., DeWitt, J., and MacLeod, E., (2020). Science capital or STEM capital? Exploring relationships between science capital and technology, engineering, and maths aspirations and attitudes among young people aged 17/18. *Journal of Research in Science Teaching*, 57, pp.1228– 1249.

Nag Chowdhuri, M., King, H., and Archer, L., (2021). The Primary Science Capital Teaching Approach: teacher handbook. [Book]. UCL Institute of Education: London, UK.

Turnbull, S., Meissel, K., Locke, K. and O'Neale, D., (2020). The Impact of Science Capital on Self-Concept in Science: A Study of University Students in New Zealand. *Frontiers in Education,* 5, pp.1-16.

End Of Application Form

Applications should be submitted electronically as follows:

Upload the completed form, along with any other required documents by logging in to the Research Ethics System at: https://frontdoor.spa.gla.ac.uk/login/

NB: PGR students are required to upload their application which is then forwarded to their named supervisor for approval and submission to the College Research Ethics Committee.

Appendix 5H: Data Protection Impact Assessment: List of Requirements

Data Protection Impact Assessment: List of Requirements

Before submitting your DPIA template to the DP Office, please ensure that you have completed and addressed all relevant points below. **The DP Office will not review your DPIA unless you can demonstrate engagement with or reference to the checklist and its attending documents and requirements.**

Are your data anonymous?

Yes ☐

No ☒

If you are claiming that your data are anonymous, are there any potential data linkages that would allow someone to identify your data subjects? Note that simply removing a name does not constitute anonymisation. Have you considered the impact of other potential identifiers e.g. you are studying individuals with an uncommon medical condition and also working with gender, age, and location data or other factors that narrow your population and potentially lead to identification?

Are your data pseudonymous?

Yes ☒

No ☐

If you hold an identifier key(s) that would allow you or another party to identify your masked data, then it is pseudonymous and therefore must be treated as personal data.

Is the University a data controller or a data processor for this project?

Data controller ☒

Data processor ☐

Will you require third parties (out with UofG) to assist you in gathering, storing, accessing, or translating or transcribing the data?

Yes ☐

Explain:

No ☒

Do you have a data sharing agreement in place?

Yes ☐

No ☒

If you do not have an agreement, but you require one, complete the Questionnaire for Data Processing Involving Third Parties and return to the Contracts Team.

Have you completed a privacy notice to inform data subjects on the intended use of their personal data? ***(If you answer "yes", please attach for review.)***

Yes ☒

No ☐

Have you completed the University's online Data Protection and/or Information Security trainings? (These trainings are mandatory for all staff; the full project team should complete both training modules)

Yes ☒

***If yes, please indicate dates of completion for all colleagues**:* - Data Protection: March 7, 2023; Information Security: March 8, 2023

If no, please explain why you do not require a data management plan. (Introduction to Research Data Management was training was completed and achieved on February 3, 2022; DMP and DPIA was reviewed on March 7, 2023).

Have you applied for, or received ethical approval?

Yes ☒

If yes, when was the application submitted? Approved? Please submit a copy with this DPIA submission. - Ethical approval application is dated 18/12/23.

No ☐

Consider the following ways to reduce potential risk and demonstrate practical compliance:

- pseudonymisation
- data minimisation
- storage limitation
- access restrictions
- detailed data flow modelling
- technical solutions (e.g. encryption)
- organisational measures (e.g. policies, procedures and workflows to comply with GDPR requirements)

Project overview	
Project Name:	**Exploring Science Capital in a London-Based Further Education College: Science Teachers' and their Students' [Mis]conceptualisations; Diversity, and Inclusive Strategies.**
Brief description of the Project:	This exploratory study adopts the interpretive-constructivist paradigm (Gormally and Coburn, 2014) to comprehend the intricate dynamics of the science capital (SC) concept, delving into the roles of intersectionality and inclusivity among science teachers and students in a further education college in London. The principal aim is to investigate the nuanced [mis]conceptualisations of SC among a socially diverse and multi-ethnic participant group, considering the possible impacts of contributing intersectional and inclusivity factors. My research aims to explore both the commonalities and differences in the SC [mis]conceptualisations of teachers and students. The exploratory nature of this study means that no universally applicable conclusions can be made, however, the study aims to contribute to the little that is known (Moote et al., 2020) of how SC is perceived and utilised by multiculturally and socio-economically diverse further education students and their teachers in England and the potential impacts on teaching and learning strategies and outcomes for students. My research method consists of 1-1 semi-structured interviews on Zoom, with audio recordings for subsequent transcription. The data analysis will employ Braun and Clarke's reflexive thematic analysis (Braun and Clarke, 2022). In exploring participants' perceptions of their SC, Bourdieu's theory of practice (Bourdieu, 1990), as conceptualised by Archer et al. (2015), will be applied; this theory will interrelate Bourdieu's key tripartite concepts of field, capital, and habitus to explore the participants' perceptions of their SC.

Project Owner: **Name, Designation and email address**	Ann Bosede-Toluhi Obatomi
Project Manager: **Name, Designation and email address**	Professor Catherine Lido **email**: Catherine.Lido@glasgow.ac.uk
External project partners, if any:	None
Summarise identified need for DPIA:	No sensitive information will be collected. However, participants' responses to the face-to-face, 1-1 interview questions asked about their summative assessment experiences will be audio-recorded, transcribed and analysed.
Timing of the Project: **Start/end dates, duration as applicable**	Start – 6 weeks from ethics submission or as soon as ethical approval is granted End date- December 31, 2025 Duration – From ethics approval to end of December 2025
Date template completed:	14/11/2023
Date submitted to the Data Protection Office:	18/12/23

Describe the processing activities

Describe the nature and purpose of the processing:
You might find it useful to refer to a flow diagram or another way of describing data flows.

- **What is the source of the data?**

Science teachers (4) and 12 vocational science students will be requested to volunteer as participants in Zoom 1-1 semi-structured interviews; this is the only source of data.

- **How will you collect data? –** Participants' responses will be audio-recorded using the UofG's Zoom Client platform.

- **How will you use the data? –** Participants' audio-recorded interview responses will be transcribed and analysed using Braun and Clarke's 6-step reflexive thematic analysis (Braun and Clarke, 2019, 2021, 2022) that includes coding, themes development and themes analysis. The analysed data will be interpreted to answer the research questions.

How will you store the data? – The University of Glasgow One Drive will be used to store all research data, which include the audio-recorded interviews, transcriptions and analysed data. The University of Glasgow guidelines require that these research data are retained for 10 years following the completion of the project. A laptop that is protected by a complex password that only I have access to will be employed for the processing of data. The laptop to be used will be configured in accordance with UofG's system recommendations, including those relating to antivirus software, keeping the operating system and applications up to date and full disk encryption. Once processing is completed, data will be permanently deleted from the laptop. Mobile phones or any other portable device will not be employed to process, transfer or store data. Paper documents that contain data will be stored securely locked in my home at ....

(A suitably trained member of IT staff should install and configure University-approved **full disk encryption** software to protect the data').

How will you delete the data? –All personal and special categories data will be disposed of confidentially on completion of the study in accordance with the UofG guidelines. Paper notes that contain personal data will be shredded and the files used to electronically process and store personal and special categories data on the laptop will be permanently

deleted. After the analyses, data will be archived in the UofG Cloud according to the guidelines that require that research data are retained for 10 years following the completion of the project.

- **Will you be sharing data with anyone (within the University or external to the University)?** – I will be sharing data with my supervisor, Professor Catherine Lido; the EdD programme manager, Professor Nicki Hedge, other appointed persons by the university and the UofG One Drive Cloud storage.

- **What measures do you take to ensure data processors comply? Do you have a data sharing agreement drafted?** – this is not applicable to this study.

- **What types of processing identified as likely high risk are involved? None**

- **What do you want to achieve?**

This research aims to explore science capital (SC) in a multi-ethnic and socially diverse London-based further education college, with a view to understanding how science teachers and students' [mis]conceptualisation of SC and the possible impacts of intersectionality and inclusivity might shape teaching, learning and students' outcomes.

- **What is the intended effect on participants or users?**

An exploration of the multifaceted dynamics of science capital conceptualisation among post-compulsory further education science students and their teachers should contribute to enhancing their understanding of science capital's potential utilisation in their science learning and beyond.

- **What are the benefits of the processing for you or the University, and more broadly?**

This study seeks a better understanding of the significance of science capital in the FE sector in England, with broader implications for enhancing science education practices, fostering inclusivity, and exploring potential disparities among students.

Describe the scope and context of the processing:

- **What is the nature of the data, and does it include special category or criminal offence data?** – Data include the participants' audio-recorded responses to the research questions; transcriptions of the audio-recorded responses; the analysed transcripts and the OS2 assignment that will be submitted for grading; the special category data included are the participants' ethnicities.

- **How many individuals are affected by your planned processing? 16 participants**

- **What is the nature of your relationship with the individuals whose data you will process? Student-teacher and manager-staff relationships.**

- **How much control will they have over what you do with their data?** – each participant will have control over their data; they will be informed, prior to, during and after the interviews that they can request for whole or parts of their data to be deleted, (but not after the data have been analysed).

- **Does your processing include children or other vulnerable groups?** No

- **What geographical area does it cover?** London

- **Are there concerns over this type of processing generally or more specifically regarding information security?** ***If yes, have you contacted Information Security for advice?*** No

- **Does the project involve the use or development of new technology?** ***If yes, have you contacted*** IT Services ***for advice?*** No

- **Are there any current issues of public concern that you should factor in?** No

- **Are you signed up to any approved code of conduct or certification scheme (once any have been approved)?** No

- **Do you have stakeholders, either within the University or external, that you must consult with regarding this intended processing?** ***If yes, who are they?*** No
- **Describe when and how you will seek these stakeholders' views – or justify why it's not appropriate to do so.** Not applicable
- **Do you need to involve anyone else within your organisation?** No
- **Do you need to ask your data processors to assist with consultation?** Not applicable
- **Do you plan to consult information security experts, or any other experts?** No

Ensuring basic compliance

Describe how you will uphold the data protection principles:

- **What is your lawful basis for processing?**

The Legal Basis for this research is GDPR Article 6(1)(e) Processing is necessary for the performance of a task carried out in the public interest.

- **What information will you give to individuals about the project?**

Each participant will be provided with the following: ***privacy notice, participant information sheet and consent form.***

- **How will you help to support their rights?**

A Participant Information Sheet will be provided to each participant. It will inform them of the purpose of the study and what to expect during the study. Participants will be informed that their data will be de-identified to preserve identity as far as possible. It will inform them of their right to withdraw from the study if they wish, however their data will be analysed and employed to answer the research questions unless they indicate otherwise.

- **How will you prevent function creep?**

  Function creep will be prevented by ensuring that the data collected are used only for the purpose of answering the research questions in the study.

- **How will you ensure data quality and data minimisation?**

Only the data required to answer the research questions will be collected.

- **How will the data be kept up to date, if necessary?**

The data collected will be reviewed regularly to ensure that unnecessary data are not held.

- **How long will you keep the data?**

  The University of Glasgow guidelines require that these research data are retained for 10 years following the completion of the project

- **How will the retention be reinforced?**

  The University of Glasgow data retention guidelines will be followed.

- **How will the data be kept securely, both during the project and after completion?**

The University of Glasgow One Drive will be used to store all research data, which include the audio-recorded interviews, transcriptions and analysed data. The University of Glasgow guidelines require that these research data are retained for 10 years following the completion of the project. A laptop that is protected by a complex password that only I have access to will be employed for the processing of data. The laptop to be used will be configured in accordance with UofG's system recommendations, including those relating to antivirus software, keeping the operating system and applications up to date and full disk encryption. Once processing is completed, data will be permanently deleted from the laptop. Mobile phones or any other portable device will not be employed to process, transfer or store data. Paper documents that contain data will be stored securely locked in my home at....

- **Will you be sharing data internationally, *e.g. sending it to or receiving it from an organisation abroad, or using an international service/platform to process your data*? No**

References

Archer, L., Dawson, E., DeWitt, J., Seakins, A. and Wong, B., (2015). "Science capital": a conceptual, methodological, and empirical argument for extending Bourdieusian notions of capital beyond the arts. Journal of Research in Science Teaching, 52 (7), pp.922-948.

Bourdieu, P., (1990). Structures, Habitus, Practices. *The Logic of Practice.* Cambridge, England. Polity Press, pp.52-65. [Online] Available at: <https://monoskop.org/images/8/88/Bourdieu_Pierre_The_Logic_of_Practice_1990.pdf/> [Accessed 28 October 23].

Braun, V. and Clarke, V., (2022). Conceptual and design thinking for thematic analysis. *Qualitative Psychology, 9*(1), pp.3–26, https://doi.org/10.1037/qup0000196.

Moote, J., Archer, L., DeWitt, J., and MacLeod, E., (2020). Science capital or STEM capital? Exploring relationships between science capital and technology, engineering, and maths aspiration attitudes among young people aged 17/18. Journal of Research in Science Teaching, 57, pp.1228– 1249.

Identify and assess risks and measures to reduce risk					
Describe the source of risk and nature of potential impact on individuals. Include associated compliance and corporate risks as necessary.	**Likelihood of harm** + (Remote, possible or probable)	**Severity of harm** = (Minimal, significant or severe)	**Overall risk** (Low, medium or high)	**Options to reduce or eliminate risk**	**Residual risk** *(after reduction)* (Low, medium or high)
-- e.g. Medical interview transcriptions performed by external company may result in data loss or misuse	*Possible*	*Significant*	*High*	*Acquire contract and/or data sharing agreement with company covering all parties responsibilities and expectations*	*Low*

Data Protection & FOI Office recommendations		
DP & FOI Office advice provided:		DP & FOI Office should advise on compliance and step 6 measures
Summary of DP & FOI advice:		

Sign off and record outcomes **(To be completed by the PI/Project Lead)**	
Mitigation measures and residual risks approved by *(sign & date)*:	Notes: • All mitigation measures must be integrated back into the project, with a documented date and responsibility for completion. • The ICO must be consulted if high risks are identified and cannot be mitigated. • If the DP & FOI Office advice is overruled, an explanation must be provided.

This DPIA will be kept under review by:	Ann Bosede-Toluhi Obatomi (the researcher)	A copy of the most recent version should be sent to the DP & FOI Office and retained in the IAR* by the PI/Project Lead.

* The University's Information Asset Register (IAR) is a repository for all data protection compliance documents, e.g. privacy notices, DPIAs etc. You can access the IAR (using VPN or remote staff desktop) here: https://www.gla.ac.uk/myglasgow/dpfoioffice/gdpr/onlineinformationassetregister/.

Note: students don't have full access to the IAR so DPIAs for student research projects and theses should be uploaded by the supervisor instead

Appendix 5J: Request for Permission to Recruit Vocational Science Students and their teachers as Participants in a Research Study

Mr. …….

Head of School – Science and Engineering

The College of ….

12/11/23

Dear Head of School (Science and Engineering),

Request for Permission to Recruit Vocational Science Students and Their Teachers as Participants in a Research Study

I am writing to request permission to recruit some science teachers and students in Science and Engineering (…Centre)

to participate in a research study that I am conducting.

My study is focused on exploring the science capital of the participants, their [mis]conceptualisations and the related diversity

and inclusivity strategies.

This study is undertaken as part of my EdD (Doctorate in Education) study at the University of Glasgow.

12 students currently enrolled in the first or second year of their 2-year advanced level (Level 3) applied science programme

who have completed at least 1 year of post-compulsory

science education and 4 teachers will be required for the study, with the possibility of recruiting more students,

in case some drop out of the study.

I believe that these groups of students would be ideal participants for this study because the study focuses on investigating

science capital perspectives in post-compulsory education.

I plan to employ face-to-face interviews with the participants in a classroom on the college premises.

With your permission, I would like to contact the eligible students and teachers by email to invite them to participate in the study.
I assure you that the research will be conducted in accordance with the UK GDPR (General Data Protection Regulation) (The Data Protection Act 2018)
ethical standards and should not pose any significant risks to the participants; risks that may arise have been considered and mitigated.

Furthermore, the guidelines on how to seek further help should participants be unintentionally exposed to psychological stress,
will be provided; this includes the University of Glasgow's open self-help counselling resources at https://www.gla.ac.uk/myglasgow/counselling/.
All data collected will be kept strictly confidential and pseudonymised and will only be used for research purposes.

To ensure that all ethical considerations are made, the University of Glasgow's College of Social Sciences Research Ethics Committee

will ensure a very detailed ethical review in accordance with GDPR guidelines by granting ethical approval for the study,

(prior to a full confirmation of the permission from you). Hence, I would require an initial outline permission;

the formal full permission will be obtained after the ethical approval when fully approved information including

the Participant Information Sheet, Privacy Notice, Consent Form, and the research instruments will be available to you.

I would be happy to provide you with additional information about the study, including the methodology and research instruments if needed.

I would also be glad to answer any questions or concerns that you may have.

Thank you for considering my request. I look forward to hearing from you soon.

Sincerely,

Ann Bosede-Toluhi Obatomi

Appendix 5K: Final Permission to Recruit Vocational Science Students and Teachers as Participants in the Research Study Titled: Exploring Science Capital in a London-Based Further Education College: Science Teachers' and their Students' [Mis]conceptualisations; Diversity, and Inclusive Strategies.

The College of…….

Mr. …….
Head of School - Science and Engineering
The College of ….
20/4/24

Dear Ann Bosede-Toluhi Obatomi,

Re: Final Permission to Recruit Vocational Science Students and Teachers as Participants in the Research Study Titled: Exploring Science Capital in a London-Based Further Education College: Science Teachers' and their Students' [Mis]conceptualisations; Diversity, and Inclusive Strategies.

Thank you for your letter of 20/4/24 in which you requested me, as the Head of School, Science and Engineering, to grant a final permission to you on behalf of the college to recruit some science teachers and students from our Science and Engineering department to participate in the above-named research study that you are conducting.

I have thoroughly studied the relevant documents needed for the final approval as stipulated and approved by the University of Glasgow's College of Social Sciences Research Ethics Committee and I am satisfied that final approval can be granted.

I hereby grant final permission for the participants to be recruited for the study.
Please, ensure that you adhere to the guidelines and conditions upon which this approval is based throughout the study.

Sincerely,

……

Appendix 6A: Zoom Invite for the Pilot Interview

Dissertation - Pilot 1-1 interview

□

ANNOBATOMI(PGR)

.....@yahoo.co.uk

Dear ……..,

Thank you for agreeing to do a 1-1 pilot interview with me for my research.

Please, find below the details of the Zoom link for the interview.

I look forward to meeting with you.

Please, do not hesitate to contact me for further clarification.

ANN O is inviting you to a scheduled Zoom meeting.

Topic: Dissertation - Pilot 1-1 Interview

Time: Jun 1, 2024, 07:00 PM London

Join Zoom Meeting

https://uofglasgow.zoom.us/j/82972912793?pwd=mv04bH5vzWHgbELZ6f9rjoQJMA2exb.1

Meeting ID: 829 7291 2793

Passcode: 554487

Appendix 6B: Zoom Cloud Recording of the Pilot Interview

Zoom<no-reply@zoom.us>

ANN OBATOMI (PGR)

zoom

Hi ANN O,

Your cloud recording is now available.

Topic: Dissertation - Pilot 1-1 Interview

Date: Jun 1, 2024, 08:29 PM London

View Detail

Thank you,

-The Zoom Team

+1.888.799.9666

©2024 Zoom Video Communications, Inc.

Visit zoom.us; 55 Almaden Blvd

San Jose, CA 95113

Appendix 7A: Zoom Interview Invitation to a Student Participant

---

From: ANN OBATOMI (PGR)

Sent: 24 June 2024 12:58

To: .....@student.....ac.uk <.....@student.....ac.uk>

Subject: 1-1 interview on science capital- SN

Zoom invite

https://uofglasgow.zoom.us/my/annobt?pwd=V2JJbDRXQWJMaHAyWkc4S0VYYjNDdz09&omn=83732513831

Thank you.

Ann

Appendix 7B: Zoom Interview Invitation to a Teacher Participant

---

From: ANN OBATOMI (PGR)

Sent: 04 July 2024 12:44

To: .....@.....ac.uk <.....@.....ac.uk>

Subject: 1-1 Science Capital interview Zoom invite link

Hi.....,

Thank you for agreeing to participate in this study.

Pls, find below the Zoom invite.

https://uofglasgow.zoom.us/my/annobt?pwd=V2JJbDRXQWJMaHAyWkc4S0VYYjNDdz09&omn=88906361886

Day/Date: Monday, 8/7/24

Time: 11.30-12.30

Venue: C304

Regards,

Ann

Appendix 8: Demonstration of Reflexivity to Improve Interview Skills

ANN O [laughter- *to create a relaxing atmosphere at the onset**]*** *01:18*

So, what does science capital mean to you? [prolonged silence from participant].

Did you hear my question?

You're muted now.

Okay, yeah. You were muted. Did you hear the question that I asked?

ANN O *04:15*

*So, can you give me examples of what 'capital' means, please? [*this question is an example of a question used to gently introduce participants to the session, help them relax, create rapport, based on a subject they're familiar with].

*[*Hesitation by participant; hence, the same question was asked slightly differently to ensure comprehension]

When you hear 'capital', what comes to your mind? [e.g. of a follow up question].

Participant B *04:32*

A centre or ahead (of something)

ANN O *04:35*

Okay. [my response here was too quick, hence, interrupting A's response, which she completed below]

Participant B *04:36*

Of something.

ANN O *04:37*

Okay.

*So, when you hear 'financial capital', what comes to your mind, 'financial capital'? [*another rapport-building question; also, a probing question]

Participant B *04:52*

Wealth and organisation?

ANN O *05:01*

All right, thank you.

How about when you hear of 'social capital', 'social capital'? [an example of a question used to gently move the participant away from a familiar topic ('capital' and 'financial capital') to a related topic that may not be as familiar – 'social capital', as confirmed by the response below].

Participant B *05:08*

Social capital. [hesitation and slightly prolonged awkward silence before response].

I don't know about that.

ANN O *05:19*

Alright.

How about 'cultural capital'? [another hesitation and slightly prolonged awkward silence before response].

Participant B *05:24*

Cultural capital

I have no idea.

ANN O *05:42*

Alright. So, when you say somebody has a high financial capital, what do you think they mean? [giving responses received to the last 2 questions and the awkward silences, participant was gently led back to a familiar topic that she had responded to earlier, to enable the continuous rapport-building process – 'financial capital']

If, for example, actually, your financial capital is high, what do you think it means?

Participant B *06:03*

High salary, is that it?

ANN O *06:05*

High salary. Okay? Alright.

So, in terms of culture, if somebody has a high cultural capital, what do you think they might mean? [participant is being eased back into the 'cultural capital' question asked earlier as this is considered an important question towards establishing…, still re-assured that they don't have to answer]

ANN O

It's alright you don't have to answer.

Participant B *06:31*

I don't know, Miss.

ANN O *06:32*

Yes. Okay. Thank you.

ANN O *07:52*

So now, in terms of the scientific forms of cultural capital, have you heard of scientific literacy before? [a closed question] -poor questioning

Participant B *08:09*

Yes [closed answer to a closed question]

ANN O *08:09*

ANN O *08:09*

You've heard

Participant B *08:11*

Yes.

ANN O *08:12*

Okay, so what do you think scientific literacy mean, what does it mean?

Participant B *08:25*

Emm….[silence] *how science works?* [answer given in form of a question, maybe indicating that B is not sure and wanted me to confirm]

ANN O *08:27*

Okay. Alright. Thank you. So how would scientific literacy help you in your learning [of] silence?

Participant B *08:40*

In learning science?

ANN O *08:41*

Yes. How do you think scientific literacy would help you in learning science, for example?

Participant B *08:58*

It helped me understand, ehmm…

It made me understand the work, the lessons that we take and progress inside.

ANN O *09:23*

Okay, in what way?

So, how important do you think your scientific knowledge would be to your learning [of] science? [this is an example of a question linking back to a question that wasn't answered earlier– the scientific literacy Q]

ANN O*13:19*

*So, what can we do with science? [*an example of a probing question, which seeks further clarification]

Participant B *21:22*

Yeah, one of my close friends did chemistry and biology.

ANN O *21:28*

Okay. [another unnecessary jumping in from me that might have cut short the participants' response- evidence of not using silence very well]

ANN O *22:44*

Oh, thank you.

Are there some factors you think are important in somebody wanting to do science? [an example of a general question to ease the next topic into our discussion and enable smooth transition].

Participant B *23:00*

Can you explain that more? I didn't hear [evidence that the question asked was not clear enough]

ANN O *25:10*

So now, so do you think that your family's educational background has affected you wanting to do science? [closed question- should have been, 'how has your family's educational background affected your doing science at this level, if at all?]

Participant B *25:18*

Yeah, yeah. [the closed question asked solicited this closed answer, which prompted me to ask the next question to open up the question]

ANN O *25:20*

In what way?

Participant B *25:23*

If I didn't know that if I want to be to do nursing, I need to do science or something that is closer to science or my aunt not advising me to do science, or how not doing science would have affected me because she's the kind of person that is a model for me. So, I would have had maybe different interests, if she did something else at the time.

ANN O *25:53*

Okay. Hmm.

So, in terms of educational background again in the family, you said [that] it was your auntie, the medical doctor who helped you and guide you and guided yo in wanting to do science, isn't it? [being able to re-phrase an earlier response accurately as a preamble to the next question is evidence of good active listening skill]

Appendix 9: Interview Transcripts File in NVivo 14

Name	Codes	References	Modified on	Modified by
Participant 12345	49	167	19/04/2025 11:56	ANN O
Participant A	60	455	19/04/2025 11:59	ANN O
Participant B	61	457	15/04/2025 19:54	ANN O
Participant C	69	688	19/04/2025 12:03	ANN O
Participant D	59	410	19/04/2025 12:08	ANN O
Participant E	63	581	14/04/2025 13:17	ANN O
Participant F	50	216	12/11/2024 18:52	ANN O
Participant H	49	241	12/11/2024 19:00	ANN O
Participant J	56	193	09/11/2024 10:13	ANN O
Participant K	54	278	12/11/2024 19:16	ANN O
Participant L	49	207	03/04/2025 08:26	ANN O
Participant M	56	403	03/04/2025 08:42	ANN O
Participant N	55	277	12/11/2024 19:23	ANN O
Participant P (Teacher)	56	174	09/04/2025 03:29	ANN O
Participant Q (Teacher)	61	448	09/04/2025 11:33	ANN O
Participant R (Teacher)	10	308	26/09/2024 17:42	ANN O
Participant R1 (Teacher)	39	212	14/04/2025 13:15	ANN O
Participant S (Teacher)	59	244	09/04/2025 13:16	ANN O

Appendix 10: Additional Interview Notes File in NVivo 14

Name		Codes	References	Modified on	Modified by
Participant 12345		19	26	12/11/2024 18:10	ANN O
Participant D		34	103	09/11/2024 07:43	ANN O
Participant H		29	89	02/11/2024 08:45	ANN O
Participant J		29	64	02/11/2024 08:46	ANN O
Participant L		45	136	16/04/2025 15:08	ANN O
Participant M		25	64	02/11/2024 08:44	ANN O
Participant P		35	136	02/11/2024 23:28	ANN O

Appendix 11A: Interview Transcripts: Word Frequency (10 Words)

Word	Length	Count	Weighted Percentage (%)
science	7	2185	5.47
capital	7	521	1.30
scientific	10	195	0.49
english	7	158	0.40
language	8	157	0.39
knowledge	9	130	0.33
education	9	119	0.30
learning	8	112	0.28
literacy	8	103	0.26
interest	8	94	0.24

Appendix 11B: Interview Transcripts: Word Frequency (20 Words)

Word	Length	Count	Weighted Percentage (%)
science	7	2185	5.47
capital	7	521	1.30
scientific	10	195	0.49
english	7	158	0.40
language	8	157	0.39
knowledge	9	130	0.33
education	9	119	0.30
learning	8	112	0.28
literacy	8	103	0.26
interest	8	94	0.24
college	7	92	0.23
studying	8	92	0.23
experience	10	85	0.21
information	11	77	0.19
educational	11	76	0.19
university	10	74	0.19
cultural	8	73	0.18
parents	7	73	0.18
improve	7	69	0.17
secondary	9	68	0.17

Appendix 11C: Interview Transcripts: Word Frequency (30 Words)

Word	Length	Count	Weighted Percentage (%)
science	7	2185	5.47
capital	7	521	1.30
scientific	10	195	0.49
english	7	158	0.40
language	8	157	0.39
knowledge	9	130	0.33
education	9	119	0.30
learning	8	112	0.28
literacy	8	103	0.26
interest	8	94	0.24
college	7	92	0.23
studying	8	92	0.23
experience	10	85	0.21
information	11	77	0.19
educational	11	76	0.19
university	10	74	0.19
cultural	8	73	0.18
parents	7	73	0.18
improve	7	69	0.17
secondary	9	68	0.17
interested	10	64	0.16
relevance	9	58	0.15
disadvantage	12	57	0.14
resources	9	55	0.14
understanding	13	55	0.14
economic	8	54	0.14
believe	7	51	0.13
country	7	50	0.13
encourage	9	50	0.13
everyday	8	49	0.12

Appendix 12A: NVivo 14 List of Initial Codes 1

Name		Files	References	Created on	Created by	Modified on	Modified by
Yes and No comments		7	16	28/07/2024 01:36	ANN O	15/04/2025 17:22	ANN O
Types of capital		1	3	27/07/2024 22:54	ANN O	08/04/2025 14:38	NV
Teachers' professional practice and science capital		2	5	21/08/2024 16:56	ANN O	09/04/2025 11:42	ANN O
Resources		5	18	29/07/2024 07:47	ANN O	14/04/2025 17:10	ANN O
Recommendations		15	23	28/07/2024 01:39	ANN O	19/04/2025 12:03	ANN O
Progress made		2	3	29/07/2024 07:44	ANN O	14/04/2025 17:10	ANN O
Negatory comments		19	110	28/07/2024 00:45	ANN O	19/04/2025 12:08	ANN O
Future plans		9	26	29/07/2024 07:54	ANN O	14/04/2025 17:10	ANN O
First time of hearing about 'science capital'		24	38	27/07/2024 22:51	ANN O	09/04/2025 16:02	ANN O
Demographics		11	14	28/07/2024 01:37	ANN O	15/04/2025 17:22	ANN O
Definitions and Descriptions of Terms		27	96	29/07/2024 07:23	ANN O	16/04/2025 14:37	NV
Compensatory strategies		19	103	28/07/2024 01:13	ANN O	16/04/2025 14:37	NV
Affirmatory comments		27	1126	27/07/2024 22:39	ANN O	19/04/2025 12:03	ANN O
Why choose science		4	5	01/08/2024 21:34	ANN O	14/04/2025 13:24	ANN O
Socio-economic		26	90	31/07/2024 17:32	ANN O	14/04/2025 17:10	ANN O
Scientific media		16	27	30/07/2024 23:23	ANN O	14/04/2025 17:10	ANN O
Scientific literacy		20	63	30/07/2024 23:01	ANN O	14/04/2025 17:10	ANN O
Science qualifications		14	20	30/07/2024 23:19	ANN O	14/04/2025 17:10	ANN O
Science capital relevance		27	93	30/07/2024 23:14	ANN O	19/04/2025 11:56	ANN O
Religion		1	7	09/08/2024 21:08	ANN O	14/04/2025 13:24	ANN O
Lessons learnt		2	2	09/08/2024 22:18	ANN O	14/04/2025 13:24	ANN O
Language		15	24	31/07/2024 21:21	ANN O	15/04/2025 22:12	ANN O
Interest and motivation to study science		18	70	30/07/2024 23:10	ANN O	14/04/2025 17:10	ANN O
Informal science learning		13	70	31/07/2024 21:08	ANN O	14/04/2025 13:24	ANN O
Gender		22	41	31/07/2024 17:35	ANN O	16/04/2025 14:37	NV
Family higher education		24	182	31/07/2024 21:13	ANN O	16/04/2025 14:37	NV
Family and friends -Habitus		20	88	30/07/2024 23:29	ANN O	14/04/2025 17:10	ANN O
Experience on current course		2	5	31/07/2024 17:39	ANN O	19/04/2025 12:03	ANN O
Ethnicity and culture		20	41	01/08/2024 13:52	ANN O	15/04/2025 22:12	ANN O
Discussing science with others		8	71	30/07/2024 23:37	ANN O	14/04/2025 17:10	ANN O
Occupational background		13	59	29/07/2024 08:22	ANN O	14/04/2025 17:10	ANN O

Appendix 12B: NVivo 14 List of Initial Codes 2

Name		Files	Reference	Created on	Created by	Modified on	Modified by
Acquirable factors to science capital development		25	341	14/04/2025 23:51	ANN O	15/04/2025 10:04	ANN O
Culture and science capital		3	4	15/04/2025 22:08	ANN O	15/04/2025 22:23	ANN O
Habitus		23	78	15/04/2025 00:38	ANN O	19/04/2025 07:33	ANN O
Informal science learning environments		12	24	15/04/2025 00:21	ANN O	19/04/2025 08:25	ANN O
Language and science capital		8	9	15/04/2025 01:00	ANN O	19/04/2025 12:08	ANN O
Progressing to science-related careers		8	11	19/04/2025 08:38	ANN O	19/04/2025 08:47	ANN O
Religion and science capital		0	0	15/04/2025 22:08	ANN O	15/04/2025 22:08	ANN O
Science interest and motivation		17	58	15/04/2025 00:03	ANN O	19/04/2025 12:03	ANN O
Science media consumption		17	32	15/04/2025 00:00	ANN O	19/04/2025 08:20	ANN O
Science qualifications		15	23	14/04/2025 23:55	ANN O	19/04/2025 08:14	ANN O
Scientific literacy		19	48	15/04/2025 01:07	ANN O	19/04/2025 08:08	ANN O
Socio-economic background		25	54	15/04/2025 00:59	ANN O	29/06/2025 23:01	ANN O
Anything unexpected or standing out		4	14	09/04/2025 02:46	ANN O	29/06/2025 23:44	ANN O
The nuances surronding teachers' routes to science education		4	7	10/04/2025 02:15	ANN O	29/06/2025 23:44	ANN O
Inherent science capital factors		23	158	25/07/2024 23:40	ANN O	15/04/2025 10:04	ANN O
Demographics of participants		11	14	15/04/2025 01:18	ANN O	16/04/2025 14:30	ANN O
Ethnicity and science capital		14	65	03/04/2025 17:11	ANN O	16/04/2025 14:37	NV
Negative effects of ethnicity		12	19	15/04/2025 22:10	ANN O	16/04/2025 14:37	NV
No effects of ethnicity		8	9	15/04/2025 22:16	ANN O	16/04/2025 14:37	NV
Positive effects of ethnicity		0	0	15/04/2025 22:10	ANN O	15/04/2025 22:41	ANN O
Gender		23	79	25/07/2024 23:40	ANN O	16/04/2025 14:37	NV
Negative effects of gender on science capital		8	12	15/04/2025 16:59	ANN O	15/04/2025 22:42	ANN O
No effects of gender on science capital		20	28	15/04/2025 17:00	ANN O	16/04/2025 14:37	NV
Positive effects of gender on science capital		2	2	15/04/2025 16:58	ANN O	15/04/2025 19:48	ANN O
Science capital perceptions and impacts		0	0	25/07/2024 23:40	ANN O	27/07/2024 02:10	ANN O
Recomendations		18	22	25/07/2024 23:40	ANN O	29/06/2025 23:45	ANN O
Relevance of science capital and science		26	96	25/07/2024 23:40	ANN O	19/04/2025 11:56	ANN O
Relevance of science		14	21	15/04/2025 12:22	ANN O	15/04/2025 14:55	ANN O
Relevance of science capital		15	24	15/04/2025 12:28	ANN O	16/04/2025 14:37	NV
Science capital descriptions or definitions		26	185	27/07/2024 00:43	ANN O	16/04/2025 14:37	NV
Differences of SC description from Archer et al.'s SC conceptualisation		7	9	14/04/2025 16:09	ANN O	15/04/2025 22:12	ANN O
First time of hearing about 'science capital' (SC) and how		24	37	14/04/2025 17:01	ANN O	14/04/2025 18:27	ANN O
Similarities of SC description with Archer et al.'s SC conceptualisation		3	5	14/04/2025 16:07	ANN O	15/04/2025 22:12	ANN O
Students' SC definitions or descriptions		21	43	14/04/2025 16:13	ANN O	16/04/2025 14:37	NV
Teachers' SC definitions and descriptions		8	8	14/04/2025 16:14	ANN O	16/04/2025 14:37	NV
Teachers' professional practices and science capital		5	69	02/04/2025 08:02	ANN O	16/04/2025 14:37	NV
Artificial Intelligence (AI) - teachers' opinions of AI		3	4	09/04/2025 01:57	ANN O	09/04/2025 12:52	ANN O
Science capital accumulation by teachers		3	9	09/04/2025 01:43	ANN O	28/06/2025 01:34	ANN O
Teachers' experiences of science growing up		1	3	10/04/2025 01:52	ANN O	10/04/2025 18:52	ANN O
Teachers' family habitus		3	5	09/04/2025 02:34	ANN O	09/04/2025 12:23	ANN O
Teachers' opinions about linguistic capital		3	3	09/04/2025 02:25	ANN O	09/04/2025 13:10	ANN O
Teachers' recommendations		3	6	09/04/2025 02:28	ANN O	15/04/2025 13:51	ANN O
Teachers' skills and students' science capital status		4	11	09/04/2025 01:04	ANN O	15/04/2025 14:26	ANN O
Teachers' support and scientific literacy		4	8	09/04/2025 01:15	ANN O	14/04/2025 12:48	ANN O
Teachers' support may affect socio-economic status consequences		5	8	09/04/2025 00:49	ANN O	16/04/2025 14:37	NV

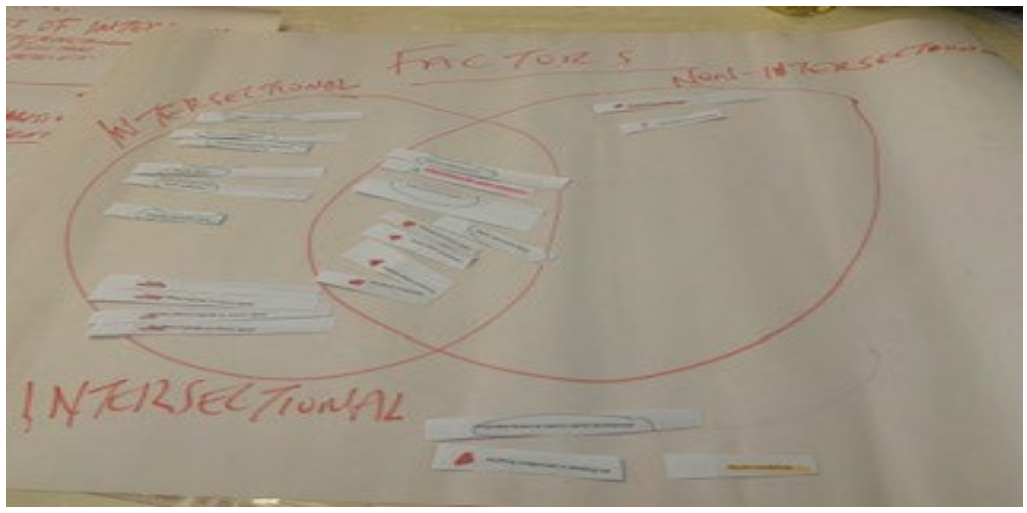
Appendix 13A: Initial Codes 1: Word Frequency (30 Words)

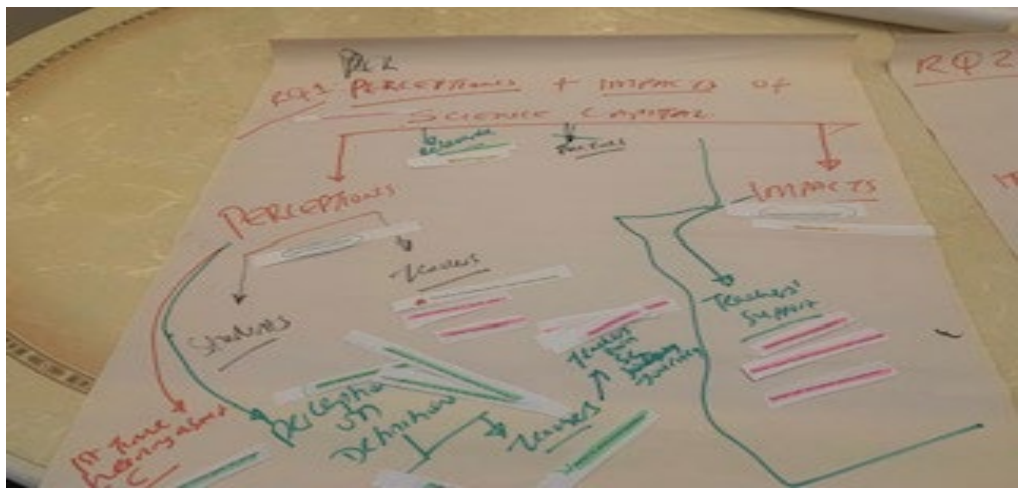
Word	Length	Count	Weighted Percentage (%)
science	7	4315	6.49
capital	7	743	1.12
education	9	333	0.50
educational	11	329	0.49
scientific	10	303	0.46
language	8	285	0.43
english	7	262	0.39
knowledge	9	260	0.39
parents	7	250	0.38
interest	8	234	0.35
learning	8	201	0.30
studying	8	173	0.26
literacy	8	153	0.23
information	11	150	0.23
experience	10	144	0.22
improve	7	144	0.22
interested	10	134	0.20
college	7	129	0.19
university	10	123	0.19
members	7	120	0.18
disadvantage	12	117	0.18
relevance	9	108	0.16
resources	9	108	0.16
advantage	9	107	0.16
believe	7	103	0.15
support	7	99	0.15
friends	7	97	0.15
understanding	13	97	0.15
country	7	96	0.14
secondary	9	96	0.14

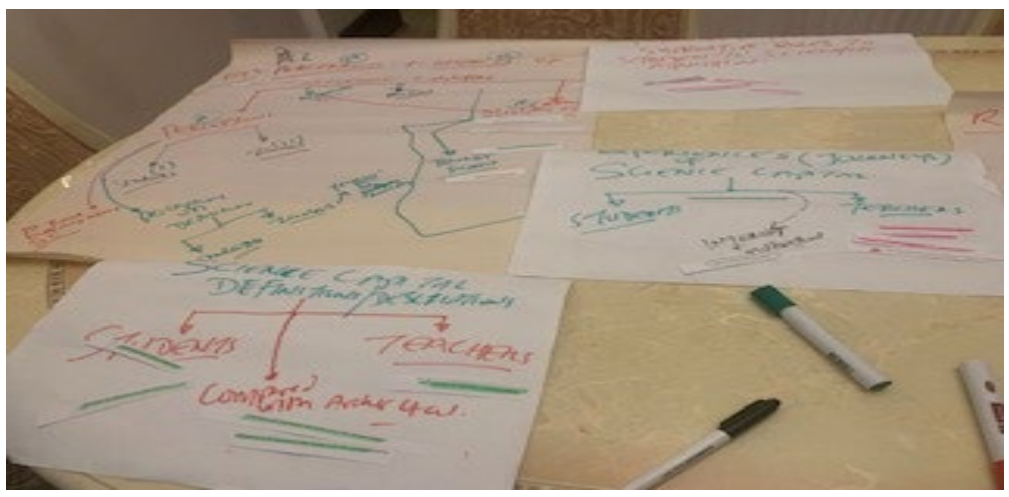
Appendix 13B: Initial Codes 2: Word Frequency (30 Words)

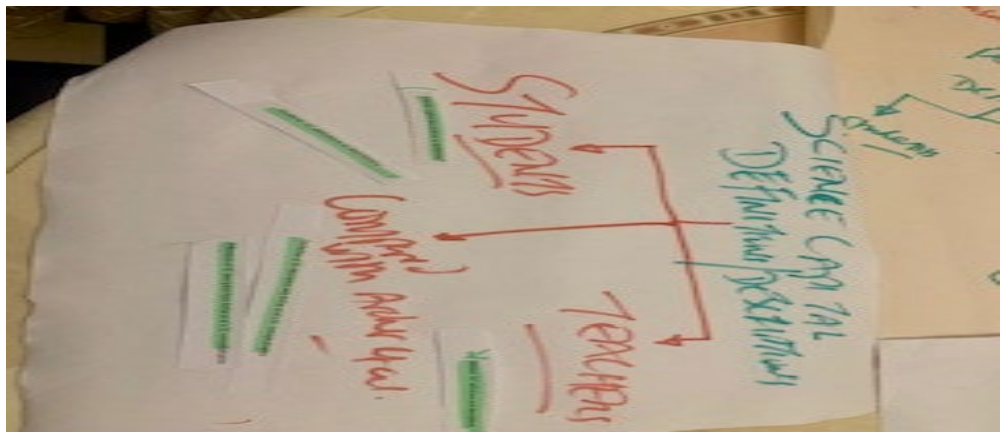
Name		Files	Reference	Created on	Created by	Modified on	Modified by
Acquirable factors to science capital development		25	341	14/04/2025 23:51	ANN O	15/04/2025 10:04	ANN O
Culture and science capital		3	4	15/04/2025 22:08	ANN O	15/04/2025 22:23	ANN O
Habitus		23	78	15/04/2025 00:38	ANN O	19/04/2025 07:33	ANN O
Informal science learning environments		12	24	15/04/2025 00:21	ANN O	19/04/2025 08:25	ANN O
Language and science capital		8	9	15/04/2025 01:00	ANN O	19/04/2025 12:08	ANN O
Progressing to science-related careers		8	11	19/04/2025 08:38	ANN O	19/04/2025 08:47	ANN O
Religion and science capital		0	0	15/04/2025 22:08	ANN O	15/04/2025 22:08	ANN O
Science interest and motivation		17	58	15/04/2025 00:03	ANN O	19/04/2025 12:03	ANN O
Science media consumption		17	32	15/04/2025 00:00	ANN O	19/04/2025 08:20	ANN O
Science qualifications		15	23	14/04/2025 23:55	ANN O	19/04/2025 08:14	ANN O
Scientific literacy		19	48	15/04/2025 01:07	ANN O	19/04/2025 08:08	ANN O
Socio-economic background		25	54	15/04/2025 00:59	ANN O	29/06/2025 23:01	ANN O
Anything unexpected or standing out		4	14	09/04/2025 02:46	ANN O	29/06/2025 23:44	ANN O
The nuances surronding teachers' routes to science education		4	7	10/04/2025 02:15	ANN O	29/06/2025 23:44	ANN O
Inherent science capital factors		23	158	25/07/2024 23:40	ANN O	15/04/2025 10:04	ANN O
Demographics of participants		11	14	15/04/2025 01:18	ANN O	16/04/2025 14:30	ANN O
Ethnicity and science capital		14	65	03/04/2025 17:11	ANN O	16/04/2025 14:37	NV
Negative effects of ethnicity		12	19	15/04/2025 22:10	ANN O	16/04/2025 14:37	NV
No effects of ethnicity		8	9	15/04/2025 22:16	ANN O	16/04/2025 14:37	NV
Positive effects of ethnicity		0	0	15/04/2025 22:10	ANN O	15/04/2025 22:41	ANN O
Gender		23	79	25/07/2024 23:40	ANN O	16/04/2025 14:37	NV
Negative effects of gender on science capital		8	12	15/04/2025 16:59	ANN O	15/04/2025 22:42	ANN O
No effects of gender on science capital		20	28	15/04/2025 17:00	ANN O	16/04/2025 14:37	NV
Positive effects of gender on science capital		2	2	15/04/2025 16:58	ANN O	15/04/2025 19:48	ANN O
Science capital perceptions and impacts		0	0	25/07/2024 23:40	ANN O	27/07/2024 02:10	ANN O
Recomendations		18	22	25/07/2024 23:40	ANN O	29/06/2025 23:45	ANN O
Relevance of science capital and science		26	96	25/07/2024 23:40	ANN O	19/04/2025 11:56	ANN O
Relevance of science		14	21	15/04/2025 12:22	ANN O	15/04/2025 14:55	ANN O
Relevance of science capital		15	24	15/04/2025 12:28	ANN O	16/04/2025 14:37	NV
Science capital descriptions or definitions		26	185	27/07/2024 00:43	ANN O	16/04/2025 14:37	NV
Differences of SC description from Archer et al.'s SC conceptualisation		7	9	14/04/2025 16:09	ANN O	15/04/2025 22:12	ANN O
First time of hearing about 'science capital' (SC) and how		24	37	14/04/2025 17:01	ANN O	14/04/2025 18:27	ANN O
Similarities of SC description with Archer et al.'s SC conceptualisation		3	5	14/04/2025 16:07	ANN O	15/04/2025 22:12	ANN O
Students' SC definitions or descriptions		21	43	14/04/2025 16:13	ANN O	16/04/2025 14:37	NV
Teachers' SC definitions and descriptions		8	8	14/04/2025 16:14	ANN O	16/04/2025 14:37	NV
Teachers' professional practices and science capital		5	69	02/04/2025 08:02	ANN O	16/04/2025 14:37	NV
Artificial Intelligence (AI) - teachers' opinions of AI		3	4	09/04/2025 01:57	ANN O	09/04/2025 12:52	ANN O
Science capital accumulation by teachers		3	9	09/04/2025 01:43	ANN O	28/06/2025 01:34	ANN O
Teachers' experiences of science growing up		1	3	10/04/2025 01:52	ANN O	10/04/2025 18:52	ANN O
Teachers' family habitus		3	5	09/04/2025 02:34	ANN O	09/04/2025 12:23	ANN O
Teachers' opinions about linguistic capital		3	3	09/04/2025 02:25	ANN O	09/04/2025 13:10	ANN O
Teachers' recommendations		3	6	09/04/2025 02:28	ANN O	15/04/2025 13:51	ANN O
Teachers' skills and students' science capital status		4	11	09/04/2025 01:04	ANN O	15/04/2025 14:26	ANN O
Teachers' support and scientific literacy		4	8	09/04/2025 01:15	ANN O	14/04/2025 12:48	ANN O
Teachers' support may affect socio-economic status consequences		5	8	09/04/2025 00:49	ANN O	16/04/2025 14:37	NV

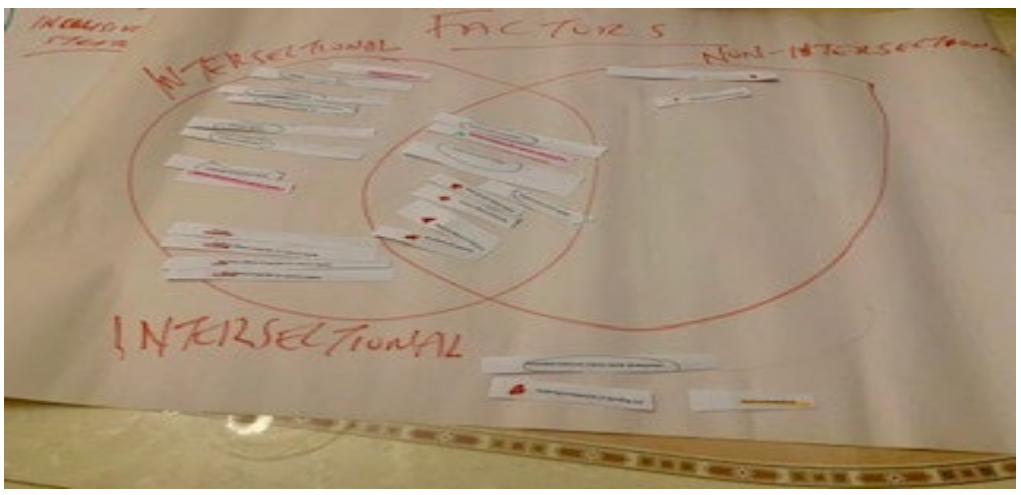
Appendix 14: Manual Formulation and Reviews of Initial Themes 2

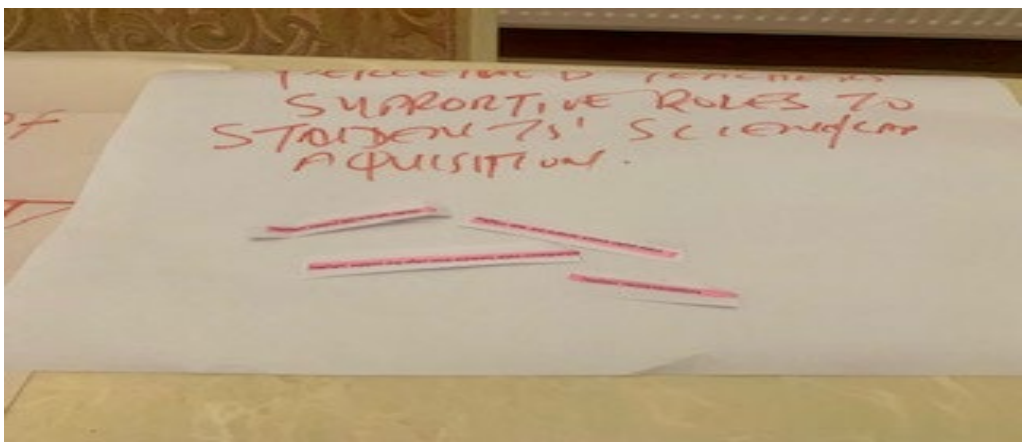




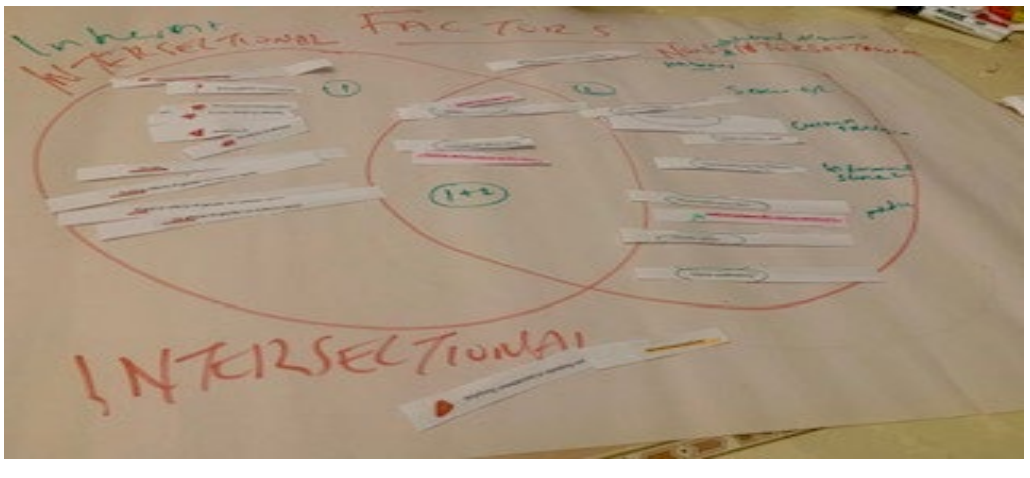


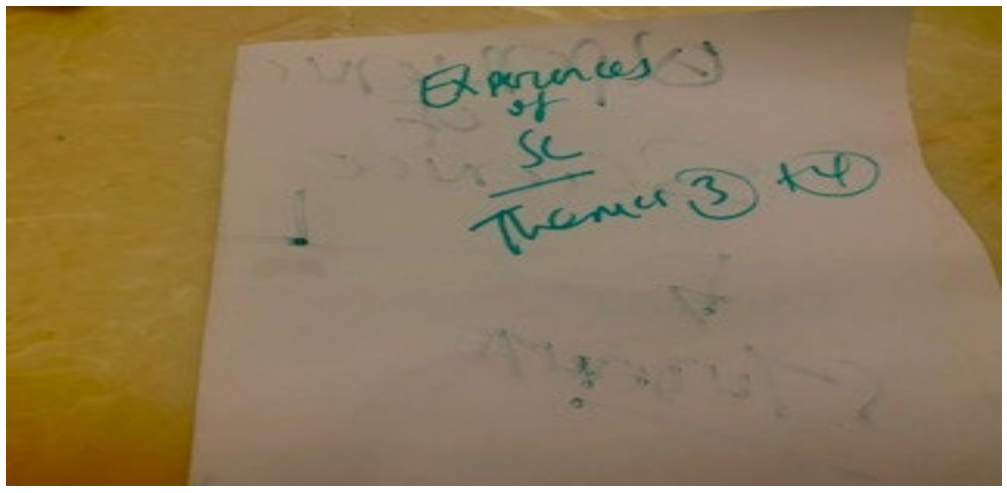


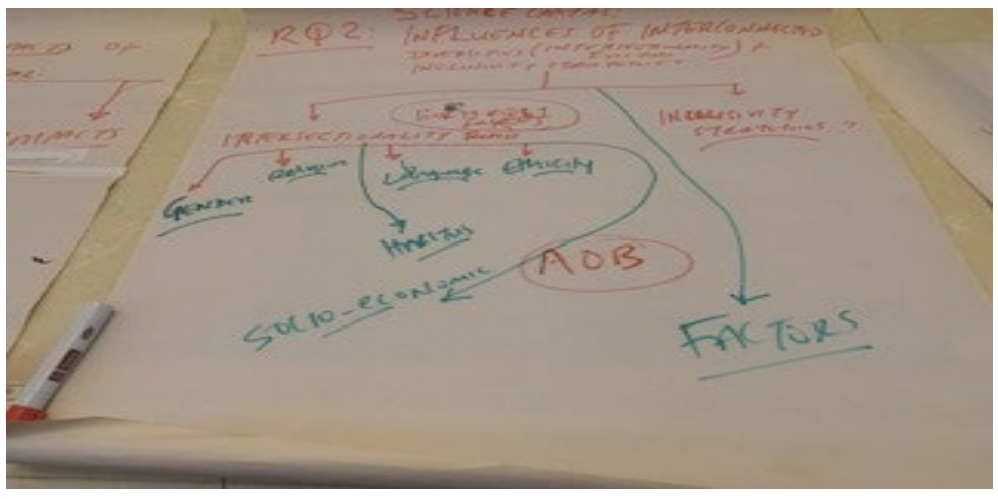

FACTORS
INTERSECTIONAL
NON-INTERSECTIONAL

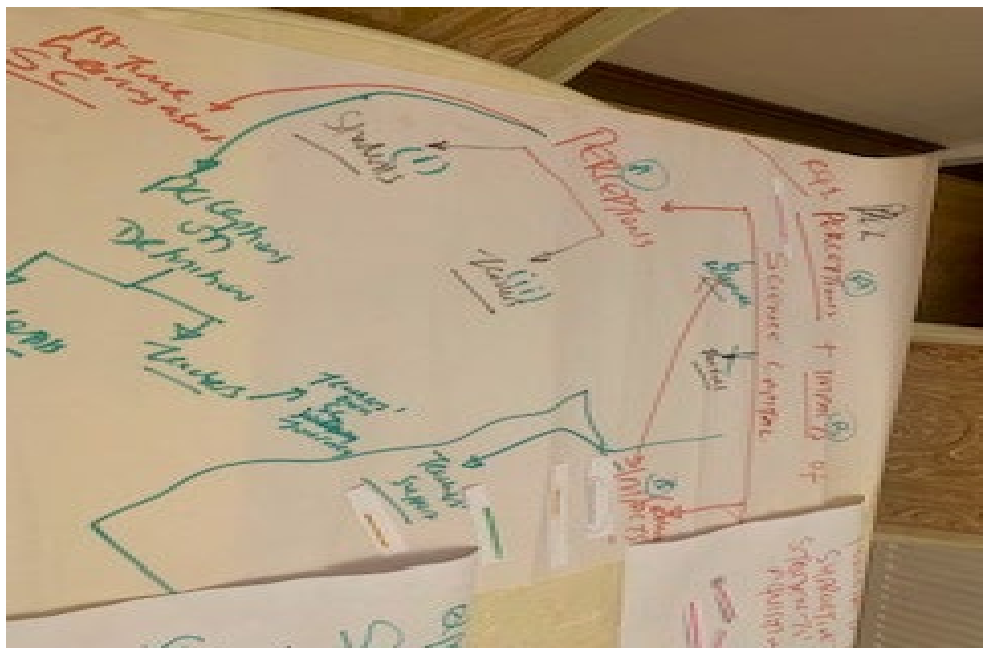

SUPPORTIVE ROLES TO
STUDENTS' SCIENCE
ACQUISITION.

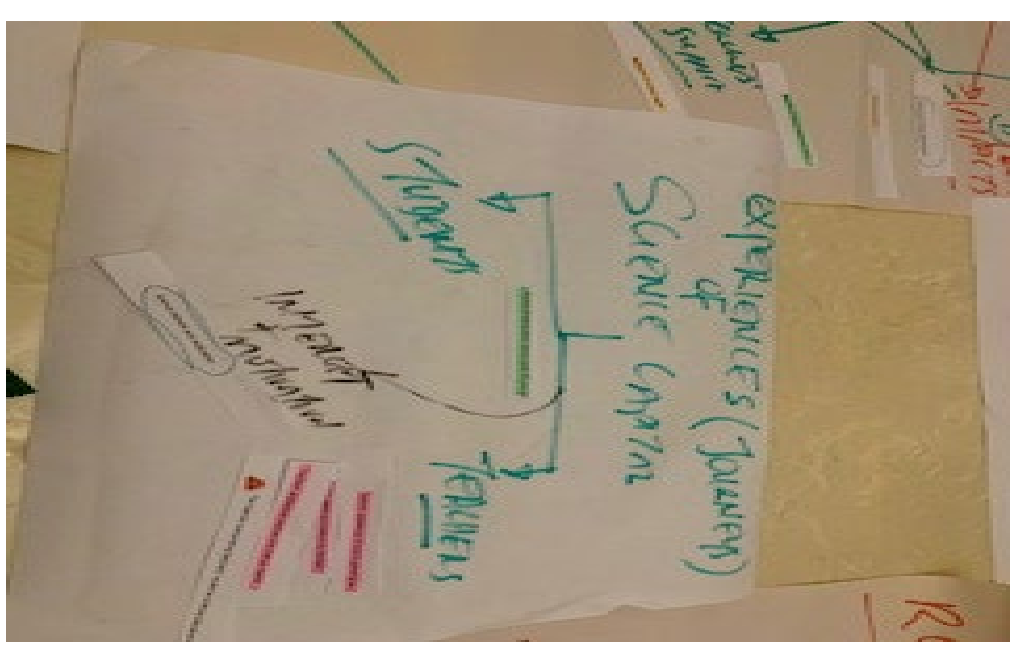
FACTORS
NON-INTERSECTIONAL

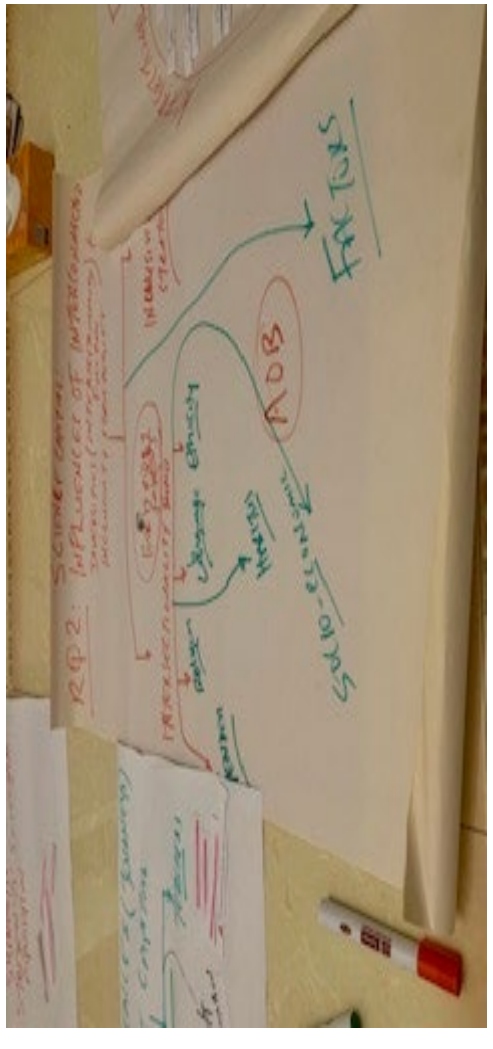

INTERSECTIONAL
FACTORS

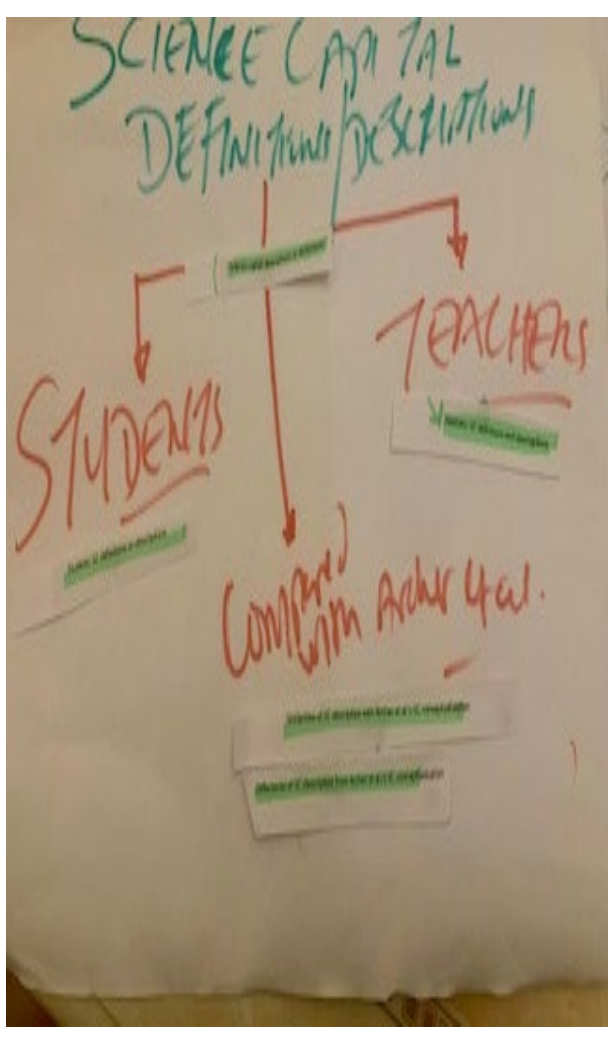

Themes 3 + 4

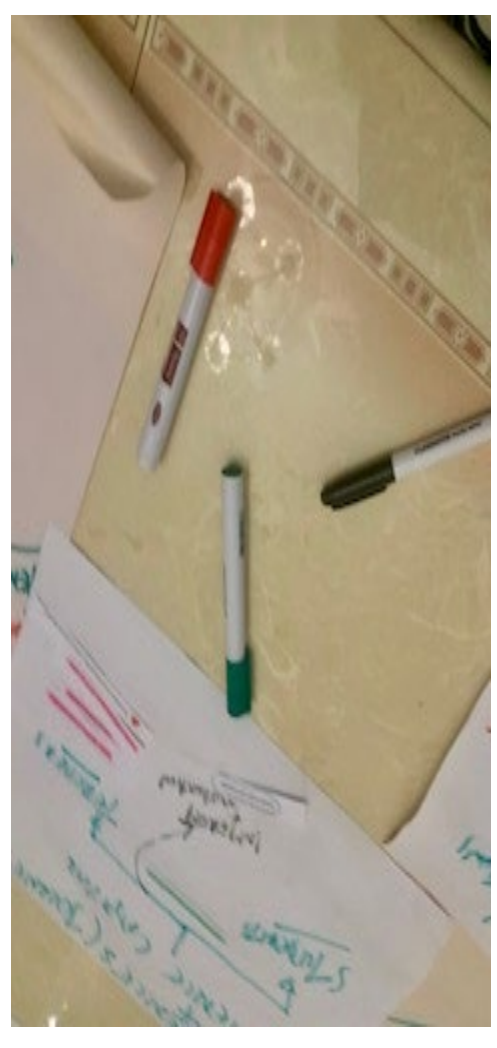

RQ2:
AOB
FACTORS




EXPERIENCES OF SCIENCE CAPITAL
STUDENTS
TEACHERS




SCIENCE CAPITAL
DEFINITIONS
STUDENTS
TEACHERS



Appendix 15A: Development of Themes (Layering & Interconnections of Initial Themes & Initial Codes)

Research Question 1: ***How do students and teachers perceive science capital and how do these perceptions influence their science engagement?***								**Research Question 2:** ***How do intersecting dimensions of identity, such as gender, ethnicity, socio-economic background, and language proficiency, influence participants' science capital?***				
RQ 1: Final Theme **5.2: Students' and Teachers' Experiences of Science Capital in Comparison with Archer et al.'s Science Capital Conceptualisation**								**RQ 2: Final Themes** **5.3: Key Science Capital Dimensions.** **5.4: Unexpected Findings and Participants' Recommendations.**				
RQ 1: Initial Themes 1-7								**RQ 2: Initial Themes 8-12**				
Initial Themes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
	Perceptions on the definitions/descriptions of science capital by **students**	Perceptions on the definitions/descriptions of science capital by **teachers**	**Students'** perceptions of their science capital experiences/journey	**Teachers'** perceptions of their science capital experiences/ journey	How the **students' and teachers'** perceptions compare with Archer et al.'s and others' perceptions of science capital	Teachers' perceptions of their students' science capital and their supportive roles to students' science capital acquisition	**Relevance** of science capital	Inherent (Non-acquired) intersectional influences (factors) that may affect science capital	Non- inherent (acquired) intersectional influences (factors) that may affect science capital	Influences that straddle both inherent and non-inherent intersectional influences that may affect science capital	Unexpected Findings	Recommendations
Initial Codes	*Students' SC definitions and descriptions	*Teachers' SC definitions and descriptions	*First time of hearing about science capital and how (students) *Science interest and motivation	*First time of hearing about science capital and how (teachers) *Science interest and motivation *Teachers' experiences of science growing up *Science capital accumulation by teachers	*Similarities of SC description with Archer et al.'s SC conceptualisation *Differences of SC description with Archer et al.'s SC conceptualisation	*Teachers' skills and students' science capital status. *Teachers' support and scientific literacy *Teachers' professional practices and science capital *Teachers' support may affect socio-economic status consequences *Teachers' recommendations	*Relevance of science and science capital *Relevance of science *Relevance of science capital *Progressing to science-related courses	*Inherent science capital factors *Demographic of participants *Ethnicity and science capital *Gender	*Socio-economic background *Culture and science capital *Religion and science capital *Scientific literacy *Science qualifications *Informal science learning environments *Science media consumption *Teachers' opinions of the influences of AI (artificial intelligence) on science capital	*Habitus *Teachers' family habitus *Language and science capital *Teachers' opinions about the influences of linguistic capital on science capital	*Anything unexpected or standing out *Similarities in anecdotes and experiences across various cultures	*Recommendations

Appendix 15B: Final Themes, Sub-themes, Themes and Initial Codes

Final Themes	Sub-themes	Initial Themes	NVivo Initial Codes	NVivo Indicative Codes
Theme 5.2: Perceptions and Impacts on Science Capital	Theme 5.2.1: Definitions and Descriptions of Science Capital	**Students:** Theme 1, Theme 5 **Teachers** Themes 2, 5, 6 & 10	• SC definitions and descriptions • Similarities of SC description with Archer et al.'s SC conceptualisation • Differences of SC description from Archer et al.'s SC conceptualisation	Students: <Files\\ADDITIONAL INTERVIEW NOTES\\Participant H> - § 1 reference coded [11.09% Coverage] – To me, science capital means having knowledge, curiosity to engage science, it is having science in everyday life, having superpower of understanding science in all its forms and learn about the amazing world we live in. Teachers: Files\\INTERVIEW TRANSCRIPTS\\Participant P (Teacher)> - § 1 reference coded [1.92% Coverage] – 'Well, I think it encompasses all the knowledge, the ability of the student, commitment of the parent, teachers, all variables that make science interesting'.
	Sub-theme 5.2.2: Students' First Time Hearing about Science Capital	**Students** Theme 3 **Teachers** Theme 4	• First time of hearing about science capital and how	Students <Files\\ADDITIONAL INTERVIEW NOTES\\Participant D> - § 1 reference coded [1.78% Coverage]- 'I heard about science capital in 2024 from my tutor (Ann)'.- Participant A 00:07:58 – It was possibly a month ago, to be honest…It was an advert that I saw in one of my cousin's place; it was talking about how some people are into science, and how some people are not, and it was also about how, for example, some people think science is for them, and how some people think science is not for them. Teachers Participant R1: I haven't come across the exact definition of this, but I have heard something similar to this in a different way. When I attended STEM training about 5-6 years ago, they were making some comments about it, but not in the exact terms, 'science capital'.
	Sub-theme 5.2.3 (a): Students' Interest and Motivation to Study Science	**Students** Theme 3 **Teachers** Theme 4	• Science interest and motivation • Science capital accumulation by teachers • Teachers' skills and students' science capital status • Teachers' professional practices and science capital	<Files\\INTERVIEW TRANSCRIPTS\\Participant C> - § 9 references coded [7.34% Coverage] - When I was young my dad used to teach me how to fix [electronic] motherboards or anything that had to do with, maybe soldering; I'm not sure but it was something with technology; to wire into a board. He taught me how to do that. So, I think that's when it developed. <Files\\INTERVIEW TRANSCRIPTS\\Participant Q (Teacher)> - § 4 references coded [12.81% Coverage] - Well, I first heard about science way back in 1969 when I was growing up. My uncle was then studying an A-level course in science, and he was always talking about science, science, science, science. Now, at that time I didn't know much about science. He made me so interested in science.
	Sub-theme 5.2.4: Relevance of Science	**Students & Teachers** Theme 7	• Relevance of science	<Files\\INTERVIEW TRANSCRIPTS\\Participant C> - § 2 references coded [2.61% Coverage] I think we do live in a very scientific world, especially in our daily lives, and since I've started to study science, I've realised that and had an open mind. And I know how the world works, which is mainly on science-made skills.
	Sub-theme 5.2.5: Relevance of Science Capital	**Students & Teachers** Theme 7	• Relevance of science capital	Participant M – '… science capital is more of like how I'm going to gain knowledge and understand how science works. It is important for me because with the help of that I'm able to like dig deeper whenever I'm doing my work, in my basic life and in general'. <Files\\ADDITIONAL INTERVIEW NOTES\\Participant P> - § 3 references coded [18.40% Coverage] - Relevance of science capital – depends solely on learners' attitudes to the subject, teachers and other operators.
	Sub-theme 5.2.6: Informal Science Learning (Teachers)	NN	Informal Science Learning (Teachers)	
	Sub-theme 5.2.7: Science Media Consumption	Theme 9	• Science media consumption and science capital • Teachers' opinions of the influences of AI (artificial intelligence) on science capital	<Files\\INTERVIEW TRANSCRIPTS\\Participant A> - § 2 references coded [10.21% Coverage] - I think it is very important, because that person will gain experience. And also on the media, it does really influence the youth to see how things work in the science industry. <Files\\INTERVIEW TRANSCRIPTS\\Participant P (Teacher)> - § 1 reference coded [12.29% Coverage] - I'm not removing the benefit of AI, but if AI takes all these away from me, I will not be able to think.
	Sub-theme 5.2.8: Scientific Literacy	Theme 9	• Scientific literacy and science capital • Informal science learning environments • Teachers' experiences of science growing up; Teachers' support and scientific literacy	<Files\\ADDITIONAL INTERVIEW NOTES\\Participant D> - § 1 reference coded [10.45% Coverage] - I agree with the importance of scientific literacy as it empowers individuals to understand and engage with the world around us, making informed decisions.
	Sub-theme 5.2.9: Progression	Theme 9	• Science qualifications; Progressing to science-related courses	<Files\\INTERVIEW TRANSCRIPTS\\Participant E> - § 1 reference coded [6.30% Coverage] - If you have science qualifications, you can go into like a lot of fields. So, you can go into medicine. You could go into becoming a doctor, pharmacy [sic]. You can go into health care workers...You can do a lot. And even if you've got a science qualification, you don't even need to go in [sic] science.
Theme 5.3: Influences of Intersectionality on Science Capital	Sub-theme 5.3.1: Ethnocultural Background and Science Capital	Theme 8 Theme 10	• Positive effects of ethnicity • Negative effects of ethnicity; No effects of ethnicity • Culture and science capital •Religion and science capital .	<Files\\INTERVIEW TRANSCRIPTS\\Participant A> - § 3 references coded [1.13% Coverage] - No, I believe that there's no advantages or disadvantage in terms of ethnicity, because a student or person could be from any type of country or area, and they will not be affected. Files\\INTERVIEW TRANSCRIPTS\\Participant Q (Teacher)> - § 2 references coded [2.57% Coverage] - It will only affect science capital if it's linked to socio-economic background. Being White. No, it shouldn't. It shouldn't…The background of the student, the cultural background, the socio-economic background shouldn't have much impact on students' ability to pursue a career in science. <Files\\INTERVIEW TRANSCRIPTS\\Participant 12345> - § 1 reference coded [2.84% Coverage] - So, for example, in my culture, women are more likely to stay at home and men are more likely to engage in difficult jobs like, I don't know, like engineering or science. That's what I mean. <Files\\INTERVIEW TRANSCRIPTS\\Participant P (Teacher)> - § 2 references coded [10.56% Coverage] - Yeah, in the northern part of [country], some Muslims do not allow their children to study science. Yes, because they feel it negates God's plans.

	Sub-theme 5.3.2: Gender and Science Capital	Theme 8	• Positive effects of gender on science capital • Negative effects of gender on science capital • No effects of gender on science capital	<Files\\INTERVIEW TRANSCRIPTS\\Participant J> - § 1 reference coded [4.15% Coverage] - I think it does have an advantage, because I feel like it's more... There is [[sick]] more like more opportunities, more occupations for me, because there are some occupations that females don't [sic] really want to do, or maybe it's hard for them to do.
	Sub-theme 5.3.3: Habitus and Science Capital	Theme 9	• Habitus and science capital; Teachers' family habitus	<Files\\ADDITIONAL INTERVIEW NOTES\\Participant D> - § 1 reference coded [17.98% Coverage] - Having parents with higher educational achievements can positively impact a leaner's science capital by providing a supportive environment for education.
	Sub-theme 5.3.4: Socio-economic Background and Science Capital	Theme 9	• Socio-economic background and science capital • Teachers' support may affect socio-economic status consequences	<Files\\INTERVIEW TRANSCRIPTS\\Participant E> - § 3 references coded [6.86% Coverage] - Advantage-wise, those of higher class,…they have more access to all the science equipment, or like teachers or tutors, or everything they need, they might go into a better paid private science school, and then they could go to maybe a better university, get better. …But then, on top of that, it might just because a lot of the time, high class people do tend to be a bit spoilt. They know, like, oh, I'm going to get it anyways…. So, I think, low class working people, they have that motivation, hardworking, like I, I can do this. I can do this. I may not be of this, but I can still get there, and that would push them further.
	Sub-theme 5.3.5: English Language Proficiency and Science Capital	Theme 9	• English Language proficiency and science capital; Teachers' opinions about the influences of their students' linguistic capital on science capital	<Files\\INTERVIEW TRANSCRIPTS\\Participant R1 (Teacher)> - § 1 reference coded [9.34% Coverage] - I think sadly, yes, and because whether it is the right system we follow at the moment or not, English language is the predominant science language internationally, and until you, until humans are able to diversify the science language into different languages, then those people who have a good command of the English language will always have the advantage.
Theme 5.4: Unexpected Findings	Sub-theme 5.4.1: English Language Proficiency Limitation			
	Sub-theme 5.4.2: Insufficient Focus on Equity, Diversity and Inclusion (EDI)			
	Sub-theme 5.4.3: Deterministic Science Capital Conceptions			

Appendix 16: NVivo Glossary of key terms

It's hard to learn a new language! NVivo has some terminology you might not be familiar with.

Here is a list of some of the most common terms in NVivo.

NVivo term	Description	Also known as
Files	The collective term for your research materials An *external* file represents data outside of NVivo that cannot be imported (such as a book or archival footage).	Data; Material; Documents Survey; Transcript; Project
Code	A virtual container that lets you collect content across sources to group related material together.	Node; Theme; Category; To Concept
Case	A virtual container that represents your research subjects	Units of observation Units of analysis Objects of study
Coding	The action of assigning source content to a node or case.	Quotations; Analysis; Taggi
Classifications	A way to add descriptive information to your sources and cases. **Examples** Reference, Journal Article, Person, Organization, Location	Types; Sorts; Classes
Attributes	Aspects of a classification. **Examples** ▪ A case classification of 'Person' might have attributes for age and gender. ▪ A source classification of 'Journal Article' might have attributes for publication and author.	Variables; Characteristics; Metadata; Rating; Descript Demographics; Bibliograph
Annotations	Text linked to specific content in a source.	Comments; Reminders; Observations; Footnote; Scribbled notes in the mar