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Exploring non-mathematics teachers' identity and responsibility for numeracy education: A Mixed Methods Study

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April 2026

Abstract

Within Scotland's Curriculum for Excellence, numeracy is positioned as a responsibility of all teachers. Despite this policy expectation, cross-curricular numeracy remains unevenly enacted in secondary schools. This study examines how non-mathematics teachers in Scotland understand and approach their responsibility for numeracy education, with particular attention to the role of teacher identity in shaping enactment.

The study used a convergent mixed-methods design adopting an interpretivist perspective. Thirty non-mathematics secondary teachers from five Scottish local authorities completed an online questionnaire exploring knowledge, confidence, beliefs, and perceptions of numeracy responsibility. Six teachers subsequently participated in semi-structured interviews to provide deeper insight into their professional experiences. Quantitative data were analysed using descriptive statistics and exploratory Spearman's rho correlations, while qualitative data were examined through reflexive thematic analysis. Findings were then integrated to support interpretive analysis across both datasets.

The findings suggest that teachers widely endorsed numeracy as educationally important and generally accepted it as a shared professional responsibility. However, enactment was often conditional and uneven. Confidence appeared to play a key mediating role between perceived knowledge and classroom practice, while anxiety and uncertainty were associated with more cautious or reactive engagement. Teachers frequently distinguished between using numeracy within subject contexts and explicitly teaching mathematical methods, with the latter often positioned as the domain of mathematics specialists. Disciplinary culture, prior experiences, and structural conditions also appeared to shape how legitimate and manageable numeracy felt within different subject areas.

The study argues that cross-curricular numeracy enactment may be understood most productively as identity-mediated practice. It shows that teachers' engagement with numeracy is shaped through the interaction of affective, biographical, social, and contextual influences rather than by policy awareness or knowledge in isolation. In this way, the study offers a tentative extension of Bennison's framework by showing how these domains may be interpreted as dynamically interacting in practice within the Scottish secondary context.

Table of Contents

Abstract	ii
List of Tables	vi
List of Figures	vii
Acknowledgements	viii
Author's Declaration	ix
Abbreviations	x
Chapter 1: Introduction.....	1
1.1 Research Context	1
1.2 Professional Relevance	2
1.3 Research Question	3
1.4 Dissertation Structure	3
Chapter 2: Background and Relevant Literature	5
2.1 Conceptualising Numeracy.....	5
2.2 Numeracy Enactment in Scotland and Internationally	9
2.2.1 Numeracy in the Scottish Context	9
2.2.2 Numeracy in International Contexts.....	12
2.3 Scottish Policy Analysis.....	16
2.3.1 Numeracy Policy under Curriculum for Excellence	16
2.3.2 Scottish Numeracy Policy Reviews and Inspection Evidence on Numeracy and Mathematics.....	21
2.4 Teacher Identity, Agency, and Cross-Curricular Numeracy Responsibility	24
2.4.1 Teacher Identity as a Negotiated Professional Positioning	25
2.4.2 Secondary Teachers' Subject Identity and Boundary Work	27
2.4.3 Teachers' Beliefs, Attitudes, and Affective Positioning Towards Numeracy.....	28
2.4.4 Self-efficacy, Mathematics Anxiety, Specialised Knowledge, and Identity-Protective Practice	30
2.4.5 Policy Enactment and Identity in the Scottish Numeracy Context	35
2.5 How the Study Contributes to the Literature.....	37
Chapter 3: Conceptual Framework.....	38
3.1 Understanding Teacher Identity	38
3.2 Conceptualising Teachers of Numeracy	40
3.3 Teachers' Perceptions, Knowledge, Confidence, Beliefs, and Attitudes Towards Numeracy	41
3.4 External Factors Influencing Teachers' Attitudes Towards Numeracy	43
3.5 Conceptual Framework for Analysis.....	45
Chapter 4: Methodology	48
4.1 Research Design	48
4.2 Interpretivist Approach	49

4.3 Sampling and Recruitment.....	51
4.3.1 Sample Characteristics	52
4.4 Data Collection Instruments.....	54
4.4.1 Online Questionnaire	54
4.4.1.1 Questionnaire Design and Structure	55
4.4.1.2 Questionnaire Dissemination.....	58
4.4.2 Semi-Structured Online Interviews	58
4.4.2.1 Development of Semi-Structured Interview Questions	59
4.4.2.2 Selection of Participants to Interview.....	61
4.4.2.3 Conducting Semi-Structured Interviews.....	63
4.5 Data Preparation	63
4.6 Data Analysis Procedures	64
4.6.1 Quantitative Analysis Procedures.....	65
4.6.2 Qualitative Analysis Procedures.....	67
4.6.2.1 Phase 1: Familiarisation with the Data.....	68
4.6.2.2 Phase 2: Generating Initial Codes.....	68
4.6.2.3 Phase 3: Constructing Initial Themes.....	69
4.6.2.4 Phase 4: Reviewing Themes.....	70
4.6.2.5 Phase 5: Defining and Naming themes	70
4.6.2.6 Phase 6: Producing the Report	71
4.6.3 Integration of Quantitative and Qualitative Findings.....	71
4.7 Ensuring Trustworthiness and Rigour.....	73
4.8 Ethical Considerations.....	74
Chapter 5: Findings.....	76
5.1 Introduction.....	76
5.2 Knowledge Domain.....	76
5.2.1 Mathematical Content Knowledge.....	76
5.2.2 Pedagogical Content Knowledge	81
5.2.3 Curriculum Knowledge.....	84
5.2.4 Summary of Findings in the Knowledge Domain	87
5.3 Affective Domain.....	88
5.3.1 Personal Conceptions of Numeracy.....	88
5.3.2 Interpreting Responsibility for Numeracy	95
5.3.3 Confidence, Anxiety, Avoidance, and Identity Positioning	97
5.3.4 Beliefs, Statistical Literacy, and Perceived Competence	105
5.3.5 Perceived Preparation to Embed Numeracy	111
5.3.6 Summary of Findings in the Affective Domain	116
5.4 Social Domain.....	118
5.4.1 School Communities	118
5.4.2 Disciplinary Positioning and Subject Differences.....	122
5.4.3 Professional Communities.....	125
5.4.4 Summary of Findings in the Social Domain	129
5.5 Life History Domain	129
5.5.1 Enduring Affective Dispositions	129
5.5.2 Legitimacy and the Limits of Formal Preparation.....	131
5.5.3 Identity Stabilisation Across the Career-Span	133
5.5.4 Summary of Findings in the Life History Domain	135
5.6 Context Domain	135

5.6.1 School-Level Implementation of Numeracy Policy	136
5.6.2 Assessment, Coherence, and System Architecture.....	137
5.6.3 Resource Conditions	139
5.6.4 Summary of Findings in the Context Domain	141
5.7 Interactions Between Domains.....	141
Chapter 6: Discussion	144
6.1 Reframing Numeracy Enactment as Identity-Mediated Practice.....	144
6.2 The Knowledge-Affect Nexus: Confidence as a Key Mediator.....	147
6.3 Life History and the Formation of Numeracy Positioning.....	150
6.4 Disciplinary Culture and the Social Construction of Legitimacy to Teach Numeracy	152
6.5 Structural Conditions: Why Policy Awareness is Insufficient	154
6.6 Interpreting Bennison's Framework.....	156
Chapter 7: Implications, Directions for Future Research, and Limitations of the Study.....	160
7.1 Implications	160
7.1.1 Implications for Policy.....	160
7.1.2 Implications for Professional Learning.....	161
7.1.3 Implications for Initial Teacher Education	162
7.2 Directions for Future Research	162
7.3 Limitations of the Study	164
7.4 Concluding Remarks	167
References	168
Appendix 1: Questionnaire Items	177
Appendix 2: Ethical Approval Documentation.....	181

List of Tables

Table 1 Conceptual framework for identity as an embedder of numeracy (Bennison, 2015a, p.15).....	46
Table 2 Subjects taught by participants	52
Table 3 Number and percentage of participants employed in each local authority	54
Table 4 Semi-Structured Interview Questions and Prompts.....	60
Table 5 Semi-structured interview participant demographics.....	62
Table 6 Percentage of teachers who Read and/or used E's and O's	84
Table 7 Percentage of teachers and their initial conceptualisations of numeracy	89
Table 8 Curriculum organisers (Adapted from Education Scotland, 2017).....	91
Table 9 Teachers' personal conceptions of numeracy as codes and subcodes...	92
Table 10 Personal conceptions of numeracy as subtopics in relation to curriculum organisers	93
Table 11 Teachers' attitudes towards numeracy as codes and subcodes.....	98
Table 12 Teachers' perceived confidence with numeracy	99
Table 13 Spearman's rho correlations between confidence-related items.....	103
Table 14 Teachers' views of probability and statistics in real-life	105
Table 15 Spearman's rho correlations between perceived confidence and real-life situations relating to probability and statistics	107
Table 16 Teachers' professional learning experience	111
Table 17 Spearman's rho correlations between professional learning exposure and perceived benefit from professional learning	113
Table 18 Mean scores and standard deviations for selected affective questionnaire items by disciplinary grouping.....	122
Table 19 Teachers' preferences for who should lead numeracy professional learning.....	126

List of Figures

Figure 1 Participants’ years of teaching experience..... 53

Figure 2 Interaction of Domains.....158

Acknowledgements

I would like to express my sincere gratitude to my supervisors, Dr Ismail Özgür Zembat and Dr Utkun Aydin, for their guidance, support, and encouragement throughout this research. Their insight and expertise have been invaluable at every stage of this project.

I am especially grateful to my husband for his constant encouragement, patience, and support throughout this journey. I am also deeply thankful to my mother for her understanding and unwavering support. I would also like to thank my friends and family for their belief, patience, and reassurance throughout this process.

Finally, I would like to thank all the participants who generously gave their time and shared their experiences; this research would not have been possible without their contribution.

Author's Declaration

I declare that, except where explicit reference is made to the contribution of others, 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: CLAIRE DRUMMOND

Signature:

Abbreviations

List of abbreviations used in this dissertation:

ACARA	Australian Curriculum, Assessment, and Reporting Authority
CfE	Curriculum for Excellence
CK	Curriculum Knowledge
CLPL	Career-long professional learning
E's and O's	Experiences and Outcomes
ERA	Education Reform Act
GDPR	General Data Protection Regulation
HMIE	Her Majesty's Inspectorate of Education
ITE	Initial Teacher Education
MCK	Mathematical Content Knowledge
NIF	National Improvement Framework
NRIM	National Response to Improving Mathematics
OECD	Organisation for Economic Co-operation and Development
PCK	Pedagogical Content Knowledge
PISA	Programme for International Student Assessment
RTA	Reflexive Thematic Analysis
SLWG	Short Life Working Groups
SPSS	Statistical Package for the Social Sciences
SQA	Scottish Qualification Authority
SSLN	Scottish Survey of Literacy and Numeracy
TIMSS	Trends in International Mathematics and Science

Chapter 1: Introduction

1.1 Research Context

Numeracy is widely recognised as a fundamental capability that underpins participation in education, employment, and everyday life. Within Scotland's Curriculum for Excellence (CfE), numeracy is positioned, alongside literacy and health and wellbeing, as both a core component of learners' development and a responsibility of all teachers, regardless of subject specialism. This policy framing reflects an understanding that numeracy extends beyond mathematics classrooms and is embedded across a range of disciplines, including science, social subjects, and the arts. However, despite this clear policy expectation, less is known about how non-mathematics secondary teachers interpret and enact this responsibility.

Existing research suggests that teachers' confidence, subject knowledge, attitudes, and beliefs about numeracy significantly influence their willingness and ability to integrate numeracy into their teaching (Aquilina et al., 2025; Bennison, 2016; Callingham et al., 2015; Fisher et al., 2016; Goos et al., 2011; Whitney-Smith & Day, 2023). For non-mathematics specialists, these factors may present unique challenges, including uncertainty about pedagogical approaches, fear of making mistakes, or assumptions that numeracy is solely the responsibility of mathematics departments (Beswick et al., 2006; Muir, 2008). At the same time, opportunities exist for cross-curricular collaboration and contextualised numeracy learning, which can enhance pupils' engagement and understanding (Bennison, 2015b; Bennison et al., 2020; Forgasz et al., 2017; Goos et al., 2011; Milton et al., 2007).

The study explores how non-mathematics secondary teachers in Scotland view and approach their responsibility for numeracy education. Specifically, it examines teachers' perceptions of policy expectations, their confidence and preparedness to teach numeracy, and how they use numeracy within their subject contexts. By investigating these perspectives, the study aims to contribute to understanding barriers to whole-school numeracy development, identify potentially effective practice, and offer insights that may inform professional learning and policy. In doing so, it builds on existing work on numeracy across learning by examining how responsibility is interpreted and

negotiated within secondary subject cultures and by foregrounding the role of teacher identity in shaping cross-curricular policy enactment. The study also explores how teachers' engagement with numeracy across the curriculum may be influenced by the interaction of professional identity, disciplinary culture, and structural conditions.

1.2 Professional Relevance

The study holds significant professional relevance for me as a practising teacher within the Scottish education system. Engaging systematically with teachers' experiences of numeracy across the curriculum has deepened my understanding of how professional identity, confidence, subject knowledge, and policy expectations intersect to shape classroom practice.

As a secondary mathematics teacher, I brought subject-specific knowledge and professional experience that informed both the focus of the study and the interpretation of teachers' accounts. My position provided insight into curricular expectations, assessment practices, and dominant discourses surrounding numeracy and mathematical competence in secondary education. At the same time, I remained aware of the potential influence of this positioning, particularly when engaging with teachers from non-mathematics disciplines, for whom numeracy may be experienced as an externally imposed or contested responsibility. Reflexive strategies were, therefore, employed throughout the research process to critically examine assumptions, limit the influence of mathematics-specialist perspectives, and remain attentive to the diverse ways numeracy is understood and enacted across subject areas.

Designing and conducting this research strengthened my capacity to engage critically with educational literature, methodological decision-making, and ethical practice, thereby enhancing my professional judgement and research literacy. This process has informed a more reflective and evidence-informed approach to teaching, curriculum planning, and professional dialogue with colleagues.

The findings of the study also provide a basis for more informed engagement in professional learning related to numeracy development. By foregrounding

teachers' perspectives, this research has enabled me to contribute more effectively to collaborative professional learning and cross-curricular dialogue.

Finally, the study prompted sustained reflexive engagement with my own professional identity as both a teacher and a researcher, highlighting how personal experience, institutional context, and policy discourse shape professional positioning. This reflexivity will inform my ongoing practice and future leadership roles within education.

In this way, the research contributes not only to my professional development and capacity to support meaningful and contextually responsive numeracy education, but also to the wider literature by exploring how non-mathematics secondary teachers in Scotland understand and approach responsibility for numeracy across the curriculum (see Section 2.5).

1.3 Research Question

This research is guided by the following main question:

How do non-mathematics secondary teachers in Scotland view and approach their responsibility for numeracy education?

To address this question, the study explores how teachers understand numeracy and mathematics, the extent to which they know what knowledge or concepts are included within their numeracy responsibility in relation to their subject specialism, and how confident, prepared, and equipped they feel to meet this responsibility. It also examines whether teachers regard the idea of a 'teacher of numeracy' as part of their professional identity, what support, including professional learning, they would find helpful, and how, if at all, they think numeracy education could be better supported within the curriculum.

1.4 Dissertation Structure

This dissertation consists of seven chapters.

Chapter One introduces the research context, outlines the professional relevance of the study, presents the research question, and provides an overview of the dissertation structure.

Chapter Two reviews the key conceptual, international, and policy literature that informs the study. It examines definitions of numeracy, its positioning in Scotland and internationally, and Scottish policy on numeracy across the curriculum. It also reviews literature on teacher identity, agency, affect, and professional legitimacy, and identifies the gap to which this study responds: limited research on how non-mathematics secondary teachers in Scotland understand and approach responsibility for numeracy.

Chapter Three presents the conceptual framework for the study. Building on Chapter Two, it examines teacher identity, considers what it means to view teachers as teachers of numeracy, and explores how teachers' perceptions, knowledge, confidence, beliefs, and attitudes may shape engagement with numeracy across the curriculum. It then introduces Bennison's (2015a) framework of identity as an embedder of numeracy, which provides the analytical lens for the study.

Chapter Four outlines the research design and methodology for the study. This chapter includes information on participants, recruitment, data collection methods, data preparation, and the different phases of analysis, including coding and theme development. Ethical considerations are also discussed within this chapter.

Chapter Five presents the findings of the study, organised in relation to the conceptual framework and key themes emerging from the data.

Chapter Six discusses the findings in relation to existing literature. It examines the interaction of knowledge, confidence, past experiences, disciplinary culture, and structural conditions, and uses these findings to interpret Bennison's framework in relation to cross-curricular numeracy enactment.

Chapter Seven considers the implications of the study for policy, professional learning, and initial teacher education, and outlines directions for future research. It also discusses the limitations of the study and concludes by reflecting on the study's overall contribution to understanding numeracy as an identity-mediated cross-curricular practice.

Chapter 2: Background and Relevant Literature

This chapter reviews the key conceptual, international, and policy literature that informs the study of numeracy as the responsibility of all teachers, with particular attention to the implications for secondary teachers in Scotland. It establishes the theoretical and contextual foundations necessary for examining how numeracy is defined, enacted, and supported across different education systems.

The chapter begins by exploring competing definitions of numeracy and its relationship with mathematics, highlighting longstanding conceptual ambiguities and the shift from narrow, skills-based interpretations towards broader, socially situated, and critical understandings. It then considers how numeracy is positioned internationally, drawing on comparative examples to illustrate the diverse ways in which education systems conceptualise and structure responsibility for numeracy development.

The focus subsequently narrows to the Scottish context, examining how numeracy is prioritised within national policy and enacted in secondary education under CfE. Through a critical analysis of curriculum documentation and policy reviews, this chapter identifies tensions between policy aspirations and practical guidance, particularly for non-mathematics teachers. It then examines literature on teacher identity, agency, and affect in order to establish the conceptual rationale for investigating how teachers interpret and enact numeracy responsibility. Collectively, this literature provides essential context for understanding why numeracy across the curriculum remains a contested policy objective and establishes the rationale for investigating teachers' perceptions, confidence, and professional identities in relation to numeracy education.

2.1 Conceptualising Numeracy

The terms *numeracy* and *mathematics* are often used interchangeably, which can cause significant confusion to learners and professionals alike. Where mathematics is a discipline, numeracy skills are often considered a subset of it (Askew, 2015). Askew explains that there is little consensus about what this means for the teaching profession:

At one extreme, numeracy is interpreted as equipping school leavers with the basic skills of arithmetic, and so numeracy is regarded as a subset of mathematics. At the other extreme, it is argued that the teaching of numeracy should address the political dimensions of mathematics and its uses in society, so that learners are supported in becoming critical citizens (Askew, 2015, p.707).

The former is a view that is generally accepted and widely reproduced by pupils, teachers, and parents alike, reflecting the longstanding association between schooling and reading, writing and arithmetic (Steen, 1990). Whereas the latter view is often how numeracy is conceived at policy level and is more in line with the Organisation for Economic Co-operation and Development (OECD) view that numeracy should include the mathematics required to be a “constructive, concerned and reflective citizen” (OECD, 1999, p.12). Askew (2015) argues that this is part of the problem and numeracy education must move past a narrow focus on basic skills. Instead, it should support learners in questioning how mathematics operates in real-world contexts. From this perspective, critical numeracy is not neutral but plays a vital role in advancing social justice. The difference between these perspectives helps to explain the persistent lack of conceptual clarity surrounding numeracy in both educational policy and classroom practice.

The term *numeracy* was first coined in England as part of the Crowther Report, which addressed the state of secondary education and made several influential recommendations for its improvement (Crowther, 1959). The term was introduced to emphasise the importance of understanding numerical concepts in everyday life. This can be understood in a similar sense to literacy, which involves more than simply reading and writing words on a page; it also involves interpreting and making meaning from what is read (Crowther, 1959).

In 1982, another influential study commissioned in England was the Cockcroft Report. This study investigated the purpose of teaching mathematics, and over a hundred adults were interviewed regarding how they use mathematics in daily life and/or work (Cockcroft, 1982). Ultimately 107 people agreed to be interviewed, with approximately the same number again refusing to take part due to their perception of “mathematics as a daunting subject” (Cockcroft, 1982, p.6). The report refers to several dictionary definitions of numeracy, all of which relate to the ability to perform basic arithmetic calculations. This is

similar to the first definition offered by Askew (2015). The findings in the Cockcroft Report, however, expressed concern that:

those who set out to make pupils ‘numerate’ should pay attention to the wider aspects of numeracy and not be content merely to develop the skills of computation (Cockcroft, 1982, p.11, quotations in original).

This recommendation is more in line with the idea of developing critical numeracy that would be useful in daily life. Many researchers in recent years have offered their own definitions of numeracy, all of which are more akin to the recommendation of the Cockcroft Report. Goos et al. (2012, p.3) define numeracy as “the mirror image of literacy but involving quantitative thinking.” Callingham et al. (2015, p.552) suggest “the goals for numeracy should include developing human capital, which is essential for the development of professional capital”. Venkatakrishnan and Graven (2006, p.14) propose that “the test of numeracy...is whether a person naturally uses appropriate skills in many different contexts”. These definitions collectively emphasise that numeracy involves transferable mathematical or quantitative reasoning (used here in a broad, applied sense to refer to the use and interpretation of numerical information across contexts, rather than the more formalised construct in mathematics education research (e.g., Thompson, 1993)). In this sense, numeracy extends beyond formal mathematics and carries significant social and economic value. This supports conceptualisations of numeracy as a cross-curricular capability rather than a discrete mathematical skill set.

Other terms used interchangeably with numeracy include *mathematical literacy* and *quantitative literacy* (Bennison, 2016). Although these terms differ in wording, they share an emphasis on applying mathematical knowledge and reasoning to address problems situated within social contexts (Callingham et al., 2015). However, their use is often shaped by national policy traditions and assessment frameworks, and the lack of consistent terminology can contribute to conceptual ambiguity in curriculum design and classroom practice. This inconsistency may further obscure teachers’ understanding of what numeracy entails and who is responsible for its development across the curriculum.

The necessity to be numerate in today’s world has grown exponentially since the emergence of computers. Historically, being able to add, subtract, multiply, and divide was more than enough for the majority to get by, but in our modern data-

driven world what constitutes being numerate is continually evolving (Steen, 1990). Geiger et al. (2015a) highlight the significance of numeracy by noting that low numeracy levels can greatly hinder students' transitions from school into further education or employment. They argue that this can lead to reduced work opportunities, diminished self-esteem, poorer health outcomes, and limited social and political engagement. These expanding demands support a conceptual rationale for developing numeracy across a range of subjects and learning contexts, an approach reflected in policy claims that numeracy is a responsibility shared by all teachers.

In the years following the Cockcroft Report, the concept of numeracy development has become more globalised since the OECD launched the Programme for International Student Assessment (PISA) in 1997. The purpose of PISA was to measure the performance of 15-year-old students in mathematics, science, and reading (OECD, 2000), although their publications more commonly use the term *mathematical literacy*. Differences in terminology appear to be largely geographical in nature: with the United States of America favouring the term *quantitative literacy* (Gargroetzi et al., 2025; Steen, 2001); in addition to PISA, countries such as South Africa, Japan and Poland tend to opt for *mathematical literacy* (Goos & O'Sullivan, 2023b; Marciniak, 2015; Tasaki, 2017; Venkatakrishnan & Graven, 2006); whereas Australia, New Zealand, Canada, and the United Kingdom generally prefer to use the term *numeracy* (Dion, 2014; Goos et al., 2012). Callingham et al. (2015) argue that although these different phrases all describe the same intent to connect mathematics with the social environment, the issue is these phrases are frequently misunderstood as being synonymous with the formal mathematics curriculum (Callingham et al., 2015).

More recent conceptualisations of numeracy emphasise its cross-curricular nature, positioning it as a capability to be developed across subject areas rather than exclusively in mathematics lessons (Bennison, 2016; Goos et al., 2014). From this perspective, numeracy involves recognising and responding to quantitative demands embedded in disciplinary contexts such as science, art, and technology, and social subjects. This framing has important implications for teachers' professional roles and identities, particularly for those working outside mathematics, as it expands responsibility for numeracy development across the teaching workforce.

2.2 Numeracy Enactment in Scotland and Internationally

While attention to numeracy is increasing internationally, there remains no universally accepted definition, and the meaning of numeracy, therefore, varies across countries (Geiger et al., 2015b). Numeracy has gained traction internationally through the introduction of various standardised assessments, such as PISA and the Trends in International Mathematics and Science Study (TIMSS). The PISA results, in particular, are closely scrutinised and widely used for international comparison (Geiger et al., 2015a). The origin of such globalised testing is thought to stem from the Education Reform Act (ERA) 1988 in England (Sahlberg, 2016). Levin and Fullan (2008, p.289) refer to this Act as “a watershed event not just in that country but internationally”. The education policies that followed built on the Thatcherite neoliberal free-market principles of prioritising competition and data as catalysts for improvement (Levin & Fullan, 2008), with these principles informing policy not only in England but across the wider United Kingdom.

Decades on from the beginning of this policy shift, Ball (2017, p.2) suggests that education has been repositioned as a key driver of economic performance and international competitiveness in the context of the “knowledge economy”. As a result, policy development is now strongly influenced by global pressures and by specific political rationalities that shape how education is understood and governed (Ball, 2017). Sahlberg (2016) argues that the ERA became an internationally influential and extensively researched policy intervention. Its legacy, together with later global reform initiatives, played a significant role in accelerating the growth of large-scale standardised testing and fostering international comparisons of literacy, numeracy, and science (Sahlberg, 2016).

2.2.1 Numeracy in the Scottish Context

This section examines how numeracy is positioned as a national priority within Scottish education policy and how this is enacted in practice in secondary schools.

Improving attainment in numeracy is an educational priority in Scotland (Scottish Government, 2023). The National Improvement Framework (NIF) positions literacy and numeracy as core priorities for raising attainment in Scottish education, alongside closing the poverty-related attainment gap and improving

wellbeing and skills for life and work. It sets out that every child should achieve high standards in numeracy, and that improvements in numeracy attainment should be monitored through nationally agreed measures of achievement in line with CfE levels (Scottish Government, 2023).

Over the past decade, there has been a significant push to improve standards in numeracy within the primary sector and among mathematics specialists in the secondary sector. A range of pedagogical approaches have been introduced in response, such as a focus on pupils working with and developing their understanding of numbers through Number Talks and Numicon, and discussing links to numeracy in other subjects, topics, and contexts so as to fully immerse pupils in their numeracy learning. In West Lothian, each primary school has at least one 'Numeracy Champion', who meet monthly to engage in professional learning and share pedagogical ideas and strategies. However, improving standards in numeracy is not just a focus for primary schools.

Secondary schools are equally responsible for improving standards in numeracy, if not more so as pupils are expected to achieve qualifications relating to their numeracy ability. This creates a key tension. The numeracy qualifications that pupils sit are completed alongside their mathematics qualifications. Thus, in the secondary context, numeracy is often treated in practice as the responsibility of mathematics teachers. However, under CfE, numeracy is the responsibility of all teachers (Education Scotland, 2018). In practice, accountability for numeracy in secondary schools often appears to rest predominantly with mathematics departments, despite policy claims that responsibility is shared. For example, the numeracy Benchmarks are presented alongside the mathematics Benchmarks in CfE, rather than as separate cross-curricular resources (Education Scotland, 2017). This placement may contribute to the ambiguity around responsibility, as it can imply that numeracy remains primarily within the remit of mathematics teachers even while policy frames it as a whole-school responsibility. As such, the extent to which teachers in non-mathematics subject areas are supported to embed numeracy within their curricular areas remains unclear, despite the assertion of Education Scotland (2018) that it is already embedded across learning.

One source of national evidence on numeracy attainment in Scotland was the Scottish Survey of Literacy and Numeracy (SSLN), a sample survey which

measured the national performance in literacy and numeracy for pupils in P4, P7, and S2. In its final numeracy-focused survey in 2015, the SSLN found that the largest proportion of pupils not yet working within the expected numeracy level was found at S2 (Scottish Government, 2016). This is particularly significant for this study because S2 sits within the secondary phase of schooling. The SSLN findings, therefore, indicate that the secondary stage is an important context in which to examine how non-mathematics teachers understand and enact their numeracy responsibility. In addition, the SSLN identified from the teacher questionnaire results that:

the vast majority of primary and secondary mathematics teachers are confident in teaching numeracy; secondary non-mathematics teachers reported relatively lower levels of confidence (Scottish Government, 2016, p.3).

This suggests a need for further investigation into how non-mathematics teachers in Scotland understand and enact their responsibility for numeracy education, particularly in relation to confidence and cross-curricular practice.

The study, therefore, aimed to investigate how non-mathematics teachers understand, interpret, and enact their responsibility for numeracy education within their own curricular areas. A particular focus on secondary education was important because, although numeracy is framed as the responsibility of all teachers, its enactment in secondary schools appears less consistently embedded across subjects than in primary contexts. Bennison (2015a) argues that when teachers have the knowledge and capacity to identify and provide numeracy learning opportunities in their own subjects, “the students’ numeracy capabilities along with learning in each subject is likely to be enhanced” (Bennison, 2015a, p.561). Bennison’s work provides a conceptual rationale for positioning numeracy as a cross-curricular responsibility; however, it does not in itself provide direct evidence that such an approach leads to improved learner outcomes. Given the international policy attention attached to numeracy attainment, particularly through comparisons driven by the PISA programme, the issues explored in this study are likely to have some relevance beyond Scotland and the United Kingdom.

2.2.2 Numeracy in International Contexts

To contextualise Scotland's approach to numeracy across the curriculum, this section explores how numeracy is defined and positioned within a selection of international education systems. It considers policy developments and research from Australia, Ireland, South Africa, Japan, Canada, and the United States, with particular attention to variation in how numeracy is conceptualised and how responsibility for its development is distributed across teachers, subjects, and curriculum structures. These contexts were selected because they provide contrasting examples of these policy approaches, rather than to present particular geographical regions or to offer a comprehensive comparison of jurisdictions most closely aligned with Scotland. The intention was to use these differing approaches to situate Scotland's framing of numeracy as a responsibility of all teachers within a broader international context. Other UK policy contexts, although potentially valuable comparators, fell outside the intended scope of this analysis, which focused on selected international examples of how numeracy responsibility is conceptualised and enacted.

In Australia, numeracy has been positioned at both state and national levels as a significant priority within education policy (Callingham et al., 2015). In a similar approach to the Scottish education system, Australia lists numeracy as one of seven general capabilities that all teachers have responsibility to develop in their students (Forgasz et al., 2017). However, like Scotland, this has not always been the case. In an older policy document, the definition of numeracy offered was:

to be numerate is to use mathematics effectively to meet the general demands of life at home, in paid work, and for participation in community and civic life (Commonwealth of Australia, 1997, p.39).

Callingham et al. (2015) regarded this definition as problematic, arguing that it suggested numeracy and mathematics were the same and led to a focus on mathematical understanding over the transferability of mathematical skills in other contexts. Gradually, the subtle nuances of the language around numeracy began to shift and by 2013, the Australian Curriculum, Assessment, and Reporting Authority (ACARA) was defining numeracy as involving:

students recognising and understanding the role of mathematics in the world and having the dispositions to use mathematical knowledge and skills purposefully (ACARA, 2013, p.14).

In 2022, ACARA published a revised curriculum, which presented literacy and numeracy as learning progression frameworks (ACARA, 2022). The numeracy framework is broadly similar to the numeracy experiences and outcomes (E's and O's) produced by Education Scotland (2017); detailed descriptions of what should be taught, but limited guidance on how this might be enacted across the curriculum.

In Ireland, there has been a similar focus on numeracy as part of their curriculum reform, which has been in part driven by Ireland's decline in mathematical literacy performance in the PISA rankings (Goos & O'Sullivan, 2023b). Ireland is in a similar position to both Scotland and Australia in that their policy documents remain ambiguous about the distinction between mathematics and numeracy. In 2011, Ireland launched their national strategy to improve literacy and numeracy. Goos and O'Sullivan (2023b) note in their analysis that the document consistently prioritises mathematics in its language, with numeracy receiving limited direct attention.

In 2024, Ireland's Literacy, Numeracy and Digital Literacy Strategy 2024-2033 was introduced as a refresh of the previous strategy. Here, numeracy is defined as:

the ability to observe, explore and manipulate objects, and hear mathematical language. It involves using mathematical understanding and skills in a variety of contexts to describe, predict and explain phenomena, recognising the role that mathematics plays in the world. A numerate learner applies mathematical skills and makes the well-founded judgements and decisions needed by constructive, engaged and reflective members of society (Government of Ireland, 2024, p.29).

As in Scotland and Australia, teachers in Ireland are likewise expected to embed numeracy across the curriculum, and there is some explanation regarding what this encompasses. This is similar to policy documents in both Scotland and Australia. However, there remains no guidance on how this should be achieved in practice. This policy ambiguity may shape how teachers understand their role in numeracy development, contributing to uncertainty about responsibility, particularly in subjects not traditionally viewed as mathematical.

In some countries, such as South Africa, numeracy, referred to in that context as mathematical literacy, is offered as a distinct subject and as an alternative to mathematics (Bennison, 2015a). The description of this subject in the *National*

Curriculum Statement for Mathematical Literacy (Department of Education [RZA], 2003) suggests that this course is more comparable to Scotland's *application of mathematics* course at National 5 and Higher than to the traditional mathematics curriculum. This differs from the cross-curricular model in Scotland, where numeracy is positioned as a shared responsibility across the curriculum, in addition to what could be viewed as Scotland's version of a mathematical literacy course.

Since its introduction in 2006, all learners entering the senior phase of their education in South Africa are required to take either mathematics or mathematical literacy (Graven & Buytenhuys, 2011). This separate offering emerged through post-apartheid curriculum reforms that were driving towards the goal of “*mathematics for all* and *mathematics by all*” (Goos & O’Sullivan, 2023b, p.350, italics in original). The former emphasises equity in curriculum access, while the latter focuses on the quality of mathematical participation and engagement by learners and educators. Goos and O’Sullivan (2023b) argue that the conflict between these priorities has contributed to a renewed move towards differentiated subject pathways in schools, including the creation of Mathematical Literacy as a distinct subject in secondary education. Graven and Buytenhuys (2011) characterise Mathematical Literacy in South African schools as a subject focused on the use of mathematics in real-world contexts. Its purpose is to develop learners’ numerical and spatial reasoning, as well as their confidence to interpret, critically assess, and respond to everyday problems.

In Japan, numeracy or mathematical literacy, has been approached in a similar way to the South African government. Since 2008, the Japanese curriculum has placed substantially greater emphasis on mathematical practices, particularly those that involve applying mathematics to everyday life and wider social contexts (Koyama, 2019). The revised curriculum was driven chiefly by a decline in PISA rankings in both mathematical literacy and reading literacy (Goos & O’Sullivan, 2023b). It was also motivated by the aim of equipping learners with the competences and academic skills required to navigate an increasingly dynamic society (Tasaki, 2017).

Canada and the United States (US) appear to position numeracy somewhat differently from the countries discussed above. Dion (2014) argues that, although both numeracy and literacy are recognised as essential skills, they are

not treated equally in educational policy and practice. In both Canada and the US, numeracy, or *quantitative literacy* as it is more commonly termed in the US, appears to receive limited attention at school level, yet it is increasingly required for entry to many university programmes (Burdman, 2024). Examining university prospectuses across the US, Burdman (2024) found that quantitative reasoning requirements are usually satisfied through prior study of mathematics in high school. However, she argues that these requirements are not primarily concerned with mastery of narrowly defined mathematical content. Rather, they emphasise the ability to work with numerical information, draw inferences, evaluate reasonableness, recognise limitations, and communicate quantitative ideas effectively. The relative absence of references to specific mathematical topics, such as trigonometry, suggests that these are not the intended focus of such requirements (Burdman, 2024). Burdman further notes that courses used to meet these requirements are typically offered by mathematics departments, even though quantitative reasoning is not inherently discipline-specific. She argues that other subject areas also have an important role to play, since learning to use quantitative ideas in relevant disciplinary contexts may be more meaningful for students than studying them only in standalone mathematics courses.

This is significant because quantitative literacy is not generally framed as mastery of discrete mathematical topics, but as the capacity to use quantitative information meaningfully across varied real-world contexts (Gargroetzi et al., 2025). In this respect, it overlaps strongly with broader conceptions of numeracy as a contextual, applied, and communicative practice. The emphasis on quantitative reasoning in North American higher education, therefore, supports the view that such capabilities need not be developed only through mathematics, but can also be fostered across disciplinary settings.

Across these international contexts, numeracy is increasingly recognised as essential for participation in contemporary society. However, responsibility for its development is positioned in markedly different ways: as a cross-curricular capability (Scotland, Australia, Ireland), a distinct subject (South Africa, Japan), or an implicit requirement embedded within mathematics pathways (US, Canada). These structural differences have important implications for how teachers interpret their professional responsibilities, the support they receive,

and the confidence with which they engage in numeracy education. Such variation further reinforces the need to examine how teachers understand and enact numeracy within specific national contexts.

2.3 Scottish Policy Analysis

This section critically examines Scottish education policy in relation to numeracy across the curriculum, with particular attention to how responsibility, guidance, and accountability are articulated for secondary teachers. It analyses key CfE documentation and subsequent policy developments to explore the extent to which non-mathematics teachers are supported in enacting their role in numeracy education. This analysis provides important context for understanding how teachers may interpret, negotiate, or resist expectations surrounding numeracy across learning.

2.3.1 Numeracy Policy under Curriculum for Excellence

The CfE Statement for Practitioners document (Education Scotland, 2016) suggests two resources that should be used by teachers to plan learning, teaching and assessment. The resources referred to are the experiences and outcomes (E's and O's), and the Benchmarks, both of which, according to Education Scotland, "have been developed to provide clarity on the national standards expected within each curriculum area at each level" (Education Scotland, 2017, p.2). Yet this clarity does not extend to how numeracy should be embedded across the curriculum.

Nevertheless, the E's and O's and Benchmarks are compiled into one document for each curricular area, with mathematics and numeracy combined into a single document (Education Scotland, 2017). While this is helpful for teachers of mathematics, it is less so for teachers of other curricular areas as there is no clear guidance on where the numeracy Benchmarks and E's and O's apply in different subjects. This may also contribute to the perception among some teachers that mathematics and numeracy are essentially the same (Carter et al., 2015) or that numeracy is solely the responsibility of mathematics teachers.

To distinguish between mathematics and numeracy, the numeracy Benchmarks are highlighted in bold and italics. The only indication in the document that this

could be relevant for practitioners of curricular areas other than mathematics is in small print at the bottom of each page which asserts:

The statements in ***bold and italics*** in both the Experiences and Outcomes and the Benchmarks are the responsibility of all and as such, evidence from across the curriculum should be considered when making judgements about achieving a level (Education Scotland, 2017, p.8, formatting in original).

There is limited guidance on how this evidence should be compiled or shared by colleagues across curricular areas. The guidance that is given is somewhat ambiguous:

Benchmarks have been designed to support professional dialogue as part of the moderation process...they should not be ticked off individually...Benchmarks for literacy and numeracy should be used to support teachers' professional judgement of achievement of a level. In other curriculum areas, Benchmarks support teachers and other practitioners to understand standards and identify children's and young people's next steps in learning. Evidence of progress and achievement will come from a variety of sources including: observation and feedback; coursework, including tests; learning conversations; planned holistic assessment; and information from standardised assessment (Education Scotland, 2017, p.2).

This guidance raises significant issues regarding implementation. In particular, it makes an assumption that teachers in non-mathematics curricular areas possess sufficient confidence and assessment literacy to make reliable judgements about numeracy attainment. Furthermore, the absence of mechanisms for tracking individual Benchmarks creates uncertainty around how learners' progress should be monitored over time. Although numeracy is positioned as a collective responsibility, no explicit accountability structures are articulated to support or enforce this expectation. There is also a lack of clarity regarding how and when mathematics teachers and teachers of other curricular areas are expected to engage in professional dialogue to moderate evidence of numeracy learning, or how the validity and reliability of such evidence should be ensured.

Another document of interest is the CfE Numeracy Across Learning: Principles and Practice (Education Scotland, 2009). This document has a concise summary of what it means to be a numerate individual and references the numeracy E's and O's which are structured into eight organisers: Estimation and Rounding; Number and number processes; Fractions, decimal fractions and percentages; Money; Time; Measurement; Data and Analysis; and Ideas of chance and

uncertainty (Education Scotland, 2009, p.1). In relation to the eight organisers, the document states:

all of these areas of numeracy will be familiar and all teachers will recognise how they impact on their own lives. Reflecting on this will help teachers to identify where opportunities may exist to develop numeracy for children and young people (Education Scotland, 2009, p.1).

This statement may be seen as problematic because it appears to assume that all teachers will recognise aspects of numeracy in their everyday life and be able to translate this into their teaching practice. This does not take into account those teachers for whom aspects of numeracy are a struggle. Further on in the document, it suggests that secondary teachers should ask themselves how they are currently meeting the numeracy needs of their learners. It emphasises that:

the greatest impact for learners will come where all practitioners, in all learning environments, include rich numeracy experiences as part of their day-to-day learning and teaching programmes (Education Scotland, 2009, p.2).

While the literature provides a conceptual rationale for developing numeracy across different curricular contexts, this does not necessarily provide empirical evidence that a cross-curricular policy approach will lead to improved learner outcomes. Furthermore, limited guidance is provided on how such an approach should be enacted in practice. Later, the document further highlights numeracy skills, while offering limited practical exemplification of how numeracy might be enacted by teachers in non-mathematics subjects.

You may want to consider where numeracy plays a part in the aspects you contribute to the curriculum. Does your programme involve estimating, measuring, using and managing time, carrying out money calculations? Does it involve reading information from charts and tables or explaining consequences of actions? If it does, and you highlight this and build upon it in the learning activities, you are making a valuable contribution to developing numeracy in all learners (Education Scotland, 2009, p.2).

This guidance is useful in that it prompts teachers to recognise possible numeracy opportunities within their subject. However, it remains framed at a general and reflective level, offering limited direction on how such opportunities should be planned, taught, or assessed in practice. For non-mathematics teachers in particular, the document identifies possible areas of contribution without fully clarifying what enactment of numeracy responsibility should look like in their classroom.

The guidance appears to rest on an underlying assumption that developing numeracy across curricular areas is inherently beneficial for learners. There is a strong conceptual rationale for this position, particularly where numeracy is understood as the ability to apply mathematical knowledge meaningfully within varied contexts. However, the empirical basis for assuming that a cross-curricular policy approach will, in itself, lead to improved learner outcomes is less clear. Much of the literature on numeracy across the curriculum has focused on teachers' understandings of numeracy, their ability to recognise numeracy opportunities, and the knowledge, confidence, and professional learning required to enact these opportunities (Bennison, 2015b; Callingham et al., 2015; Goos et al., 2014), rather than directly evaluating the impact of cross-curricular approaches on learners' numeracy attainment. The potential benefits of numeracy across learning should, therefore, not be regarded as automatic, but may be dependent on the quality of its enactment and the extent to which teachers are adequately prepared and supported to develop numeracy within their disciplinary contexts.

More recently, Education Scotland published the 'Numeracy across learning - professional learning resource' (Education Scotland, 2023a). This resource offers some basic guidance for potential professional learning discussions with colleagues regarding how to plan rich numeracy experiences in a curriculum area other than mathematics. There are some helpful reflective questions that could be used to encourage dialogue between colleagues regarding: prior learning that pupils would need to have in order to access the learning experience; how pupils can draw on prior learning of numeracy skills and apply them in a new or unfamiliar context; and how pupils can be encouraged to recognise the relevance and importance of their numeracy skills (Education Scotland, 2023a). However, the final reflective question takes us back to the idea of collecting evidence, "How will learners' numeracy skills be assessed and recorded?" (Education Scotland, 2023a, p.6). Once again, there are no suggestions on how this should be accomplished in practice.

There is also a link within this document to the earlier Numeracy Professional Learning Resources Guidance Document (Education Scotland, 2020). This document identifies supporting practitioners to develop pupils' numeracy skills

as a key objective in promoting learning across the curriculum (Education Scotland, 2020). It also states that it aims to:

impact positively on numeracy attainment by supporting schools and establishments to build their capacity in teaching numeracy concepts and associated skills (Education Scotland, 2020, p.3).

The document goes on to emphasise the importance of numeracy and offers a definition that is broadly consistent with OECD understandings. However, although the document clearly expresses an intention to build practitioners' capacity, it offers less detail on how this should be realised in practice, particularly for teachers outside mathematics.

Under the section titled "Key national guidance and documentation" (Education Scotland, 2020, p.6), they refer to the numeracy E's and O's and Benchmarks but again, do not explain how these should be used to plan a numeracy experience in another curricular area. On further exploration, this document appears to contain much of the same information as the previous document, but with a stronger focus on early level, which is unlikely to provide sufficient clarity for secondary practitioners. There are two further links on pages 6 and 7 of the document which at first glance, look promising with titles "Numeracy across learning" and "Numeracy in Social Studies" (Education Scotland, 2020, pp.6-7). However, on closer inspection, neither link was functional, and the documents could not be accessed through the Education Scotland website. If made accessible, such resources could offer valuable support for practitioners seeking to understand how numeracy can be enacted across curricular areas.

At no point in any of the guidance documents is there clear explanation of how numeracy should be assessed or recorded in other curricular areas. Without further guidance at school, local authority, or national level, this would be difficult for classroom teachers to enact consistently. Carter et al. (2015) similarly note that embedding and assessing numeracy across the curriculum can be difficult to implement in secondary schools because of their size, management structures, and number of discrete curricular areas.

Collectively, these CfE documents articulate a clear policy aspiration for numeracy to be embedded across learning. However, they offer limited practical guidance on pedagogy, assessment, collaboration, or accountability for teachers outside the mathematics department. This gap between policy intention and

practical enactment creates considerable scope for variation in interpretation and practice, placing significant responsibility on individual teachers and schools to determine how numeracy across the curriculum should be understood and enacted. This context is central to the study's examination of how non-mathematics teachers perceive, interpret, and experience their role in supporting numeracy education.

2.3.2 Scottish Numeracy Policy Reviews and Inspection Evidence on Numeracy and Mathematics

In addition to formal curriculum documentation, a number of national reviews and policy initiatives have played a significant role in shaping contemporary approaches to numeracy and mathematics education in Scotland. These reviews provide insight into how national expectations are interpreted, monitored, and supported at system level, as well as the challenges associated with implementation in schools.

This section examines key inspection reports and policy developments published since 2019, including the work of Her Majesty's Inspectorate of Education (HMIE), the National Response to Improving Mathematics board (NRIM), and the OECD. It highlights emerging priorities, ongoing concerns, and the implications of these developments for teachers' roles in supporting numeracy across the curriculum.

In 2019, HMIE conducted a thematic review of mathematics and numeracy education in Scotland. For this review, HM inspectors visited 40 schools from early years and childcare through to secondary (HMIE, 2019). They collected evidence and evaluated progress regarding the effectiveness of the numeracy and mathematics curriculum, the quality of teaching and learning, and the attainment of learners in numeracy and mathematics. They noted that in the secondary sector "work remains to be done to achieve effective collegiate approaches to improving numeracy across the curriculum" (HMIE, 2019, p.10) and that mathematics departments should move beyond working in isolation and assume a central role in supporting the development of numeracy across the curriculum (HMIE, 2019). This is significant because it suggests that, at system level, numeracy across the curriculum was still not being enacted through coherent whole-school practice in the secondary sector. The emphasis on

mathematics departments taking a central role also points to an ongoing tension within policy enactment: although numeracy is framed as a shared responsibility, support for its development still appeared to rest heavily with mathematics specialists.

With regard to the collating of evidence and evaluation of numeracy achievement, the only recommendation was that:

further work is needed to ensure there is shared confidence...in the judgements made by staff about how well children understand, and what they have learned and can practice in a range of contexts (HMIE, 2019, p.13).

While this recommendation acknowledges the importance of professional confidence in assessment judgements, it provides little clarification about what evidence should be gathered, how it should be documented, or how such judgements should be reached in practice, particularly for teachers outside mathematics. As a result, there remains uncertainty about what constitutes appropriate evidence of non-mathematics teachers' contributions to numeracy and what purpose such evidence is intended to serve. Mockler and Stacey (2021) caution that, in contexts shaped by performative and test-based accountability, teachers' work can be reduced to narrow evidence requirements and reframed by external accountability demands. In this light, the lack of clarity around evidencing numeracy achievement highlights both the practical difficulty of embedding numeracy across curricular areas and the challenge of establishing robust yet meaningful approaches to assessment.

NRIM was set up in spring 2021 as an improvement partnership aimed at addressing longstanding concerns about mathematics and numeracy outcomes in Scotland and in response to the 2019 thematic review (Education Scotland, 2023b). Despite its title, NRIM included explicit aims relating to numeracy, including embedding skills for learning, life, and work within teaching and learning, ensuring high standards of professional learning, improving levels of numeracy, and raising attainment in numeracy and mathematics (Education Scotland, 2023b).

To focus on different areas of Scottish education, a number of short life working groups (SLWGs) were established in January 2022. These SLWGs, which comprised members of NRIM, identified 32 priorities for numeracy and mathematics in Scotland. These priorities were later refined to seven key

recommendations, including the development of a national numeracy and mathematics strategy, a review of CfE policy and guidance, a national professional learning offer, clearer guidance for initial teacher education, and a more explicit definition of stakeholder roles and responsibilities (Education Scotland, 2023b). Collectively, these recommendations suggest a growing policy recognition that greater coherence, clearer guidance, and stronger professional support were still needed in numeracy and mathematics education. This is directly relevant to the study because it indicates that issues of role clarity, professional learning, and implementation were not only concerns emerging from classroom practice, but also recognised at policy level.

Also in 2021, the OECD published its assessment of the implementation of CfE in Scotland (OECD, 2021). The review examined how CfE had been implemented across the education systems and identified both strengths and areas for improvement. The report affirms that CfE's overall vision of a holistic, flexible curriculum is widely supported and valued, and that numeracy, alongside other cross-curricular skills such as literacy and health and wellbeing, is intended to be developed across the curriculum. It also notes that CfE gives schools considerable autonomy in designing learning pathways that incorporate numeracy and support skills for learning, life, and work. However, the review also highlights persistent ambiguities in curriculum documentation and implementation. As a result, it recommends greater clarity in curriculum design, stronger alignment between curriculum and assessment, and more systematic support for teachers and school leaders to enact CfE's core capacities, including numeracy, in a coherent way (OECD, 2021). This is significant because it indicates that, despite broad support for CfE's vision, uncertainty remained about how cross-curricular capacities such as numeracy should be enacted consistently in practice.

In response to the OECD recommendations and international comparisons, HMIE published a further thematic review focusing on the quality of mathematics education in Scotland (HMIE, 2024). Although centred on mathematics as a curricular area, the findings have direct implications for numeracy, given that numeracy is embedded within the CfE experiences and outcomes for mathematics and positioned as a shared responsibility across the curriculum. The review identified a need for more systematic and sustained professional learning

to strengthen teachers' pedagogical expertise and confidence in supporting learners who experience challenges with numeracy and mathematics (HMIE, 2024). This may suggest that existing provision is uneven and that many teachers do not yet feel adequately equipped for this aspect of their role. It also reinforces earlier concerns about the gap between national aspirations for numeracy across learning and the practical support available to enact them.

Overall, recent reviews and policy developments articulate strong expectations that numeracy should be a collective responsibility, yet they continue to reveal persistent gaps in guidance, professional learning, assessment practices, and accountability structures. As a result, substantial ambiguity appears to remain for non-mathematics teachers regarding what numeracy responsibility entails in practice, how it should be evidenced, and how learners should be supported. This ambiguity may contribute not only to uncertainty and uneven implementation, but also to variation in how responsibility is interpreted and enacted across subjects. Where policy expectations outpace practical guidance, teachers may be required to interpret and renegotiate their professional roles. In this sense, numeracy across learning may be understood not simply as a curricular reform, but also as a demand on professional identity, inviting teachers to reconsider what counts as legitimate practice within their subject and what it means to teach it well.

2.4 Teacher Identity, Agency, and Cross-Curricular Numeracy Responsibility

Teacher engagement with curriculum reform is shaped not only by policy expectations but also by how teachers interpret these expectations within their professional roles. As discussed in Section 2.3, Scottish policy positions numeracy as a shared responsibility across the curriculum, yet national reviews highlight uneven enactment in secondary schools. Understanding this variation requires attention to the professional reasoning through which teachers interpret their responsibilities and determine what constitutes legitimate disciplinary practice. For this reason, teacher identity provides a useful analytical lens for examining how numeracy responsibility is understood and enacted within subject contexts. While CfE positions numeracy as a responsibility of all teachers, teachers do not take up responsibilities simply because they are stated in policy (Beijaard et al., 2004). Instead, responsibilities are interpreted and enacted through teachers'

professional self-understandings, their sense of legitimacy and competence, and the social and organisational contexts in which they work (Beijaard et al., 2004; Mockler, 2011; Sachs, 2001). In this study, teacher identity is, therefore, treated not as an individual trait, but as a dynamic, socially negotiated professional positioning that shapes what teachers feel authorised to do, what they prioritise, and how they respond to cross-curricular expectations (Biesta et al., 2015).

2.4.1 Teacher Identity as a Negotiated Professional Positioning

Teacher identity refers to the ways teachers understand and position themselves as professionals, and how these understandings develop over time through experience, relationships, and institutional conditions (Beijaard et al., 2004; Mockler, 2011; Sachs, 2001). Rather than a fixed personal attribute, identity is dynamic and socially negotiated, emerging at the intersection of personal biography (such as prior schooling experiences and subject background), professional contexts (including departmental norms and leadership expectations), and broader policy environments (Flores & Day, 2006; Rodgers & Scott, 2008). For cross-curricular numeracy, this framing is particularly salient. Embedding numeracy across learning requires teachers to extend their professional remit beyond subject content to include responsibility for a broader capability. Whether this shift is embraced or resisted appears to depend on how it aligns with teachers' existing self-understandings and perceptions of legitimacy and competence.

Beijaard et al. (2004) conceptualise professional identity as relational and developmental, shaped through reflection on both who one is as a teacher and who one aspires to become. Teachers do not passively absorb externally imposed expectations; they interpret and selectively integrate them in ways that resonate with their professional values and prior experiences. Identity, therefore, reflects an ongoing negotiation between contextual pressures and individual meaning making. Importantly, identity is not singular. Teachers hold multiple role-based understandings connected to subject expertise, pastoral care, assessment, or leadership. When these role identities align, professional identity feels coherent; when they conflict, particularly during reform, tension and instability may emerge. Kelchtermans (2005) deepens this analysis by

conceptualising identity as professional self-understanding: a biographical and interpretive framework through which teachers make sense of their work. Central to this framework is task perception: teachers' normative and moral understanding of what it means to teach well. Because teaching is inherently moral and enacted in conditions of uncertainty, professional self-understanding is intrinsically vulnerable. Reforms that challenge teachers' task perception do not simply require behavioural change; they may threaten professional self-esteem and provoke strong emotional responses. Identity is, therefore, not only developmental but morally and emotionally invested.

Rodgers and Scott (2008) extend this perspective by conceptualising the self as an evolving, yet relatively coherent construct formed through interaction with cultural, institutional, and interpersonal contexts. Differences in teachers' developmental capacities for meaning-making shape how they interpret reform, respond emotionally, and engage in professional learning. Similarly, Akkerman and Meijer (2011) describe identity as dialogical, comprising multiple internal positions that shift across contexts yet remain connected through ongoing internal dialogue. Teachers may foreground different roles in different situations, reflecting discontinuity, while sustaining coherence over time through narrative alignment of past experiences, present action, and future aspiration.

Beauchamp and Thomas (2009) emphasise the conceptual complexity of identity, highlighting its entanglement with emotion, narrative, reflection, agency, and contextual influence. Identity is constructed relationally within institutional and disciplinary settings, where school cultures, collegial relationships, leadership practices, and subject traditions shape what forms of practice feel legitimate. Beauchamp and Thomas (2009) also highlight how early professional experiences can affirm or destabilise emerging self-understandings, and how emotional responses such as confidence, vulnerability, belonging, or marginalisation are central to identity formation rather than peripheral to it.

Sachs (2001) further situates teacher identity within broader policy discourses, arguing that professional identities are shaped by competing managerialist and democratic narratives. Managerialist environments oriented towards accountability and performance tend to produce entrepreneurial identities, whereas democratic contexts foster activist identities grounded in collaboration and collective agency. Identity is, therefore, not merely biographical but

politically situated and contested. This perspective complements Kelchtermans' emphasis on vulnerability and Beijaard et al.'s focus on expertise by foregrounding how external discourses legitimise or constrain particular professional self-understandings.

Across these perspectives, teacher identity emerges as biographical, relational, dialogical, morally invested, and politically situated. It is continuously reconstructed through experience and enacted in practice. Understanding teachers' engagement with cross-curricular numeracy, therefore, requires attention not only to their knowledge of numeracy, but to how numeracy intersects with, challenges, or reshapes their professional self-understandings within specific institutional and policy contexts. These perspectives highlight that teacher identity is shaped not only by individual biography, but also by disciplinary cultures and professional communities. In secondary schooling, where identity is often strongly anchored in subject specialism, these contexts play a particularly important role in shaping how teachers interpret cross-curricular responsibilities such as numeracy.

2.4.2 Secondary Teachers' Subject Identity and Boundary Work

In secondary schools, teacher identity is often strongly anchored in subject specialism (Beauchamp & Thomas, 2009). Teachers are typically recruited, trained, and organised around disciplinary expertise, and departmental structures reinforce the idea that professional legitimacy rests on deep subject knowledge and subject-specific pedagogy. This strong subject-specialist identity can support high-quality disciplinary teaching, but it can also create boundaries around what is perceived as an individual teacher's job and what is positioned as belonging to another department or specialist domain (Mockler, 2011; Sachs, 2001). Cross-curricular initiatives are, therefore, interpreted within existing identity frameworks and departmental cultures.

This is particularly significant for numeracy, because numeracy is frequently conflated with mathematics (Askew, 2015; Callingham et al., 2015). Where numeracy is conceptualised narrowly as basic arithmetic or procedural calculation, it is easily positioned as mathematics' territory, and responsibility is more likely to be deferred to mathematics specialists. In contrast, broader conceptualisations of numeracy, including interpretation of data, measurement,

estimation, and critical engagement with quantitative claims, create clearer lines of relevance to non-mathematics subjects (Askew, 2015; Bennison, 2016; Goos et al., 2014). However, even when relevance is acknowledged, teachers may still experience uncertainty about legitimacy: recognising numeracy opportunities does not automatically mean teachers feel authorised to intervene instructionally, particularly when practices are framed culturally as belonging to mathematics (Callingham et al., 2015).

Policy expectations can inadvertently intensify these boundaries if they are experienced as abstract or under-specified. From examining CfE guidance (see Section 2.3), numeracy is clearly described as a cross-curricular responsibility, but there is limited practical direction on pedagogy, assessment, progression, and moderation for non-mathematics teachers. When cross-curricular responsibilities are articulated without coherent enactment support, they can be interpreted as additional workload or as symbolic requirements, rather than as integral aspects of disciplinary teaching (Callingham et al., 2015). In these contexts, teachers may maintain strong subject boundaries as a practical strategy for prioritising examinable content and protecting curriculum coverage, particularly in the senior phase where time and assessment pressures are prevalent (Bennison, 2016; Carter et al., 2015).

These disciplinary boundaries are not only organisational but also affective. Where teachers perceive numeracy as belonging primarily to mathematics specialists, their confidence and sense of legitimacy to engage with numerical ideas may be reduced. Understanding teachers' personal relationships with mathematics, therefore, becomes important for explaining how numeracy responsibility is interpreted and enacted.

2.4.3 Teachers' Beliefs, Attitudes, and Affective Positioning Towards Numeracy

Teachers' beliefs and attitudes towards teaching and learning are widely recognised as significant influences on classroom practice. Research across education has consistently shown that teachers' instructional decisions are shaped not only by their formal knowledge but also by their beliefs about subject matter, learning processes, and their own professional role (Battista, 1994; Beswick et al., 2006; Buehl & Beck, 2014; Goos, 2013; Pajares, 1992; Richardson, 1996). Pajares (1992) argues that beliefs often exert a particularly

powerful influence because they carry strong affective and evaluative components and can shape how teachers interpret new information and respond to pedagogical expectations. In complex or uncertain areas of practice, beliefs may be especially influential in guiding behaviour. As a result, teachers may possess relevant knowledge, yet enact it selectively depending on whether particular practices align with their beliefs and professional priorities.

Within mathematics education, the affective dimension has long been recognised as shaping both teacher practice and learner outcomes (Beswick et al., 2006; Grootenboer & Marshman, 2016; McLeod, 1992). Teachers' attitudes towards mathematics and numeracy influence how they interpret the purpose of numerical learning, the kinds of tasks they prioritise, and the degree to which they feel confident integrating numeracy into their teaching (Thornton & Hogan, 2004; Whitney-Smith & Day, 2023). Research has suggested that positive attitudes and confidence are central to numeracy because numeracy involves not only mathematical understanding, but also a disposition and willingness to use mathematics in context (Beswick et al., 2006). Confidence is, therefore, not simply an accompaniment to practice, but part of what makes engagement with numeracy more or less likely. Conversely, where teachers feel uncertain about mathematics or lack confidence in their own capacity to use it, they may be less inclined to engage deeply with numerical ideas or to foreground them explicitly in their teaching (Callingham et al., 2015).

These affective orientations are particularly significant in the context of cross-curricular numeracy. For teachers working outside mathematics, numeracy may be perceived as either an authentic dimension of disciplinary learning or as an additional demand that sits outside their subject expertise (Callingham et al., 2015). Research suggests that teachers' beliefs about the nature of numeracy and its relevance to their subject strongly influence whether they recognise opportunities to embed numerical reasoning in their teaching (Callingham et al., 2015; Goos et al., 2014). Where numeracy is understood narrowly as procedural calculation or formal mathematics, teachers may view it as the responsibility of mathematics specialists. In contrast, broader conceptions of numeracy as contextualised reasoning, interpretation of data, and quantitative communication may make its relevance more visible across disciplines. Callingham et al. (2015) further suggest that when teachers do not recognise the

mathematical dimensions of contexts outside mathematics, opportunities for numeracy development may be overlooked or ignored.

Teachers' attitudes towards numeracy are also shaped by considerations of professional legitimacy and risk. In environments characterised by strong subject boundaries or accountability pressures, teachers may be cautious about engaging with practices they perceive to fall outside their expertise (Ball, 2003; Lasky, 2005). Concerns about accuracy, credibility, or potential judgement by colleagues or learners may discourage teachers from explicitly addressing numerical concepts. In these circumstances, teachers may acknowledge the importance of numeracy while engaging with it only indirectly or intermittently. This is consistent with research suggesting that many teachers dislike or actively avoid mathematics, with the result that opportunities for numeracy development may be missed (Callingham et al., 2015). Conversely, supportive professional cultures, collaborative planning opportunities, and sustained professional learning can strengthen teachers' confidence and reinforce the legitimacy of numeracy as part of disciplinary teaching (Bennison, 2015b; Park & Flores, 2021). Research on teacher beliefs also suggests that such beliefs are context-sensitive and may be influenced through carefully designed professional learning connected to classroom practice (Beswick, 2007).

Collectively, this literature suggests that teachers' beliefs and attitudes play an important role in shaping how numeracy responsibilities are interpreted and enacted. Engagement with cross-curricular numeracy, therefore, depends not only on knowledge or policy awareness but also on how teachers perceive the relevance, legitimacy, and manageability of numeracy within their professional practice. These affective and interpretive dimensions interact closely with teachers' subject identities and professional self-understandings, influencing whether numeracy is integrated into classroom practice or positioned as peripheral to disciplinary teaching.

2.4.4 Self-efficacy, Mathematics Anxiety, Specialised Knowledge, and Identity-Protective Practice

For teachers working outside mathematics, engagement with numeracy may depend not only on general beliefs about teaching and learning, but also on how they perceive their own mathematical competence. This section, therefore,

examines self-efficacy, mathematics anxiety, and the protective practices that may emerge in response to perceived risk or uncertainty.

Teacher identity is also shaped by teachers' personal relationships with mathematics and numeracy, including prior schooling experiences and their confidence with numerical content (Bennison, 2015a). Cultural narratives around mathematics matter here. Mathematics is often positioned socially as a specialist domain, and it is widely considered acceptable for adults to admit difficulty with it in ways that are less socially tolerated in relation to literacy (Callingham et al., 2015). Such narratives can normalise low confidence and contribute to professional hesitancy, especially for teachers whose subject identities are considered non-mathematical (Askew, 2015; Bennison, 2015b; Callingham et al., 2015).

This matters because confidence is not simply an emotion; it can be viewed as an identity signal (Kelchtermans, 2005). A useful theoretical perspective for understanding the relationship between confidence and action is Bandura's (1997) theory of self-efficacy. Within Bandura's social cognitive framework, self-efficacy refers to individuals' beliefs in their capability to organise and execute the actions required to achieve particular outcomes (Bandura, 1997). Such beliefs influence whether individuals attempt a task, how much effort they invest, and how they respond to perceived difficulty or risk. In educational contexts, teachers with stronger self-efficacy are more likely to engage with challenging instructional practices, whereas lower perceived capability can lead to avoidance or cautious engagement.

Closely related to self-efficacy is mathematics anxiety, which can undermine teachers' confidence and willingness to engage with mathematical content. Gresham (2008), in a study of pre-service elementary teachers, found that higher levels of mathematics anxiety were associated with lower levels of mathematics teaching efficacy. Teachers who experienced anxiety about mathematics were less confident in their ability to teach mathematical ideas and more likely to avoid situations requiring mathematical explanation or reasoning. Although this research focuses on pre-service teachers, it highlights the broader importance of affective experiences in shaping teachers' confidence and willingness to engage with mathematical content. For teachers working outside mathematics, such anxiety may reinforce perceptions that numeracy lies

beyond their professional expertise, thereby influencing how confidently they engage with numeracy across the curriculum.

Skemp's distinction between instrumental and relational understanding, first published in 1976 and subsequently reprinted (Skemp, 2006), provides a further way of conceptualising the mathematical knowledge that may underpin teachers' engagement with numeracy. Instrumental understanding refers to knowing rules or procedures and being able to apply them, whereas relational understanding involves understanding both what to do and why a procedure or relationship works. More recent examination of these concepts emphasises that instrumental and relational understanding should not necessarily be regarded as a simple binary, but as forms of understanding that may coexist and vary according to context (Herheim, 2023). Nevertheless, this distinction is particularly relevant to cross-curricular numeracy, since teachers may be sufficiently confident in applying familiar numerical procedures within their own practice while possessing less secure conceptual understanding when required to explain or adapt those procedures in supporting learners. Relational understanding may, therefore, be especially important where teachers are expected not simply to use numeracy, but to respond to learners' misconceptions or explain numerical ideas within unfamiliar contexts.

This distinction also connects with Shulman's (1987) argument that effective teaching requires more than subject matter knowledge alone. Holmes (2012) provides a useful bridge between these perspectives, distinguishing between frameworks concerned with content knowledge, including Skemp's instrumental and relational understanding, and frameworks concerned with content knowledge for teaching, including those developed by Shulman and Ball. From this perspective, possessing relational understanding may provide greater conceptual depth in mathematical knowledge, but this alone does not necessarily equip a teacher to make that knowledge accessible to learners. Shulman (1987) proposes the concept of pedagogical content knowledge (PCK) to describe the specialised understanding teachers need to make subject matter accessible to learners. PCK includes knowledge of how particular topics are organised, represented, and explained to students, as well as awareness of common misconceptions and effective instructional strategies. Building on Shulman's work, subsequent research has further differentiated the forms of

knowledge required for teaching. Ball et al. (2008), for example, argue that teaching involves forms of mathematical knowledge unique to the work of instruction, including explaining why procedures work, interpreting learners' reasoning, and selecting appropriate representations and examples.

This distinction is particularly relevant to cross-curricular numeracy. Teachers outside mathematics may possess sufficient mathematical knowledge to use numeracy within their subject, yet feel less secure in the specialised knowledge required to teach it explicitly. Battista (1994) similarly argues that teachers' beliefs about mathematics are often shaped by earlier experiences of learning it as a procedural and rule-bound subject. From this perspective, hesitancy around explicit numeracy teaching may reflect not only limited confidence, but also deeper assumptions about what counts as mathematics and how it should be taught. This has wider implications for numeracy reform, where sustained improvement depends not only on teachers' general mathematical competence but also on the development of pedagogical content knowledge and the organisational conditions that support its enactment. Gaffney and Faragher (2010) argue that improvement in numeracy is most likely to be sustained when the development of teachers' pedagogical knowledge occurs alongside leadership capacity and school-based support structures. As a result, hesitancy around numeracy may reflect not only low confidence, but also uncertainty about whether one possesses the knowledge required for legitimate instructional intervention.

For teachers whose professional identities are positioned as non-mathematical, numeracy teaching may, therefore, be experienced as a context in which both perceived capability and professional legitimacy are uncertain (Callingham et al., 2015). In these circumstances, teachers may adopt identity-protective strategies that allow them to remain credible while still engaging superficially with numeracy (Callingham et al., 2015). For example, they may emphasise interpretation and discussion rather than explicit teaching of numerical methods, or they may signpost numeracy as it arises rather than plan for it explicitly. Such approaches can be understood as rational responses to perceived professional risk, especially when there is limited shared pedagogical language across departments and inconsistent terminology across curricular or qualification frameworks (Bennison, 2016).

Teacher education and early career experiences can either disrupt or reinforce these identity positions (Bennison, 2016; Gaffney & Faragher, 2010; Gresham, 2008). Where pre-service programmes treat numeracy as an implicit competence (assumed through qualifications) rather than as a teachable cross-curricular practice, teachers may enter the profession without a secure sense of legitimacy to enact numeracy beyond their subject (Bennison, 2016; Milton et al., 2007). Over time, these identity positions can become stabilised through workplace norms and expectations. If numeracy is rarely observed, discussed, assessed, or moderated outside mathematics, it may remain peripheral to teachers' enacted identities, even when valued in principle (Geiger et al., 2015b). In other words, a gap may persist between policy expectations, where numeracy is framed as a responsibility of all, and enacted identity, where numeracy continues to be treated as the responsibility of mathematics teachers, unless teachers are supported to see it as both legitimate and manageable within their own practice.

As outlined in Section 2.4.1, teacher identities are formed and re-formed through early professional experiences and workplace cultures, with emotion and recognition playing a central role in what feels legitimate or risky to enact. In the case of numeracy across learning, these identity processes are particularly visible in teachers' confidence to engage, their perceived entitlement to teach numerical ideas, and the strategies they adopt to protect credibility when expectations are unclear or support is limited (Beauchamp & Thomas, 2009; Bennison, 2016).

The literature also emphasises that identity is closely linked to agency. Teachers' self-understandings influence how they respond to educational change, what they regard as legitimate classroom practice, and how they engage with professional learning (Biesta et al., 2015). Where an aspect of practice aligns with teachers' sense of role and competence, it is more likely to be taken up and sustained. Conversely, where change threatens professional credibility, particularly in high-accountability environments, teachers may respond cautiously, prioritising approaches that protect their legitimacy and reduce perceived risk (Mockler & Stacey, 2021). Within numeracy across learning, this can mean that teachers may be willing to use numeracy in context (e.g., interpreting graphs or data) while resisting or avoiding teaching underlying

numerical concepts explicitly, especially if they fear getting it wrong (Milton et al., 2007).

These identity-protective responses suggest that teachers' engagement with numeracy cannot be understood solely in terms of knowledge or skill. Rather, it reflects how teachers interpret expectations within their professional identities and workplace contexts. This perspective aligns with broader research on policy enactment, which emphasises that educational reforms are actively interpreted and negotiated by teachers within particular institutional and cultural environments.

2.4.5 Policy Enactment and Identity in the Scottish Numeracy Context

This identity perspective helps to explain the challenges evident in Scottish policy enactment (see Section 2.3). CfE guidance positions numeracy as embedded across learning, yet provides limited practical guidance on how non-mathematics teachers should plan for numeracy, develop pedagogical confidence, or evidence achievement across contexts. National reviews similarly highlight uneven collegiate approaches, limited shared confidence in judgement, and persistent gaps between policy aspiration and classroom routine. These conditions leave substantial room for local interpretation, meaning that teachers must negotiate numeracy responsibility through existing identities, departmental norms, and perceptions of risk (Bennison, 2016; Callingham et al., 2015).

This interpretive space is widely recognised in policy enactment literature. Educational reform rarely follows a simple pathway from policy articulation to classroom practice; rather, teachers actively interpret, translate, and adapt policy expectations within the cultural, organisational, and professional contexts of their schools (Ball et al., 2012; Spillane et al., 2002). In Scotland, CfE places considerable emphasis on teacher autonomy and professional judgement in curriculum development and enactment (Priestley & Humes, 2010), positioning teachers not simply as implementers of policy but as professionals who interpret and shape the curriculum in practice.

Donaldson (2014) similarly emphasises the role of professional judgement in interpreting curricular change. This aligns with ecological perspectives on teacher agency, which conceptualise teachers' actions as emerging through the

interaction of personal experience, professional identity, and the structural and cultural conditions of schooling (Priestley et al., 2015). Together, these perspectives suggest that reforms such as numeracy across learning are enacted through interpretation and negotiation rather than technical implementation alone.

From this perspective, numeracy across learning is not only a curricular reform but also an identity demand. It asks non-mathematics teachers to see numeracy as part of what it means to teach their subject well, and to act with sufficient confidence and legitimacy to support learners' numeracy development (Goos & O'Sullivan, 2023a). Where teachers hold broader conceptions of numeracy and can recognise authentic links to subject practice, numeracy is more likely to be taken up as meaningful learning. Where conceptions are narrower, confidence is fragile, or support structures are weak, teachers may engage conditionally, valuing numeracy but treating it as incidental, optional, or primarily the responsibility of mathematics specialists (Askew, 2015; Bennison, 2016; Goos et al., 2014). Numeracy across learning, therefore, represents not simply the addition of new content, but a subtle re-articulation of what counts as legitimate disciplinary practice in secondary schooling.

These perspectives suggest that understanding the enactment of numeracy across learning requires attention not only to curriculum policy but also to how teachers interpret and negotiate this responsibility within their professional identities and subject cultures. Investigating teachers' perspectives, therefore, provides important insight into how cross-curricular numeracy is understood and why its implementation varies across subjects.

Overall, this chapter has shown that numeracy across the curriculum is shaped by more than policy aspirations alone. Conceptual ambiguity, limited practical guidance, subject specialism, and teachers' beliefs, confidence, and professional identities all appear to influence how numeracy responsibility is understood and enacted. These issues suggest the need for a framework that can account for the multiple influences on teachers' engagement with numeracy. Chapter 3, therefore, introduces the conceptual framework for the study and explains how these different dimensions are brought together analytically.

2.5 How the Study Contributes to the Literature

This chapter has shown that the literature does not yet provide a clear account of how non-mathematics teachers understand and respond to responsibility for numeracy across the curriculum. While previous research highlights uncertainty around the meaning of numeracy, differences in how responsibility is organised across education systems, and gaps in Scottish policy guidance, there is still limited understanding of how teachers themselves make sense of these expectations in practice.

This study contributes to the literature by focusing specifically on non-mathematics secondary teachers in Scotland. It examines how they understand numeracy, how confident and prepared they feel to support it, and how their subject background and professional identity may shape their responses to cross-curricular expectations. In doing so, it adds to existing work by moving beyond policy intentions and looking more closely at how teachers interpret numeracy responsibility within their own subject contexts.

Chapter 3: Conceptual Framework

This chapter sets out the conceptual framework used to explore how teachers understand and enact their responsibility for numeracy across the curriculum. Building on the literature reviewed in Chapter 2, it shifts the focus from theoretical concepts to how teachers' professional experiences, beliefs, and identities can influence their engagement with numeracy. Given that CfE frames numeracy as a shared responsibility, this chapter considers how teachers might interpret and negotiate this role, and how this may translate into classroom practice.

The chapter begins by considering what teacher identity might mean for non-mathematics teachers and the potential impact on how they see themselves as teachers of numeracy. It explores how knowledge, confidence, beliefs, and attitudes may shape engagement with numeracy, alongside wider influences such as subject specialism, prior experiences, professional learning, school expectations, and mathematics anxiety. Finally, it introduces Bennison's (2015a) framework of identity as an embedder of numeracy, which provides the theoretical lens for the study and informs the analysis, research instrument design, and interpretation of findings.

3.1 Understanding Teacher Identity

Teacher identity in this study is understood not as a fixed entity, but as something that develops through teachers' experiences and professional contexts. It refers to how teachers understand who they are professionally, what they see as part of their role, and what they feel able and justified to do in practice (Mockler, 2011; Sachs, 2001). Bennison (2016) suggests that identity may be shaped by factors such as prior experiences, subject specialism, school and departmental norms, policy expectations, and professional relationships. This idea is complemented by Priestley et al.'s (2015) ecological conception of teacher agency. From their perspective, agency is not treated as a fixed individual quality, but as something that is achieved through the interaction of teachers' prior experiences, the cultural and structural conditions of their current contexts, and their orientations towards future possibilities for practice (Priestley et al., 2015). Teacher identity can, therefore, be understood as something shaped by both prior experiences and present professional contexts.

Within the context of numeracy across the curriculum, this perspective is useful because it suggests that teachers' engagement with CfE policy expectations may depend not only on what they know or believe, but also on how these relate to disciplinary cultures, school expectations, and supports available to them. This suggests that putting policy into practice is not a straightforward process; rather, teachers are likely to interpret policy through their existing professional self-understandings (Biesta et al., 2015; Kelchtermans, 2005).

CfE positions numeracy as a shared responsibility, expecting teachers in all subject areas to recognise and support numeracy within their teaching. Yet for secondary teachers whose professional identities are strongly linked to their subject expertise, numeracy may be seen as outside their core role or as primarily the responsibility of mathematics teachers. In this context, engaging with numeracy may involve more than simply adapting lesson content; it could require teachers to reconsider whether numeracy is part of teaching their subject well, whether they feel confident addressing it, and whether they see themselves as legitimate teachers of numeracy. Where numeracy policy expectations align with teachers' sense of role and expertise, they may be more easily integrated into practice. Where they challenge established subject boundaries, perceived competence, or professional legitimacy, teachers may respond more cautiously or selectively. In this sense, a teacher's identity may influence how policy expectations are understood and enacted in classroom practice.

Due to these complex dynamics, in this study, teacher identity is conceptualised as involving knowledge, affective, social, historical, and contextual dimensions (Beauchamp & Thomas, 2009; Beijaard et al., 2004; Bennison, 2016). It includes teachers' understandings of numeracy, their beliefs about responsibility, their confidence and perceived competence, and the contextual conditions that shape what forms of numeracy practice are seen as legitimate within their curricular area. This understanding aligns with sociocultural perspectives that view identity as continually shaped through teachers' experiences (Bennison, 2016). The following sections elaborate these dimensions and introduce the framework used to analyse them.

3.2 Conceptualising Teachers of Numeracy

The concept of a *teacher of numeracy* extends beyond mathematics specialists to include teachers across subject areas who are expected to contribute to learners' numeracy development under CfE. This means that conceptualising teachers as teachers of numeracy requires attention not only to curriculum expectations and pedagogical knowledge, but also to whether teachers see numeracy as part of their role within their curricular area.

Mathematics is typically associated with formal structures, abstract reasoning, and specialist disciplinary knowledge, whereas numeracy is increasingly understood as the application of mathematical ideas in everyday, workplace, and cross-curricular contexts (Askew, 2015; Bennison, 2016; Callingham et al., 2015; HMIE, 2019; OECD, 2021). Where mathematics teachers are more likely to have studied mathematics in depth at university level, non-mathematics teachers may be less likely to have pursued mathematics beyond secondary school and may, therefore, interpret numeracy more narrowly, often equating it with mathematics (Callingham et al., 2015; Goos et al., 2014).

This suggests that embedding numeracy within non-mathematics subjects may require more than awareness of policy alone. From a knowledge perspective, this involves not only recognising where numeracy appears within subject matter, but also pedagogical content knowledge (PCK) (Carter et al., 2015). In this context, PCK is the knowledge of *how* to teach numeracy skills (Kleickmann et al., 2013; Shulman, 1987). Ball et al. (2008) argue that teaching involves forms of content knowledge unique to the work of instruction, including explaining ideas, anticipating misconceptions, interpreting learners' reasoning, and selecting appropriate strategies. This distinction is particularly relevant to cross-curricular numeracy. Non-mathematics teachers may possess sufficient mathematical knowledge to apply numeracy concepts within their subject contexts, but may feel less confident that they have knowledge needed to teach these ideas explicitly (Callingham et al., 2015; Carter et al., 2015). As a result, uncertainty about knowledge could translate into uncertainty about professional legitimacy. Such knowledge is likely to vary according to teachers' prior experiences, preparation, and professional learning (Carter et al., 2015; Loughran et al., 2012). Research suggests that effective numeracy integration may depend not only on what individual teachers know, but also on whether

there is a shared understanding across the school about key principles and responsibilities (Gaffney & Faragher, 2010).

However, knowledge alone may not determine enactment. Teachers may also need to perceive numeracy as legitimate, relevant, and aligned with their professional role (Callingham et al., 2015). Where numeracy is seen as peripheral to subject identity or as belonging primarily to mathematics specialists, engagement may remain superficial or conditional. Conceptualising teachers as teachers of numeracy requires attention not only to curriculum expectations and pedagogical knowledge, but also to how teachers position themselves in relation to numeracy within their subject cultures.

3.3 Teachers' Perceptions, Knowledge, Confidence, Beliefs, and Attitudes Towards Numeracy

Research suggests that teachers' perceptions of numeracy could play an important role in shaping how, and whether, numeracy is embedded in classroom practice (Bennison, 2015b; Callingham et al., 2015; Goos et al., 2011; Whitney-Smith & Day, 2023). What non-mathematics teachers understand numeracy to be, might influence whether they identify as teachers of numeracy (Bennison, 2015b).

Teachers' perceptions of numeracy are closely linked to their attitudes, beliefs, emotions, and values, which can impact how numeracy is understood and enacted in practice (Bennison, 2016; Grootenboer & Marshman, 2016). Teachers bring diverse educational histories and personal experiences to their work, and these may shape how they interpret policy expectations (Bennison, 2016). Within mathematics education, these issues have been widely examined in relation to classroom decision-making and pedagogy (e.g., Aquilina et al., 2025; Battista, 1994; Fisher et al., 2016; Grootenboer & Marshman, 2016; Harper & Daane, 1998; Karp, 1991; McLeod, 1992; Mkhize, 2020; Öçal, 2021; Pocalana et al., 2023; Watson, 2001; Whitney-Smith & Day, 2023). However, comparatively few studies specifically focus on teachers' attitudes towards numeracy, particularly among non-mathematics specialists (Bennison, 2016; Beswick, 2007; Callingham et al., 2015; Muir, 2008).

Teachers' perceptions of their own numeracy knowledge and their level of confidence in this knowledge may also impact their engagement with numeracy

across the curriculum (Goos, 2013). Research suggests that teachers' self-efficacy in numeracy can affect their willingness to embed numeracy in practice (Beswick, 2007; Campbell et al., 2020). Where teachers feel that they lack the specialised knowledge needed to teach numeracy confidently, they may restrict their engagement to contextual use rather than explicit instruction (Ball et al., 2008). Limited confidence or negative prior experiences with mathematics may also lead teachers to avoid numeracy-related activities or adopt only limited approaches to embedding numeracy (Campbell et al., 2020).

Distinguishing between knowledge and belief is conceptually complex. Pajares (1992, p. 309) argues that "beliefs have stronger affective and evaluative components than knowledge" and often exert a powerful influence on classroom practice. Teachers may have sufficient numeracy knowledge to support learners, yet whether they use this knowledge may depend on whether they see numeracy as important, relevant, and consistent with their professional role. Pajares (1992) also suggests that beliefs about teaching are often formed early and may be difficult to change, particularly when they are linked to wider assumptions about subject boundaries and responsibility.

Closely related to beliefs, but conceptually distinct, are attitudes. Liljedahl and Oesterle (2014, p. 584) describe attitudes as "the manifestations of beliefs," while Mkhize (2020) argues that attitudes are often shaped by prior educational experiences. In the context of numeracy, teachers' attitudes may affect not only their classroom practices, but also influence learners' dispositions towards numeracy. Negative attitudes towards mathematics have also been shown to impact with teacher learning and professional growth (Liljedahl & Oesterle, 2014).

Mathematics anxiety is another important affective factor. It has been defined as a deeply rooted fear that constrains engagement with mathematical tasks (Gresham, 2008). As such, it is often associated with low confidence and avoidance behaviours (Bursal & Paznokas, 2006). Teachers experiencing mathematics anxiety may reduce the time they devote to numeracy or avoid explicit engagement with it altogether, thereby limiting opportunities for learners (Park & Flores, 2021). While anxiety may stem from ineffective teaching experiences or missed learning opportunities (Williams, 2013), it may also be associated with specific learning difficulties such as *dyscalculia*: a condition

similar to dyslexia, but involving numbers and arithmetic (Butterworth, 2010; Butterworth et al., 2011). Teachers who experience, or have experienced, such difficulties may have lower confidence with numbers and, therefore, be less willing to engage with numeracy in their curricular context.

Perceptions of numeracy may also be shaped by whether teachers see it as a legitimate part of their role and by the risks they associate with teaching it. Where numeracy is seen as the territory of mathematics specialists, teachers may draw boundaries that limit enactment (Callingham et al., 2015). In school environments shaped by accountability and performance pressures, concerns about error or judgement may further discourage engagement (Ball, 2003; Lasky, 2005; Mockler & Stacey, 2021). Conversely, supportive professional learning and collaborative cultures may strengthen teachers' confidence and their identification with numeracy as a legitimate part of subject teaching (Bennison, 2015b; Park & Flores, 2021).

From the literature, we can see that knowledge, beliefs, attitudes, and confidence often develop within institutional and policy environments that shape expectations around curriculum coverage, assessment, and accountability. Where numeracy is presented as a cross-curricular priority, teachers may see this either as a meaningful opportunity for integration or as an additional demand competing with subject-specific priorities (Carter et al., 2015). In school contexts shaped by high workload and accountability pressures, numeracy may be subordinated to examinable content. These wider conditions may, therefore, interact with teachers' knowledge and affective orientations to shape how numeracy is addressed in practice.

Taken together, these perspectives suggest that teachers' engagement with numeracy may be shaped not only by what they know, but also by how they understand numeracy, how confident they feel, and whether they see it as relevant and legitimate within their role. These factors may influence whether numeracy is integrated into classroom practice or remains peripheral to their subject matter teaching.

3.4 External Factors Influencing Teachers' Attitudes Towards Numeracy

Beyond teachers' individual perceptions and dispositions, wider professional and institutional factors may also shape how they respond to numeracy across the

curriculum. These include, but are not limited to, subject-based assumptions, policy expectations, initial teacher education, professional learning, and school culture (Bennison, 2016; Goos, 2013).

For non-mathematics teachers, the CfE responsibility of all expectation may create tension if their professional identity is strongly tied to their subject specialism. Teachers in subjects such as art, history, or English may find it difficult to reconcile being a teacher of numeracy with their established sense of expertise (Bennison, 2016). In this context, numeracy may be experienced not simply as additional content, but as something that stretches or unsettles existing subject boundaries and ideas about what belongs within their role (Callingham et al., 2015).

These tensions may be reinforced when numeracy is treated as equivalent to formal mathematics. Carter et al. (2015) found that many non-mathematics teachers viewed numeracy as content that should be addressed in mathematics classrooms, while mathematics teachers expected numeracy to be developed across subjects. This mismatch may contribute to a diffusion of responsibility. Where numeracy is understood as a subset of mathematics, teachers may be less likely to recognise its wider role in supporting learners' everyday functioning and future opportunities (Askew, 2015). Such interpretations may act as a barrier to meaningful cross-curricular integration.

School and policy contexts may also play an important role in shaping how teachers understand their responsibilities in relation to numeracy. When policy presents numeracy as a cross-curricular priority, it may change expectations about what teachers should do and may influence how they understand what it means to teach well in this area (Bennison, 2015b). However, in contexts shaped by accountability pressures, such expectations may be experienced as compliance-driven, which may encourage minimal rather than meaningful engagement (Ball, 2003). Where there are limited opportunities for professional learning and collaborative planning, teachers may remain uncertain about how numeracy should be enacted (Carter et al., 2015). Time pressures and curriculum coverage demands can intensify this, leading teachers to prioritise examinable subject content over cross-curricular integration (Carter et al., 2015).

Initial teacher education (ITE) may also influence preparedness and role understanding. Milton et al. (2007) found that early career secondary teachers were much less likely to identify as teachers of numeracy than as teachers of literacy, and many reported feeling underprepared to teach numeracy. Later research similarly highlights confusion among student teachers about the distinction between mathematics and numeracy and about the pedagogical approaches needed to embed numeracy within subject contexts (Carter et al., 2015; Forgasz et al., 2017). Where numeracy is not addressed clearly in ITE, teachers may enter the profession without a secure sense of confidence or legitimacy in this area.

Access to sustained professional learning is also important. Research suggests that non-mathematics teachers rarely engage in structured dialogue about numeracy within their subjects (Callingham et al., 2015). Yet embedding numeracy requires both subject-relevant knowledge and teaching strategies that make numeracy skills, such as interpreting or evaluating data, estimating, and measuring, visible and meaningful within different disciplinary contexts. Where schools cultivate collaborative cultures and shared responsibility, teachers may be more likely to view numeracy as legitimate and manageable (Bennison, 2015a).

Taken together, these factors suggest that teachers' attitudes towards numeracy may be shaped not only by individual beliefs or confidence, but also by the wider professional and institutional conditions in which they work. Engagement with numeracy responsibility may, therefore, depend not only on willingness, but also on whether teachers work in environments that support them to recognise numeracy as a genuine part of their subject practice.

The following section, therefore, introduces Bennison's (2015a) framework of identity as an embedder of numeracy, which provides the theoretical lens for the study.

3.5 Conceptual Framework for Analysis

The study uses Bennison's (2015a) framework of identity as an embedder of numeracy to examine how teachers understand and enact their responsibility for numeracy across the curriculum. The framework brings together five domains of

influence (knowledge, affective, social, life history, and context) and is used here as an interpretive lens rather than a predictive model.

It informed the design of the research instruments and the interpretation of the findings by providing categories through which teachers' perceptions, experiences, and professional roles could be explored. These domains reflect Bennison's synthesis of earlier research on teacher identity and cross-curricular numeracy. She identifies key aspects of teachers' professional experience that may shape both their ability and willingness to embed numeracy within their subject area. Bennison's framework is outlined in Table 1.

Table 1

Conceptual framework for identity as an embedder of numeracy (Bennison, 2015a, p. 15)

Domains of influence	Characteristics
Knowledge	Mathematics content knowledge (MCK) Pedagogical content knowledge (PCK) Curriculum knowledge (CK)
Affective	Personal conceptions of numeracy Attitudes towards mathematics Perceived preparation to embed numeracy
Social	School communities Professional communities
Life History	Past experiences of mathematics Pre-service programme Initial teaching experiences
Context	School policies Resources

This framework was selected because it offers a broad account of the factors that may shape whether teachers feel able and willing to embed numeracy across the curriculum. Rather than treating cross-curricular numeracy teaching as only a policy or pedagogical matter, it highlights the ways in which engagement with numeracy may be shaped by personal, professional, and school-based influences. This makes it particularly useful for examining cross-curricular numeracy in secondary schools, where teachers' roles are often strongly shaped by subject specialism and departmental culture (Carter et al., 2015).

The five domains are distinct but closely connected. Teachers' subject knowledge and pedagogical confidence may be shaped by prior educational experiences, professional learning, and school culture, while policy expectations may also influence confidence and classroom practice. In this sense, being a teacher of numeracy is understood not as a fixed role, but as something teachers may accept, resist, or reinterpret within their own subject and school context.

In this study, questionnaire items and interview prompts were designed to gather data relevant to each of the five domains, allowing exploration of how these influences operate within the context of CfE and local authority accountability structures. The framework, therefore, provides the structure through which this study's research question is examined, supporting analysis of how teachers understand numeracy responsibility, how they see their role in relation to it, and how this may shape enactment across subject areas. While Bennison's framework does not capture every possible influence on teachers' work, it offers a strong and relevant structure for analysing how teachers negotiate numeracy responsibility in practice.

The next chapter builds on this conceptual foundation by outlining the research methodology and design, including how the framework informed data collection, instrument development, and the approach to analysis used to investigate teachers' experiences and perspectives in the Scottish secondary context.

Chapter 4: Methodology

This chapter sets out the methodological approach adopted to investigate how non-mathematics secondary teachers in Scotland understand and enact their responsibility for numeracy education. It explains the research design, data collection methods, analytic procedures, and ethical considerations that guided the study, and provides a rationale for the methodological choices made in relation to the research question and conceptual framework.

The chapter begins by outlining the overall mixed methods design and situating the study within an interpretivist epistemological stance, which is consistent with the study's focus on teachers' professional experiences, perspectives, and identities. It then explains the use of Braun and Clarke's (2006; 2019) reflexive thematic analysis as the primary qualitative analytic approach, alongside quantitative descriptive and exploratory analysis of questionnaire data.

Subsequent sections describe the participant sample, the development and administration of the questionnaire and semi-structured interviews, the preparation and analysis of the data, and the procedures used to integrate the quantitative and qualitative strands. The chapter concludes by outlining the steps taken to support trustworthiness, rigour, and ethical integrity throughout the research process.

By setting out these methodological decisions clearly, this chapter aims to show the coherence of the study design and to provide a basis for evaluating the credibility of the findings presented in Chapter 5.

4.1 Research Design

This study adopted a sequential mixed methods design, comprising an initial online questionnaire phase followed by a semi-structured interview phase. The questionnaire generated both qualitative and quantitative data, providing an initial overview of patterns in teachers' knowledge, confidence, beliefs, and experiences in relation to numeracy. Questionnaire responses subsequently informed the selection of participants for the interview phase, with participants chosen to reflect variation in responses, and also provide a basis for the more detailed exploration of individual experiences and perspectives during interviews. Quantitative and qualitative data were analysed using appropriate

procedures and subsequently integrated during interpretation and reporting to develop a more comprehensive understanding of how non-mathematics teachers understand and enact their responsibility for numeracy education.

A mixed methods approach was particularly appropriate given the exploratory nature of the study and the relatively small sample size (30 participants). It supported triangulation and strengthened the interpretation of the findings by drawing on more than one source and type of evidence (McChesney & Aldridge, 2019). In this study, the quantitative data were useful not only for identifying descriptive patterns across the participant group, but also for exploring possible relationships between variables through Spearman's rho analyses. This allowed the study to examine whether particular factors, such as confidence, anxiety, or past experiences, appeared to be associated within the dataset. The qualitative data then allowed more detailed exploration of teachers' views, experiences, and the contextual factors shaping their responses. Quantitative data alone would have offered limited insight into meaning and context, while qualitative data alone would have made it more difficult to identify broader patterns across the sample (Creswell & Plano Clark, 2017; Johnson & Onwuegbuzie, 2004). Bringing the two together, therefore, supported a more complete understanding of the research problem.

4.2 Interpretivist Approach

This research is situated within an interpretivist paradigm because it sought to examine teachers' views, realities, and experiences in relation to numeracy education. An interpretivist stance views knowledge as socially constructed and emphasises the importance of understanding participants' subjective meanings and lived experiences (McChesney & Aldridge, 2019). Accordingly, the goal of interpretivist research is to understand the multifaceted lived experience of the subject matter from the perspective of those who have experienced it (Schwandt, 1998). The knowledge arising from research of this nature is intrinsically linked to the participants involved and is, therefore, highly contextualised rather than universal (McChesney & Aldridge, 2019).

Interpretivist research does not rely solely on data that can be quantified, but instead recognises that some issues can only be understood "through social constructions such as language, consciousness and shared meanings" (Gichuru,

2017, p. 1). Several researchers (Guba & Lincoln, 1994; Schwandt, 1998; Von Glasersfeld, 1989) view interpretivism as an alternative paradigm to positivism, one that has traditionally privileged qualitative methods (Guba & Lincoln, 1994). This is where mixed methods research can be useful in bridging the gap between quantitative and qualitative research (Johnson & Onwuegbuzie, 2004). This pragmatic integration supported a more nuanced understanding of how teachers construct and negotiate their identities as teachers of numeracy within the Scottish educational context.

Within an interpretivist framework, I was not positioned as a neutral or detached observer, but as an active participant in the production and interpretation of knowledge. As a practising teacher working within the Scottish education system, I brought prior professional experiences, assumptions, and values relating to numeracy education, teacher responsibility, and curriculum policy into the research process. These experiences inevitably shaped the formulation of the research question (see Section 1.3), the design of the data collection instruments, and the interpretive lens applied during analysis.

Rather than attempting to eliminate subjectivity, this study acknowledged it as an analytic resource that can contribute to deeper understanding, provided it is critically examined (Braun & Clarke, 2019). In this study, teacher identity was conceptualised not as a fixed or objectively measurable attribute, but as a dynamic and relational construct shaped through professional experiences, institutional expectations, and social interaction.

Consistent with this perspective, qualitative data from the questionnaire and semi-structured interviews were analysed with the aim of interpreting how teachers make sense of their roles, practices, and professional positioning in relation to numeracy. Rather than seeking causal explanations or generalisable laws, the analysis focused on identifying patterns of meaning across participants' accounts and exploring how these meanings were negotiated within Scottish education and numeracy policy contexts.

To support reflexive engagement, systematic reflexive practices were embedded throughout the research process. These included taking reflexive notes during interviews, analytic memos during coding, and a detailed analysis diary documenting coding decisions, theme development, supervisory feedback, and shifts in interpretation over time. This documentation enabled ongoing critical

consideration of how my professional positioning, expectations, and emerging interpretations may have shaped the analytic process and the construction of themes.

By making my role in the research process visible and analytically accountable, this approach strengthened the transparency and interpretive integrity of the study and aligned with contemporary standards for rigorous qualitative and mixed methods research within interpretivist traditions.

4.3 Sampling and Recruitment

Scotland comprises 32 local authorities. For this study, participants were recruited from secondary schools in five local authorities across the central belt of Scotland: West Lothian, City of Edinburgh, Glasgow City, North Lanarkshire, and South Lanarkshire. Ethical permission was also sought from Midlothian Council; however, this was declined, as the authority was not permitting research to be conducted in its schools at the time. These local authorities were selected because their size and geographical distribution provided access to a diverse range of school contexts and teacher experiences, supporting an in-depth exploration of how numeracy responsibility is understood and enacted.

According to the Scottish Government's *Summary Statistics for Schools in Scotland 2024*, there were 24,988 secondary teachers working in Scotland's secondary schools. This figure has remained relatively stable in recent years, fluctuating by only a few hundred annually and, therefore, provides a reasonable estimate of the current size of the secondary teaching workforce (Scottish Government, 2024). Of these 24,988 teachers, 8,377 were working in the council areas listed above, representing approximately 33.5% of all secondary teachers in Scotland. This figure is provided to contextualise the geographical areas from which participants were recruited rather than to define a sampling frame for the study.

In total, 42 teachers responded to the questionnaire; however, 15 responses were incomplete. In all cases, participants had completed only the first five questions, which collected demographic information such as name, email address, subjects taught, years of teaching experience, and teaching qualification. Participants who submitted incomplete responses were contacted by email and invited to complete the questionnaire. This follow-up resulted in

three further full responses, giving a final total of 30 completed questionnaires. As the incomplete responses did not contain data relating to participants' perceptions or understandings of numeracy, they were excluded from the analysis.

While the sample size is modest, it is appropriate for an exploratory mixed methods study focused on in-depth understanding rather than statistical generalisation. The sample is, therefore, not intended to be statistically representative of the wider population of Scottish secondary teachers. Rather, the study aimed to generate analytically grounded insights into how teachers interpret and negotiate their responsibility for numeracy across the curriculum.

4.3.1 Sample Characteristics

All participants were secondary teachers who taught a subject other than mathematics. There was a broad range of subject specialisms across the curriculum, as shown in Table 2. The total number of responses is 36 rather than 30 because some participants reported teaching more than one subject.

Table 2
Subjects taught by participants

Subject	Responses	
	Frequency (<i>n</i>)	Percentage (%)
Sciences	6	16.7
Computing, Business and/or IT	5	13.9
English and Media	5	13.9
Languages	5	13.9
Social Subjects	4	11.1
Personal and social education	3	8.3
Technologies	3	8.3
Art and Design	2	5.6
Physical Education	2	5.6
Photography	1	2.8
Total	36	100.0

It was important to exclude mathematics teachers from the study because the research sought to explore the views of non-mathematics teachers in relation to numeracy as a responsibility of all teachers under CfE. Mathematics teachers teach numeracy routinely as part of the mathematics curriculum and it is, therefore, likely to form a significant part of their professional role and teacher

identity. The study instead focused on how numeracy is understood and enacted across the curriculum by teachers who are not mathematics specialists, and whether they consider themselves teachers of numeracy.

Primary teachers were also excluded for similar reasons. In primary education, teachers have explicit responsibility for teaching numeracy through the Early, First, and Second Level experiences and outcomes. *Building the Curriculum 3* sets out the framework for learning at these stages, and primary teachers are expected to teach across all curricular areas, including numeracy, on a regular basis (Scottish Government, 2008). The focus of this study was, therefore, on secondary teachers, for whom numeracy may be less explicitly embedded in day-to-day practice outside mathematics.

Participants had varied levels of teaching experience, although the majority had more than 10 years of experience. This is shown in Figure 1.

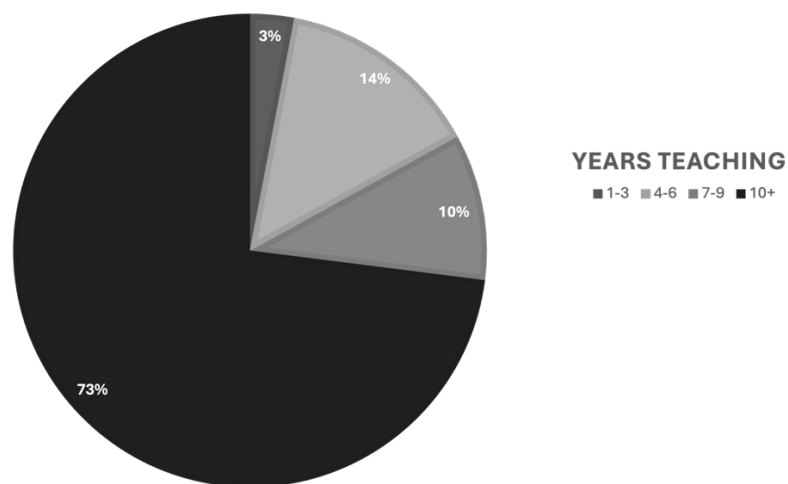


Figure 1
Participants' years of teaching experience

Of the 30 participants, 21 (70.0%) completed a one-year PGDE course in their chosen subject, five (16.7%) completed a three- or four-year degree in their chosen subject with Education, and four (13.3%) completed a one-year PGCE in England.

Participants were drawn from each of the local authorities contacted, with the majority working in West Lothian Council. This may reflect my professional

association with that local authority, as several participants were either acquainted with me or aware of my role. This uneven distribution limits the representativeness of the sample and should be taken into account when interpreting the findings. The number and percentage of participants employed in each local authority are shown in Table 3.

Table 3
Number and percentage of participants employed in each local authority

Local Authority	Frequency (<i>n</i>)	Percentage (%)
West Lothian	19	63.3
North Lanarkshire	6	20.0
City of Edinburgh	2	6.7
South Lanarkshire	2	6.7
Glasgow City	1	3.3
<i>Total</i>	<i>30</i>	<i>100.0</i>

4.4 Data Collection Instruments

Quantitative and qualitative data were first collected through an online questionnaire. Further qualitative data were gathered through semi-structured interviews with six participants who had completed the questionnaire. Interview participants were selected on the basis of variation in questionnaire responses in order to explore contrasting experiences and perspectives.

4.4.1 Online Questionnaire

Online questionnaires offer several methodological advantages, including rapid and cost-effective data collection, automated data handling, and the ability to reach geographically dispersed participants (Ward et al., 2014). An online format was, therefore, selected to allow teachers to participate remotely and at a time convenient to them. This was particularly important given workload demands and time constraints in school settings and was, therefore, likely to support participation.

The questionnaire was created using Qualtrics because of its functionality, reliability, and suitability for mixed methods research. The platform supports a wide range of question formats, enabling the collection of both quantitative and qualitative data within a single instrument. It also allows features such as skip

logic, ensuring that participants are presented only with relevant questions based on previous responses, thereby reducing respondent burden and improving data quality. In addition, Qualtrics is compatible with multiple devices and automatically optimises display for computers, tablets, and mobile phones, enhancing accessibility and usability for participants. These features were considered important in promoting engagement and completion.

From a data management perspective, Qualtrics facilitated secure storage and efficient handling of responses, allowed direct export to statistical software packages such as Statistical Package for the Social Sciences (SPSS) and Microsoft Excel. It provides built-in tools for preliminary descriptive analysis, reducing the risk of transcription errors and supporting timely analysis. The platform further supports ethical research practice through secure data hosting, confidential handling of participant information, and the integration of informed consent procedures within the questionnaire. Its use complies with University of Glasgow research governance requirements and the General Data Protection Regulation (GDPR). Collectively, these features made Qualtrics a methodologically robust and ethically appropriate platform for questionnaire-based data collection within a mixed methods study.

4.4.1.1 Questionnaire Design and Structure

The questionnaire opened with a consent form detailing the title of the project and my contact information, along with that of my supervisors. Participants were asked to confirm that they had read the participant information sheet, that their participation was voluntary, and that they might be referred to by pseudonym during analysis. The consent form was provided at the beginning of the questionnaire rather than being signed and returned by another method, in order to ensure that participants were fully informed about the purpose, procedures, and implications of the study before taking part.

The consent form was followed by the questionnaire, which comprised nine sections and included 54 individual items. These sections were titled: Personal Details, Background Information, Defining Numeracy, Professional Development, Teaching Numeracy, Enjoyment in Teaching Numeracy, Confidence with Numeracy, Numeracy in Everyday Life, and Numeracy Skills (see Appendix 1 for the full questionnaire). The average completion time for the questionnaire was

30 minutes. The only directly identifying information collected through the questionnaire was participants' names and email addresses. Although this information was collected solely to facilitate the follow-up interview phase, requesting names and email addresses meant that the questionnaire was not fully anonymous. This may have influenced recruitment and participation, as some teachers may have been less willing to begin or complete a questionnaire concerning their professional confidence, knowledge, and practices if their responses were potentially identifiable to the researcher. It is therefore possible that requesting identifying information contributed to the modest sample size. However, because the questionnaire was distributed indirectly through head teachers, the number of teachers who ultimately received the invitation is unknown and a formal participation rate cannot be calculated. It is therefore not possible to determine the extent to which the collection of names and email addresses affected participation.

The questionnaire items were designed to address the central constructs of the study, namely teachers' knowledge, confidence, beliefs, and contextual experiences in relation to numeracy. Question development was guided by Bennison's (2015a) conceptual framework of identity as an embedder of numeracy, with items mapped onto the five domains of knowledge, affective factors, social influences, life history, and context. Where possible, questions were adapted from existing studies in the literature (Bursal & Paznokas, 2006; Callingham et al., 2015; Forgasz et al., 2017; Milton et al., 2007; Suinn & Winston, 2003) on teacher confidence, beliefs about numeracy, mathematics anxiety, and numeracy teaching. Additional items were developed to reflect the Scottish policy context, cross-curricular expectations, and the research question (see Section 1.3).

Care was taken to ensure that questions were concise, unambiguous, and accessible to teachers across subject areas. Draft versions of the questionnaire were reviewed by my academic supervisors, whose feedback resulted in refinements to wording, question order, and the inclusion or removal of some questions. For example, an initial question asking participants to select which definition of numeracy most closely aligned with their personal view was revised following supervisory feedback, as it risked implying the legitimacy of particular definitions and constraining participants' conceptualisations. It was, therefore,

replaced with an open-ended question inviting participants to define numeracy in their own words.

The questionnaire incorporated a combination of open-ended, multiple-choice, and Likert-scale items. Multiple-choice questions were used where it was important to standardise responses and allow comparability across participants. This was particularly important given the intention to identify patterns in teachers' experiences and perceptions of their responsibility for numeracy education. For example, participants were asked whether they had read and/or used the numeracy experiences and outcomes (E's and O's) outlined by Education Scotland. This question had three possible responses: read only, read and used, or not read. Using a multiple-choice format reduced respondent burden by allowing participants to select an answer quickly without the cognitive and time demands associated with extended written responses. This was an important consideration when surveying practising teachers, whose participation may be constrained by workload and time pressures. From an analytical perspective, multiple-choice formats also facilitate efficient and reliable quantification of responses, allowing patterns and distributions to be examined systematically using SPSS.

Likert scales were used in some questions to capture the degree and intensity of teachers' beliefs, confidence, and self-perceived competence in relation to numeracy and numeracy teaching. Responses were recorded on a five-point scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. This format was well suited to the belief- and confidence-related aspects of the conceptual framework, enabling more nuanced measurement of participants' views.

Using a combination of open-ended, multiple-choice, and Likert-scale questions supported a more comprehensive and methodologically robust design (Dillman et al., 2014). Together, these formats enabled triangulation within the questionnaire itself, strengthening the overall quality of the data by capturing both breadth and depth in participants' responses (Creswell & Plano Clark, 2017).

4.4.1.2 *Questionnaire Dissemination*

Initially, the participant information sheet, privacy notice, and link to the online questionnaire were sent to head teachers in secondary schools across the following local authorities: West Lothian, City of Edinburgh, Glasgow City, North Lanarkshire, and South Lanarkshire. Ethical approval was sought and granted from each local authority to contact head teachers directly regarding the research project (see Appendix 2 for details). A copy of this approval was sent to each head teacher for their records. All head teachers received the same wording in the email to ensure consistency and to reduce the risk of the purpose or importance of the study being rephrased.

Head teachers were asked to forward the participant information sheet, privacy notice, and questionnaire link to non-mathematics teachers in their school. A reminder email was sent four weeks after the initial email, which was distributed at the beginning of May 2025 and coincided with the start of the SQA exam diet. As there were only 30 completed responses to the questionnaire, it is possible that some head teachers did not distribute the questionnaire to staff. This is an unfortunate limitation of the study.

To mitigate potential power imbalances and perceived coercion, all communication emphasised the voluntary nature of participation and clarified that head teachers would not have access to individual responses or records of participation. As responses were returned directly to me, head teachers were not aware of who had participated.

4.4.2 *Semi-Structured Online Interviews*

For the interviews, a semi-structured approach was adopted to allow for a natural flow of conversation while maintaining a focus on the study's core research question. Semi-structured interviews offer a flexible yet systematic approach to qualitative data collection, combining the depth of open-ended inquiry with sufficient structure to ensure consistency across participants (Galletta, 2013). This is particularly valuable when investigating complex and subjective issues such as teacher identity and experiences of teaching numeracy, where individual perspectives and contextual factors may vary widely. Conducting interviews online also increased accessibility and convenience, allowing teachers to participate from their own settings and at times that fit

around professional commitments. This approach can enhance recruitment, broaden geographical reach, and support the inclusion of participants for whom travel may present a barrier (Archibald et al., 2019).

Galletta (2013) argues that semi-structured interviews encourage a reciprocal exchange between researcher and participant and enable reflexive engagement with issues and dilemmas that arise during the research process. In this sense, reciprocity can be understood as a relational process involving mutual exchange and the co-construction of meaning and power (Lather, 1986). Such interaction is valuable because interviews may surface perspectives or ideas that were not anticipated in advance, thereby extending and enriching the scope of the study (Galletta, 2013). Conducting interviews online may further support this process by creating a degree of psychological distance that enhances participant comfort and openness, particularly when discussing sensitive matters such as professional confidence, accountability pressures, or perceived competence in teaching numeracy.

Interviews were conducted using Microsoft Teams, which facilitated accurate data capture through built-in recording functions and supported the transcription process. Audio and video files were uploaded directly to my University of Glasgow OneDrive, ensuring secure storage in accordance with institutional ethical guidelines and data protection requirements. Data were pseudonymised during transcription, and transcribed files were also stored on OneDrive. Semi-structured online interviews, therefore, provided a rigorous and practically feasible means of generating rich, contextualised data while supporting flexibility, accessibility, and integration within a mixed methods design.

4.4.2.1 Development of Semi-Structured Interview Questions

The initial interview questions were developed with reference to the research question, the conceptual framework, and relevant literature on teacher identity and numeracy education. The overall aim of the project was to understand how non-mathematics teachers view and approach their responsibility for numeracy education. The questions were, therefore, designed to support exploration of this issue.

The primary purpose of the interviews was to explore teachers' perceptions of themselves as teachers of numeracy, their experiences of embedding numeracy within their subject areas, and contextual factors shaping these practices, such as professional development, personal feelings about numeracy, and perceived supports and constraints. This was informed by the theoretical framing of teacher identity as dynamic, socially constructed, and contextually situated in relation to numeracy teaching and professional identity (Bennison, 2016). Open-ended questions were formulated to encourage participants to provide detailed, reflective accounts of their experiences and perspectives. Questions were deliberately phrased in neutral, non-leading language to minimise bias and to allow participants to define issues in their own terms. Follow-up prompts were incorporated to facilitate clarification and elaboration where appropriate, while maintaining flexibility to pursue relevant issues raised by participants. Given that interviews were conducted online, additional consideration was given to question length and cognitive load in order to support engagement in a digital environment. Ethical considerations, including sensitivity around professional confidence and accountability pressures, also informed the wording and ordering of questions. The questions and prompts are summarised in Table 4.

Table 4
Semi-Structured Interview Questions and Prompts

Initial Question Number	Question
1	In your questionnaire response, you defined numeracy as ... can you elaborate on... i.e. why you think that? How you arrived at that definition?
2	In your questionnaire response, you described ... as areas of professional learning you have undertaken with regard to numeracy. Can you describe the impact you feel this has had on your teaching practice?
3	In your questionnaire response, you described your responsibility to numeracy as ... can you elaborate on why you feel that way?
4	In your questionnaire response, you said that you find it enjoyable/not enjoyable to teach aspect of numeracy in your lessons, why do you think that is?
5	What supports, if any, are available to help you teach numeracy in your classroom?
6	What barriers, if any, have you experienced to teaching numeracy in your practice?
7	What improvements, if any, do you think could be made to better support all learners in numeracy?
Additional Prompts	Can you elaborate on why you think that? Can you explain what you mean by... Why do you think that is the case?

These questions were also reviewed by my academic supervisors, whose feedback led to refinements in wording and the inclusion of the additional prompts where participants had not fully answered the question. This approach ensured that the interview questions were theoretically grounded while remaining flexible enough to capture the complexity of teachers' identities in relation to numeracy.

4.4.2.2 Selection of Participants to Interview

Participants for the semi-structured interview phase were selected from those who completed the questionnaire and indicated their willingness to be contacted for a follow-up interview. This option was included in the consent stage of the questionnaire. Participants were also asked whether they would consent to being audio- or video-recorded if invited to interview. Selecting neither option meant that they would not be invited to interview.

It was important to ensure that interview participants represented a range of perspectives relevant to the study's research question concerning teachers' identities as teachers of numeracy. Questionnaire responses were examined to identify variation across key dimensions, including self-reported confidence in teaching numeracy, beliefs about the role of numeracy across the curriculum, enjoyment of mathematics as a pupil, subject specialism, years of teaching experience, and local authority. This maximum variation approach was intended to capture both common patterns and contrasting experiences, thereby strengthening the depth and explanatory power of the qualitative phase (Galletta, 2013). A summary of participant demographics is shown in Table 5.

Table 5

Semi-structured interview participant demographics

Participant	Teaching Experience (years)	Local Authority	Subject Specialism	Confidence in teaching numeracy	Enjoyment of mathematics at school
T1	10+	West Lothian	History and Modern Studies	Moderate	Moderate
T2	10+	West Lothian	English	Low	High
T3	4-6	North Lanarkshire	Computing Science; Business Management	High	High
T4	10+	South Lanarkshire	English; Personal and Social Education	Low	Low
T5	7-9	City of Edinburgh	English; Italian	Moderate	Moderate
T6	10+	West Lothian	Computing	High	Low

Participants were selected on the basis of their potential to illuminate different configurations of teacher identity in relation to numeracy. In particular, I sought participants who reported high, moderate, and low levels of confidence in teaching numeracy, as well as differing levels of enjoyment of mathematics at school, as these positions were likely to provide insight into how identity is shaped under differing professional conditions.

Selected participants were contacted individually by email and were provided with detailed information about the interview phase, along with a copy of their questionnaire responses to refer to during the interview. Participation was voluntary, and no individual was obliged to take part in the interview phase after completing the questionnaire. Ten participants were invited to interview; four declined, and six interviews were completed. Participants were offered a selection of dates and times, although this remained flexible and adjustments were made where necessary to accommodate their schedules. Identifying information was stored separately from survey data in order to protect confidentiality.

4.4.2.3 *Conducting Semi-Structured Interviews*

The semi-structured interviews were conducted online via Microsoft Teams in order to accommodate participants' geographical dispersion and professional commitments. The platform also allowed interviews to be recorded easily, either by audio or video. Interviews took place between June 2025 and September 2025. Recording format depended on participant preference: five participants agreed to video recording, while one opted for audio recording only. Each interview lasted between 18 and 37 minutes, with an average duration of 26 minutes.

Interviews followed a semi-structured approach using the questions in Table 4 as an interview guide. This ensured that key topics were addressed consistently across participants while allowing flexibility in sequencing and probing. Open-ended questions and follow-up prompts were used to encourage elaboration, clarification, and reflection, enabling participants to articulate their experiences and perspectives in their own terms. Notes were taken during each interview and reviewed reflexively afterwards in order to document emerging assumptions, analytic insights, and any ways in which my own positioning may have shaped the interaction.

Throughout the interview process, attention was given to establishing rapport, adopting a neutral and non-judgemental stance, and creating a supportive environment in which participants felt comfortable discussing professional experiences, including challenges relating to confidence, accountability, and numeracy teaching practices.

4.5 Data Preparation

All qualitative data from the questionnaire and interviews were imported into NVivo 14 for coding and thematic analysis. NVivo was used because it supports the systematic organisation, retrieval, and comparison of large volumes of textual data, thereby enhancing efficiency and analytical rigour. Prior to analysis, interview transcripts were formatted consistently, speaker labels were checked, and open-ended questionnaire responses were incorporated into the same project file. Case classifications were then created to link qualitative data to participant characteristics such as subject specialism and years of experience, enabling comparison across groups.

Quantitative data were exported from Qualtrics into SPSS. The dataset was screened for missing values and outliers, and responses with substantial missing data were removed using listwise deletion, resulting in a final sample of 30 participants. Likert-scale items were also checked to ensure correct coding direction and were then prepared for descriptive and inferential analysis.

Interview recordings were transcribed using the auto-transcription facility in Microsoft Teams and then manually reviewed to correct errors and ensure accuracy. Data were pseudonymised during transcription, and participants were assigned identifiers from T1 to T30 for use across the dataset. These identifiers were applied consistently across questionnaire and interview data, so that T1 to T6 in the questionnaire responses corresponded to the six participants who also took part in semi-structured interviews. Direct quotations used in Chapter 5 (Findings) were, therefore, pseudonymised and were included only where they contributed meaningfully to the interpretation of the findings.

Throughout data preparation and analysis, I documented decisions relating to data cleaning, coding, and categorisation in order to support transparency and auditability. All digital data were stored securely on the University of Glasgow OneDrive system in accordance with institutional data protection policies and GDPR.

4.6 Data Analysis Procedures

The study employed a sequential mixed methods analytic strategy in which questionnaire data were analysed to identify initial patterns and inform the subsequent qualitative interview phase. Quantitative and qualitative data were analysed using descriptive statistics and, where appropriate, Spearman's rho correlations, while qualitative data from open-ended questionnaire responses and semi-structured interviews were analysed using Braun and Clarke's reflexive thematic analysis. Findings from the quantitative and qualitative strands were subsequently integrated during interpretation and reporting. This reflected the sequential nature of the research design, in which findings and responses from the questionnaire informed decisions relating to the subsequent interview phase.

The purpose of the quantitative analysis was to identify patterns and trends in teachers' confidence, beliefs, professional learning experiences, and

perceptions of numeracy across the curriculum. The qualitative analysis aimed to develop a deeper understanding of how teachers made sense of numeracy and of their professional identities within specific educational contexts. Integration took place during the analysis and presentation of findings in Chapter 5, where qualitative themes were used to interpret and contextualise quantitative trends, and quantitative patterns provided breadth to the qualitative findings.

Quantitative questionnaire data were analysed using SPSS, a statistical software package widely used in educational and social science research (Field, 2018; Pallant, 2020). SPSS supported systematic data screening, cleaning, and statistical analysis, thereby contributing to transparency and methodological rigour. Its compatibility with Qualtrics exports also reduced the risk of transcription error and supported efficient data management. Details of the quantitative analytic procedures are outlined in Section 4.6.1.

Qualitative data from open-ended questionnaire responses and semi-structured interviews were analysed using NVivo to support the organisation and coding of textual data. Computer-assisted qualitative data analysis software (CAQDAS) is widely recommended for qualitative and mixed methods research because it supports transparent, systematic, and auditable analytic procedures (Bazeley & Jackson, 2013; Braun & Clarke, 2021). NVivo supported the organisation of large datasets, facilitated the development and refinement of codes and themes, and allowed efficient retrieval and comparison of coded data across participants and sources. This supported reflexive engagement with the data by enabling iterative movement between coded segments, emerging themes, and broader interpretations. Importantly, NVivo functioned as an analytic support tool rather than a substitute for analysis; interpretive judgement, reflexivity, and theoretical sensitivity remained central throughout. Details of the qualitative analytic procedures are presented in Section 4.6.2.

4.6.1 Quantitative Analysis Procedures

Quantitative data collected through the questionnaire were exported from Qualtrics into SPSS for analysis. Prior to analysis, the dataset was cleaned by removing incomplete responses and screening for missing values and inconsistencies. Only fully completed questionnaires ($n = 30$) were included in the final dataset.

Given the exploratory nature of the study and the relatively small sample size, early analysis focused primarily on descriptive statistics. Frequencies and percentages were calculated to summarise participants' demographic characteristics, levels of confidence in teaching numeracy, engagement with policy documentation, prior professional learning, enjoyment of mathematics, and perceptions of cross-curricular responsibility.

Likert-scale responses were primarily summarised using frequencies and percentages in order to retain visibility of the distribution of participants' responses. For selected items used to explore descriptive patterns across disciplinary groupings, mean scores were also calculated to provide a concise comparison between groups. Although individual Likert items are ordinal, these means were used only as descriptive summaries and were not treated as evidence of statistically significant differences between groups. Given the small overall sample and particularly small numbers within some disciplinary groupings (see Table 2), these comparisons were interpreted cautiously alongside the qualitative findings. In groups containing only two or three participants, mean scores were particularly sensitive to individual responses and should therefore be understood as descriptive indicators within this dataset rather than as a basis for ranking or making broader comparisons between disciplines.

For the descriptive comparison of affective responses by discipline presented in Section 5.4.2, participants were assigned to a single disciplinary grouping so that each participant contributed once to the comparison. Where participants reported teaching more than one subject, disciplinary classification was based on their principal subject specialism. This produced mutually exclusive disciplinary groupings for the purposes of the descriptive analysis. These groupings were used only for this analysis and did not replace the fuller representation of subject taught presented in Table 2.

No inferential analyses aimed at population generalisation were undertaken. However, exploratory non-parametric correlations were conducted using Spearman's rho to examine possible associations between selected variables, including reported anxiety, overall confidence, confidence in supporting pupils with gaps, avoidance of numeracy-related situations, prior enjoyment of mathematics, and engagement with curriculum documentation. Spearman's rho

was selected because of the ordinal nature of the data and because it does not require assumptions of normal distribution or linearity (Field, 2018).

Correlations were interpreted cautiously in terms of direction and relative strength rather than formal effect size thresholds. They were not used to establish causality or support statistical generalisation, but to identify patterns of association within the sample. In keeping with the interpretivist orientation of the study, statistically significant relationships were treated as indications of patterned positioning rather than predictive claims about wider populations.

Quantitative findings were then considered alongside qualitative themes in order to examine areas of convergence, divergence, and complementarity. In this way, survey data provided breadth and pattern identification, while interview data offered explanatory depth.

4.6.2 Qualitative Analysis Procedures

Qualitative data from open-ended questionnaire responses and semi-structured interviews were analysed using Braun and Clarke's (2006; 2019) reflexive thematic analysis (RTA). Analysis was supported by NVivo software to facilitate systematic data organisation, transparent coding procedures, and iterative theme development. NVivo functioned as an analytic support tool rather than an analytic determinant; interpretive judgement, theoretical sensitivity, and reflexive engagement remained central throughout.

RTA was selected because of its epistemological compatibility with the interpretivist stance underpinning the study and its suitability for exploring complex, socially constructed phenomena such as teacher identity. Within RTA, themes are not understood as objective entities that simply emerge from the data, but as patterns of shared meaning actively constructed through the researcher's interpretative engagement with participants' accounts (Braun & Clarke, 2019). This aligned with the study's conceptualisation of identity as dynamic, relational, and contextually situated, while acknowledging my role in the co-construction of meaning.

The analysis combined deductive and inductive approaches (see Section 4.6.2.2) and incorporated both semantic and latent coding (Byrne, 2021). This enabled analysis to be informed by the study's conceptual framework while remaining

open to meaning and patterns that had not been anticipated in advance. The analysis followed the six recursive phases outlined by Braun and Clarke (2006; 2019). Consistent with the reflexive orientation of RTA, the process was non-linear and iterative, with movement back and forth between phases as understanding developed. An analysis diary and reflexive notes were maintained to document coding decisions, emerging interpretations, supervisory input, and shifts in the analytic framework, thereby providing a transparent audit trail and supporting analytic rigour.

The phases of analysis are outlined below.

4.6.2.1 Phase 1: Familiarisation with the Data

All interview transcripts and open-ended questionnaire responses were read repeatedly in order to achieve immersion in the dataset. Interview recordings were revisited alongside transcripts to retain sensitivity to tone, emphasis, and hesitation, thereby supporting contextual and interpretive depth.

Initial observations were recorded through reflexive analytic notes and an analysis diary. These distinguished between descriptive summaries and early interpretive reflections in order to avoid premature theme development. Early patterns were noted in relation to confidence, responsibility, enjoyment, accountability, preparation to teach numeracy, and conceptions of numeracy. Instances of uncertainty, contradiction, and unexpected responses were also documented and revisited during later stages of analysis in order to support reflexive awareness of how interpretations developed.

4.6.2.2 Phase 2: Generating Initial Codes

Initial coding combined deductive and inductive approaches. A preliminary coding framework was developed deductively from the study's conceptual framework (Bennison, 2015a), particularly the domains of knowledge, affective factors, social influences, life history, and contextual conditions. Within this structure, data were coded inductively in order to capture participants' meanings and experiences.

Coding was conducted line by line in NVivo, with codes applied in ways that retained surrounding contextual meaning. Both semantic codes, which captured

explicit statements, and latent codes, which captured underlying assumptions, identity positioning, and professional boundaries, were generated.

Early coding focused particularly on the affective domain, including attitudes towards numeracy. Subcodes relating to enjoyment or dislike, responsibility, relevance, confidence, and accountability were developed and then refined. Overlapping codes, for example enjoyment and dislike, were merged during analysis, and accountability emerged as a distinct code following repeated references to external expectations and perceived scrutiny. Earlier transcripts and questionnaire responses were revisited when new codes were introduced in order to maintain consistency across the dataset.

4.6.2.3 Phase 3: Constructing Initial Themes

As coding progressed, patterns of shared meaning were examined across participant accounts and clustered into broader analytic groupings to construct initial themes. This stage involved moving beyond individual codes to consider how related codes might combine to capture meaningful aspects of teachers' accounts of numeracy, professional responsibility, and identity.

These early thematic groupings were treated as candidate themes, that is, provisional analytic propositions representing possible patterns in the data rather than final thematic conclusions. In line with Braun and Clarke's (2006; 2019) approach, themes were understood as actively constructed through interpretive engagement rather than simply discovered within the data (Byrne, 2021).

During this phase, several high-prevalence codes began to cluster around shared concerns relating to confidence, relevance, and responsibility. Participants also frequently described limited preparation during initial teacher education, a lack of formal professional learning in numeracy, and uncertainty regarding institutional expectations for cross-curricular numeracy teaching.

Coding of participants' conceptions of numeracy initially generated a wide range of content-specific subcodes, for example counting, operations, measurement, graphs, time, and money. Following supervisory discussion, these were reorganised into three broader analytic categories:

- content specific to mathematics

- content specific to the participant's subject field
- real-life skills

This restructuring was implemented through systematic recoding within NVivo and documented in the analysis diary.

4.6.2.4 Phase 4: Reviewing Themes

Candidate themes were refined through iterative comparison both within individual cases and across the dataset. Themes were evaluated in relation to internal coherence, conceptual distinction, and relevance to the research question (Braun & Clarke, 2006; 2019). Coded extracts were re-examined to ensure that each theme was supported by sufficient depth and breadth of data.

To strengthen conceptual clarity and policy relevance, numeracy-related subcodes were later reorganised in alignment with the CfE numeracy organisers:

- Number, Money and Measure
- Shape, Position and Movement
- Information Handling

These organisers were applied to both mathematics-specific and subject-specific content. Real-life numeracy references were grouped into categories including time, money, everyday life, problem solving, and food or cooking. Redundant or weakly supported codes were removed, while some codes were duplicated across organisers where conceptually appropriate. All restructuring decisions were documented in the analysis diary, ensuring transparency in the development of the analytic framework.

This stage involved sustained movement between raw data, codes, and emerging themes, reinforcing the reflexive principle that themes are actively constructed through iterative engagement with the data.

4.6.2.5 Phase 5: Defining and Naming themes

Final themes were defined in relation to their central organising concepts and their contribution to understanding teacher identity and responsibility for numeracy education. Theme definitions were refined through iterative writing

and comparison with the conceptual framework and relevant literature on teacher identity and numeracy.

Theme names were selected to reflect analytic meaning rather than surface topic areas, capturing how participants positioned themselves professionally in relation to numeracy rather than simply what they discussed.

During later analytic phases, attention was directed not only to the internal coherence of individual themes but also to patterned relationships across themes and conceptual domains. Cross-domain comparisons were conducted to examine how domains co-occurred and interacted within and across participants' accounts. This relational analysis informed the identification of structured positioning patterns presented in Chapter 5. As analysis progressed, recurring cross-domain patterns prompted further refinement of the initial framework and supported a more integrated interpretation of how different influences appeared to shape teachers' engagement with numeracy, as discussed in Chapter 6.

4.6.2.6 Phase 6: Producing the Report

Themes were presented in the findings chapter using anonymised illustrative extracts selected for conceptual richness and explanatory value rather than frequency alone. The analysis explicitly acknowledged my interpretive role and situated the findings within the study's theoretical and policy context.

Throughout reporting, I considered how prior professional experience, theoretical commitments, supervisory feedback, and evolving analytic decisions may have shaped interpretation. An audit trail comprising coding iterations, reflexive notes, and analysis diary entries was retained in order to support transparency and to allow the reader to trace the development of analytic claims from data to interpretation.

4.6.3 Integration of Quantitative and Qualitative Findings

Integration occurred at more than one stage of the sequential mixed methods design. First, questionnaire responses informed the selection of participants for the subsequent interview phase and shaped the areas explored during individual interviews. Following separate quantitative and qualitative analyses, findings from both strands were then brought together during interpretation and

reporting in order to develop a more complete understanding of teachers' identities as teachers of numeracy.

Integration was undertaken primarily through a thematic weaving approach. Qualitative themes generated through reflexive thematic analysis provided the organising structure of the findings chapter, within which relevant quantitative results, including frequencies, percentages, and selected descriptive mean scores derived from the questionnaire, were embedded. This approach enabled numerical patterns relating to confidence, responsibility, professional learning, and engagement with numeracy policy to be interpreted alongside teachers' narrative accounts of experience, meaning-making, and professional positioning. In this way, quantitative findings provided breadth and pattern identification, while qualitative analysis offered explanatory depth and contextual understanding.

In addition, exploratory non-parametric correlations using Spearman's rho were used to examine associations between key affective and professional variables, including confidence, anxiety, avoidance, prior enjoyment of mathematics, and engagement with curriculum documentation. These correlations were interpreted alongside qualitative themes in order to explore how associations in questionnaire data aligned with or differed from teachers' narrative accounts of professional positioning and classroom enactment. This comparative interpretation supported the identification of areas of convergence and divergence between numerical trends and participants' experiences.

Consistent with the interpretivist orientation of the study, integration was treated as an interpretive process rather than a form of statistical validation. Quantitative data were, therefore, not used to generalise beyond the sample, but to situate qualitative insights within broader patterns across participants. Quantitative patterns, particularly associations identified through exploratory correlations, also sensitised qualitative interpretation to possible structured relationships between affective positioning and numeracy enactment practices.

This integrative strategy supported coherence between the study's interpretivist epistemological position, its use of reflexive thematic analysis, and its mixed methods design, while strengthening the explanatory depth of the findings presented in Chapter 5. Through this process, meta-inferences were generated

that connected quantitative patterns with qualitative interpretations and informed the conceptual development presented in Chapter 6.

4.7 Ensuring Trustworthiness and Rigour

In qualitative and mixed methods research situated within an interpretivist paradigm, methodological quality is often considered in terms of trustworthiness rather than statistical validity alone (Guba & Lincoln, 1994). Accordingly, this study adopted strategies to strengthen credibility, dependability, confirmability, and transferability across all stages of the research process.

Credibility was supported through methodological triangulation between quantitative questionnaire data and qualitative interview data, allowing patterns identified in survey responses to be explored and contextualised through participants' narrative accounts (Creswell & Plano Clark, 2017). The use of semi-structured interviews enabled more in-depth exploration of teachers' experiences and meanings, while prolonged engagement with the dataset during iterative coding and theme development supported close familiarity with participants' accounts (Braun & Clarke, 2019). The inclusion of verbatim extracts in the findings chapter further supports credibility by showing how interpretations were grounded in the data.

Dependability was strengthened through the systematic documentation of analytic procedures and decision-making. An analysis diary and reflexive memos were maintained throughout data preparation and analysis to record coding developments, theme revisions, and theoretical reflections. NVivo was used to manage qualitative data and retain records of coding structures and theme development, while SPSS output files documented quantitative analytic procedures. Together, these materials provide a transparent audit trail through which the research process can be traced and evaluated (Bazeley & Jackson, 2013).

Confirmability was addressed through sustained reflexive practice and explicit acknowledgement of my professional positioning within Scottish education. Reflexive notes were used to examine how prior experiences, assumptions, and theoretical commitments might shape analytic interpretations, consistent with the reflexive orientation of Braun and Clarke's thematic analysis (Braun &

Clarke, 2019). Supervisory discussions during analysis also functioned as a form of peer debriefing, supporting critical examination of emerging interpretations and reducing the risk of unexamined bias (Guba & Lincoln, 1994).

Transferability was supported through the provision of detailed contextual information about the study setting, participants, and policy environment. Thick description of the Scottish secondary education context, participant demographics, and numeracy policy framework allows readers to judge the possible relevance of the findings to other educational contexts (Tracy, 2010). While the study does not aim for statistical generalisation, it seeks to generate theoretically informative insights that may be relevant to comparable educational settings.

Together, these strategies support the trustworthiness of the study and demonstrate that it was conducted in a transparent, systematic, and ethically responsible manner.

4.8 Ethical Considerations

Ethical approval for the study was obtained from the University of Glasgow Research Ethics Committee prior to data collection. The study was conducted in accordance with institutional guidelines and the principles of informed consent, voluntary participation, confidentiality, and data protection. Ethical approval was also sought and obtained from each of the five local authorities in which participants were employed (see Appendix 2).

All participants were provided with a detailed participant information sheet outlining the purpose of the study and the nature of their involvement. They were also given a privacy notice explaining how their personal data would be used, stored, and processed, and outlining their rights as participants. In addition, participants were sent a copy of the ethical approval letter from the relevant local authority. For the questionnaire, consent was obtained electronically before participants could access the survey. Interview participants provided additional verbal consent at the start of each interview. Participants were informed of their right to withdraw from the study at any time, without penalty and without giving a reason, up to the point at which data analysis began. This limit was necessary because responses were pseudonymised and

incorporated into the main dataset shortly after collection. Once analysis had begun, it would no longer have been possible to identify and remove individual contributions reliably without affecting the integrity of the dataset.

Participation was entirely voluntary. As the questionnaire was distributed via head teachers, care was taken to ensure that staff did not experience any direct or indirect pressure to participate. No identifying information was shared with schools or local authorities.

To protect confidentiality, personal identifiers were removed from the dataset and participant codes were used in place of names. Interview participants were assigned pseudonyms where appropriate, and references to specific schools, local authorities, or individuals were anonymised in transcripts and reporting. Personal data were stored until the end of the research project (30th April 2026), at which point they were manually deleted. Pseudonymised questionnaire and interview data will be stored in the University of Glasgow data repository, Enlighten, for a period of 10 years.

Given the focus on professional identity, confidence, and experiences of teaching numeracy, it was possible that some questions might prompt discomfort or self-reflection. Participants were, therefore, reminded that they could decline to answer any question and could pause or end the interview at any time. Contact details for professional support services were kept available throughout the research process in case they were needed.

As interviews were conducted online, additional measures were taken to ensure privacy and data security, including the use of secure meeting links and secure storage and transfer of recordings and transcripts.

Finally, my professional role as a teacher within the Scottish education system was recognised as a potential source of perceived power imbalance, particularly where participants worked in the same local authority. This was addressed through clear communication about the independence of the research, its non-evaluative purpose, and the strict separation of research data from my professional role.

Chapter 5: Findings

5.1 Introduction

This chapter presents the findings of the study in relation to the research question and the conceptual framework underpinning the research. The framework suggests that teachers' identities as teachers of numeracy are shaped by five domains of influence: knowledge, affect, social factors, life history, and context. Direct quotes in this chapter are labelled with a teacher code from T1 to T30 in order to distinguish between participants. The six teachers who took part in interviews are labelled T1 to T6, and quotations from these teachers may be drawn from either interview or questionnaire data. Initial analysis of the questionnaire and interview data indicated that the issues raised most frequently across the dataset related to the knowledge and affective domains. Findings associated with the knowledge domain are presented first.

5.2 Knowledge Domain

This section presents the findings relating to the knowledge domain, which encompasses teachers' mathematical content knowledge (MCK), pedagogical content knowledge (PCK), and curriculum knowledge (CK). In this context, MCK refers to the teachers' perceived knowledge of mathematical concepts; PCK comprises teachers' knowledge of pedagogical practices in relation to numeracy education; and CK relates to their knowledge of the curriculum, policy, and documentation relating to numeracy education.

The findings draw on questionnaire and interview data to explore how non-mathematics teachers perceive their knowledge in these areas, and how these perceptions influence their confidence, instructional decisions, and engagement with numeracy within their subject teaching.

5.2.1 *Mathematical Content Knowledge*

This section examines the teachers' MCK and its influence on numeracy enactment. Analysis of the questionnaire and interview data suggests that the teachers' MCK was experienced less as a stable body of expertise and more as something that shaped confidence and perceived responsibility for numeracy. Teachers commonly described their mathematical knowledge as functional and

context-bound, sufficient for interpreting data or engaging with numeracy in everyday or subject-specific situations, but less secure when required for explicit instruction or explanation.

This framing was evident in teachers' definitions of numeracy. Across the 30 questionnaire definitions, numeracy was often associated with practical and accessible skills rather than abstract mathematics. Teachers frequently referred to skills such as "using numbers in everyday life" (T15), "the ability to understand and use numbers... simple things like addition and subtraction" (T29), "numbers, ratios, timelines and dates" (T5), or "manipulating and applying numbers to solve problems, analyse and interpret data" (T8).

Interview data reinforced this interpretation. All six interview participants distinguished numeracy from abstract mathematics, describing it as involving concrete or real-life applications. One teacher explained that numeracy involved "things that you would perhaps use in everyday life rather than some of the more abstract stuff... like algebra" (T1), while another (T5) emphasised the importance of being able to apply numbers to everyday contexts, such as budgeting or interpreting financial information. A third teacher described numeracy as "the equivalent of what letters mean to sense making... being able to use numbers, the basics of the numbers and what they stand for, and sort of apply that to everyday life" (T2).

Across the dataset, and particularly in interview data, confidence in embedding numeracy was closely tied to perceived security with core mathematical concepts. The majority of interview participants ($n = 5$, 83.3%) identified gaps or fragility in their understanding of foundational areas such as fractions, division, time, spatial awareness, and basic calculations. These areas were often framed as sources of discomfort rather than challenge, with teachers expressing concern about making mistakes, using inconsistent methods, or undermining pupils' understanding. For example, T3 described being "very wary of teaching them...because the way I was taught to do it is quite different to the way they do it now. I don't want to confuse them." In this sense, limited MCK appeared to translate into reduced pedagogical confidence, particularly among teachers who already positioned numeracy as peripheral to their subject identity.

This insecurity appeared to shape how teachers interpreted their responsibility for numeracy. All six interview participants articulated a clear boundary

between recognising numeracy opportunities and feeling responsible for acting on them. Even where the teachers could identify numeracy within their subject (such as interpreting graphs, working with percentages, or analysing statistics), all six expressed some degree of hesitation or reluctance to take ownership of the underlying teaching of numerical methods.

Across the interview data, three teachers expressed clear reluctance to teach numerical methods directly, while the remaining three described using numeracy within their subject but limited their role to contextual application rather than explicit instruction. For example, one teacher noted that although numeracy appeared in their subject through activities such as analysing graphs and statistics, they would not attempt to teach the underlying methods, explaining: “actively and explicitly teaching it? I've got not a clue how to do that in a very honest sense” (T2). Similarly, another teacher stated that although they could demonstrate how to calculate percentages, they were hesitant to do so because it might conflict with approaches used by the mathematics department: “I'd be confident in showing them a method... I'm reluctant to do it though, because I kind of feel that's something the maths department does and I don't want to confuse the way that the maths department teaches it” (T3).

This positioning was also evident in broader reflections about responsibility for numeracy, with one teacher suggesting that specialist teachers should retain primary ownership of numerical instruction: “I want masters, I want experts... those are the people who know best... the maths teachers know much more than the computing teacher or the art teacher” (T1). Even when teachers supported numeracy conceptually, they framed their role primarily as reinforcing or applying existing skills rather than teaching them directly. As one teacher explained, their responsibility was to ensure that pupils possessed sufficient numeracy to engage with the subject content: “my main focus is to make sure that they understand enough about numeracy to make sense of my subject... I don't see it as my responsibility to teach somebody how to count...and do basic arithmetic” (T3). Another teacher stated: “as a classroom teacher, I wouldn't do any specific numeracy related activities...the stuff that's in the E's and O's...are quite specific about a way to teach a certain aspect of numeracy” (T4). An English teacher expressed: “I don't feel like I would be good at maybe explaining it because I'm not a maths teacher” (T5). This sentiment was echoed by T6, a

Computing teacher, who explained that their responsibility for numeracy was primarily to ensure that it was used within their subject:

where we use numeracy in our subject, it aligns with some of the experiences and outcomes...whether we are going over them in a way where somebody who is a more skilled numeracy teacher might teach them, is a different matter (T6).

These responses suggest that numeracy was treated as something to be applied rather than explicitly taught. This positioning appeared to lead to responsibility being deferred to mathematics teachers, with non-mathematics specialists acting primarily as users rather than teachers of numeracy.

While teachers frequently described insecurity with foundational procedures, the data indicate an important distinction between the use of numeracy in applied contexts and the ability to teach underlying methods. Eight questionnaire respondents (26.7%) cited confidence in applied and interpretive numeracy, such as interpreting graphical data, working with percentages, or judging whether an answer is reasonable (T3; T11; T12; T13; T15; T18; T23; T28). However, this confidence did not consistently extend to explaining underlying algorithms or modelling step-by-step procedures. This was particularly evident in the interview data, where all six teachers explicitly expressed uncertainty about how to teach certain aspects, or avoided doing so altogether. These patterns suggest that teachers did not necessarily lack MCK; rather, they were more confident with some aspects than others, with greater security in contextualised and sense-making aspects of numeracy than in formal procedural explanation. This unevenness appeared to shape teachers' willingness to assume responsibility, particularly where explicit instruction was required.

In the questionnaire, eight teachers (26.7%) reported enjoying numeracy-related activities to a large or great extent, yet these teachers also described a tendency to focus on interpretation or discussion rather than teaching underlying methods. For example, T7 described their role as: "helping pupils relate numeracy to real world problems", and T15 explained: "I enjoy working out rhythm in poetry...helping pupils work out percentages in their questionnaires and drawing conclusions based on quantitative research". This distinction highlights that positive attitudes towards numeracy do not necessarily translate into confidence in explicitly teaching it, particularly in the absence of strong MCK.

Across questionnaire and interview data, teachers' accounts indicate that MCK was closely associated with confidence, perceived legitimacy, and willingness to assume responsibility for numeracy. For example, one teacher expressed: "I'm very happy correcting obvious mistakes...actively and explicitly teaching it? I've not got a clue how to do that" (T2), another expressed uncertainty due to reduced confidence in mathematical expertise: "maybe I'm completely wrong...because I haven't done maths in a long time" (T5). Where teachers felt insecure in their understanding of foundational concepts, numeracy was more likely to be positioned as peripheral to their role, with responsibility deferred to mathematics specialists. Conversely, where teachers felt more secure using numeracy in applied or interpretive contexts, they appeared more willing to engage, though typically without explicit instruction in underlying methods.

Across questionnaire responses, 30.0% ($n = 9$) of teachers reported no engagement with professional learning in numeracy. This may suggest that confidence with MCK was shaped not only by individual knowledge but also by access to professional learning opportunities that could improve MCK. In the questionnaire responses, one teacher indicated that greater professional learning opportunities would support their engagement with numeracy. This teacher requested "curriculum specific development to showcase how numeracy can be signposted and delivered effectively within Social Subjects" (T10), another asked for "practical examples of how our specific courses can use numeracy" (T24), while a third teacher called for "a national programme, created and funded at governmental level, which provides all teachers with regular CLPL on Literacy and Numeracy" (T4). In interview data, four teachers (66.7%) highlighted uncertainty about what pupils had been taught and emphasised the importance of understanding how numeracy is taught within mathematics. One teacher explained that "the biggest barrier is knowing what they've been taught and how they've been taught it" (T3), highlighting uncertainty about what pupils were expected to know when entering their classroom. A notable minority ($n = 6$, 20.0%) of teachers explicitly highlighted the need for consistent approaches to numeracy across departments. For example, one teacher noted that it would be helpful to "use the same language as maths teachers use" (T21) when discussing numerical concepts. Another called for "consistent approaches to teaching numerical skills" (T11), while a third teacher stated: "it would be useful to see how pupils are taught numeracy

skills so that we can use the same language” (T23). In some cases, this uncertainty about approaches led teachers to avoid teaching numerical methods altogether, with one teacher explaining that they were reluctant to demonstrate calculations because they did not want to “confuse the way that the maths department teaches it” (T3). Together, these responses suggest that teachers’ confidence in engaging with numeracy was shaped not only by their own mathematical knowledge, but also by the degree of professional support, shared understanding, and cross-curricular coordination available within the school context. It appeared that in the absence of these supports, numeracy tended to remain positioned as a specialist responsibility, contributing to cautious engagement and limiting cross-curricular enactment.

5.2.2 Pedagogical Content Knowledge

Analysis of the data suggests that non-mathematics teachers’ PCK for numeracy was uneven and mediated by confidence and perceptions of professional responsibility. While all 30 teachers were able to identify numeracy opportunities within their subject areas, their accounts suggest that the ability to teach numeracy meaningfully, rather than simply recognise or correct it, was limited.

Across both datasets, teachers demonstrated greater confidence in recognising and responding to numeracy than in teaching it directly. All six interview participants described being able to identify errors or misconceptions in pupils’ work, positioning themselves as capable of judging correctness. Five interview participants (83.3%) explicitly stated that they did not feel confident teaching numeracy concepts, with one teacher explaining that they were “absolutely OK correcting things” but had “not a clue” how to teach numeracy explicitly (T2). Another noted that they “wouldn’t feel confident explaining it properly” (T5). Similarly, questionnaire responses reflected confidence in applied engagement, with 22 teachers (73.3%) agreeing or strongly agreeing that they were confident in sourcing data or numeracy-related questions for use in lessons. However, this confidence did not necessarily extend to instructional practice.

The distinction between recognising and teaching numeracy was also evident in questionnaire responses. 12 teachers (40.0%) positioned their role as supportive rather than instructional, emphasising reinforcement, signposting, or contextual

application of numeracy within their subject rather than direct teaching of numerical skills. For example, one teacher explained that their role was to “help ensure basic understanding as it [is] relevant to my subject and correct any misunderstandings” (T2), while another described their responsibility as to “signpost when implementing numeracy skills” (T10). This reactive positioning was also evident in responses that framed numeracy as something to be addressed only when it emerged naturally in teaching. One teacher described numeracy as “a shared responsibility - something I should be willing to address whenever it comes up with learners” (T17), and another stated: “I feel more confident in being able to draw attention to numeracy as it crops up, but not necessarily as confident with teaching the skills” (T30). Similarly, T28 emphasised a supportive pastoral role, stating: “I should do my best to help pupils feel comfortable dealing with numeracy in the contexts of my subject.” These responses suggest that for these 12 teachers, responsibility for numeracy was interpreted less as direct instruction and more as contextual support, reinforcement, and confidence-building within subject-specific practice.

Although teachers demonstrated some elements of diagnostic PCK, their confidence in responding instructionally to misconceptions was limited. Four interview participants (66.7%) described being able to identify when pupils had made errors, but were uncertain how to address this pedagogically. As one teacher noted, they could recognise and address errors but find they “don’t know how to teach [pupils] to do this” (T2). This indicates that misconceptions were often acknowledged but not systematically addressed within subject teaching.

Where teachers did describe pedagogical strategies, these were typically embedded within applied or real-world contexts rather than framed as explicit numeracy instruction. Across questionnaire responses, teachers described activities such as analysing statistics, interpreting graphs, working with timelines, measuring, or using survey data. For example, one teacher described “helping pupils relate numeracy to real world problems” (T7), while another referred to “helping pupils work out percentages in their questionnaires” (T15). These examples demonstrate that teachers possess subject-relevant pedagogical knowledge that could support numeracy learning. However, such practices were rarely identified as numeracy teaching; instead, they were framed as literacy,

critical thinking, or contextual application. This appears to indicate that numeracy was often engaged with indirectly, allowing teachers to maintain confidence in application without assuming responsibility for explicit instruction.

Teachers' reluctance to teach numerical concepts was further influenced by perceptions of pupils' prior learning and their own prior learning. Two interview participants explicitly expressed concern about teaching differing methods and the risk of reinforcing misconceptions: "I'm very wary of teaching them [percentages and fractions] because the way I was taught to do it is quite different to the way they do it now. I don't want to confuse them" (T3). T1 expressed a similar concern: "How maths and numeracy are taught now...feels different to how I was taught."

Another concern highlighted by teachers was a lack of shared pedagogical language and approaches across subjects. This concern was reflected in the questionnaire data, where six teachers (20.0%) highlighted the need for consistent approaches and shared language across departments. One teacher called for "consistent approaches to teaching numerical skills" (T11); another expressed a desire for "consistency in graphs across maths and the sciences" (T12); while a third teacher believes it would be helpful to use "the same language as maths teachers use" (T21). Similarly, in their interview, T4 argued that with regard to numeracy "people need to be following a common curriculum" and called for "a national bank of teaching resources" with "exemplars" and an "assessment framework." Two teachers specifically questioned the ambiguity of SQA language. The first noted that "the SQA dictate different language for the same skills or same language for different skills" (T23), while the other argued that "the SQA need to specify" expectations around graph conventions (T12). Specifics regarding the SQA did not emerge explicitly in the interview data, although broader concerns about consistency of language and approach were evident across the dataset. These responses indicate underlying uncertainty about the terminology used for numeracy skills elsewhere in the school and suggest a perceived lack of coherence in language, expectations, and approaches across departments. Read alongside the wider findings in this section, this uncertainty appeared to contribute to cautious engagement with numeracy, particularly where explicit teaching of methods was involved.

In addition, the data indicate limited confidence in understanding how numeracy concepts are developmentally sequenced across stages. Without visibility of how numeracy is introduced and developed within mathematics, the teachers were reluctant to extend or adapt instruction. This lack of progression knowledge appeared to constrain pedagogical confidence and reinforced the perception that explicit numeracy teaching required specialist expertise.

Overall, the findings indicate variation in teachers' PCK for numeracy. Teachers demonstrated confidence in recognising, applying, and contextualising numeracy within their subject areas, but reported limited confidence in teaching underlying concepts or addressing misconceptions systematically. Where pedagogical approaches lacked clarity or alignment across the school, numeracy was more likely to be treated as incidental rather than integral. As a result, PCK appeared to function as a key mediator of enactment: where teachers felt pedagogically secure, numeracy was more likely to be embedded within practice; where uncertainty prevailed, engagement remained cautious.

5.2.3 Curriculum Knowledge

Quantitative data relating to teachers' engagement with the numeracy experiences and outcomes (E's and O's) illustrate varied CK among non-mathematics teachers. While almost all teachers ($n = 29$, 96.7%) had read the numeracy E's and O's, only 56.7% ($n = 17$) indicated that they used them in practice. Notably, 40.0% ($n = 12$) of teachers reported that they had read but not applied them in practice, which appears to indicate that awareness of curriculum documentation does not readily translate into practice (see Table 6).

Table 6
Percentage of teachers who Read and/or used E's and O's

	Frequency (n)	Percentage (%)	Cumulative Percentage (%)
Read only	12	40.0	40.0
Read and used	17	56.7	96.7
Not read	1	3.3	100.0
Total	30	100.0	

Teachers' accounts indicate uncertainty about what numeracy across learning requires within their subject contexts. Across the dataset, 10 teachers (33.3%)

(T1; T2; T3; T4; T5; T6; T10; T26; T29; T30) described difficulties distinguishing between numeracy as a cross-curricular responsibility and mathematics as a specialist discipline. This was reflected in expressions of uncertainty (e.g., T1: “I am not as clear as I should be”), limited pedagogical confidence (T2: “I don’t really know how to teach pupils basic ideas...”), and the deferral of responsibility to mathematics specialists (T3: “I feel that’s something the maths department does”). Teachers also questioned whether their practices constituted numeracy (T4: “I would hesitate to call it numeracy as such”) and positioned their role as drawing attention to numeracy rather than teaching it (T30: “more confident... drawing attention... but not... teaching the skills”). This ambiguity appeared to reinforce a boundary where incidental correction or contextual application was viewed as acceptable, but explicit instruction was avoided. While numeracy was widely acknowledged as a shared responsibility, this lack of conceptual clarity contributed to uncertainty about how curriculum guidance should be enacted in practice.

The qualitative data indicate that teachers’ curriculum knowledge extends beyond awareness of documentation to practical understanding of how numeracy expectations could be operationalised in teaching and assessment. Four teachers explicitly requested subject-specific exemplification and clearer guidance on how numeracy could be embedded within their own curricular areas. For example, one respondent highlighted the need for “examples of numeracy embedded into lesson plans” (T5), while another emphasised the importance of understanding “how key tasks link to the Benchmarks for numeracy” (T30). Similarly, requests for professional learning “with examples, all linked to E’s and O’s and Benchmarks” (T3) suggest a desire for more concrete, curriculum-aligned support. Alongside this, teachers also identified challenges relating to progression and supporting learners with lower levels of numeracy. Uncertainty about prior learning was a recurring issue, with one teacher stating that they “don’t really know how to teach pupils basic ideas around time telling, spatial awareness... [or] basic addition, subtraction, dividing and multiplication” (T2). Others highlighted the need to better support access for all learners, particularly those with weaker numeracy skills, indicating a need for clearer guidance on differentiation and progression within a cross-curricular context.

This uncertainty influenced decisions about planning and teaching, contributing to cautious engagement with numeracy. Several teachers highlighted limited confidence or perceived scope, with one noting that there were “few instances where the teaching of numeracy would take place” in their classroom (T4), and another describing numeracy as difficult to incorporate “without it feeling shoe-horned in” (T2). Such responses suggest that, in the absence of clear conceptual boundaries and pedagogical guidance, teachers were more likely to restrict their engagement with numeracy to familiar or reactive practices rather than sustained or explicit instruction.

The data further indicate that CK for numeracy was relational rather than purely documentary, with teachers’ knowledge shaped by their understanding of how numeracy connected across subjects and stages. Six teachers (20.0%) described limited visibility of what pupils had previously been taught, how learning had been approached, and how it progressed beyond their own subject area. For example, T3 identified “the biggest barrier” as “knowing what [pupils have] been taught and how they’ve been taught it.” This lack of shared understanding extended across subjects, with teachers highlighting the need for “using the same language as maths teachers use” (T21) and recognising the difficulty of alignment when “the SQA dictate different language for the same skills” (T23). Others emphasised the need to understand how “key tasks link to the Benchmarks... across the school” (T30), suggesting that numeracy knowledge was dependent on broader curricular coherence rather than isolated subject knowledge.

There was also limited evidence of confidence in relation to assessment beyond mathematics, with one teacher identifying a need to support “assessment judgements across the school, not just in the maths dept.” (T30). In the absence of this relational understanding, teachers reported reduced confidence in intervening instructionally, often describing numeracy as difficult to embed “without it feeling shoe-horned in” (T2) or noting that there were “few instances” where it would be explicitly taught (T4). This suggests that limited visibility of progression and practice constrained engagement, leading to minimal or selective incorporation of numeracy within teaching.

Assessment emerged as a more limited but notable source of uncertainty. One teacher explicitly highlighted the need to support “assessment judgements

across the school, not just in the maths dept” (T30), suggesting a lack of clarity around how numeracy should be assessed beyond mathematics. More broadly, only a small number of teachers ($n = 3$, 10.0%) explicitly expressed uncertainty about how numeracy links to Benchmarks and curriculum expectations. For example, T1 noted that they were “not as clear as [they] should be,” while T27 acknowledged that they were “not using Benchmarks...[but] should”, and T30 emphasised the need to better understand how “key tasks link to the Benchmarks for numeracy... across the school.” This highlights that expectations for assessment and the application of numeracy Benchmarks may not be consistently understood across subject areas.

Overall, teachers’ accounts suggest that curriculum knowledge for numeracy is influenced by access to shared planning tools, cross-departmental dialogue, and structured professional learning. Where such supports were absent, teachers reported difficulty translating curriculum guidance into practice, often relying on reactive or incidental approaches. These responses indicate that curriculum knowledge depended on shared understanding, consistent approaches across departments, and access to practical, structured support.

5.2.4 Summary of Findings in the Knowledge Domain

Findings from the knowledge domain suggest that non-mathematics teachers’ engagement with numeracy was shaped by varied levels of MCK, PCK, and CK. Teachers’ mathematical content knowledge was typically functional and context-specific, supporting interpretation, estimation, and application, but less secure when procedural explanation or explicit instruction was required. This conceptual-procedural distinction influenced willingness to assume responsibility, with explicit teaching frequently deferred to mathematics specialists.

Pedagogical content knowledge was similarly varied. Teachers demonstrated awareness of common misconceptions and recognised the need for structured progression yet reported limited confidence in sequencing concepts or remediating errors without contradicting established methods.

Curriculum knowledge extended beyond awareness of documentation to concerns about progression, coherence, and assessment. Teachers described

limited visibility of what pupils had previously been taught, how learning developed across stages, and how numeracy was assessed outside mathematics, which reduced their confidence in teaching it. These gaps did not reflect resistance, but rather uncertainty within systems that were experienced as fragmented and unclear. As a result, teachers tended to engage with numeracy cautiously and selectively, often positioning the teaching of it as the responsibility of mathematics rather than a fully shared responsibility.

Although varied levels of MCK, PCK, and CK appeared to constrain numeracy enactment, knowledge was shaped by teachers' beliefs, confidence, and professional identity. Teachers' responses suggest that knowledge was not simply something they either had or lacked, but something interpreted through perceptions of legitimacy, authority, and responsibility. Their willingness to act on numeracy opportunities depended not only on what they knew, but also on how they understood their role in relation to mathematics as a discipline. The next section, therefore, turns to the affective domain, examining how identity, confidence, and belief systems influenced the enactment of numeracy across subject boundaries.

5.3 Affective Domain

This section examines the findings associated with the affective domain, focusing on teachers' personal conceptions of numeracy, their attitudes towards numeracy, and their perceived level of preparation to embed numeracy across the curriculum. In this study, affect is understood not only as an emotive response but as professional positioning: how teachers feel about numeracy is inseparable from how they locate it within their remit, and whether they feel authorised to enact it.

The following sections are organised around three initial codes within the affective domain: personal conceptions of numeracy, attitudes towards numeracy, and perceived preparation to embed numeracy.

5.3.1 Personal Conceptions of Numeracy

Personal conceptions of numeracy constituted the most prevalent code within the affective domain, accounting for 313 of the 652 coded references (48.0%).

This prominence reflects the central focus of the study regarding how non-mathematics teachers understand and interpret their responsibility for numeracy education. Teachers' conceptualisations of numeracy shape what they recognise as numeracy, where they perceive it to sit within their subject, and how far numeracy is understood as specialist territory or shared practice.

An early questionnaire item invited teachers to define numeracy in their own words. Analysis of these responses suggested three dominant conceptualisations which are summarised in Table 7. While some responses blended elements of more than one category, definitions were grouped according to their dominant framing.

Table 7

Percentage of teachers and their initial conceptualisations of numeracy

Category	Frequency (<i>n</i>)	Percentage (%)
Numeracy as arithmetic/procedural manipulation	13	43.3
Functional or everyday application	11	36.7
Foundational or underpinning competence	6	20.0
<i>Total</i>	<i>30</i>	<i>100.0</i>

The largest group ($n = 13$, 43.3%) conceptualised numeracy in procedural or arithmetic terms. These definitions foregrounded calculation, manipulation, and working with numbers, frequently referencing “addition, subtraction, multiplication and division” (T1), “using numbers and formula[e] to complete calculations” (T9), or “the ability to understand and manipulate numbers” (T18). In these responses, numeracy was closely aligned with operational competence rather than broader reasoning or contextual interpretation. Although some definitions extended to interpreting graphs or data, the emphasis remained on numerical manipulation as a technical skill set.

A second group ($n = 11$, 36.7%) articulated a functional conceptualisation of numeracy, emphasising application in everyday or real-world contexts. Teachers in this category described numeracy as “being able to use numbers in everyday life” (T15) “making sense of the world around us” (T24), or “using numbers to apply to everyday situations such as money” (T13). These responses framed numeracy less as a subset of mathematics and more as a transferable life skill

embedded across contexts. While calculation was still present, it was positioned within a broader social or practical purpose.

The smallest group ($n = 6$, 20.0%) conceptualised numeracy as a foundational competence underpinning learning. These definitions explicitly framed numeracy as the “basic building blocks necessary for mathematics” (T29) or “the concept of what numbers are [and] how they relate to each other” (T2). Rather than focusing only on procedures, these responses emphasised conceptual understanding and described numeracy as underpinning learning across subjects.

At first glance, Table 7 suggests an interesting pattern: Procedural framings constituted the largest group ($n = 13$, 43.3%), exceeding both functional ($n = 11$, 36.7%) and foundational ($n = 6$, 20.0%) conceptualisations, indicating a strong emphasis on arithmetic competence. This positioning appears to align numeracy closely with mathematics as a subject, rather than framing it as a form of reasoning that extends across the curriculum. This aligns with earlier findings, where five out of the six teachers interviewed (83.3%) reported insecurity with foundational mathematical concepts (see Section 5.2.1).

These patterns indicate a continuum of conceptualisations, varied in breadth and orientation. There is some evidence to suggest that teachers’ conceptualisations of numeracy aligned with how they positioned their professional responsibility. For example, teachers who emphasised procedural or arithmetic definitions were more likely to describe their role as limited to supporting or correcting numeracy rather than teaching it explicitly. One teacher defined numeracy as “being able to count and to work with numbers” (T3) and later described their role as:

to make sure they understand enough about numeracy to be able to make sense of my subject...I don’t see it as my responsibility to basically teach somebody how to count...and do basic arithmetic...I’m happy to look at whatever support they need...But I kinda feel that’s extra on what I ought to be doing. It’s not my core role (T3).

In contrast, teachers who foregrounded real-life or applied conceptions of numeracy were more likely to describe active engagement within their subject contexts. For instance, one teacher defined numeracy as “being able to use numbers in everyday life” (T15) and described “helping pupils work out percentages in their questionnaires,” while another emphasised making sense of “the world around us” (T24) and described embedding numeracy through

proportion and measurement in art and photography. However, this relationship was not consistent across all cases. Some teachers articulated broader or blended definitions of numeracy but still expressed uncertainty about how to teach it, suggesting that conceptualisation alone did not determine enactment.

To explore how these conceptualisations were expressed in practice, responses were further analysed across three categories: Content specific to mathematics; Content specific to teachers' curricular fields; and Real-life skills. Content specific to mathematics referred to topics explicitly taught within the mathematics curriculum under CfE. Content specific to teachers' curricular fields captured skills identified as numeracy within their own subject areas. Real-life skills encompassed applications of numeracy beyond the classroom context. Content specific references were further subcoded using the curriculum organiser headings from the CfE Mathematics and Numeracy Benchmarks (Education Scotland, 2017). Using this structure enabled systematic categorisation of responses and facilitated comparison across organisers. For reference, the curriculum organisers are presented in Table 8.

Table 8
Curriculum organisers (Adapted from Education Scotland, 2017)

Curriculum Organiser Header	Curriculum Organisers
Number, Money and Measure	Estimation and rounding Number and number processes Multiples, factors and primes Powers and roots Fractions, decimal fractions and percentages Money Time Measurement Patterns and relationships Expressions and equations
Shape, Position and Movement	Properties of 2D shapes and 3D objects Angle, symmetry and transformation
Information Handling	Data and analysis Ideas of chance and uncertainty

Table 9 presents the distribution of teachers' personal conceptions of numeracy across the three main codes and associated subcodes. Real-life skills were categorised by specific themes (e.g., time, money, cooking), as this provided greater insight than alignment to curriculum organisers, while recognising areas

of overlap. Frequencies in Tables 9 and 10 represent the number of coded references across the dataset rather than the number of individual teachers.

Table 9

Teachers' personal conceptions of numeracy as codes and subcodes

Codes	Subcodes	Frequency
Content specific to mathematics	Number, Money and Measure	275
	Information Handling	123
	Shape, Position and Movement	13
Content specific to their field	Number, Money and Measure	164
	Information Handling	95
	Shape, Position and Movement	11
Real-life skills	Time	63
	Money	60
	Everyday life	55
	Skills for problem solving	30
	Food and/or Cooking	14

As shown in Table 9, Number, Money and Measure attracted the highest number of references across both content-based categories. This indicates that teachers' understandings of numeracy were strongly oriented towards number-focused content. This emphasis was reflected in teachers' descriptions of numeracy, which frequently foregrounded arithmetic processes such as "addition, subtraction, multiplication and division" (T1) and "a basic grasp of arithmetic" (T3). While frequency counts indicate prevalence across the dataset, they do not capture the depth or strength of individual teachers' understandings.

References to Shape, Position and Movement were consistently low across both content-based categories. This suggests that spatial aspects of numeracy were less prominent in teachers' conceptualisations, despite their formal inclusion in the CfE Numeracy framework. References to spatial aspects of numeracy were limited and largely confined to specific subject areas such as art and design or technology, for example: "proportion and perspective" (T24) or "measuring and marking out...scales" (T14). The uneven distribution across curriculum organisers indicates selective engagement with aspects of numeracy rather than a comprehensive conceptualisation. Numeracy, therefore, appeared to be conceptualised primarily through number-centred and data-related domains, with spatial and relational aspects occupying a peripheral position. This selective emphasis reinforces the procedural and number-focused orientation identified in teachers' initial definitions, and aligns with earlier findings in

Section 5.2, where teachers demonstrated greater confidence with applied numerical processes than with broader or less familiar aspects of numeracy.

Table 10 further differentiates the subcodes from Table 9 into curriculum-aligned subtopics. Where individual organisers were infrequently referenced, categories were combined to reflect the data more accurately. For example, estimation and rounding; multiples, factors and primes; and powers and roots were grouped under number and number processes due to minimal representation. Similarly, patterns and relationships and expressions and equations were grouped as Algebra; and properties of 2D shapes and 3D objects was merged with angle, symmetry and transformation to become Shape and Space. In contrast, Information Handling was subdivided into interpreting data; graphs or other visual representations; and statistics due to the high number of references within this organiser.

Table 10
Personal conceptions of numeracy as subtopics in relation to curriculum organisers

Codes	Subcodes	Subtopics	Frequency
Content specific to mathematics	Number, Money and Measure	Numbers and number processes	115
		Fractions, ratio, decimals and/or percentages	64
		Measurement	47
		Algebra	19
		Time	18
		Money	12
	Information Handling	Interpreting data	58
		Graphs or other visual representations	37
		Statistics	28
	Shape, Position and Movement	Shape and space	13
Content specific to their field	Number, Money and Measure	Numbers and number processes	60
		Fractions, ratio, decimals and/or percentages	38
		Measurement	24
		Time	24
		Money	10
		Algebra	8
	Information Handling	Interpreting data	44
		Graphs or other visual representations	28
		Statistics	23
	Shape, Position and Movement	Shape and space	11
Real-life skills	Time		63
	Money		60
	Everyday life		55
	Skills for problem solving		30
	Food and/or Cooking		14

Note: Frequencies represent the number of coded references rather than the number of teachers.

As shown in Table 10, the most frequently referenced subtopics were numbers and number processes; fractions, ratio, decimals and/or percentages; interpreting data; and measurement. This emphasis was reflected in teachers' descriptions of numeracy in practice, which frequently centred on calculations, percentages, and data interpretation. For example, one teacher referred to "graphs, pie charts, calculations involving percentages, [and] ratios" (T13) as elements of numeracy that appear in their subject. This pattern was consistent across a range of subject areas, including science, where teachers referenced "percentage change" and statistical calculations (T11), and social subjects, where interpreting graphs was central to evaluation tasks (T10). The prominence of these subtopics may partially reflect the phrasing of questionnaire prompts, which encouraged teachers to provide concrete examples of numeracy use within their subject areas, potentially foregrounding more visible and routine practices.

Although less frequently referenced in relation to classroom teaching, time and money featured prominently in descriptions of numeracy as a real-life skill. These were commonly framed as transferable competencies developed through schooling and applied beyond the classroom, such as managing finances, interpreting timetables, or engaging in everyday problem-solving. Examples included activities such as "budgeting, shopping, [and] time keeping" (T15) and "scaling a recipe...[or] paying for fuel" (T3), reinforcing the perception of numeracy as a practical life skill. This suggests that while teachers initially offered broad or general definitions of numeracy, further prompts enabled more specific and applied articulations of their conceptions of numeracy within both subject-specific and everyday contexts.

These conceptual patterns are important because they establish the boundaries within which responsibility becomes recognised and enacted. When numeracy is framed primarily as procedural arithmetic (such as calculation, percentages, or data interpretation), explicit instruction can be more readily positioned as mathematics territory. In contrast, where numeracy is framed through real-life or subject-specific applications, such as budgeting, measuring, or analysing data within texts, it becomes easier to locate within wider pedagogical work.

The next section examines how teachers translated these conceptual boundaries into accounts of professional responsibility and whether responsibility was taken

up as pedagogical ownership, framed as contextual support, or deferred as specialist instruction.

5.3.2 Interpreting Responsibility for Numeracy

Teachers were asked directly how they understood their responsibility for numeracy within their professional role. Their responses indicated widespread acknowledgement of numeracy as a whole-school responsibility, but were varied in what this meant in practice. Across the questionnaire responses, 15 teachers (50.0%) explicitly described numeracy as a shared or whole-school responsibility, using phrases such as “a responsibility of all” (T21), “all teachers have responsibility” (T16), or that “both numeracy and literacy are whole-school responsibilities” (T6). These declarative statements suggest strong awareness of institutional expectations and alignment with the CfE framing of numeracy as a shared professional obligation.

However, closer examination reveals important variation in how this responsibility was interpreted and operationalised. While rhetorical endorsement was consistent, enactment was often limited in practice. This highlights a gap between policy alignment and pedagogical enactment. Five teachers (16.7%) explicitly framed their responsibility in reactive or contextual terms, describing their role as drawing attention to numeracy “when it crops up” (T30), “signpost when implementing numeracy skills” (T10), “where we can draw attention to it - we do” (T29), or helping pupils “feel comfortable dealing with numeracy” (T28) within subject-specific contexts. One other teacher positioned their role as “[helping to] ensure basic understanding as it [is] relevant to my subject and correct any misunderstandings to allow pupils to be successful” (T2). These accounts suggest that responsibility was often interpreted as supportive or reinforcing rather than as proactive teaching of numeracy concepts. This distinction is consistent with findings in the knowledge domain, where teachers differentiated between using numeracy within subject contexts and explicitly teaching underlying numerical methods. Therefore, responsibility often appeared constrained by teachers’ confidence in teaching numeracy and their concern about whether it was appropriate within their subject.

Five teachers (16.7%) also conveyed uncertainty or ambivalence. One teacher acknowledged that numeracy is “everyone’s responsibility but I don’t think that translates into practice” (T5), while another noted being “not as clear as I should be” (T1). Uncertainty was particularly evident in relation to tracking and monitoring numeracy development, with one teacher stating: “monitoring and tracking specific aspects of numeracy development - I’m not sure” (T8). Such comments indicate that while the principle of shared responsibility is understood, clarity is needed regarding its practical applications. This was particularly evident in non-STEM related subjects such as English, History, and Art.

In contrast, teachers working in numerically intensive subjects, such as science, were more likely to describe numeracy as inherent within their curriculum, with one teacher noting that “numeracy is inherent in every unit from S1 to S6” (T12). Here, responsibility appeared less contested and more fully integrated into subject identity. This variation indicates that teachers may interpret responsibility differently depending on how numerically oriented they perceive their subject to be.

Overall, these responses indicate that responsibility for numeracy is widely accepted at a declarative level but interpreted conditionally in practice. Teachers rarely rejected the principle of shared responsibility; rather, they negotiated its scope. Responsibility was often framed as contextual, reactive, or bounded by subject relevance and personal confidence. In this sense, policy discourse appears to have been internalised rhetorically, yet filtered through perceptions of competence, clarity, and professional identity. For example, while teachers frequently stated that numeracy was “a responsibility of all” (e.g. T16, T21), this was often followed by more limited descriptions of practice. When asked to identify topics where numeracy is used within their subject area, T16, a technologies teacher, stated: “measuring”, and T21, a social subjects teacher, stated: “looking at graphs, percentages, increases and decreases.” This may indicate that teachers are not resisting numeracy but have a narrower view of where it can be used in their subject. This is reflected in teachers’ accounts of deferring responsibility due to lack of confidence or subject expertise (e.g., T30; T2), rather than outright rejecting the principle of numeracy across learning.

Teachers may accept responsibility in principle while limiting its practical expression to areas that feel aligned with their subject expertise. Understanding how this conditional responsibility intersects with confidence, anxiety, and perceptions of preparedness is, therefore, critical. The following section explores these affective dimensions in greater depth. The quantitative analysis that follows tests whether this conditional responsibility aligns more closely with confidence and anxiety than with engagement in policy documentation.

5.3.3 Confidence, Anxiety, Avoidance, and Identity Positioning

Teachers' attitudes towards numeracy were broadly positive in principle, with 15 teachers (50.0%) explicitly describing numeracy as a shared or whole-school responsibility. However, this was often limited in practice, for example, by teachers who described only addressing numeracy "when it crops up" (T30) or who acknowledged that while numeracy was everyone's responsibility, this "doesn't translate into practice" (T5).

Teachers' attitudes towards numeracy were not simple positive or negative orientations, but a multi-dimensional construct encompassing beliefs, self-perceptions, cultural framing, contextual pressures, and emotional responses. Across the dataset, references clustered most strongly around beliefs, particularly perceptions of responsibility (38 references) and relevance (37 references), alongside self-perceptions of confidence (31 references). This pattern seems to indicate that teachers' attitudes towards numeracy were shaped as much by how numeracy was positioned within their professional role as by how confident they felt engaging with it. For example, teachers frequently affirmed that numeracy was "a responsibility of all" (T21) or that they should help pupils "feel comfortable dealing with numeracy" (T28), while also expressing uncertainty about their own ability to teach it effectively.

Ten teachers (33.3%) framed numeracy in relation to broader contextual influences, including time constraints, assumptions around pupils' prior learning and the availability of professional learning opportunities. For example, one teacher noted that "there just isn't the scope for us to deliver numeracy in classes as we are so stretched for time in History" (T29), while another described "limited opportunities... with regard to teaching time" (T4). Others

highlighted uncertainty about pupils' prior learning, with one teacher explaining:

I think that the basic numeracy skills that they ought to have should have [been taught] at primary and then be augmented in their maths classes...I don't see it as my responsibility to basically teach somebody how to count when they get to secondary school and do basic arithmetic. That's really something they ought to know (T3).

Requests for support were also evident, with teachers calling for "curriculum specific development" (T10) and "practical examples of how our specific courses can use numeracy" (T24). These findings indicate that attitudes towards numeracy were not formed in isolation, but negotiated within existing norms, expectations, and practices.

To capture this complexity, subcodes within attitudes towards numeracy were developed to reflect both internal affective responses (e.g., confidence, enjoyment) and externally mediated influences (e.g., time constraints, accountability, resources). This enabled analysis of how personal beliefs interact with institutional and cultural factors in shaping teachers' engagement with numeracy. Table 11 summarises the coding structure and frequency of references within this theme.

Table 11
Teachers' attitudes towards numeracy as codes and subcodes

Codes	Subcodes	Frequency
Beliefs	Responsibility	38
	Relevance	37
Self-perceptions	Confidence	31
	Ability	8
Culture framing	Issues of culture around numeracy	16
	Professional learning	6
	Pupil prior learning	5
Contextual pressures	Time constraints	10
	Resources	8
	Accountability	5
Emotions	Enjoyment	11

As shown in Table 11, references to beliefs regarding responsibility and relevance were most frequent, followed by confidence. Overtly negative

Initial questionnaire responses suggested moderate but uneven levels of confidence among teachers. Teachers' responses to Likert-scale questions encompassing confidence are presented in Table 12.

Response Category	I am confident I can help students address gaps in their numeracy N (%)	I am confident I can source data or questions to use in lessons N (%)	I am confident in all aspects of numeracy N (%)	I experience anxiety when I teach numeracy N (%)	I do not like dealing with numbers N (%)	I will actively avoid situations involving numeracy N (%)	I do not like making calculations in everyday life N (%)
Strongly disagree	2 (6.7)	0 (0.0)	4 (13.3)	12 (40.0)	13 (43.3)	15 (50.0)	13 (43.3)
Disagree	7 (23.3)	4 (13.3)	3 (10.0)	10 (33.3)	5 (16.7)	7 (23.3)	9 (30.0)
Neutral	3 (10.0)	4 (13.3)	9 (30.0)	6 (20.0)	9 (30.0)	4 (13.3)	6 (20.0)
Agree	10 (33.3)	15 (50.0)	8 (26.7)	2 (6.7)	3 (10.0)	3 (10.0)	2 (6.7)
Strongly agree	8 (26.7)	7 (23.3)	6 (20.0)	0 (0.0)	0 (0.0)	1 (3.3)	0 (0.0)

Note. Percentages are based on total sample (n = 30). Due to rounding, percentages may not total 100.

While 60.0% ($n = 18$) of teachers agreed or strongly agreed that they were confident in helping pupils address gaps in numeracy, 30.0% ($n = 9$) disagreed or strongly disagreed, indicating a considerable split within the sample rather than a uniformly moderate position. In addition, 30.0% ($n = 9$) of teachers selected neutral on key items '*I am confident in all aspects of numeracy*' and '*I don't like dealing with numbers*', which points to a substantial group whose perceived confidence with numeracy was unclear or undecided. Confidence appeared highest in relation to practical engagement, i.e., 'sourcing data or questions to use in lessons' (73.3%, $n = 22$; agree/strongly agree), compared with lower confidence in broader aspects such as '*all aspects of numeracy*' (46.7%, $n = 14$; agree/strongly agree). This pattern was also reflected in qualitative responses, where teachers described feeling "more confident in being able to draw attention to numeracy as it crops up, but not necessarily as confident with teaching the skills" (T30). These distributions may indicate possible relationships between confidence and negative affect. For instance, low reported anxiety (73.3%, $n = 22$) coexists with only moderate confidence in teaching (46.7%, $n = 14$), a pattern explored further in correlational analysis later in this section.

This suggests that teachers distinguished between using numeracy within their subject and teaching it explicitly, with this distinction recurring across both datasets. For example, one teacher explained that they were "very happy correcting obvious mistakes," but that "actively and explicitly teaching it? I've got not a clue how to do that" (T2), while another described being "confident in showing them a method" but reluctant to do so because it was seen as the responsibility of the mathematics department (T3).

In contrast, confidence was weaker in relation to broader or pedagogical aspects of numeracy, particularly supporting pupils with identified gaps. This gradient indicates that teachers may differentiate between using numeracy within their subject and assuming responsibility for developing pupils' numeracy understanding. The distinction between being able to work with numeracy and being able to teach it explicitly emerged as a recurring theme across both questionnaire and interview data.

Responses to negatively worded items further nuance this profile. Most teachers rejected overtly negative positioning: 73.3% ($n = 22$) disagreed or strongly disagreed that they '*actively avoid situations involving numeracy*', 60.0% ($n =$

18) disagreed that they '*do not like dealing with numbers*', and 73.3% ($n = 22$) disagreed that they '*experience anxiety when teaching numeracy*'. Explicit avoidance and dislike were, therefore, rare. However, relatively high proportions of neutral responses (ranging from 13.3% to 30.0%) point to ambivalence rather than secure confidence. Neutrality was particularly evident for statements such as '*I do not like dealing with numbers*' (30.0%, $n = 9$) and '*I experience anxiety when I teach numeracy*' (20.0%, $n = 6$), indicating that a notable minority neither clearly endorsed nor rejected negative affective positioning. Confidence appears context-dependent rather than a stable disposition.

Enjoyment responses reflected a similarly conditional pattern. While most teachers reported some enjoyment in teaching numeracy, this was predominantly moderate, with 53.3% selecting '*somewhat*' and only 26.7% ($n = 8$) reporting enjoyment to a large or great extent. One-fifth of teachers (20.0%, $n = 6$) indicated little or no enjoyment. Open responses illustrate this variation. 21 teachers (70.0%) described specific aspects of numeracy they enjoyed, including "helping pupils relate numeracy to real world problems" (T7), "analysing/evaluating graphs" (T10), "subject-specific calculations" (T11), and "working out rhythm in poetry... [and] percentages in their questionnaires" (T15). In each case, enjoyment was linked to meaningful application within subject contexts.

Conversely, enjoyment appeared to be lower where confidence was less secure. Five teachers (16.7%) explicitly linked reduced enjoyment to uncertainty or lack of familiarity. One teacher stated: "I want to enjoy teaching numeracy, but the lack of confidence that I am accurately teaching/approaching [it] contributes to the lack of enjoyment" (T30), while another noted: "the more advanced the level, the less confident I feel" (T4). Others expressed discomfort with unfamiliar content, such as: "trying to remember equations that I am not familiar with" (T22), or "I'm not particularly confident with numeracy that requires formulas" (T10). Another noted:

I just don't enjoy it. I try to teach my History lessons based on creativity and freedom of approach - which is then contrasted with numeracy having set processes. I don't have the ability to open it up to different focuses (T29).

These responses appear to show that enjoyment was closely tied to perceived competence and pedagogical security.

A recurring boundary emerged between being personally numerate and being able to teach numeracy. This distinction was evident across both datasets. In interview data, all six teachers described some difference between using numeracy and teaching it explicitly. One teacher who selected a neutral response regarding overall confidence described themselves as “still far from confident in terms of numeracy across the curriculum” (T1), expressing uncertainty about basic terminology such as identifying a bar graph. Another reported being “reasonably numerate” (T2) in everyday contexts and confident correcting errors, yet unsure how to teach numeracy explicitly. Questionnaire responses reflected similar patterns, with teachers highlighting aspects of numeracy that they don’t enjoy teaching such as division “not because it is difficult but because pupils often perceive that they can’t do it” (T19), or “how to measure and use a ruler” (T26). In both cases, the teachers had identified as being confident in all aspects of numeracy. These accounts suggest that confidence in teaching numeracy was pedagogically contingent rather than simply a reflection of mathematical ability.

The qualitative responses in Section 5.3.2 suggest that responsibility is commonly endorsed at a declarative level but enacted in limited ways; often as signposting, correcting, or responding “when it crops up” (T30) rather than as planned instruction. This conditional responsibility was repeatedly justified through reference to confidence, fear of error, and uncertainty about methods. To examine whether these affective dimensions formed structured relationships, Spearman’s rho correlations were conducted across confidence, anxiety, avoidance, past enjoyment of mathematics, years of teaching experience, and engagement with curriculum documentation ($n = 30$). Given the ordinal data and small sample size, findings are interpreted cautiously as indicative patterns within this dataset. The correlations are illustrated in Table 13.

Table 13*Spearman's rho correlations between confidence-related items*

	1	2	3	4	5	6	7
1. I am confident I can help students address gaps in numeracy	-	-	-	-	-	-	-
2. I enjoyed mathematics when I was at school	.227	-	-	-	-	-	-
3. I will actively avoid situations involving numeracy	-.614**	-.335	-	-	-	-	-
4. I experience anxiety when I teach numeracy	-.422*	-.263	.578**	-	-	-	-
5. I am confident in all aspects of numeracy	.314	.478**	-.441*	-.719**	-	-	-
6. I have read and/or used the E's and O's	.035	-.052	-.181	-.148	.045	-	-
7. Years of teaching experience	-.148	-.129	.447*	.077	-.164	-.117	-

**. Correlation is significant at the 0.01 level (2-tailed)
 *. Correlation is significant at the 0.05 level (2-tailed)

A strong negative association was identified between anxiety when teaching numeracy and confidence in all aspects of numeracy ($r_s = -.719$, $p < .001$). Anxiety was also moderately negatively associated with confidence in helping pupils address gaps ($r_s = -.422$, $p = .020$). Teachers reporting higher anxiety tended to report lower confidence. In addition, anxiety was strongly positively associated with avoidance of numeracy-related situations ($r_s = .578$, $p < .001$), while avoidance was negatively associated with confidence in all aspects of numeracy ($r_s = -.441$, $p = .015$) and strongly negatively associated with confidence in helping pupils address gaps ($r_s = -.614$, $p < .001$). These findings indicate that anxiety, avoidance, and confidence are strongly associated within the dataset, forming an interconnected pattern of relationships. However, these associations are correlational in nature and do not imply causation.

Importantly, avoidance did not emerge qualitatively as rejection of numeracy itself. Instead, it appeared to function as a cautious or protective response. Teachers described limiting their engagement to familiar contexts, such as signposting “when implementing numeracy skills” (T10) or avoiding explicit teaching where they felt uncertain or risked contradicting established methods (T3). In this sense, avoidance appeared to reflect pedagogical caution.

Further associations illuminate the historical dimensions of affective positioning. Past enjoyment of mathematics at school was moderately positively associated with current confidence in all aspects of numeracy ($r_s = .478$, $p = .008$), suggesting that past experiences continue to shape self-perception. Additionally, years of teaching experience were positively associated with avoidance ($r_s = .447$, $p = .013$) indicating that more experienced teachers were more likely to report cautious positioning. While this does not imply causation, it may suggest that teachers' positioning towards numeracy becomes more established over time, possibly reflecting when they entered the profession and how strongly cross-curricular expectations featured in their early career.

In contrast, engagement with curriculum documentation (reading/using the numeracy E's and O's) was not significantly associated with confidence or anxiety. This supports earlier findings that teachers could reproduce policy expectations ("responsibility of all") without this translating into affective security or pedagogical confidence (see Section 5.3.2).

Additionally, Spearman's rho analyses were conducted to explore potential relationships between affective measures and other background variables, including teaching qualification, numeracy input during ITE, and probationary-year numeracy inputs. No further statistically significant relationships were identified and were, therefore, not interpreted further. In particular, teaching qualification and reported ITE preparation were not significantly associated with confidence, anxiety, or avoidance measures. This suggests that affective positioning towards numeracy in this sample was not strongly patterned by formal qualification or reported training experiences.

Taken together, the findings demonstrate that teachers' affective engagement with numeracy is structured and patterned rather than incidental. These findings suggest that confidence may be a central factor in teachers' accounts, shaping how beliefs about responsibility are translated into enjoyment, anxiety, and avoidance. Teachers did not reject numeracy in principle; rather, their engagement was conditional, shaped by perceived competence, clarity, and confidence in their role.

5.3.4 Beliefs, Statistical Literacy, and Perceived Competence

While earlier analysis identified anxiety as an important correlate of perceived numeracy self-efficacy, further examination of teachers' beliefs about statistics and their applied statistical literacy provides a more nuanced understanding of how confidence is shaped by broader cultural and knowledge-based factors. Questionnaire responses indicate that teachers' beliefs about numeracy and statistics were largely positive and centred on relevance, realism, and social utility. This was reflected in teachers' descriptions of numeracy as "being able to use numbers in everyday life" (T15) and "making sense of the world around us" (T24), as well as references to applying numeracy to real-world contexts such as money, data, and decision making. The quantitative findings are presented in Table 14.

Table 14
Teachers' views of probability and statistics in real-life

Response Category	You need to know about statistics to be an intelligent consumer N (%)	I can easily read and understand graphs and charts in newspaper articles N (%)	I can understand almost all statistical terms in newspapers or television N (%)	Understanding probability and statistics is becoming increasingly important in our society N (%)	Statements about probability such as the odds of winning the lottery seem very clear to me N (%)	People who have contrasting views can each use the same statistics to support their view N (%)	I could easily explain how an opinion poll works N (%)
Strongly disagree	1 (3.3)	0 (0.0)	1 (3.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Disagree	5 (26.7)	0 (0.0)	3 (10.0)	3 (10.0)	4 (20.0)	1 (3.3)	1 (3.3)
Neutral	7 (23.3)	2 (6.7)	4 (13.3)	10 (33.3)	11 (36.7)	9 (30.0)	5 (16.7)
Agree	16 (53.3)	12 (40.0)	12 (40.0)	8 (26.7)	9 (30.0)	14 (46.7)	16 (53.3)
Strongly agree	1 (3.3)	16 (53.3)	10 (33.3)	9 (30.0)	0 (0.0)	6 (20.0)	8 (26.7)
<i>Note. Percentages are based on total sample (n = 30). Due to rounding, percentages may not total 100.</i>							

Agreement was relatively high that people with contrasting views can use the same statistics to support their position (66.7%, $n = 20$), that understanding probability and statistics is increasingly important in society (56.7%, $n = 17$), and that knowledge of statistics is necessary to be an intelligent consumer (56.6%, $n = 17$). These responses align with a conception of numeracy applying to real-life situations as a tool for interpreting public discourse, navigating media claims, and making informed decisions, rather than solely as a computational skill.

However, notable proportions of neutral responses were evident across these belief items. Neutral responses ranged from 6.7% to 36.7%, indicating that although numeracy was broadly valued in principle, endorsement was not uniformly strong. The presence of ambivalence raises questions about the depth and stability of these beliefs, particularly regarding classroom enactment. This ambivalence was reflected in some teachers' uncertainty about their own understanding, with one noting that they were "not as clear as [they] should be" (T1) about their responsibility to numeracy.

While endorsement of statistics as socially important was broadly positive, self-reported competence in interpreting graphs and statistical terminology was even stronger, suggesting that teachers perceived themselves as capable statistical consumers. However, responses relating to probabilistic reasoning showed higher levels of neutrality and disagreement, indicating uneven confidence across statistical domains. For example, while 93.3% ($n = 28$) of teachers described confidence in interpreting graphs and data in newspaper articles, and 80.0% ($n = 24$) reported confidence in explaining opinion polls, far fewer (30.0%, $n = 9$) expressed clarity about probabilistic reasoning or concepts such as odds and uncertainty. This indicates substantially lower confidence in probabilistic reasoning. The strong recognition (66.7%, $n = 20$) that contrasting views can be supported by the same statistical evidence further reflects awareness of the interpretive and rhetorical dimensions of data use. These patterns indicate that statistical literacy was both valued and partially secure but differentiated across contexts.

To explore whether such beliefs were associated with teachers' perceived competence, Spearman's rho correlations were conducted across relevant Likert-scale items ($n = 30$). Given the ordinal nature of the data and the small sample size, findings are interpreted cautiously as indicative patterns within this dataset. These correlations are shown in Table 15.

Table 15

Spearman's rho correlations between perceived confidence and real-life situations relating to probability and statistics

	1	2	3	4	5	6	7	8
1. I am confident in all aspects of numeracy	-	-	-	-	-	-	-	-
2. You need to know about statistics to be an intelligent consumer	-.032	-	-	-	-	-	-	-
3. I can easily read and understand graphs and charts in newspaper articles	.434*	-.025	-	-	-	-	-	-
4. I understand almost all statistical terms in newspapers or television	.586**	.243	.555**	-	-	-	-	-
5. Understanding probability and statistics is becoming increasingly important in our society	.299	.284	.193	.426*	-	-	-	-
6. Statements about probability such as the odds of winning the lottery seem very clear to me	.405*	.195	.414*	.681**	.609**	-	-	-
7. People who have contrasting views can use the same statistics to support their view	.312	.522**	.306	.530**	.253	.316	-	-
8. I could easily explain how an opinion poll works	-.050	-.071	.186	.301	-.006	.177	.530**	-
**. Correlation is significant at the 0.01 level (2-tailed)								
*. Correlation is significant at the 0.05 level (2-tailed)								

Confidence in all aspects of numeracy was positively associated with self-reported ability to read and understand graphs and charts in newspaper articles ($r_s = .434$, $p = .016$), understanding of statistical terms in newspapers or television ($r_s = .586$, $p < .001$), and clarity regarding probability statements such as lottery odds ($r_s = .405$, $p = .026$). These relationships suggest that teachers who reported greater overall numeracy confidence also perceived

themselves as more competent in interpreting and making sense of statistical information in real-life contexts. These correlations indicate that perceived competence in applied statistical contexts formed an important component of teachers' broader numeracy confidence. Notably, no statistically significant association was observed between overall numeracy confidence and endorsement of statistics as necessary for informed consumption ($r_s = -.032$, $p = .869$). This suggests that valuing statistics does not correspond to perceived competence. While these associations do not indicate causal direction, they indicate that teachers' perceived numeracy confidence and applied statistical literacy are closely intertwined within this sample.

Strong associations were also evident among the statistical literacy items themselves. Understanding statistical terms was positively correlated with the ability to read graphs and charts ($r_s = .555$, $p < .001$), with perceiving probability as increasingly important in society ($r_s = .426$, $p = .019$), with clarity around probability statements ($r_s = .681$, $p < .001$), and with recognising that people with contrasting views can use the same statistics to support their position ($r_s = .530$, $p = .003$). Similarly, perceiving probability and statistics as socially important was strongly associated with clarity regarding probability statements ($r_s = .609$, $p < .001$). These correlations indicate that applied statistical competence, epistemic awareness, and recognition of the social use of statistics may form a coherent cluster within the dataset. Teachers who perceived themselves as statistically literate were also more likely to endorse nuanced understandings of how statistics function in public discourse.

Negative associations further illuminate this pattern. Self-reported ability to read graphs was negatively correlated with agreement that weather forecasts are often so inaccurate that they should not be taken seriously ($r_s = -.544$, $p = .002$), and understanding statistical terms was similarly negatively associated with this sceptical position ($r_s = -.395$, $p = .031$). Teachers who reported stronger statistical literacy were, therefore, less likely to dismiss probabilistic information outright, suggesting a more sophisticated engagement with uncertainty rather than categorical scepticism. Statistical understanding appears linked to critical appraisal rather than distrust. The strongest association was between understanding statistical terms and clarity regarding probability

statements ($r_s = .681$, $p < .001$), indicating that conceptual understanding may underpin confidence in probabilistic reasoning.

Qualitative data reinforce and contextualise these quantitative relationships. Teachers consistently framed numeracy as a life-skill connected to citizenship, media literacy, and everyday decision-making, for example, describing it as “being able to use numbers in everyday life” (T15) or applying it to contexts such as budgeting (T1; T5; T6; T11; T15; T18; T23; T26; T29) and interpreting data (T1; T3; T4; T5; T10; T11; T12; T13; T21; T23). This alignment between statistical literacy and civic participation mirrors the quantitative clustering observed between applied competence and endorsement of statistics as socially important. However, qualitative accounts also reveal that endorsement of importance did not automatically translate into pedagogical ownership. This was evident in teachers’ descriptions of their role as limited to highlighting or applying numeracy, rather than teaching it explicitly, for example, addressing numeracy when it occurs naturally in a lesson (T30) or focusing on ensuring “basic understanding as it [is] relevant to my subject” (T2). Teachers frequently described numeracy as important, but their engagement with it in practice was often limited by subject traditions, time pressures, or uncertainty about how to teach it.

Cultural narratives further shaped this positioning. Two teachers noted in interview that it is socially acceptable to admit difficulty with numeracy in ways that would be unacceptable for literacy. For example, T4 argues that it is “more socially acceptable” to say, “I’m not very good with numbers,” whereas “nobody ever says I’m not very good with words.” Related to this point, T2 described a persistent dichotomy in which people are positioned as either a “maths person” or an “English person,” arguing that this view can be detrimental for pupils. T1 argued that parents still say: “I was rubbish at maths at school” and highlights the impact that this can have on young people. This cultural framing appeared to be internalised by some teachers, with T5 noting: “I don’t feel like I would be good at...explaining it because I’m not a maths teacher,” positioning numeracy as specialist knowledge beyond their remit. This normalisation of mathematical insecurity contributes to the positioning of numeracy as specialist or technical rather than universally expected. Within school contexts, numeracy was often described as culturally located within mathematics departments, reinforcing a

distinction between recognising the importance of statistics and assuming responsibility for teaching it. Taken together, the quantitative findings suggest a close relationship between confidence, applied statistical literacy, and awareness of how statistics are used. However, the interview data show that this does not necessarily translate into classroom practice, as structural and cultural conditions also shape teachers' engagement.

Assumptions about pupil prior learning, concerns about technology dependence, limited professional learning, and curriculum overload further constrained engagement. One teacher described numeracy as “the last thing that’s going to be on people’s minds” (T5) in the absence of accountability or concrete guidance. Even those who valued statistical reasoning emphasised that, particularly in senior phases, subject content and examination demands dominated their priorities. As one teacher stated: “when we get to S4/S5, numeracy isn’t my priority...my priority has got to be my subject” (T2). This may indicate that teachers’ beliefs and confidence are also shaped by the specific contexts in which they are expected to teach numeracy.

Overall, the analysis indicates that teachers’ beliefs about statistics are broadly aligned with perceptions of applied competence, forming a consistent pattern linking confidence, statistical literacy, and understanding of how statistics are used in everyday contexts. However, qualitative evidence demonstrates that this pattern is mediated by cultural framing, professional identity, and structural constraint. Numeracy was widely recognised as socially important, yet its enactment in practice was often conditional. Confidence appears to be a key mediator between declarative responsibility and enacted responsibility. These findings reinforce the interpretation that affective positioning towards numeracy is structured and relational rather than incidental, shaped by the interaction of competence, belief, culture, and context rather than by attitude alone. This suggests that affective positioning does not operate independently of the knowledge structures identified in Section 5.2 but interacts with them. As confidence emerged as a key factor, the preparation available to teachers appeared to influence whether it was strengthened or constrained.

5.3.5 Perceived Preparation to Embed Numeracy

Teachers' perceived preparation to embed numeracy was varied and inconsistent rather than clear or uniform, with 30.0% ($n = 9$) reporting no professional learning and others describing provision as "so light touched it was frightening" (T1). Instead, it was closely intertwined with reported experiences of professional learning, confidence, and clarity of expectations. Across the dataset, initial teacher education was frequently described as limited, absent, or insufficiently focused on numeracy. While one-third of teachers reported some ITE input ($n = 10$, 33.3%), this was often characterised as superficial or awareness-raising rather than as preparation for classroom practice. As one teacher reflected, numeracy during ITE "just doesn't prepare you for that responsibility of all" (T1) and later argued that "a numeracy expert would definitely develop my skills." Another teacher noted that numeracy "didn't feature...at all" in their PGDE (T6).

This pattern becomes more pronounced when considered alongside questionnaire data (Table 16). Although 30.0% ($n = 9$) of teachers reported no engagement with numeracy-related professional learning, a substantial majority ($n = 26$, 86.7%) indicated that they would or might benefit from it. This contrast suggests a clear mismatch between provision and perceived need, indicating that limited engagement with professional learning is unlikely to reflect lack of interest or resistance, but rather insufficient access to relevant, sustained, or practically applicable opportunities. In this sense, perceived preparedness appears to be shaped less by teachers' disposition and more by the availability and quality of professional learning within their institutional context.

Table 16
Teachers' professional learning experience

Type of Professional Learning	Frequency (n)	Percentage (%)
Numeracy professional learning during ITE	10	33.3
Probationer teacher numeracy professional learning	8	26.7
Local authority numeracy professional learning	6	20.0
Personal numeracy professional learning	4	13.3
Other	5	16.7
None	9	30.0

*Note: Frequencies are the number of teachers who selected each option
Percentages are based on $n = 30$ for each type of professional learning*

Questionnaire data indicate that opportunities for formal professional learning in numeracy were limited across all stages of teachers' careers. Only one-third of teachers ($n = 10$, 33.3%) reported receiving any numeracy input during initial teacher education (ITE), with this figure dropping to 26.7% ($n = 8$) during their probationary year. Engagement with local authority professional learning was lower ($n = 6$, 20.0%), and fewer still ($n = 4$, 13.3%) reported undertaking personal professional learning related to numeracy. Notably, 30.0% ($n = 9$) of teachers indicated that they had received no professional learning related to numeracy at all. These patterns provide important context for teachers' accounts of feeling underprepared to embed numeracy within their teaching.

As noted in Figure 1 (see Section 4.4), the majority of teachers ($n = 22$, 73.3%) reported more than ten years of teaching experience. For these teachers, ITE occurred over a decade ago, and for some this may have been within earlier curricular and policy contexts. The implementation of CfE in 2010 formally positioned numeracy as a shared, cross-curricular responsibility. Teachers who completed ITE prior to this policy shift are unlikely to have experienced structured preparation for "responsibility of all" numeracy within their training. This was reflected in interview accounts, where teachers described numeracy as either minimally addressed or entirely absent during ITE. One teacher recalled that numeracy was absent in their PGDE, noting that awareness of cross-curricular expectations only emerged during their probationary year (T6) (T6 noted in interview that their probation year coincided with the first year of CfE). Reported gaps in preparation may, therefore, reflect the fact that some teachers completed their training before these policy expectations were introduced. Reflections on ITE provision should, therefore, be interpreted as historically situated accounts rather than as commentary on current programme design. This historical dimension is explored in greater depth in Section 5.5.

Responses to questionnaire items exploring the perceived value of professional learning further illustrate the tentative and uneven nature of teachers' preparation. When asked whether they would benefit from professional learning in numeracy, 14 teachers (46.7%) indicated that they would benefit from professional learning and 12 teachers (40.0%) said they might benefit. Only four teachers (13.3%) indicated that they would not benefit from additional professional learning. Reasons cited include "I have excellent numeracy skills"

(T28), “feel competent” (T14), or where numeracy is embedded within their subject and they do not feel additional support would be necessary (T11; T22). For the teachers who said they might benefit from professional learning, their responses suggested uncertainty about the relevance, purpose, or potential impact rather than resistance, indicating that teachers were unsure what numeracy-focused professional learning would involve or that its value would depend on subject-specific relevance and practical application (e.g., “perhaps subject-specific ways...” (T15); “more subject-specific examples...” (T27)). Even where numeracy appeared in probationary programmes or local authority provision, it was often described as tokenistic, brief, or disconnected from classroom practice. For example, one teacher described receiving only “an hour session on numeracy for a full year” (T1), and opportunities to apply numeracy strategies were described as “a wee bit limited” (T3), reinforcing perceptions that provision lacked relevance to classroom practice.

To explore whether perceived need for professional learning was associated with prior exposure, Spearman’s rho correlations were conducted across professional learning variables.

Table 17

Spearman’s rho correlations between professional learning exposure and perceived benefit from professional learning

	1	2	3
1. None (no professional learning)	-	-	-
2. Local authority professional learning	-.327	-	-
3. I would benefit from professional learning	.368*	-.369*	-
*. Correlation is significant at the 0.05 level (2-tailed)			

Correlational analysis in Table 17 further clarifies this pattern. Teachers who reported no professional learning in numeracy were significantly more likely to indicate that they would benefit from such support ($r_s = .368$, $p = .045$), while those who had participated in local authority professional learning were less likely to express this need ($r_s = -.369$, $p = .045$). This appears to show that perceived need for further preparation was more closely associated with access to structured professional learning than with experience or qualification alone. Notably, professional learning engagement was not significantly associated with years of teaching experience or qualification route, indicating that preparedness

was varied for other reasons rather than cohort-bound. These findings reinforce qualitative accounts in which teachers described recognising gaps in their preparation without rejecting the principle of shared responsibility for numeracy.

Quantitative analysis further suggests that this cautious positioning may be shaped by professional trajectory. A moderate positive association was identified between years of teaching experience and reported avoidance of numeracy-related situations ($r_s = .447$, $p = .013$) (see Table 13). Within this sample, more experienced teachers were more likely to report avoidance behaviours. While this does not imply causation, it raises the possibility that professional identities consolidated prior to the policy positioning of numeracy as a cross-curricular responsibility, may be more resistant to reinterpretation. This correlation should be interpreted cautiously, but it could indicate that teachers' preparation and classroom practice might be shaped not only by access to professional learning, but also by how established their subject identities are.

During interview, three teachers (50%) questioned the assumption that holding a qualification in mathematics was sufficient preparation for teaching numeracy across the curriculum. One teacher noted that reliance on qualification masked gaps in teachers' own numeracy understanding, arguing that teacher knowledge of numeracy was often treated as an implicit expectation rather than an area requiring targeted professional learning: "[numeracy is] not given enough prominence and people aren't skilled up enough, and they rely on having a qualification, like a Higher maths...as a guarantee of being proficient at a certain level of numeracy" (T4). Another questioned whether or not all teachers "have the necessary skills to be teaching young people numeracy" (T1). Another teacher argued: "I think that teachers need to be trained up on [numeracy] as well. It would be really interesting to see what the basic numeracy of the average teacher is" (T5). This suggests that teachers may be unsure whether holding a formal mathematics qualification translates into pedagogical readiness to teach numeracy across the curriculum.

Teachers consistently expressed a desire for clarity and practical guidance rather than additional workload. Interview and questionnaire data indicated that teachers wanted support in understanding how numeracy was taught elsewhere in the school, particularly in mathematics, in order to align language, methods,

and expectations (e.g. T21; T23). One teacher described difficulty navigating inconsistent terminology when “the SQA dictate different language for the same skills” (T23), while others called for clearer exemplification and shared approaches, such as “consistent approaches to teaching numerical skills” (T11) and “more subject-specific examples” (T27). There was also evidence of uncertainty regarding assessment, with one teacher highlighting the need to link tasks to Benchmarks in order to “make assessment judgements across the school” (T30). The absence of such guidance contributed to uncertainty about how to plan, teach, and assess numeracy within non-mathematics subjects.

Perceived preparation was also shaped by teachers’ own educational experiences. Several teachers expressed uncertainty about newer pedagogical approaches to numeracy, particularly where these differed from how they themselves had been taught. This uncertainty was often linked to concerns about pedagogical accuracy and the risk of confusing pupils, with one teacher noting they were “reluctant to [explain it] ... because I don’t want to confuse them” (T3). As a result, some teachers avoided explicit instruction even when numeracy was present within their subject.

Assumptions about pupils’ prior learning further influenced teachers’ sense of preparedness. Teachers described feeling ill-equipped to address gaps in foundational understanding, particularly when pupils experienced significant difficulty. One teacher reflected this uncertainty, stating: “I don’t know how to teach you how to do this... do I sing you a song?” (T2). Others linked this to subject boundaries, expressing a lack of confidence in teaching beyond their specialism, for example: “I don’t feel like I would be good at... explaining it because I’m not a maths teacher” (T5). These accounts indicate that uncertainty did not lead to disengagement, but rather to cautious and often reactive approaches to numeracy within non-mathematics lessons.

Despite these challenges, some teachers identified experiences that enhanced their sense of preparation. These were often rooted in personal or informal learning rather than structured provision. For example, one teacher linked their confidence to prior attainment, noting “I used to be quite good at maths...so I don’t hate it” (T5), while another described revisiting subject knowledge independently, stating they had “started to work through Higher maths again...to brush up on my skills” (T3). Others highlighted the value of collegial support,

with one teacher explaining they had “gone to the maths department...[who were] very approachable” (T2). However, such experiences were unevenly distributed and largely dependent on individual initiative rather than formal provision. As one teacher noted, engagement with support “would have to come from me...it’s not like it’s signposted in a very clear way” (T5), while another acknowledged that they had “never found the time to actually go and look for stuff” (T3). This seems to indicate that opportunities to develop numeracy practice were contingent more on personal motivation than embedded within school structures.

Overall, the findings indicate that teachers’ perceived preparation to embed numeracy was shaped less by unwillingness and more by limited access to coherent, sustained professional learning, particularly during initial teacher education and early career stages. While teachers generally expressed openness to developing their practice, uncertainty about expectations, pedagogy, and support structures constrained confidence and limited engagement. Preparation to embed numeracy, therefore, emerged as variable, fragmented, and highly context-dependent across the dataset. In this sense, preparation operates as a structural counterpart to the confidence patterns identified in Section 5.3.3, shaping whether declarative responsibility translates into enacted practice. Importantly, preparation appeared to be shaped not only by access to professional learning, but by historically situated training experiences and the consolidation of professional identities over time. These temporal dimensions complicate simplistic interpretation of preparedness as either individual deficit or policy failure.

5.3.6 Summary of Findings in the Affective Domain

Findings from the affective domain indicate that the teachers’ engagement with numeracy was shaped less by resistance and more by how numeracy was conceptualised, positioned, and experienced professionally. Conceptions ranged from narrow procedural framings (arithmetic and calculation) to broader functional understandings (transferable, real-world competence). These distinctions appeared to be important. Procedural framings were more likely to locate numeracy within mathematics as specialist territory, whereas broader

framings were more likely to support recognition of numeracy within subject practice.

Although teachers expressed near-universal endorsement of numeracy as a whole-school responsibility, enactment was typically conditional. Responsibility was most often framed as reactive support, addressing numeracy “when it crops up” (T30), rather than as planned instruction. This gap between policy rhetoric and classroom practice suggests that responsibility was mediated by perceptions of legitimacy, subject identity, and the perceived risks of teaching inaccurately.

Affective positioning appeared to be strongly influenced by confidence.

Quantitative and qualitative findings converged to show that confidence, anxiety, and avoidance formed an interconnected cluster, with avoidance functioning as a protective response to pedagogical uncertainty. Confidence was highest where numeracy aligned with subject-relevant contexts and lowest where teachers anticipated the need for explicit instruction or addressing gaps in pupil understanding. These patterns were further shaped by professional biography, with prior positive experiences of mathematics associated with higher confidence, and greater teaching experience associated with more cautious or avoidant positioning.

Teachers’ responses to probability and statistics further illustrate the distinction between valuing numeracy and feeling equipped to enact it. While numeracy was widely recognised as socially important, confidence was uneven across domains, with greater confidence in data interpretation than in probabilistic reasoning. Correlational analysis indicated that confidence aligned more closely with perceived competence than with belief endorsement alone.

Perceived preparation to embed numeracy was limited and fragmented, reflecting uneven access to professional learning, unclear expectations, and a lack of shared pedagogical approaches. Teachers without prior professional learning were more likely to express a need for it, suggesting that preparedness was shaped by access rather than experience alone. These accounts must also be understood in relation to policy timing, as some participants completed initial teacher education prior to the introduction of CfE.

Overall, constraints on cross-curricular numeracy were driven by conditional legitimacy. Teachers’ willingness to enact responsibility was mediated by how

numeracy was understood, how safe it felt to teach, and whether coherent support structures were available. In this sense, these findings appear to show that confidence may function as a form of professional authorisation, shaping whether numeracy was enacted or deferred. This authorisation was not individually determined but socially negotiated within departmental cultures, policy discourses, and collegial practices. The following section, therefore, examines how these social contexts shape the enactment of numeracy across the curriculum.

5.4 Social Domain

This section explores findings related to the social domain, which encompasses the influence of school communities and professional networks on teachers' identities as teachers of numeracy. Teacher practice does not appear to develop in isolation but rather is shaped through interaction with colleagues, departmental cultures, leadership expectations, and shared professional norms. Within the context of cross-curricular numeracy, these social influences are particularly salient, as responsibility for numeracy is distributed across subject areas and often requires collaboration, shared understanding, and school support. The analysis considers how professional relationships, departmental structures, and whole-school approaches contribute to or constrain teachers' engagement with numeracy and how these social conditions shape perceptions of legitimacy, competence, and responsibility.

5.4.1 School Communities

Teachers' accounts indicate that school communities play an important role in shaping how numeracy is understood, prioritised, and enacted across the curriculum. Across both interview and questionnaire data, departmental cultures, leadership signals, expectations placed on staff, and opportunities for collaboration emerged as interrelated features of school life that collectively shaped teachers' engagement with numeracy. In this sense, teachers' enactment of numeracy was not solely an individual matter, but was mediated through shared norms, professional relationships, and institutional structures.

Departmental culture was identified by seven teachers (23.3%) as influential in shaping whether numeracy was perceived as relevant within particular subject areas. These teachers described numeracy as being culturally positioned within schools as the responsibility of mathematics departments, with this shaping what teachers felt professionally authorised to teach in their own classrooms. For example, one teacher explained: “I kind of feel that that’s something the maths department does” (T3), while another stated: “I don’t feel like I would be good at maybe explaining it because I’m not a maths teacher” (T5). This positioning appeared to constrain teachers’ sense of ownership, even where numeracy was present within their subject. In questionnaire responses, one teacher similarly argued that schools need to “break the mindset that it is just for maths and science teachers” (T26), highlighting the persistence of subject-bound assumptions about responsibility.

Only two teachers (6.7%) reported encountering resistance or disengagement from colleagues who viewed numeracy as unrelated to their subject. As one teacher noted, “some of my colleagues are like, ‘oh it has nothing to do with numeracy, English, and we shouldn’t have to do it’” (T5). However, 12 teachers (40.0%) identified multiple numeracy-rich opportunities within subjects not traditionally associated with numeracy. For example, English teachers referred to timelines, ratios, dates, and statistical interpretation within their practice (e.g., T5; T15; T30), as well as analysing evidence and structuring arguments using quantitative data (T4). Teachers in humanities subjects highlighted the use of graphs, percentages, and numerical evidence to support evaluation and interpretations (e.g., T1; T10; T29). In languages, numeracy was linked to time, currency conversion, and survey data (e.g., T17; T25), while in the arts, teachers identified applications in proportion, scale, and measurement, including technical processes such as photography settings (e.g., T24; T26). These examples suggest that numeracy was recognised as embedded within a range of subject-specific practices, even where it was not always framed as explicit instruction. In contrast, five teachers (16.7%) in subjects such as science and computing described numeracy as integral to their curriculum, referring to it as “embedded” (T13) or “inherent in every unit from S1 to S6” (T12). In these contexts, numeracy did not require justification and was more readily enacted as part of routine practice. These contrasts may indicate that departmental

identities and traditions mediate how numeracy is conceptualised and enacted, resulting in uneven integration across subject areas.

Leadership influence was described by several teachers in terms of priority-setting and accountability. While some teachers referred to school-level initiatives or discussions around numeracy, others described leadership engagement as limited or largely symbolic. One teacher characterised numeracy initiatives as “performative,” explaining that although numeracy is often discussed as a priority, it “never feels like a proper shift in how we look at these things” (T5). Similarly, questionnaire responses indicated that there had been “lots of talk about doing things regarding numeracy across the curriculum but very little appears to come from it” (T23). Other teachers pointed to a lack of practical support or follow-through, noting that while expectations may exist, “little training is available to help teachers with this” (T27). The absence of sustained accountability appeared to reduce its status relative to competing priorities. As one teacher explained: “it’s the last thing that’s going to be on people’s minds because there’s no real accountability” (T5). These accounts suggest that leadership communicates priorities not only through policy statements, but through what is actively reinforced, monitored, and revisited in practice.

Five teachers (16.7%) described expectations as ambiguous. Although numeracy was widely acknowledged as a “responsibility of all,” teachers reported uncertainty about what this meant in practice. One teacher stated plainly: “No... there’s no clear vision” (T5), when asked whether expectations were clear. Questionnaire responses echoed this uncertainty, with teachers calling for “curriculum specific development” (T10) and clearer guidance on “how to support staff to understand their role in teaching numeracy” (T26). In this context, numeracy was often displaced by competing demands, particularly in the senior phase where subject content and assessment pressures dominate. One teacher noted that “there just isn’t scope” to prioritise numeracy within limited teaching time (T29). These findings seem to indicate that a fundamental issue was teachers lacking clarity about how numeracy should be enacted within their subject.

Opportunities for collegiate planning and collaboration further shaped engagement. Several teachers described relying on mathematics departments

for support, often through informal consultation. For example, one teacher described approaching colleagues in the mathematics department to clarify expectations, explaining that they “went to the maths department and said, ‘OK, this is what I think it’s asking me. Am I right?’” (T2). These relationships were generally described as supportive, with maths colleagues seen as approachable and willing to explain (T2). Questionnaire data similarly indicated that several teachers would consult mathematics colleagues when needed (e.g., T4; T8; T24; T25; T26). However, collaboration was frequently ad hoc and dependent on personal initiative rather than clear support structures. One teacher reported that they “wouldn’t consult with anyone else” (T15), while another noted that they “usually don’t consult others even though I should,” (T30), citing limited planning time and lack of timetable overlap with specialist staff.

Even where professional learning or collaboration occurred, it sometimes exposed further uncertainty, particularly around differing pedagogical approaches and terminology. Teachers described inconsistency in how numeracy was taught across subjects, as well as limited visibility of progression across stages. As one teacher noted, it would be helpful to know “what they’ve been taught and how they’ve been taught it” (T3). Questionnaire responses reinforced this, with teachers highlighting differences in language and approaches between subjects, particularly where “the SQA dictate different language for the same skills” (T23). These inconsistencies appeared to undermine confidence and made it more difficult for teachers to align their practice with that of mathematics departments.

Overall, the findings suggest that school communities can shape teachers’ engagement with numeracy through shared norms, strong leadership, clarity of expectations, and access to collaborative support. Where departmental cultures legitimised numeracy, leadership reinforced its importance, and collaboration was accessible, teachers described greater willingness to engage. Conversely, where expectations were ambiguous, accountability limited, and collaboration informal or time-constrained, numeracy was more likely to be treated as peripheral. In this way, school communities may have influenced whether numeracy was enacted as a collective responsibility or treated more as an individual, and often specialist, concern.

5.4.2 Disciplinary Positioning and Subject Differences

To explore whether the affective patterns identified in Section 5.3 varied across disciplinary groupings, descriptive analysis was undertaken of teachers' reported confidence, anxiety, avoidance, enjoyment of teaching numeracy, and their prior enjoyment of mathematics. For the purposes of this analysis, each participant was assigned a single disciplinary grouping based on their main substantive curricular subject. Given the small and unequal numbers within these disciplinary groupings, mean scores are presented only to describe patterns within this particular sample. No inferential test of differences between groups was conducted, and the findings should not be interpreted as demonstrating statistically significant differences between disciplines or as generalisable beyond the participants in this study. These descriptive patterns are summarised in Table 18.

Table 18

Mean scores and standard deviations for selected affective questionnaire items by disciplinary grouping

Discipline	n	Confidence addressing gaps	Anxiety teaching numeracy	Avoidance of numeracy	Enjoyment teaching numeracy	Enjoyed mathematics at school
		M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
Art & Design	2	4.00 (0.00)	2.00 (0.00)	2.00 (0.00)	3.00 (0.00)	4.00 (1.41)
Computing, Business & IT	5	4.60 (0.55)	1.20 (0.45)	1.20 (0.45)	4.00 (1.00)	3.40 (1.82)
Science	6	4.17 (0.98)	1.50 (0.84)	1.33 (0.52)	3.17 (0.98)	3.83 (1.33)
Social Subjects	4	2.50 (1.00)	2.00 (0.82)	2.75 (0.96)	2.25 (0.96)	2.00 (0.82)
English & Media	5	1.60 (0.55)	2.40 (1.14)	2.60 (1.67)	2.80 (0.84)	3.80 (1.10)
Languages	3	3.33 (1.53)	2.00 (1.00)	3.00 (1.73)	2.67 (0.58)	2.67 (1.53)
Physical Education	2	4.50 (0.71)	2.50 (0.71)	1.00 (0.00)	3.50 (0.71)	3.50 (0.71)
Technologies	3	4.00 (0.00)	2.67 (1.53)	1.67 (1.15)	4.00 (1.00)	4.00 (1.00)

Note: Items were rated on a 1-5 scale, with higher scores indicating a higher level of the response named in each column. Values are group means, with standard deviations shown in parentheses, and are presented for descriptive purposes only. Group sizes are small and unequal, and values for the smallest groups are particularly sensitive to individual responses; they should therefore not be interpreted as providing a ranking of disciplines.

Teachers in Computing, Business and IT reported comparatively high confidence in helping pupils address gaps in numeracy learning ($M = 4.60$, $SD = 0.55$), alongside low levels of anxiety when teaching numeracy ($M = 1.20$, $SD = 0.45$) and avoidance of numeracy-related situations ($M = 1.20$; $SD = 0.45$). They also reported relatively high enjoyment of teaching numeracy ($M = 4.00$, $SD = 1.00$). Science teachers displayed a broadly similar pattern, reporting relatively high confidence in addressing pupils' gaps in numeracy learning ($M = 4.17$, $SD = 0.98$), alongside low levels of anxiety ($M = 1.50$, $SD = 0.84$) and avoidance ($M = 1.33$, $SD = 0.52$).

These descriptive patterns align with qualitative accounts in which teachers in these subject areas described numeracy as integral to their practice. For example, science teachers referred to numeracy as “embedded” within the curriculum (T13) or “inherent in every unit from S1 to S6” (T12), while computing teachers described routine engagement with calculations, data, and numerical problem-solving (T6). In these contexts, numeracy appeared to form part of established disciplinary practice and was described alongside a stronger sense of pedagogical confidence.

In contrast, teachers of English and Media reported the lowest mean confidence in helping pupils address gaps in numeracy learning ($M = 1.60$, $SD = 0.55$). They also reported somewhat higher levels of anxiety ($M = 2.40$, $SD = 1.14$) and avoidance ($M = 2.60$, $SD = 1.67$) than teachers in Computing, Business and IT, and Science. The relatively large standard deviation for avoidance indicates variation in responses within this small disciplinary grouping, reinforcing the need to interpret the mean cautiously. Qualitative data provide further insight into these descriptive patterns. Teachers in these subject areas frequently described numeracy as less central to their disciplinary identity, often positioning it as something that needed to be incorporated rather than something inherent to their teaching. For example, one teacher noted that numeracy in English could feel “shoe-horned in” depending on the context (T2), while another described limited opportunities for explicit numeracy teaching due to subject demands and time constraints (T4).

Social Subjects teachers reported comparatively low confidence in helping pupils address gaps in numeracy learning ($M = 2.50$, $SD = 1.00$) and the lowest mean enjoyment of teaching numeracy ($M = 2.25$, $SD = 0.96$). They also reported the

lowest mean prior enjoyment of mathematics at school ($M = 2.00$, $SD = 0.82$). Although these patterns should be interpreted cautiously given the small number of participants in this grouping, they suggest that biographical experiences of mathematics may intersect with disciplinary positioning. This is consistent with qualitative accounts in which some teachers described less positive personal relationships with mathematics or a preference for non-procedural forms of learning. For example, one teacher noted: “I just don’t enjoy it. I try to teach my History lessons based on creativity and freedom of approach - which is then contrasted with numeracy having set processes” (T29), illustrating how prior experiences of mathematics may shape teachers’ orientations towards numeracy within their practice.

Although exploratory, these descriptive patterns mirror qualitative patterns identified earlier in the chapter. Teachers in subjects where numerical activity was more routinely embedded, particularly Science and Computing, Business and IT, tended to report relatively high confidence and low levels of anxiety and avoidance. In contrast, English and Media teachers reported notably lower confidence in supporting pupils with numeracy, while Social Subjects teachers reported less positive prior experiences of mathematics and lower enjoyment of teaching numeracy. However, these patterns were not uniform across all disciplinary groupings, suggesting that subject affiliation alone does not account for teachers’ affective positioning. For example, while science teachers tended to describe numeracy as inherent (T12), some teachers in other subjects framed their role as drawing attention to numeracy when it emerges organically rather than explicitly teaching it (T30).

Importantly, disciplinary positioning did not appear to operate independently of school-level structures. As illustrated in Section 5.4.1, departmental traditions, leadership priorities, and opportunities for collaboration interacted with subject identity to either reinforce or disrupt established boundaries. For example, where teachers had access to supportive colleagues or shared approaches, they were more likely to engage with numeracy regardless of subject (e.g., T2; T24). Conversely, where numeracy remained symbolically located within mathematics departments, subject boundaries were more firmly maintained (e.g., T3; T5; T26). This suggests that disciplinary affiliation may contribute to teachers’

positioning towards numeracy, but that this relationship may also be shaped by local school contexts.

These findings suggest that teachers' engagement with numeracy may be influenced by the extent to which it is perceived as fitting naturally within established disciplinary practice or as belonging primarily to mathematics. Numeracy appeared more readily integrated where it aligned with established disciplinary practices, and was more likely to be approached cautiously where teachers perceived it as crossing subject boundaries. Confidence may, therefore, reflect not simply an individual attribute, but also a sense of professional authorisation shaped by disciplinary norms and expectations. These patterns are consistent with sociocultural perspectives on teacher identity, in which subject communities contribute to understandings of legitimate practice and professional responsibility. However, the variation evident across disciplinary groupings indicates that subject affiliation alone does not determine affective positioning; rather, confidence, anxiety, avoidance, and enjoyment appear to interact with teachers' individual experiences and the wider school contexts in which numeracy is enacted.

5.4.3 Professional Communities

Teachers' accounts indicate that professional communities beyond immediate departmental contexts significantly shaped how numeracy was interpreted, legitimised, and enacted. Across both interview and questionnaire data, engagement with professional learning networks, interactions with mathematics departments, and access to collaboration all appeared to influence teachers' confidence and sense of responsibility. However, these structures were consistently described as uneven, fragmented, and often dependent on individual initiative rather than clear and consistent provision.

Engagement with wider professional learning networks was frequently characterised as sporadic and loosely connected to classroom practice. Although teachers were aware of local authority and national provision, these opportunities were often described as abstract, inconsistent, or insufficiently applied. For example, one teacher noted that there had been "lots of talk about doing things regarding numeracy across the curriculum but very little appears to come from it" (T23). Participation was often framed as self-directed rather than

embedded within routine expectations, with teachers indicating that engagement required personal initiative and time that was not always available. This was reflected in interview accounts where teachers described not having sought out resources or support. Questionnaire responses echoed this, with one teacher stating that they “wouldn’t consult with anyone else” (T15), while another cited limited planning time and competing demands (T30).

In contrast, teachers articulated a clear preference for professional learning that was practical, contextually grounded, and directly relevant to their subject. Questionnaire responses highlighted demand for “curriculum specific development to showcase how numeracy can be signposted and delivered effectively” (T10), as well as opportunities to see “how students are taught numeracy skills so that we can use the same language” (T23). Others requested exemplar-based provision, including “online courses...linked to E’s and O’s and Benchmarks” (T3). These accounts suggest that teachers valued applied, subject-specific guidance over generic policy-driven input, particularly where it supported alignment with existing curricular practices.

Table 19

Teachers’ preferences for who should lead numeracy professional learning

Preference	Frequency (<i>n</i>)	Percentage (%)
A colleague in my school	14	46.7
A regional curriculum development officer	9	30.0
An outside ‘expert’	3	10.0
Other	4	13.3
Total	30	100.0

Quantitative data further illuminate how teachers positioned leadership for numeracy-related professional learning. As shown in Table 19, a large portion ($n = 14$, 46.7%) identified a colleague within their own school as best placed to lead professional learning, compared to 30.0% ($n = 9$) who selected a regional curriculum development officer and only a small portion ($n = 3$, 10.0%) who preferred an external ‘expert’. This pattern may indicate that teachers located legitimacy primarily within familiar, relational contexts rather than external authority. Open-ended responses further nuance this finding, with teachers emphasising that leadership should be “a highly successful and experienced practitioner” (T17), “whoever fit best” (T14), or “all of the above” (T10). These

responses indicate that legitimacy was constructed relationally and contextually, grounded in perceived credibility, experience, and understanding of local practice rather than formal role or external expertise.

Within schools, mathematics departments emerged as the most visible and accessible professional community in relation to numeracy. Teachers consistently described mathematics colleagues as their primary source of expertise, often seeking validation when unsure about tasks, terminology, or methods. For example, one teacher described approaching the mathematics department to clarify expectations, explaining that they “went to the maths department and said, ‘OK, this is what I think it’s asking me. Am I right?’” (T2). Questionnaire responses similarly indicated that several teachers would consult mathematics colleagues when needed (e.g. T4; T8; T24; T25; T26). These relationships were generally described as supportive and collegial, reinforcing the importance of interpersonal trust in enabling cross-curricular engagement.

However, this reliance also positioned mathematics departments as informal gatekeepers of numeracy knowledge. Teachers frequently described the need to check their understanding before proceeding, reinforcing a perceived distinction between using numeracy and teaching it. For example, one teacher reflected uncertainty about whether numeracy was being addressed “properly,” noting that while they “touch on” relevant skills, a “more skilled numeracy teacher might teach them” differently (T6). Similarly, another teacher expressed concern about their own capacity to teach numeracy, stating that “no-one wants to talk about teacher skills and knowledge” and questioning assumptions that holding a qualification equates to competence in teaching numeracy (T4). Importantly, some teachers also noted that mathematics colleagues themselves expressed uncertainty about how numeracy outcomes could be meaningfully addressed across the curriculum (T30), suggesting that this gatekeeping was not deliberate but emerged from shared ambiguity about expectations.

Access to structured collaboration was described as limited. Where support occurred, it was typically informal, reactive, and problem-driven rather than embedded within sustained joint planning. One teacher reported being “not really aware” of any formalised supports (T5), while another acknowledged that although they should consult colleagues more frequently, time constraints limited opportunities for collaboration (T30). Some teachers also expressed

frustration with inconsistent terminology and pedagogical approaches across subjects, particularly where “the SQA dictate different language for the same skills” (T23). This lack of shared language and coherence appeared to undermine confidence and made it more difficult for teachers to align their practice with that of mathematics departments. As one teacher explained, it would be helpful to know “what they’ve been taught and how they’ve been taught it” (T3), highlighting limited visibility of progression and pedagogy across stages.

There was strong support for more locally embedded, subject-specific professional learning as a means of improving access to support. Teachers repeatedly emphasised that generic numeracy sessions were less effective than provision demonstrating how numeracy could be meaningfully embedded within their own curricular areas. Requests included practical exemplification and opportunities to “showcase how numeracy can be signposted and delivered effectively” (T10), as well as support to “understand [their] role in teaching numeracy” (T26). Some teachers also highlighted the value of working with numeracy specialists to refine disciplinary practice, suggesting that “a numeracy expert would definitely develop my skills” (T1). However, others cautioned that professional learning alone would be insufficient without broader cultural change, arguing that “more of a culture around numeracy needs to change” (T22). This positions professional communities not only as sites of skill development, but as key mechanisms for shaping legitimacy, shared understanding, and collective responsibility.

Overall, professional communities related to numeracy were experienced as fragmented and unevenly accessed. Mathematics departments provided valuable informal support but simultaneously reinforced perceptions of numeracy as specialist knowledge. Wider professional learning networks were often perceived as distant, optional, or disconnected from classroom practice, limiting their influence on teaching. In the absence of structured and sustained collaboration, engagement remained cautious and limited. Numeracy was typically enacted within familiar disciplinary contexts rather than as a fully integrated cross-curricular practice. Where professional communities offered practical guidance, shared language, and relational trust, teachers described greater confidence and willingness to embed numeracy within their teaching.

5.4.4 Summary of Findings in the Social Domain

Findings from the social domain indicate that engagement with numeracy was shaped primarily by organisational cultures, professional relationships, and disciplinary norms. Departmental expectations and leadership priorities mediated whether numeracy was legitimised as a shared responsibility, while mathematics departments functioned as both sources of support and informal gatekeepers of expertise. Limited collaboration and uneven access to professional learning further constrained cross-curricular coherence.

Descriptive quantitative patterns suggested variation across disciplinary groupings in confidence, anxiety, avoidance, and enjoyment, which broadly mirrored qualitative accounts of subject-bound positioning. Overall, numeracy enactment appeared to depend less on individual willingness than on relational trust, shared language, and supportive organisational conditions, suggesting that confidence and legitimacy were shaped, at least in part, through social and disciplinary contexts. The following section examines how these social patterns intersect with teachers' past experiences within the life history domain.

5.5 Life History Domain

This section addresses the life history domain, examining how teachers' accumulated experiences shape their identities as teachers of numeracy. Rather than treating teachers' engagement with numeracy as something shaped only by current policy expectations, this analysis considers how earlier experiences of mathematics, formal preparation, and professional experiences over time influenced their responses. Teachers' views of numeracy appeared to develop over time through both personal experience and the contexts in which they worked.

5.5.1 Enduring Affective Dispositions

Teachers' past experiences of mathematics emerged as a powerful and durable influence on their present engagement with numeracy. Questionnaire data indicated that 15 teachers (50.0%) reported having enjoyed mathematics at school, although this did not consistently translate into confidence or engagement in their current practice. This indicates that prior enjoyment alone

is neither a sufficient nor necessary condition for current numeracy-related confidence or engagement.

Across interviews and open responses, eight teachers (26.7%) reflected explicitly on their past experiences and drew on these to explain current confidence, pedagogical comfort, and perceived legitimacy. As one teacher noted: “I used to be quite good at maths as well, so I don’t hate it. Unlike a lot of English teachers” (T5). Another linked their conceptualisation of numeracy to their own schooling, explaining that “when [they] went to school, it was divided up into arithmetic and mathematics” (T4), reflecting a distinction between basic and more advanced mathematical knowledge that continued to shape their current understanding.

For a smaller subgroup of teachers ($n = 6$; 20.0%), positive experiences of mathematics were associated with higher reported confidence in practice (T5; T7; T9; T11; T16; T28). These teachers more frequently described themselves as comfortable with mathematics and expressed relative ease in integrating numeracy within their subject, for example, noting that they felt “comfortable teaching specific types of numeracy linked to science topics” (T11). Quantitative analysis supports this pattern: a moderate positive correlation was identified between enjoyment of mathematics at school and current confidence in all aspects of numeracy ($r_s = .478, p = .008$) (see Table 13, Section 5.3.3). While this does not indicate a causal relationship, it suggests that early positive experiences of mathematics are associated with higher self-reported confidence in this dataset.

In contrast, eight teachers (26.7%) who positioned themselves as less confident in mathematics described their engagement as conditional and restricted to certain contexts (T1; T3; T4; T8; T10; T21; T29; T30). Questionnaire responses indicate uncertainty about foundational teaching, with one teacher stating: “the lack of confidence that I am accurately teaching/approaching this, contributes to the lack of enjoyment” (T30). Others explicitly linked confidence to topic familiarity, noting: “I am not particularly confident with numeracy that requires formulas” (T10). These accounts may indicate that early difficulty or limited conceptual understanding continues to influence the scope of teachers’ engagement, leading to more cautious enactment and a preference for familiar or procedural contexts.

Tensions between prior learning experiences and contemporary pedagogical approaches further reinforced this positioning. Several teachers highlighted a disconnect between how they were taught and current approaches, with one noting that “the way arithmetic is taught now is very different to how I was taught” (T2). This was often associated with uncertainty about how to explain concepts accurately, particularly where newer pedagogies conflicted with procedural methods learned during schooling. Such tensions contributed to hesitancy in teaching numeracy explicitly, even where teachers recognised its importance.

Broader cultural narratives surrounding mathematics also shaped these dispositions. One teacher observed that “numeracy education faces a cultural disadvantage in that it is socially acceptable to admit to having poor numeracy skills” (T4), contrasting this with literacy. This normalisation of mathematical difficulty appeared to legitimise lower confidence and reduce pressure to develop numeracy expertise, reinforcing cautious or deferential positioning.

Together, these findings indicate that affective dispositions towards numeracy are historically formed and persist over time, shaping how teachers interpret their role long before policy expectations are encountered. Early experiences of success or difficulty, combined with evolving pedagogical expectations and broader cultural narratives, contribute to enduring patterns of confidence, caution, and perceived legitimacy in numeracy teaching.

5.5.2 Legitimacy and the Limits of Formal Preparation

If teachers’ earlier experiences and feelings about mathematics tended to persist over time, initial teacher education appeared to do little to change them. Teachers’ accounts consistently suggested that numeracy had only a limited place within ITE, providing little clarity or confidence about cross-curricular responsibility. As one teacher stated, numeracy during ITE “just doesn’t prepare you for that responsibility of all” (T1), while another recalled that it “didn’t feature...at all” in their PGDE (T6). Questionnaire data further reflect this pattern, with only 33.3% of teachers reporting any numeracy-related input during ITE (see Table 16).

Five teachers (16.7%) struggled to recall whether numeracy had featured at all in their pre-service programmes. Even where provision was remembered, it was described as minimal or lacking depth. For example, one teacher described probationary provision as “an hour session on numeracy for a full year” (T1), while another noted: “I may have had PGDE or probation input in numeracy, but I can’t remember” (T21). Such accounts suggest that numeracy input, where present, lacked salience and sustained engagement, limiting its impact on professional learning.

However, these findings must be situated within the broader policy timeline. As discussed earlier, CfE, introduced in 2010, formalised numeracy as a shared cross-curricular responsibility. A substantial proportion of participants ($n = 22$, 73.3%) reported more than ten years of teaching experience (see Section 4.4), indicating that many completed ITE prior to this policy shift. For these teachers, pre-service training occurred within a curricular context where cross-curricular numeracy was not explicitly embedded. Reported gaps in preparation, therefore, reflect not only programme limitations but also the historical context of teacher education.

Teachers also distinguished clearly between holding mathematical qualifications and possessing pedagogical confidence to teach numeracy. Several questioned the belief that mathematics qualifications equate to preparedness, with one participant noting that there is an assumption of teachers “having a qualification...as a guarantee of being proficient [with numeracy]” (T4). Others expressed uncertainty about teacher capability more broadly, asking whether all teachers “have the necessary skills to be teaching young people numeracy” (T1). These accounts seem to indicate that numeracy knowledge is frequently treated as an implicit expectation rather than an area requiring explicit pedagogical development.

Although some teachers recalled encountering the language of ‘*responsibility of all*’, this was typically described as vague and not clearly translated into classroom practice. Engagement with curriculum documentation tended to remain subject-specific, with limited modelling of how numeracy could be enacted across disciplines. As one teacher noted, there had been “lots of talk about doing things regarding numeracy across the curriculum but very little

appears to come from it” (T23). Consequently, it appeared that numeracy was experienced as conceptual rather than practised during training.

Quantitative findings reinforce this interpretation. No significant associations were identified between reported ITE numeracy input and measures of confidence, anxiety, or avoidance (see Table 17). Pre-service exposure alone, therefore, appears insufficient to reshape affective positioning or to confer a secure sense of pedagogical legitimacy.

These findings suggest that formal preparation did little to change teachers’ earlier views about numeracy or to build confidence. Instead, these views were often carried into professional practice, shaped both by when teachers were trained and by the limited attention given to cross-curricular numeracy in pre-service programmes.

5.5.3 Identity Stabilisation Across the Career-Span

Early career experiences appeared to do little to change teachers’ existing views and responses to numeracy. Rather than building confidence or clarifying what cross-curricular responsibility meant in practice, induction and early professional learning often seemed to reinforce uncertainty and cautious engagement. As one teacher reflected, early career input focused largely on being introduced to curriculum expectations, with “an awful lot...of here come the E’s and O’s” but limited attention to how these should be enacted in practice (T6).

Teachers described probationary and early career provision as procedural rather than pedagogical. Induction was characterised by policy briefings and introductions to E’s and O’s, with limited modelling of classroom practice or sustained development of numeracy pedagogy. Although awareness of expectations increased, clarity regarding enactment remained limited. Numeracy was frequently positioned alongside multiple competing “responsibility of all” agendas, which were described as receiving “a short shrift” within already crowded curricula (T6), diluting emphasis and reducing follow-through.

Encounters with classroom realities further shaped professional identity. Teachers described teaching pupils with insecure foundational numeracy as particularly challenging and reported feeling ill-equipped to address gaps in

learning. Questionnaire responses reflect this uncertainty, with some teachers indicating they were “not as clear as [they] should be” about their numeracy responsibility (T1) and others acknowledging difficulty teaching “basic ideas around... addition, subtraction... and multiplication” (T2). These experiences often exposed rather than resolved pedagogical uncertainty, encouraging cautious engagement and reliance on mathematics colleagues for validation. As one teacher noted, they would consult “maths colleagues... to refresh understanding” (T25), suggesting that numeracy expertise was still seen as belonging mainly to mathematics teachers.

Over time, such patterns appeared to stabilise. Quantitative analysis (see Table 13) revealed a moderate positive association between years of teaching experience and reported avoidance of numeracy-related situations ($r_s = .447$, $p = .013$). Within this sample, teachers with greater years of experience were more likely to report cautious or avoidant positioning. Although causation cannot be inferred, this association is consistent with the interpretation that teachers’ professional identities become more settled over time, particularly where early uncertainty is not clearly addressed.

As CfE formally embedded numeracy as a cross-curricular responsibility, differences in years of experience may intersect with variation in formative exposure to this policy framing. Teachers who entered the profession prior to CfE are likely to have undertaken ITE in a context where cross-curricular numeracy was less explicitly positioned. In contrast, those entering post-2010 encountered this expectation as part of their foundational professional discourse. While the study did not directly compare cohorts, the association between experience and avoidance may reflect not only professional habits developed over time, but also differences in the policy context teachers encountered at the start of their careers.

Across their careers, teachers’ engagement with numeracy was not characterised by resistance, but remained largely unchanged over time and was shaped by accumulated experience. Only a small proportion of teachers ($n = 3$, 10.0%) described actively trying to change how they approached numeracy through further study or deliberate professional effort, such as “observ[ing] other teachers teach numeracy and find[ing] methods which have improved attainment” (T13). These instances were typically self-initiated rather than

supported through formal structures. In the absence of sustained and coherent professional support, earlier views and workplace experiences appeared to build over time, reinforcing particular orientations towards numeracy.

5.5.4 Summary of Findings in the Life History Domain

Findings from the life history domain indicate that teachers' engagement with numeracy is shaped by experiences accumulated over time. Early experiences of mathematics appeared to influence later confidence and feelings of legitimacy, with the quantitative data showing a link between prior enjoyment of mathematics and current confidence. Formal preparation did little to change these earlier views, as numeracy was often given limited attention in initial teacher education and was not associated with later confidence or anxiety. Early career experiences also appeared to reinforce rather than change existing views, with limited pedagogical support and a positive association between experience and avoidance suggesting that these patterns became more settled over time. Teachers' engagement with numeracy, therefore, appears to reflect accumulated personal and institutional experiences rather than individual resistance. The following section examines how these patterns are shaped by wider structural and policy contexts.

5.6 Context Domain

This section examines how structural and organisational conditions shape teachers' opportunities to enact numeracy across the curriculum. Where the social domain explored relational cultures and professional communities, and the life history domain considered teachers' past experiences, the context domain focuses on school and system conditions. In particular, it examines how policy is put into practice in schools, how accountability operates, and how time, resources, and professional support are made available. These conditions can influence whether numeracy is prioritised and enacted in practice, regardless of individual confidence or willingness.

5.6.1 School-Level Implementation of Numeracy Policy

Although cross-curricular numeracy is embedded within the national curriculum, teachers' accounts suggest that its practical enactment depended heavily on how expectations were understood and put into practice within schools. While policy awareness was widespread, structured implementation was less evident. Questionnaire data indicate that 29 teachers (96.7%) reported some engagement with numeracy policy documentation, such as the E's and O's (see Table 6). However, this high level of awareness did not correspond with reported use in practice: only 17 teachers (56.7%) indicated that they applied these frameworks in their teaching. This represents a substantial gap between policy engagement and classroom enactment. This suggests that engagement with policy was often procedural rather than practice-focused, with teachers familiar with documentation but uncertain how to enact it within subject-specific practice.

Qualitative responses suggest that this awareness is rarely translated into intentional curriculum planning within subject areas. Instead, numeracy was commonly described as reactive and incidental. As one teacher explained, "I wouldn't usually make a conscious effort... I would usually just address numeracy skills as they crop up" (T30), while another described their role as to "help ensure basic understanding as it [is] relevant to my subject and correct any misunderstandings" (T2). In practice, this reflects a model of reinforcement rather than planned cross-curricular integration. Awareness did not automatically translate into ownership.

Quantitative analysis reinforces this distinction. As outlined in Section 5.3, no statistically significant relationships were identified between reported engagement with numeracy E's and O's and measures of confidence, anxiety, or perceived ability to support pupils' numeracy development. Familiarity with policy documentation alone, therefore, did not appear to correspond with greater confidence or pedagogical security, suggesting that policy awareness on its own may have had limited impact on practice.

Accountability arrangements also appeared to influence classroom practice. Three teachers (10.0%) described numeracy as a stated priority that lacked sustained monitoring or evaluative follow-through (T5; T6; T23). One teacher noted that there was "no real accountability... you're not genuinely being observed about that all the time" (T5), while another reflected that there had

been “lots of talk about doing things regarding numeracy across the curriculum but very little appears to come from it” (T23). This gap between rhetorical prioritisation and enacted practice seemed to position numeracy as optional rather than embedded.

Time pressures intensified this dynamic and were identified by four teachers (13.3%) as a key constraint (T5; T6; T29; T30). One teacher explained that “there just isn’t the scope for us to deliver numeracy... we already don’t have enough time to cover the skills we need” (T29), another suggested that numeracy “gets left behind” due to competing priorities (T5). These views highlight how competing curricular demands can displace numeracy in practice.

Five teachers (16.7%) suggested that whether numeracy was included depended on their own judgement of how well it fitted their subject (T2; T4; T22; T29; T30). Where numeracy was perceived as externally imposed or as not well aligned with subject content, teachers were less likely to engage with it. One teacher described attempts to integrate numeracy as “shoe-horned in... making it unnatural... making it false” (T2). In contrast, when numeracy was seen as a natural part of the subject, teachers were more likely to include it in their regular teaching, referring to it as “embedded” (T13) or “inherent” (T12).

Overall, these findings indicate that, at school level, numeracy policy was experienced less as a clear directive and more as an expectation that teachers interpreted in different ways. Although awareness of policy was relatively widespread, enactment appeared to depend on clear structures, accountability, and perceived subject relevance. Where these conditions were absent, numeracy was enacted less consistently and was more easily displaced by competing priorities.

5.6.2 Assessment, Coherence, and System Architecture

Beyond school-level operationalisation, teachers’ accounts also reflected broader uncertainties within the assessment and curriculum architecture surrounding numeracy. While expectations were clear in principle, their translation into coherent, assessable practice across subjects was less certain. Across the dataset, a minority of teachers ($n = 6$, 20.0%) explicitly expressed uncertainty about what constitutes valid evidence of numeracy beyond

mathematics and how consistent judgements should be made. One teacher noted that it would be helpful to understand “how key tasks link to the Benchmarks for numeracy...not just in the maths department” (T30), highlighting a perceived gap between policy expectations and subject-specific enactment. Others questioned the extent to which assessment practices were standardised, suggesting that if schools are not “using the same assessments in BGE,” there is effectively “no national picture” of numeracy attainment (T4). In this context, numeracy was more frequently framed as informal reinforcement rather than as something planned, taught, and assessed.

This uncertainty was compounded by the perceived abstraction of national guidance. While almost all teachers ($n = 29$, 96.7%) reported some form of engagement with the Benchmarks and E’s and O’s, qualitative responses indicate that this was often difficult to translate into classroom practice. A small but notable group of teachers ($n = 6$, 20.0%) expressed a desire for clearer exemplification and practical demonstration (T3; T4; T5; T10; T24; T30). For example, one teacher requested “examples of numeracy embedded into lesson plans and lessons” (T5), while another highlighted the need for “curriculum specific development to showcase how numeracy can be signposted and delivered effectively” (T10). These responses indicate that teachers were not rejecting policy expectations but required more concrete guidance to operationalise them within their disciplinary contexts.

Inconsistencies in terminology across subjects and qualification frameworks further undermined coherence. A very small number of teachers ($n = 2$, 6.7%) described confusion arising from differences in how similar concepts were labelled and taught across disciplines. One teacher noted the difficulty of aligning practice where “the SQA dictate different language for the same skills or same language for different skills”, noting confusion between “line graphs” and “XY scatters” (T23). Similarly, another teacher shared this view arguing that between “point-to-point or line-of-best-fit in line graphs...the SQA need to specify which [type], [pupils] should be learning, if either” (T12). Although technical in nature, such discrepancies contributed to a broader sense of inconsistency and reduced confidence in cross-curricular alignment.

Taken together, these findings indicate that wider curriculum and assessment systems can shape numeracy enactment in important ways. Where assessment

expectations, examples of practice, and curriculum language were unclear or inconsistent, teachers were more likely to treat numeracy as something additional or informal rather than as an integral and assessable part of their subject.

5.6.3 Resource Conditions

Teachers' ability to enact numeracy was also shaped by practical resource conditions. In this study, resources were understood not only as equipment, but also as the wider practical and organisational supports that made integration possible, including time, access to materials, professional learning, staffing, and infrastructure.

Time emerged explicitly as a constraint for five teachers (16.7%) (T5; T6; T27; T29; T30). They did not generally dispute that opportunities for numeracy existed within their subjects; rather, they framed time as the primary limiting factor preventing meaningful integration. In content-heavy subjects, numeracy often competed directly with examinable material. As one teacher explained, "there just isn't the scope... we already don't have enough time to cover the skills we need" (T29). This pressure was particularly evident in senior phase contexts, where curriculum coverage and assessment demands were prioritised. Time scarcity also constrained engagement with available supports. Even where resources were assumed to exist, teachers reported limited capacity to access them, with one noting that they had "never found the time to actually go and look" (T27). As a result, numeracy was often enacted reactively rather than through sustained or planned integration.

Material and digital resources were characterised by uneven visibility and accessibility. Participants were asked in the questionnaire if they had access to concrete materials such as double-sided counters, Cuisenaire rods, and calculators, among other resources (see Appendix 1). Questionnaire responses indicate that 26 teachers (86.7%) reported not using concrete materials to support numeracy, with 13 teachers (43.3%) reporting having access to concrete materials in some form, and 17 teachers (56.7%) explaining that they do not have access to any concrete materials. One teacher stated: "I genuinely don't know about what is available" (T27), while another noted, "there might be somewhere, but I am unaware of these" (T30). Resources were often perceived

as located within mathematics departments rather than as shared school assets, reinforcing subject-bound ownership. Access, therefore, depended on informal relationships rather than formal or consistent provision. Limited digital infrastructure also shaped practice. In response, teachers sometimes relied on improvised solutions, such as “usually get pupils to use calculators on their phone” (T10), showing how resource limitations were managed in practical ways.

Access to professional learning was also widely identified as limited and uneven. Questionnaire data indicate that 30.0% ($n = 9$) of teachers reported no professional learning related to numeracy, while engagement with local authority ($n = 6$, 20.0%) and personal professional learning ($n = 4$, 13.3%) remained relatively low (see Table 16). At the same time, 26 teachers (86.7%) indicated that they would or might benefit from professional learning, suggesting that demand exceeded structured provision. Qualitative responses reinforce this pattern, with teachers requesting “examples of numeracy embedded into lesson plans and lessons” (T5) and “curriculum specific development to showcase how numeracy can be signposted and delivered effectively” (T10). These accounts indicate a preference for practical, subject-specific support rather than generic provision.

Staffing and access to expertise were also important resources shaping teachers’ engagement with numeracy. Eight teachers explicitly indicated that they would consult or rely on mathematics colleagues for validation and reassurance, reinforcing the central role of specialist expertise within schools (T2; T4; T5; T8; T17; T24; T25; T26). However, this reliance also reflected limits in time and access, as high teaching loads reduced opportunities for collaboration and professional learning. In this sense, access to knowledgeable colleagues appeared to be an important, but unevenly available, resource.

Overall, resource constraints appeared to work together. Limited time, uneven visibility of materials, inconsistent digital access, fragmented professional learning, and reliance on informal support networks all shaped how numeracy was enacted. Where clear, accessible, and sustained support was lacking, integration depended heavily on individual capacity and initiative rather than on consistent support across the school.

5.6.4 Summary of Findings in the Context Domain

Findings from the context domain indicate that teachers' engagement with numeracy was shaped largely by the conditions in which they worked rather than by individual willingness alone. Although policy was widely recognised, it was not always clearly put into practice, and numeracy was often addressed incidentally rather than through planned teaching and accountability.

Uncertainty around assessment and curriculum coherence, together with limits on time, resources, and professional learning, further reduced opportunities for integration. As a result, teachers' engagement with numeracy depended heavily on how well schools and wider systems supported it in practice.

5.7 Interactions Between Domains

Analysis across the domains indicates that teachers' engagement with numeracy was shaped not by any single factor, but by the interaction of knowledge, affect, life history, social, and contextual conditions. The quantitative findings support this. For example, strong associations were identified between confidence, anxiety, and avoidance (see Section 5.3.3). Past enjoyment of mathematics was significantly associated with current confidence, while anxiety and avoidance were also closely linked. Together, these patterns suggest that teachers' responses to numeracy were shaped by connected emotional, personal, and professional influences rather than by isolated factors.

Across the dataset, these influences appeared to work together in ways that made teachers' views and practices more settled over time. Differences in mathematical content knowledge, pedagogical content knowledge, and curriculum knowledge interacted with confidence, anxiety, and caution. This is reflected in strong associations between anxiety and confidence ($r_s = -.719$, $p < .001$) and between anxiety and avoidance ($r_s = .578$, $p < .001$), indicating that affective dispositions about numeracy were closely linked to perceived competence. This may indicate a self-reinforcing pattern: limited knowledge may contribute to reduced confidence, reduced confidence may increase caution, and cautious enactment may limit opportunities to further develop knowledge.

Past experiences also seemed to shape this pattern. Teachers' earlier experiences of mathematics, whether positive or negative, continued to

influence how confident they felt about numeracy in the present. The positive association between past enjoyment of mathematics and current confidence is consistent with the interpretation that historical life experiences continue to shape teachers' confidence in relation to numeracy. These earlier views did not appear to be changed much by ITE or early career experiences, which were widely described as limited in relation to cross-curricular numeracy. Over time, these patterns appeared to become more settled, which is also consistent with the association between years of teaching experience and reported avoidance of numeracy-related situations. In this sense, avoidance did not appear to reflect simple unwillingness, but could be understood as part of a longer-term pattern shaped by past experiences and subject identity.

School and policy conditions also influenced whether confidence translated into practice. Teachers were generally aware of policy expectations, but policy on its own did not appear to increase confidence or reduce anxiety. There were no statistically significant relationships between engagement with curriculum documentation and measures of confidence or anxiety. This suggests that awareness of policy was not enough by itself to change how teachers felt about teaching numeracy. Where schools lacked clear accountability, coherent approaches to assessment, and practical examples of how numeracy could be embedded, teachers could value numeracy in principle while still giving it less priority in practice.

Social conditions also shaped whether teachers felt able to act on policy expectations. Where schools lacked shared language, modelling, and regular collaboration across departments, subject boundaries remained strong. These social conditions appeared to shape not only how teachers described their practice but also what they felt entitled or qualified to teach. Descriptive differences across disciplinary groupings were also consistent with this interpretation. For example, teachers of English and Media reported the lowest mean confidence in helping pupils address gaps in numeracy learning ($M = 1.60$, $SD = 0.55$), compared with higher mean confidence among teachers in Computing, Business and IT ($M = 4.60$, $SD = 0.55$) and Science ($M = 4.17$, $SD = 0.98$). Although these patterns cannot establish that disciplinary affiliation determines confidence, they suggest that perceived competence may be connected to the

extent to which numeracy is regarded as a legitimate and familiar part of subject practice.

Resource conditions added to these difficulties. Limited time, uneven access to materials, fragmented professional learning, and reliance on informal support all reduced opportunities for teachers to build confidence and develop their practice. Even when teachers held positive views of numeracy, these structural constraints limited sustained engagement. However, where professional learning, supportive subject cultures, and clear school expectations came together, teachers described greater confidence and a greater willingness to teach numeracy more explicitly.

Taken together, these findings point to a layered and interactional understanding of numeracy enactment across domains. This pattern can be tentatively conceptualised as follows:

- Life history experiences shape affective dispositions towards numeracy
- Affective dispositions may influence perceived professional authorisation to teach numeracy
- Social and disciplinary cultures may reinforce or challenge these perceptions
- Contextual structures mediate whether numeracy is enacted in practice
- Resource conditions enable or constrain opportunities for change.

More specifically, these domains did not operate separately or in a fixed sequence. Instead, they interacted reciprocally to shape practice. From this perspective, numeracy across the curriculum may be understood as a professional practice shaped by interacting personal, social, structural, and temporal influences. The findings also suggest that approaches focusing on knowledge, confidence, or policy clarity in isolation are unlikely to support sustained change on their own unless there is greater coherence across domains. Overall, the study highlights that engagement with cross-curricular numeracy is unlikely to be explained by any single factor alone, but instead may emerge through the interaction of multiple domains.

Chapter 6: Discussion

The purpose of the study was to examine how non-mathematics teachers understand and enact numeracy across the curriculum within the context of CfE, with particular attention to how their engagement with numeracy is shaped by professional identity. The study adds to research on teacher identity by showing how teachers respond when responsibility for a subject area is shared across departments. While existing literature has examined subject identity, teacher beliefs, and professional agency, less attention has been given to how teachers respond when responsibility for a curricular domain is formally shared but legitimacy to teach that domain remains uneven across disciplines.

The study shows that teachers' use of numeracy depends less on willingness or awareness of policy and more on whether they feel it is part of their role within their subject. It further demonstrates that teachers' orientations towards numeracy are shaped through the interaction of affective, biographical, social, and contextual influences rather than by isolated factors operating independently.

The following sections discuss the findings considering these points.

6.1 Reframing Numeracy Enactment as Identity-Mediated Practice

The findings challenge simple linear models of cross-curricular numeracy implementation. Policy literature has often assumed that curriculum expectations can be communicated clearly and then implemented in classroom practice (Donaldson, 2014; Spillane et al., 2002). However, research on policy enactment shows that teachers do not simply apply policy as written; they interpret and adapt it within their professional contexts (Ball et al., 2012). Within CfE, where teacher autonomy and professional judgement are emphasised (Priestley & Humes, 2010), this interpretive process is particularly significant.

The findings support this perspective. The teachers in the study did not reject numeracy or oppose its inclusion within their teaching. Awareness of numeracy policy and curriculum documentation was widespread. However, this awareness showed no clear relationship with confidence or reported enactment. Teachers who were familiar with policy expectations were not necessarily more likely to

use numeracy in their classrooms. This challenges the assumption that clarity of expectations or increased policy engagement will lead to changes in practice.

Instead, the teachers' use of numeracy depended on how they understood their role within their subject. The issue, therefore, is not willingness, but how teachers see numeracy in relation to their professional responsibilities. Teachers were more likely to use numeracy where it aligned with their subject and where they felt secure in doing so. Where numeracy was seen as less central to the subject, or where it required teaching mathematical methods explicitly, teachers were more cautious.

The teachers' definitions of numeracy played an important role in this process. Some described numeracy in narrow terms, closely linked to arithmetic or calculation. Others described it more broadly, including interpretation of data, measurement, or real-world application. This mirrors the definitional ambiguity identified in the literature (Askew, 2015; Callingham et al., 2015), where numeracy oscillates between procedural mathematics and broader contextual reasoning (Bennison, 2016; Goos et al., 2014). Where numeracy was understood in broader terms, it was easier to see how it connected to different subjects. Where it was understood as procedural mathematics, responsibility was more likely to be located within the mathematics department. These differences shaped whether teachers saw themselves as users of numeracy within their subject or as responsible for teaching it.

A key distinction in the data was between using numeracy and teaching it explicitly. Many teachers described confidence in applying numeracy within their subject, such as interpreting data or working with measurements. However, they were more hesitant when this involved explaining mathematical procedures, addressing gaps in understanding, or teaching methods directly. This distinction reflects uncertainty not only about knowledge, but about whether explicit instruction in mathematical concepts falls within their role.

This interpretation aligns with research on teacher identity, which shows that teachers interpret new expectations in relation to their existing sense of role and expertise (Beijaard et al., 2004; Biesta et al., 2015). Teachers do not simply adopt externally defined responsibilities; they evaluate whether these responsibilities align with what they see as legitimate within their subject. In the study, even where numeracy was recognised as important, explicit teaching

of mathematical methods was often positioned as belonging to mathematics specialists. This reflects wider patterns in the literature, where numeracy remains closely associated with mathematics despite policy framing it as cross-curricular (Askew, 2015; Carter et al., 2015).

How teachers interpreted what legitimately falls within their role aligns with Kelchtermans' (2005) concept of task perception. Teachers in the study frequently identified opportunities to use numeracy but were less certain about taking responsibility for teaching it explicitly. This hesitation was typically expressed as uncertainty about boundaries rather than resistance.

Affective factors also shaped how teachers responded to this uncertainty. The relationships observed between confidence, anxiety, and avoidance suggest that teachers were more cautious where they felt less secure. This is consistent with Bandura's (1997) theory of self-efficacy, which emphasises the role of perceived capability in shaping action in situations involving risk or uncertainty. However, the findings here appear to show that confidence was not only about perceived ability. It was also tied to whether teachers felt comfortable taking responsibility for numeracy within their subject.

This interpretation also aligns with research on teacher agency. Priestley et al. (2015) argue that agency emerges through the interaction of personal capacities, cultural norms, and structural conditions. The findings reflect this interaction. Teachers' past experiences shaped their confidence; subject expectations influenced what was seen as appropriate practice; and structural conditions affected opportunities to act. Numeracy enactment, therefore, emerged through the interaction of these factors, rather than as a direct response to policy.

Together, these findings indicate that cautious or selective use of numeracy did not reflect resistance. Rather, it reflected how teachers navigated uncertainty about their role, their knowledge, and expectations within their subject. Where numeracy aligned with subject practices and the teachers felt secure, it was more likely to be used. Where alignment was less clear, teachers tended to rely on incidental or reactive use of numeracy rather than planned, explicit instruction.

This leads to a reframing of cross-curricular numeracy enactment. Rather than being understood as a straightforward outcome of policy or training, enactment

can be seen as shaped by how teachers interpret their role within their subject and school context. Teachers draw on their confidence, their understanding of numeracy, and their sense of what is appropriate within their subject when deciding how to use numeracy in practice. The next section considers how confidence links knowledge to classroom practice.

6.2 The Knowledge-Affect Nexus: Confidence as a Key Mediator

The findings show a consistent pattern: knowledge did not reliably translate into classroom action. Instead, its influence appeared to depend on how confident teachers felt using that knowledge.

In this study, affective positioning referred to the confidence, anxiety, and beliefs through which teachers interpreted numeracy and their role in relation to it. Previous literature suggests that teachers' beliefs and attitudes shape how they interpret expectations and whether they adopt new practices (Buehl & Beck, 2014; Pajares, 1992). The findings of the study show that knowledge alone was not enough; what mattered was whether teachers felt secure enough to act on it.

Mathematical content knowledge was often described by the teachers as sufficient for using numeracy within their subject (for example, interpreting data or working with measurements) but less secure when explaining procedures or addressing gaps in pupils' understanding. This distinction is important. Teachers did not simply lack knowledge; rather, they were uncertain about how to use it in ways that involved explicit teaching. Gaps in areas such as fractions, division, and proportional reasoning were described not as deficits, but as areas where teachers felt less confident in their role.

This pattern also aligns with Bandura's (1997) theory of self-efficacy. The quantitative findings support this: higher anxiety was associated with lower confidence, and lower confidence was associated with greater avoidance (see Table 13). Teachers who felt less confident were more likely to limit their use of numeracy. However, the findings extend beyond self-efficacy as a purely psychological construct. Confidence was not only about perceived ability, but also about whether teachers felt comfortable taking responsibility for numeracy within their subject.

The distinction between using numeracy and teaching it explicitly helps to clarify this point. Many teachers were comfortable applying numeracy in context (such as interpreting graphs or checking calculations) but were more hesitant when this involved explaining methods or modelling procedures. These accounts may be interpreted through Skemp's (2006) distinction between instrumental and relational understanding. While instrumental understanding involves knowing and applying rules or procedures, relational understanding involves understanding both what to do and why it works. Although teachers' mathematical understanding was not directly assessed in this study, their reported confidence in applying familiar numerical procedures, alongside greater hesitation when explaining, justifying, or adapting mathematical ideas for pupils, is consistent with the distinction Skemp describes. This should not, however, be taken as evidence that participants lacked relational understanding.

A similar distinction can be considered in relation to Shulman's (1987) differentiation between subject matter knowledge and pedagogical content knowledge. Teachers' accounts suggested that they often felt sufficiently confident to use numeracy within familiar contexts while feeling less confident in their ability to explain numerical ideas, address misconceptions, or support pupil understanding. This may reflect perceived limitations in the pedagogical content knowledge required to make mathematical ideas accessible to learners rather than demonstrated limitations in their mathematical knowledge. This interpretation also aligns with Ball et al.'s (2008) argument that teaching requires specialised forms of content knowledge. In the study, hesitation around explicit instruction appeared to reflect uncertainty about both knowledge and role.

Teachers' curriculum knowledge further illustrates the limits of policy awareness. Findings indicate that engagement with CfE documentation showed no statistically significant relationship with confidence or anxiety. Although most teachers reported reading the numeracy E's and O's, this did not necessarily affect their classroom practice. Teachers emphasised the need for shared approaches, consistent terminology, and clearer progression across subjects. In the absence of this coherence, policy remained difficult to apply. This reflects wider research showing that teachers interpret policy through existing practices

and organisational conditions rather than applying it directly (Ball et al., 2012; Spillane et al., 2002).

The relationships between knowledge, confidence, and avoidance suggest a connected pattern. Teachers who reported lower confidence were more likely to feel anxious, and more likely to avoid situations involving numeracy.

Importantly, this avoidance did not indicate rejection of numeracy. Rather, it reflected concern about getting it wrong, confusing pupils, or contradicting colleagues. This aligns with research on teacher identity, which shows that teachers are sensitive to situations that may challenge their sense of competence or professional standing (Biesta et al., 2015; Kelchtermans, 2005; Rodgers & Scott, 2008).

In this context, teaching numeracy, particularly when it involved explaining mathematical methods, could be seen as carrying professional risk. Teachers described concerns about making errors, using inconsistent methods, or undermining their credibility. These concerns were not only about knowledge, but about how their teaching would be perceived by pupils and colleagues. Confidence, therefore, influenced whether teachers chose to engage with numeracy explicitly or to limit their involvement.

This may help to explain the difference between incidental and planned numeracy enactment. Numeracy that arose naturally within subject content was generally described as unproblematic. In these cases, teachers could reinforce or apply numerical ideas without stepping beyond their established role. Planned, explicit instruction required greater preparation and exposed teachers' knowledge more directly. As a result, teachers were more likely to engage with numeracy reactively than through deliberate planning. Similar patterns have been noted in previous research, where teachers avoid practices that they feel uncertain about or do not see as part of their role (Bennison, 2016; Callingham et al., 2015).

Collectively, these findings imply that knowledge influenced classroom action mainly through how secure teachers felt using it. Where teachers felt confident, they were more likely to include numeracy in their teaching. Where they felt less secure, they were more cautious or selective in how they used it. Numeracy enactment is, therefore, best understood not as a direct outcome of knowledge,

but as shaped by how teachers feel about using that knowledge within their subject.

Policy reform models often assume that providing guidance or increasing awareness will lead to implementation. The findings point to a more indirect process. Policy may inform knowledge, but whether that knowledge is used depends on confidence, which in turn shapes how teachers see their role and what they are willing to do in the classroom.

How teachers' past experiences influence their affective positioning towards numeracy is discussed next.

6.3 Life History and the Formation of Numeracy Positioning

The findings indicate that teachers' positioning towards numeracy did not arise solely from current policy expectations. It was shaped by earlier experiences and then reinforced through professional practice. Importantly, this does not suggest that teachers' identities are fixed or resistant to change. Rather, early experiences informed how teachers interpreted numeracy later in their careers. These experiences helped shape confidence and expectations, but did not determine practice on their own.

The quantitative findings support this interpretation. Past enjoyment of mathematics was positively associated with current confidence (see Table 13). This is consistent with research showing that prior experiences of success shape later confidence (Bandura, 1997). These findings also align with research showing that teacher identity is shaped by prior experiences and current contexts (Beijaard et al., 2004; Flores & Day, 2006; Rodgers & Scott, 2008).

In the study, teachers frequently referred to their own experiences of learning mathematics at school, describing how success, difficulty, or disengagement continued to affect their confidence. They appeared to interpret their role through past experiences, which shaped what they felt confident doing and what they saw as part of their responsibility. This aligns with Kelchtermans' (2005) concept of professional self-understanding, particularly the ways in which teachers understand what properly belongs within their role. From this perspective, the teachers did not appear to respond to numeracy as a simple policy expectation. Rather, they appeared to interpret it through earlier

experiences of learning, teaching, and professional role formation, which appeared to shape both their confidence and their sense of responsibility.

This may help to explain why ITE had a limited impact on teachers' positioning towards numeracy. Numeracy within ITE was often described by the teachers as peripheral or lacking clear links to classroom practice. Even where numeracy was presented as a shared responsibility, it was not consistently supported through subject-specific examples or pedagogical modelling. As a result, ITE appeared to introduce expectations without significantly reshaping teachers' existing views. This reflects wider research (e.g., Bennison, 2016; Callingham et al., 2015; Milton et al., 2017) suggesting that cross-curricular numeracy is often treated as an implicit competence rather than an explicitly taught practice.

The relationship between experience and avoidance further illustrates how positioning develops over time. The findings showed an association between years of teaching experience and more cautious engagement with numeracy. While this does not indicate a causal relationship, it shows that early orientations can become reinforced through routine practice (Akkerman & Meijer, 2011; Kelchtermans, 2005). As teachers gain experience, their approaches are validated within established subject norms. Where numeracy is positioned as peripheral within those norms, this positioning is more likely to be maintained than challenged.

This does not imply that experienced teachers are resistant to change. The teachers in the study expressed willingness to develop and recognised the importance of numeracy. However, willingness alone was not sufficient to shift established patterns of practice. When earlier experiences framed numeracy as specialised knowledge, and this view was not significantly reshaped during early career stages, cross-curricular expectations were more difficult to integrate.

These findings complicate assumptions that policy or professional learning can quickly reshape practice. Teachers' responses to numeracy were shaped by experiences that pre-dated current policy and were reinforced over time. As a result, numeracy expectations introduced later in teachers' careers were interpreted through already established professional identities.

In this sense, past experiences underpin the knowledge-affect relationship described in Section 6.2. Confidence was influenced not only by current

knowledge, but by accumulated experiences of success, difficulty, and teaching practice (Bandura, 1997). These experiences shaped how teachers interpreted their competence and their role in relation to numeracy.

6.4 Disciplinary Culture and the Social Construction of Legitimacy to Teach Numeracy

While the previous arguments highlighted how confidence and past experiences can shape teachers' engagement with numeracy, the findings from the social domain (Section 5.4) indicate that engagement can also be shaped by subject cultures and school contexts. In particular, teachers' sense of whether they could teach numeracy was not only a matter of personal confidence, but also of what was seen as appropriate within their subject.

A consistent pattern across the data was that mathematics departments were viewed as the main source of numeracy expertise. Non-mathematics teachers frequently described seeking reassurance or clarification from mathematics colleagues before engaging in explicit numeracy instruction. While these interactions were supportive, they also reinforced the idea that responsibility for teaching what were perceived as mathematical methods and concepts, sat primarily with mathematics teachers. This reflects research showing that teacher identity is shaped within professional contexts, where shared expectations define roles and responsibilities (Beauchamp & Thomas, 2009; Mockler, 2011; Sachs, 2001).

Descriptive patterns in Table 18 indicated that teachers in Computing, Business and IT, and Science reported comparatively high confidence in addressing pupils' numeracy gaps, alongside relatively low levels of anxiety and avoidance. In contrast, English and Media teachers reported notably lower mean confidence, while Social Subjects teachers reported lower mean enjoyment of teaching numeracy and lower prior enjoyment of mathematics. These patterns were not uniform across all disciplinary groupings and should be interpreted cautiously given the small subgroup sizes. When considered alongside the qualitative findings, these descriptive differences were interpreted as being consistent with the extent to which numeracy was perceived to align with established subject practices, rather than as evidence of differences attributable to policy awareness alone. Where numeracy was already part of everyday teaching,

teachers tended to see it as part of their role. This aligns with research showing that subject identity plays a strong role in shaping what teachers see as legitimate practice (Beauchamp & Thomas, 2009; Mockler, 2011).

These patterns highlight the role of disciplinary culture in shaping responsibility. Although CfE positions numeracy as a shared responsibility, long-standing subject expectations continue to influence who is seen as responsible for teaching explicit mathematical methods. In the study, numeracy (particularly when it involved explicit teaching of skills) was often associated with mathematics. As a result, teachers in other subjects were more likely to position themselves as users of numeracy rather than as responsible for teaching it. Similar patterns are noted in previous research, where numeracy remains closely tied to mathematics despite policy framing it as cross-curricular (Askew, 2015; Callingham et al., 2015; Goos et al., 2014).

This may help to explain why teachers distinguished between using numeracy and teaching it explicitly. Using numeracy within subject contexts aligned with established practices and did not require a shift in professional role. Teaching methods or addressing gaps in understanding, however, required teachers to step beyond these boundaries. Where this was not supported within subject norms, teachers were more cautious.

Collaboration between departments has the potential to challenge these patterns, but in this study, it was often informal and inconsistent. Where teachers described more structured forms of collaboration, these accounts were also associated with greater reported clarity and confidence. However, in the absence of sustained opportunities to work across subjects, existing expectations about responsibility for numeracy were largely maintained. This reflects wider research (e.g., Bennison, 2016; Carter et al., 2015; OECD, 2021) showing that cross-curricular reform depends on sustained collaboration and shared approaches, which are often difficult to establish in secondary schools.

These findings (see Table 13) support the argument that teachers' engagement with numeracy cannot be explained by confidence alone (Callingham et al., 2015). Teachers in Science and Computing, Business and IT frequently worked within subject contexts where numeracy was already embedded and recognised as legitimate, which may have contributed to their comparatively high confidence. In contrast, some teachers in subjects where numeracy was

perceived as less central described greater uncertainty about taking responsibility for explicit numeracy teaching. This sense of legitimacy also appears to be socially produced within subject cultures and school structures. Policy expectations are, therefore, filtered through these contexts rather than applied directly (Ball et al., 2012; Spillane et al., 2002).

If numeracy continues to be associated primarily with mathematics, teachers in other disciplines are likely to remain cautious about taking on explicit teaching roles. In this sense, uneven enactment of numeracy reflects not individual reluctance, but the way responsibility is organised and understood within schools.

6.5 Structural Conditions: Why Policy Awareness is Insufficient

Although numeracy is presented as a shared responsibility, it does not appear to be enacted consistently across subjects. This suggests that clearer policy guidance alone is insufficient; how numeracy is taken up depends on how it fits with the teachers' roles and subject expectations.

A key finding was the absence of a statistically significant relationship between engagement with CfE numeracy documentation and measures of confidence, anxiety, or avoidance. The teachers were generally aware of policy expectations, but this awareness did not necessarily influence classroom practice. This indicates that policy does not operate directly on practice, but is interpreted through existing professional contexts.

Several structural factors may help to explain this pattern. The teachers described accountability for cross-curricular numeracy as limited or inconsistent. Although teachers were aware that numeracy was expected across the curriculum, their accounts indicated that this was not always supported by sustained monitoring or follow-up. In practice, subject-specific priorities, particularly those linked to assessment and examination requirements, often took precedence. Where expectations around numeracy are not reinforced through ongoing accountability, established subject practices are more likely to continue.

Policy guidance was also described as difficult to translate into subject-specific teaching. Although the language of cross-curricular numeracy was generally

understood, the teachers reported limited examples of how it could be applied within different disciplines. This made it harder to move from general expectations to classroom practice. Similar issues have been identified in wider evaluations of cross-curricular reform, where broad guidance is not always accompanied by subject-specific support (Carter et al., 2015).

Uncertainty around assessment further reduced the impact of policy. The teachers were often unsure how numeracy should be evidenced or assessed outside mathematics. In the absence of clear expectations, numeracy was more likely to be treated as an additionality rather than as a core part of subject teaching. As Mockler and Stacey (2021) argue, assessment practices signal what is valued within school systems. Where assessment expectations are unclear, the status of that learning remains uncertain.

Resource constraints also influenced practice. The teachers referred to time pressures, uneven access to materials, and limited opportunities for structured professional learning. As a result, support for numeracy was often informal, relying on consultation with mathematics colleagues rather than sustained collaboration across departments. Although support existed, it was not always structured or accessible enough to bring about wider change in practice.

The findings also highlight a gap between teachers' reported need for professional learning and their participation in it. Many teachers expressed interest in further support, particularly in relation to pedagogy and curriculum expectations. However, fewer reported sustained engagement with relevant professional learning opportunities. This suggests that availability alone is not sufficient; participation depends on how well professional learning aligns with teachers' subject contexts and perceived roles (Bennison, 2016; Carter et al., 2015).

Time was frequently described as a constraint, but its role appeared more complex than simple scarcity. References to limited time often appeared alongside areas where teachers felt less secure or where numeracy was less clearly embedded within subject practice. In subjects with dense content requirements, introducing explicit numeracy instruction was described as difficult to accommodate. In this context, time pressures may have been experienced more strongly where numeracy required changes to established

teaching approaches. This seems to indicate that time constraints and confidence were interconnected rather than independent factors.

This interpretation does not diminish the reality of time pressures in secondary education. Rather, it highlights how structural constraints interact with teachers' confidence and perceptions of role. Where teachers felt confident and saw numeracy as part of their subject, they were more likely to describe it as embedded within their teaching. Where this alignment was less secure, time pressures were more frequently emphasised. In this way, structural conditions did not operate in isolation, but alongside teachers' interpretations of their role.

The findings appear to show that policy expectations are more likely to influence practice when they are supported by clear guidance, subject-specific examples, coherent assessment approaches, and professional learning that aligns with teachers' confidence and sense of role. Without this alignment, policy is likely to have limited impact on classroom practice.

6.6 Interpreting Bennison's Framework

Bennison's (2015a) framework of identity as an embedder of numeracy provided the starting point for this study. The framework identifies five domains (knowledge, affective, social, life history, and context) that shape teachers' capacity and willingness to embed numeracy. It offers an important challenge to linear models of implementation by showing that numeracy integration depends on how teachers see themselves in relation to this responsibility, rather than on policy or knowledge alone.

However, while Bennison's framework identifies the key influences on teachers' engagement with numeracy, it is less explicit about how these influences interact in practice, particularly in cross-curricular contexts where responsibility is shared but not evenly taken up. The findings of the study suggest that understanding numeracy enactment requires closer attention to how these domains combine to shape teachers' decisions in specific classroom situations.

The findings highlight that Bennison's domains can be read as interacting influences that shape practice when teachers interpret and respond to cross-curricular expectations. The findings suggest that perceived knowledge, confidence, subject expectations, past experiences, and structural conditions

interacted to shape teachers' engagement with numeracy, and that no single factor explained practice on its own. In other words, several factors were combined to shape whether teachers regarded numeracy as part of their role and felt able to act on it. Viewed together, these patterns suggest that teachers' orientations towards numeracy were shaped by connected affective, historical, and behavioural influences rather than by isolated factors. In practical terms, these domains did not operate independently but formed a dynamic system that shaped how numeracy was understood, legitimised, and enacted in practice.

In this sense, it may be possible to think about Bennison's domains as an interacting system rather than as separate influences. Each domain appears to play a distinct role in shaping practice:

- Affective positioning (including confidence, anxiety, beliefs, and attitudes) most directly influenced whether numeracy was enacted.
- Perceived knowledge became consequential through its relationship with confidence.
- Disciplinary culture shaped what was seen as legitimate practice within a subject.
- Accumulated biographical experiences influenced teachers' confidence and positioning over time.
- Structural context enabled or constrained how these factors were expressed in practice.

This interpretation is particularly important in cross-curricular contexts. While responsibility may be formally shared, teachers vary in whether they see numeracy as part of their role. Figure 2 illustrates the interaction of the domains.

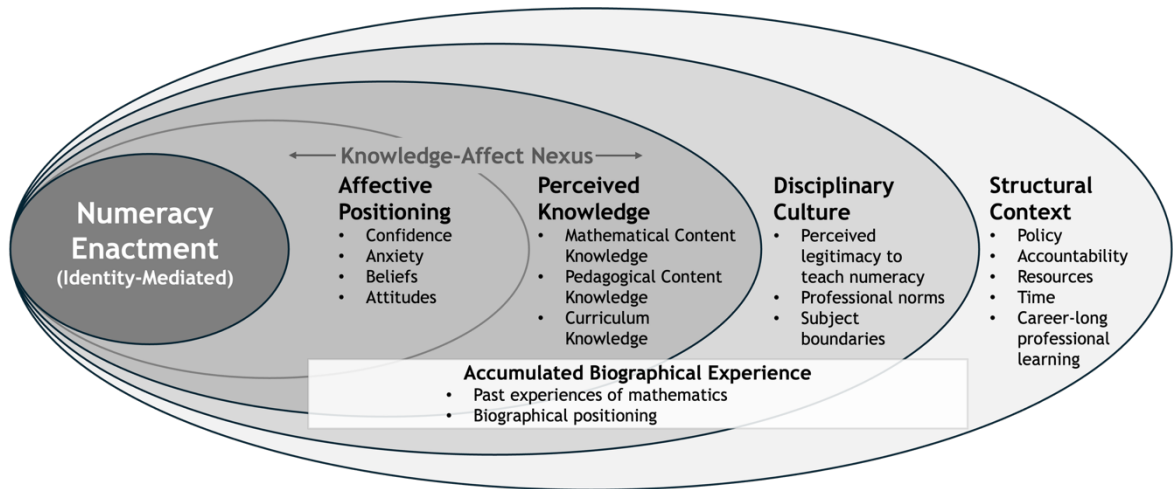


Figure 2
Interaction of Domains

One of the key arguments arising from the study is the relationship between *knowledge* and *confidence*. The findings showed that knowledge influenced practice mainly through how secure teachers felt using it. Teachers who felt confident were more likely to include numeracy in their teaching, while those who felt less secure were more cautious. This relationship seems to be reciprocal. Confidence appears to shape how teachers interpret their knowledge and whether they seek further support. In this sense, knowledge does not seem to operate independently; its influence depends on how it is experienced by teachers.

The role of *disciplinary culture* in shaping legitimacy is also central to this interpretation. While policy presents numeracy as a shared responsibility, subject expectations appear to influence whether teachers see it as part of their role. In the study, numeracy (particularly when it involved teaching methods) remained closely associated with mathematics. This may help to explain why teachers often distinguished between using numeracy and teaching it explicitly. Where numeracy aligned with subject practices, it was more easily integrated. Where it required a shift in role, teachers were more cautious. Legitimacy was, therefore, not only a personal judgement, but something shaped by subject cultures and school contexts.

Structural conditions appear to influence whether these patterns are maintained or challenged. The absence of a relationship between policy engagement and confidence seems to indicate that awareness alone does not change practice.

Weak accountability, limited exemplification, and unclear assessment expectations allow existing patterns to persist. These patterns can become self-reinforcing over time. Lower confidence may lead to more cautious engagement, which limits opportunities to develop knowledge and shared practice. This may reinforce the perception that numeracy belongs to mathematics specialists. In this way, enactment patterns do not seem to be shaped by individual factors only, but by how these factors interact within school systems.

Together, these findings suggest three ways in which Bennison's framework might be interpreted more fully:

1. Focusing not only on the domains themselves, but also on how they interact, provides a clearer account of how teachers move from policy expectations to classroom practice.
2. The relationship between knowledge and confidence helps explain why knowledge does not automatically translate into practice.
3. Legitimacy is shaped not only by individual confidence, but also by disciplinary cultures and school contexts, helping to explain why responsibility for numeracy remains uneven even when it is formally shared.

Improving numeracy across the curriculum depends not only on knowledge or policy, but on how these factors align with teachers' confidence and their understanding of their role within their subject.

The next chapter considers the implications of the study, its limitations, and recommendations for future research.

Chapter 7: Implications, Directions for Future Research, and Limitations of the Study

7.1 Implications

The study suggests that improving numeracy across the curriculum requires alignment across multiple factors rather than isolated interventions. Since teachers' engagement with numeracy appears to be shaped by confidence, perceived knowledge, subject expectations, past experiences, and structural conditions, reform efforts must address how these elements work together in practice.

7.1.1 Implications for Policy

The findings indicate that policy clarity alone is insufficient to influence classroom practice. Although numeracy is framed within CfE as a shared responsibility, some teachers appeared to be uncertain about what this responsibility involved within their subject. Broad expectations appeared to be interpreted differently across disciplinary contexts, contributing to variation in how numeracy was enacted.

A key implication is that policy needs to be translated into subject-specific guidance. Teachers require clearer examples of what numeracy looks like within different subjects and where responsibility lies. Without this, responsibility is left to individual interpretation, increasing the likelihood of cautious or limited engagement.

The findings also indicate that accountability plays an important role. Where numeracy was not consistently monitored or prioritised, it was more easily displaced by subject-specific demands. However, accountability alone is unlikely to be effective if teachers do not feel confident or see numeracy as part of their role. In such cases, it may lead to superficial compliance rather than meaningful integration.

Policy approaches should, therefore, aim to align expectations, support, and accountability. Policy support must be experienced as practical and applicable, not simply available. Although the teachers were often aware of local authority and national provision, such support was often described as too abstract,

inconsistent, or insufficiently connected to subject practice. Policy, therefore, needs not only to provide guidance and professional learning opportunities, but to ensure that these are coherent, context-sensitive, and clearly related to teachers' everyday work. This includes embedding numeracy within existing quality assurance processes, clarifying expectations across different stages of schooling, and ensuring that leadership practices support cross-curricular coherence. The effects of specific accountability approaches would require further investigation.

7.1.2 Implications for Professional Learning

The findings show that professional learning needs to address more than knowledge alone. Teachers' engagement with numeracy was shaped by how confident they felt and whether they saw it as part of their role. As a result, professional learning that focuses only on abstract numeracy concepts is unlikely to lead to sustained changes in practice.

An important implication is the need for subject-specific professional learning. Teachers responded most positively to support that was clearly connected to their subject and classroom practice, particularly where it was reinforced through familiar professional relationships and local collaborative structures. This is important because the findings suggest teachers did not automatically treat nationally or locally provided support as professionally authoritative. Instead, they appeared more likely to value support that came through familiar, relational, and context-sensitive forms, such as trusted colleagues, collaborative planning, or examples closely aligned to their own subject practice. This suggests that professional learning is more likely to be effective when it is locally mediated and practically grounded, rather than delivered only as generic external provision. This includes examples of how numeracy can be integrated within different disciplines, opportunities to work with colleagues, and access to shared approaches.

Since addressing confidence directly is important, professional learning that includes modelling, co-planning, and supported experimentation may, therefore, be particularly valuable. These approaches allow teachers to develop both knowledge and confidence in low-risk contexts.

Finally, the gap between demand for, and participation in, professional learning appears to show that accessibility and relevance are critical. Professional learning is more likely to be taken up where it aligns with teachers' subject contexts and supports their existing practice, rather than being experienced as an additional or external requirement (Bennison, 2015a; Priestley et al., 2015). While the findings indicate that subject-specific and collaborative professional learning may be valuable, intervention-based research would be needed to establish which approaches are most effective.

7.1.3 Implications for Initial Teacher Education

The findings indicate that teachers' confidence and positioning towards numeracy are influenced by earlier experiences, including their own schooling and initial training. This suggests that ITE represents an important stage in shaping how teachers understand their role in relation to numeracy.

A key implication is that numeracy should be addressed more explicitly within ITE programmes. Rather than being treated as an assumed competence, it should be linked to subject-specific teaching practices and expectations. This includes making clear how numeracy relates to different disciplines and how it can be taught within those contexts.

ITE also provides an opportunity to address how teachers see their role. Structured reflection on prior experiences of mathematics and numeracy may help prospective teachers recognise how these experiences influence their confidence and expectations. This may support a more secure sense of role when they encounter cross-curricular responsibilities in practice.

While these implications are supported by the findings, further research would be needed to examine how different approaches to ITE influence teachers' longer-term engagement with numeracy.

7.2 Directions for Future Research

The study focused on what teachers said about their role and their use of numeracy. Future research could include classroom observation, analysis of lesson materials, or pupil work to show what teachers do in practice. This would help to understand whether teachers' reported confidence and avoidance are

reflected in their teaching, and how numeracy is used, adapted, or left out during lessons.

The study looked at teachers at one point in time. Given the importance of past experiences and career stage, future research could follow teachers over time. For example, studies could track how teachers' views and practices change as they gain experience, take part in professional learning, or respond to policy changes. This would help to show how stable or changeable teachers' approaches to numeracy are.

While the study identified patterns using a relatively small sample, larger studies with a greater number of teachers could test these findings. Surveys across different regions or countries could explore whether the same patterns appear more widely. Other statistical methods, such as multiple regression, structural equation modelling, or multilevel modelling, could also be used to examine the relationships between confidence, knowledge, and enactment in greater depth, and to test the interaction between individual and contextual factors. This would be particularly useful in testing the study's suggestion that teachers' orientations towards numeracy are structured through the interaction of multiple domains rather than shaped by single variables in isolation.

The findings suggest that disciplinary context may play an important role in shaping how teachers understand and engage with numeracy. Future research could compare different subjects, such as humanities, sciences, and arts, to explore how numeracy is understood and used in each. Studies across different countries could also show how expectations about numeracy vary in different education systems. Future research could also include mathematics teachers to examine differences in how numeracy responsibility is interpreted across subject areas.

The model developed in this study indicates that change depends on the interaction of several factors. Future research could test practical approaches designed to support this. For example, studies could look at the impact of subject-specific training, joint planning between mathematics and other departments, or school leadership approaches that support shared responsibility. These studies could examine not only whether teachers feel more confident, but also whether their teaching changes over time.

Future research could also examine how teachers respond to different sources of support, including national provision, local authority offers, and school-based collaboration. In particular, it would be useful to explore whether support is more likely to influence practice when it is experienced through familiar professional relationships and locally relevant contexts rather than through external or generic provision.

7.3 Limitations of the Study

The study has certain limitations that should be considered when interpreting its findings and the scope of its conclusions.

First, the study was conducted with a relatively small sample of secondary teachers ($n = 30$), with a subset ($n = 6$) participating in follow-up interviews. Participation was voluntary and facilitated through school leadership, introducing the possibility of self-selection bias. Teachers with a particular interest in numeracy or teacher identity may, therefore, have been more inclined to participate. In addition, some local authorities were more strongly represented than others. Consequently, the findings are not intended to be statistically generalisable to the wider population of Scottish teachers. Rather than producing population-level generalisations, the study offers insights grounded in analysis of patterns within the dataset that may contribute to theoretical understanding of cross-curricular numeracy enactment. The modest sample size also limits statistical power and requires cautious interpretation of quantitative associations. The small numbers within individual disciplinary grouping further mean that comparisons between subject areas should be treated as descriptive and exploratory.

The study relied on self-reported data collected through questionnaires and interviews. Such data capture teachers' perceptions of their confidence, anxiety, knowledge, and enactment rather than directly observed classroom practice or independently verified measures of teaching behaviour. As a result, the findings reflect perceived positioning rather than objective measures of competence or classroom practice. Self-reported data are inherently subjective and may be influenced by social desirability, recall bias, or teachers' interpretations of questionnaire and interview questions. Importantly, perceived confidence does not necessarily equate to demonstrable mathematical

competence, nor does reported avoidance definitively indicate non-enactment in practice. The study, therefore, examines how teachers understand and construct their relationship with numeracy, rather than verifying classroom behaviour through observation.

While the questionnaire enabled data collection from a broader group of teachers than interviews alone would have permitted, its structured format necessarily imposed constraints. Likert-scale and multiple-choice items may have limited the range and nuance of responses and may not have fully captured the complexity of teachers' beliefs, identities, and experiences in relation to numeracy. The questionnaire items were informed by previous research on teacher beliefs, confidence, and numeracy education; however, they were adapted for the purposes of this study rather than drawn from a previously validated scale.

Given the exploratory nature of the study and the modest sample size, it was not possible to conduct formal reliability or factor analyses. The questionnaire should, therefore, be understood as a tool for identifying patterns of perception rather than as a psychometric instrument designed to produce validated measurement scales. Although open-ended items were included to mitigate this limitation, some depth was inevitably sacrificed in favour of breadth.

The quantitative analysis employed descriptive statistics and, where appropriate, non-parametric Spearman's rho correlations. Spearman's rho was used to examine associations between selected ordinal variables, reflecting the level of measurement of much of the questionnaire data. The small sample size limited statistical power and, consequently, the findings from these analyses were interpreted cautiously. Descriptive comparisons were used for disciplinary groupings because the small and unequal numbers within individual subject groups limited the appropriateness and interpretability of inferential comparisons. Correlations indicate the strength and direction of an association between variables but do not establish causation or the direction of any causal influence. The identified associations should, therefore, be interpreted as indicative patterns within this dataset rather than as evidence of causal relationships. The explanatory strength of the study lies in the integration of quantitative patterns with qualitative accounts, rather than in statistical generalisation.

The use of online data collection methods introduced both practical advantages and methodological constraints. Online interviews facilitated access to teachers across geographically dispersed locations; however, they limited opportunities to observe non-verbal communication and contextual features of school environments that might have enriched interpretation. Additionally, although the mixed-methods design allowed for both breadth and depth, only a subset of questionnaire respondents could be interviewed. As a result, not all patterns identified in the questionnaire were explored in detail in the interviews.

The findings are situated within the specific policy and curricular context of Scottish education, particularly CfE, and the framing of numeracy as a shared responsibility. This context shapes teachers' professional identities and experiences, so the findings may not transfer directly to other national or international policy settings. The transferability of the findings to other educational systems should, therefore, be considered with caution, particularly where policy structures, accountability arrangements, or subject cultures differ.

In addition, my professional background as a teacher within the Scottish education system may have influenced both data collection and analysis. While reflexive practices were employed to enhance transparency and analytic rigour, complete neutrality is neither possible nor consistent with the interpretivist stance adopted in the study. Familiarity with the policy context supported rapport but also required careful reflection to avoid assumptions.

The mixed-methods design strengthened the study by enabling triangulation of quantitative and qualitative data. Questionnaire findings provided an overview of patterns in teachers' perceptions, while interview data enabled deeper exploration of how these perceptions were interpreted and enacted within professional contexts. The integration of these data sources strengthened the interpretive depth of the analysis.

Despite these limitations, the study provides useful and contextually grounded insights into how teachers construct and negotiate their identities as teachers of numeracy within cross-curricular numeracy policy contexts. The findings should be understood as analytically explanatory rather than statistically generalisable. They offer a way to interpret Bennison's framework that may be further tested, refined, and extended through future research.

7.4 Concluding Remarks

This study set out to explore how non-mathematics secondary teachers in Scotland understand and approach their responsibility for numeracy education. Overall, the findings suggest that numeracy was widely recognised as part of teachers' responsibility, but this did not translate into uniform practice across subjects.

In answering the research question, the study has shown that teachers' approaches to numeracy were shaped by how they understood numeracy, how far they saw it as part of their role, and how well this responsibility was supported within their subject and school context. Numeracy across the curriculum was therefore not simply a matter of policy expectation, but of how that expectation was interpreted and negotiated in practice.

This study contributes to understanding why cross-curricular numeracy may be widely endorsed in principle, yet unevenly enacted in practice.

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Appendix 1: Questionnaire Items

Section 1: Personal details

- Name
- Email address

Section 2 - Teacher Background

- What subject(s) do you teach or have previously taught?
- How many years have you been teaching for? (Please select one category)
 - Less than 1 year
 - 1-3 years
 - 4-6 years
 - 7-9 years
 - 10+ years
- What is your teaching qualification?
 - 1 year PGDE
 - 3 or 4 year Subject with Education
 - Other (Please specify below) [Open-response text box]

Section 3 - Defining numeracy

[Open response]

- What does numeracy mean to you?
- Please define numeracy in your own words.
- Can you identify any areas/topics in your curricular area of teaching where there are opportunities for pupils to develop numeracy skills?
- In what ways do you think these areas/topics require numeracy skills?

Section 4 - Professional Development

- What professional learning, if any, have you undertaken with regard to numeracy? (Please select all that apply)[Tick box]
 - Numeracy inputs during initial teacher education (ITE),
 - probationer teacher inputs,
 - local authority professional learning,
 - personal professional learning, etc.)
 - Other (Please give details below) [Open-response text box]
 - None
- Have you read and/or used the numeracy experiences and outcomes as outlined by Education Scotland? [Tick box]
 - Read only
 - Read and used
 - Not read

- Do you think you would benefit from professional learning to support you in teaching aspects of numeracy? [Tick box with further question dependent on response]
 - Yes
 - Maybe
 - No
- [If yes] What type of professional learning do you feel would benefit you most? [Open-response]
- [If maybe] What type of professional learning do you feel might support you in teaching aspects of numeracy?
- [If no] Why do you feel this is the case?
- In your opinion, who would be best to lead professional learning on numeracy? [Tick box]
 - A colleague in my school
 - A regional curriculum development officer;
 - An outside “expert”
 - Other (Please specify below) [Open-response text box]
- Do you have any other specific comments regarding professional learning in relation to numeracy education?

Section 5a - Teaching numeracy

[Open response]

- How do you understand your responsibility to teaching numeracy?
- If/when you are planning to teach a topic that involves aspects of numeracy, what resources would you refer to?
- If/when you are planning to teach a topic that involves aspects of numeracy, would you consult anyone else? Whom?
- In your school, do you have access to any of the following concrete materials to support learners? (Please select all that apply)
 - Dienes blocks
 - Cuisenaire rods
 - Double-sided counters
 - Other (Please specify) [Open-response text box]
 - I do not have access to concrete materials
- Have you ever used any of the following concrete materials to support learners in your lessons? (Please select all that apply)
 - Dienes blocks
 - Cuisenaire rods
 - Double-sided counters
 - Other (Please specify) [Open-response text box]
 - I have never used concrete materials
- Do you have access to any of the following digital technologies to support learners in their numeracy? (Please select all that apply)
 - calculators
 - computers/laptops

- tablets
- Other (please specify) [Open-response text box]
- No access to digital technologies
- What do you think of when you hear the word “average”? Consider its meaning in a variety of contexts. Briefly outline how you might explain “average” to your students. How much class time would you spend? [Open-response]

Section 5b - Enjoyment in teaching numeracy

[Likert scale from 1 (not at all) to 5 (to a great extent)]

- To what extent do you find it enjoyable to teach or incorporate aspects of numeracy education into your lessons?

[Open response]

- Does this differ depending on the aspect of numeracy involved?
- Are there any aspects of numeracy that you particularly enjoy teaching/incorporating into lessons?
- Are there any aspects of numeracy that you particularly dislike teaching/incorporating into lessons?

Section 6 - Conceptual understanding of numeracy in everyday life

[Likert scale from 1 (strongly disagree) to 5 (strongly agree)]

- It is useful to be able to work out the amount I would save from a discount.
- It is useful to be able to interpret information from graphical representation.
- It is useful to be able to perform basic probability calculations.
- It is useful to be able to calculate averages.
- It is useful to be able to perform calculations involving time.

[Open response]

- Please outline any areas, situations, etc. where numeracy is relevant in everyday life. You can list as many as you can think of.

Section 7 - Confidence with Numeracy

[Likert scale from 1 (strongly disagree) to 5 (strongly agree)]

- When I work with my students on numeracy, I am confident that I can help students to address gaps in their numeracy understanding.
- When I am preparing to teach a topic that includes an aspect of numeracy, I am confident that I can source data/questions to use in the lesson.
- I can estimate the total cost of my shopping before I get to the till.

- I can calculate the amount of change I should receive.
- I can easily perform mental calculations.
- I am confident with all aspects of numeracy.
- I experience anxiety when I have to teach aspects of numeracy.
- I do not like dealing with numbers.
- I will actively avoid situations involving numeracy.
- I do not like making calculations in everyday life.
- I enjoyed mathematics when I was at school.

Section 8 - Statistics in Everyday Life

Listed below are some statements concerning beliefs or attitudes about chance and data. Please indicate your level of agreement with each statement.

[Likert scale from 1 (strongly disagree) to 5 (strongly agree)]

- You need to know something about statistics to be an intelligent consumer.
- I can easily read and understand graphs and charts in newspaper articles.
- When buying a new car, it is better to ask a few friends about the problems with their cars than read a car satisfaction survey in a consumer magazine.
- I can understand almost all of the statistical terms that I see in newspapers or on TV.
- Understanding probability and statistics is becoming increasingly important in our society.
- Statements about probability (such as the odds of winning a lottery) seem very clear to me.
- To learn about the side effects of a drug, it is better to refer to the results of a medical study that tested it on a few people, than to talk to someone who has taken the drug.
- People who have contrasting views can each use the same statistical finding to support their view.
- I could easily explain how an opinion poll works.
- Weather forecast about the chances of rain are wrong so often that I don't take them seriously.

Section 9 - Numeracy Skills

[Open response]

- A student has a 270g packet of chocolate that says "35% more chocolate for free". What numeracy opportunities does this present?

Appendix 2: Ethical Approval Documentation



College of Social
Sciences

08 April 2025

Dear Claire Drummond

College of Social Sciences Research Ethics Committee

Project Title: Researching teacher attitudes to numeracy in secondary education in Scotland

Application Number: 400240191

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: 01/05/2025
- Project end date: 30/04/2026
- 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/staffandpostgraduateresearchstudents/>

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



Our Ref: CD/AMC
 Your Ref:
 Contact:
 Tel:
 E-mail:
 Date: 1st May 2025

FAO Claire Drummond

Education and Families

Barry Smedley
 Chief Officer
 Civic Square
 Windmillhill Street
 Motherwell, ML1 1AB
www.northlanarkshire.gov.uk

Dear Claire,

Research Project: Researching teacher attitudes to numeracy in secondary education in Scotland

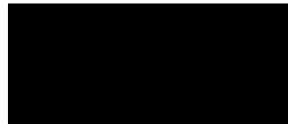
Thank you for returning the completed application form. I am pleased to inform you that approval has been granted at authority level for you to approach the head teachers of NLC secondary schools to seek their approval for staff to participate in your project.

A copy of this letter should be included with your email as confirmation of North Lanarkshire Council's authorisation but I would remind you that it is the head teachers who have the final veto over whether or not they can provide access to their staff for this research.

When you have completed your research you should provide the schools, if requested, with a copy of your findings.

I wish you very success with your project.

Yours sincerely,



Barry Smedley
 Chief Officer
 Education and Families



**LIVE
 LEARN
 WORK
 INVEST
 VISIT**



OFFICIAL

Glasgow City Council Education Services

24.45

Application Reference

Research Access Request Notification

RESEARCHER NAME	Claire Drummond
PROJECT TITLE	Researching teacher attitudes to numeracy in secondary education in Scotland.
REQUEST STATUS	Approved ☒ Refused ☐
COMMENTS (IF APPLICABLE)	- Although permission for research access has been given by the research group it is still very much up to the Head of Establishment to decide whether or not they participate and assist you in your research. Schools also reserve the right to withdraw from the project at any time if they are no longer able to participate. - A copy of this letter should be forwarded to the establishment when contacting them to request their participation. - Opt-in consent must be used in all circumstances. This is in line with GDPR regulations. - Any personally identifiable data collected from participants must be done so within GDPR guidelines.

OFFICIAL

If you require any further assistance please email PPR@education.glasgow.gov.uk

• EDINBURGH •
THE CITY OF EDINBURGH COUNCIL
CHILDREN, EDUCATION AND JUSTICE SERVICES

Date 5th May 2025

Your ref EPS/61

Our Ref MG/BH

Dear Claire Drummond,

I am writing in response to your application requesting permission to undertake research in schools in The City of Edinburgh.

Your request has been considered, and I am pleased to inform you that you have been given permission in principle to undertake your research. I must stress that it is the policy of this Authority to leave the final decision about participation in research projects of this kind to Head Teachers and their staff, so that approval in principle does not oblige any particular establishment to take part.

I request that you forward a copy of your completed findings to me when they become available. In this case an electronic summary of your thesis would be preferred. Your work may be of interest to a number of staff in the Children, Education and Justice Services Department.

I would like to thank you for contacting the Children, Education and Justice Services Department about your work, and wish you every success in the completion of your project.

Yours sincerely

Martin Gemmell
Principal Psychologist

The Educational Psychology Service
Level 1.3 Waverley Court, 4 East Market Street, Edinburgh EH8 8BG
Tel 0131 469 2800




Educational Psychology Service

West Lothian Civic Centre
Howden South Road
Livingston
West Lothian
EH54 6FF

Principal Educational Psychologist:
Jennyfer McNiven

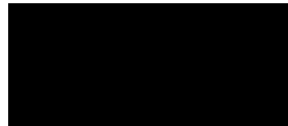
Contact:
Tel: 01506 283130
[www.westlothian.gov.uk/](http://www.westlothian.gov.uk/EducationPsychologyService)
EducationPsychologyService

29/04/2025

To whom it may concern,

The Educational Psychology research committee at West Lothian Council grants ethical approval for the research of Claire Drummond titled '*Researching teacher attitudes to numeracy in secondary education in Scotland*'. It is our understanding that the research will be conducted by the researcher between May 2025 and April 2026 with volunteering secondary school teachers as part of their EdD at the University of Glasgow.

Yours faithfully,



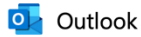
Jennyfer McNiven
(Principal Educational Psychologist)

"Working to improve the wellbeing and educational outcomes of children and young people in West Lothian through the practical application of psychology."

Data Label: OFFICIAL - Sensitive



westlothian.gov.uk



FW: Ethical approval query

From Smith, Pamela ED HQ [REDACTED]
Date Thu 10/04/2025 11:31
To Claire Drummond (PGR) [REDACTED]

Good morning Claire,

Thank you for your request to carry out research in South Lanarkshire Council Secondary Schools.

I am pleased to advise you that approval has been granted for you to approach the Head Teachers to ask if they will take part in your project. When you contact the Head Teacher you should attach a copy of this email as proof of local authority authorisation. The Head Teacher will have the final veto over whether the school participates.

We would ask that due diligence is given to the handling of any staff information which must be treated on a confidential basis and, any findings from your research must be shared with the Head Teacher and us prior to publication.

I wish you every success with your research and if I can be of any further assistance please don't hesitate to contact me.

Kind regards

Pamela Smith
Central Support Services Co-ordinator
Education Resources
South Lanarkshire Council
Almada Street
Hamilton
ML3 0AA



Council Website: www.southlanarkshire.gov.uk



Contact us via an online
Sign Language Interpreter
Contact Scotland BSL

More information about Contact Scotland BSL can be found at their website <https://contactscotland-bsl.org/>