

DCU

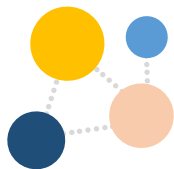
Ollscoil Chathair
Bhaile Átha Cliath
Dublin City University

**Conceptualising
Curriculum Integration:**
*A Synthesis of Theory,
Research and Practice*

REPORT 1

**Patrick Burke
Paula Lehane**

A report commissioned by the
*National Council for
Curriculum and Assessment*



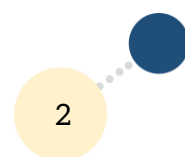
Note for the Reader

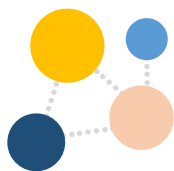
Readers should bear the following in mind:

- This is the first of two reports commissioned by the National Council for Curriculum and Assessment to inform the ongoing development of the *Primary Curriculum Framework*. Report 1 addresses *conceptualisations* of curriculum integration. Research evidence on the efficacy of curriculum integration is examined in Report 2, *Weaving the Literature on Integration, Pedagogy and Assessment: Insights for Classrooms and Curriculum*. The second report also addresses the literature on pedagogy and assessment.
- Though disciplines and curriculum areas are, by necessity, referenced in this report, they are not the primary concern. For information other areas of the *Primary Curriculum Framework*, please see the reports on Social and Environmental Education, Wellbeing, STEM, and the Arts on the NCCA website.
- This report is accompanied by Annex 1, which details the tabulation of studies that underpinned the systematic review.

Timeline of Report Preparation and Publication

May 2022	DCU researchers notified that they were successful bidders in the public tender for the project
July 2022	Research for Report 1 commenced
December 2022	Draft of Report 1 presented to NCCA Executive
January 2023	Report 1 presented to NCCA structures (Board for Early Childhood and Primary; Schools Forum; Development Groups)
February 2023	Research for Report 2 commenced
May 2023	Draft of Report 2 presented to NCCA Executive
June 2023	Report 2 presented to NCCA Board for Early Childhood and Primary; Reports 1 and 2 presented to NCCA Council
September 2023	Reports 1, 2 and associated annexes published online






Conceptualising Curriculum Integration: *A Synthesis of Theory, Research and Practice*

Report 1

Examining Integration, Pedagogy and Assessment in the
Context of the Redeveloped Irish Primary School Curriculum

Dr Patrick Burke 

Dr Paula Lehane 

Institute of Education
Dublin City University

January 2023

Authorship

Authors are listed in alphabetical order. Both contributed equally to this report.

Acknowledgements

We wish to thank the National Council for Curriculum and Assessment for commissioning and supporting this project. We are particularly grateful for the feedback and assistance provided by Dr Derek Grant throughout the drafting of this report. The organisational acumen and professionalism of Ms Orla Dawson must be recognised – she was a major support for both researchers throughout the project. We also wish to acknowledge the contributions of the following peer-reviewers who made a meaningful contribution to earlier drafts of this report: Dr Nicola Broderick, Dr Benjamin Mallon, Dr Annie Ó Breacháin, Dr Conall Ó Breacháin and Dr Aisling Twohill. Thank you to Mr Denis Moynihan for his careful proof-reading of the report, Mr James Flannery for his support as librarian and Dr Triona O’Hanlon for her support as Research Development Officer. Finally, we wish to thank our current and former heads of school at Dublin City University for their support: Dr Geraldine French, Dr Aoife Brennan and Dr Joe Travers.

This report can be cited as:

Burke, P. & Lehane, P. (2023). *Conceptualising Curriculum Integration: A Synthesis of Theory, Research and Practice*. Dublin: National Council for Curriculum and Assessment.

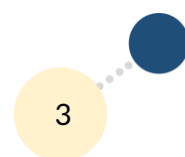
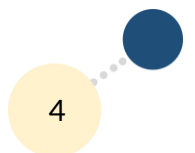
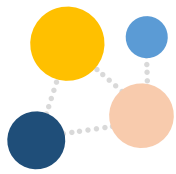




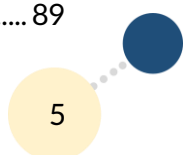
Table of Contents

Note for the Reader	2
Timeline of Report Preparation and Publication.....	2
Visual Summary	9
Executive Summary	10
Conceptual and Theoretical Insights	10
Research Questions.....	11
Methodology	11
Findings	12
Case Study Findings	12
Findings from the Systematic Review	12
Conclusions.....	13
Moving Forward.....	13
Chapter 1 Overview and Context	15
Chapter 2 Key Concepts, Theories and Frameworks	19
Introduction.....	19
Curriculum Models.....	19
Knowledge, Disciplines and Curriculum Integration.....	20
Multi-, Inter- and Transdisciplinarity in Curriculum Integration.....	24
Frameworks for Curriculum Integration.....	25
Agency	29
Learner Agency	30
Teacher Agency.....	33
Conclusion.....	35
Chapter 3 Methodology	37
Introduction.....	37
Research Questions and Research Design.....	37
Part 1: Case Study	39
Part 2: Systematic Review	39
Search Strategy.....	39
Eligibility Criteria.....	41
Screening Procedure	41
Data Extraction and Narrative Synthesis.....	44





Limitations.....	44
Summary of the Methodological Approach.....	45
Chapter 4 Curriculum Integration: International Case Studies.....	47
Introduction.....	47
Australia.....	47
Overview	47
Role of Curriculum Integration.....	49
Experiences of Implementation.....	51
Implications and Key Learning from the Australian Experience	54
Scotland.....	55
Overview	55
Role of Curriculum Integration.....	58
Experiences of Implementation.....	59
Implications and Key Learning from the Scottish Experience.....	61
International Baccalaureate (IB)	62
Overview	62
Role of curriculum integration.....	63
Experiences of Implementation.....	63
Implications and Key Learning from the International Baccalaureate Primary Years Programme.....	65
Cross-Case Summary.....	66
Chapter 5 Curriculum Integration: Systematic Review.....	68
Introduction.....	68
Demographic Characteristics of Research Studies	68
Conceptualisations of Curriculum Integration.....	69
Curriculum Integration: General.....	70
Curriculum Integration: Literacy/Language.....	73
Curriculum Integration: Arts	75
Curriculum Integration: STEM.....	78
Curriculum Integration: Social Studies/Environmental Education.....	82
Curriculum Integration: Wellbeing.....	85
Conceptualisations of Curriculum Integration: Summary	86
Barriers and Challenges to Curriculum Integration.....	86
Teacher Knowledge and Expertise	86
Curriculum Structure and Guidance	89





Time and Resources.....	90
Perceived Subject Hierarchies.....	92
Barriers and Challenges to Curriculum Integration: Summary.....	93
The Role of Learner Agency.....	94
Emphasis on Learner Agency.....	94
Opportunities for exercising agency.....	95
The Role of Learner Agency: Summary.....	96
The Role of Teacher Agency.....	96
Accountability and curriculum requirements.....	97
The importance of professional learning and collaboration.....	97
Developing shared understanding and values.....	98
Enabling teachers to make decisions about curriculum at a local level.....	98
Supporting materials and resourcing.....	99
The Role of Teacher Agency: Summary.....	100
Conclusion.....	100
Chapter 6 Conclusions and Implications.....	102
Introduction.....	102
Conceptualising Curriculum Integration: Purpose, Knowledge and Responsiveness....	102
Purpose.....	103
Sources of Knowledge.....	104
Responsiveness.....	105
How can these considerations inform curriculum development?.....	106
What are the implications of these considerations for the <i>Primary Curriculum Framework</i> ?.....	107
What are the implications for the enactment of an integrated curriculum?.....	109
Initial Teacher Education (ITE) and Professional Development.....	110
Curriculum Guidelines - Why, what, when and how.....	110
System Supports.....	111
Concluding Comments.....	112
References.....	115
Appendix A.....	140

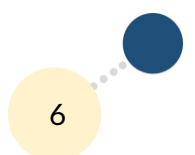
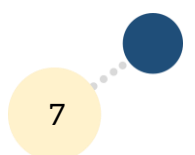




Table of Figures

Figure 1 Continuum of integrative design options, modified from Jacobs (1989).....	25
Figure 2 A Model of Learner Agency, modified from Vaughn (2020).....	31
Figure 3 Sun Model of Co-Agency Developed by OECD Student Focus Group	33
Figure 4 Ecological Model of Teacher Agency, modified from Priestley et al. (2015a)	34
Figure 5 Summary of Research Approach.....	38
Figure 6 PRISMA Flow Diagram.....	43
Figure 7 The 3-Dimensional Design of Australia’s Foundation-Year 10 Curriculum (from ACARA, 2022b)	48
Figure 8 Content objectives for the ‘Managing Digital Privacy and Identity’ sub-element (from ACARA, 2022c).....	50
Figure 9 Guidance on how to address the ‘Managing Digital Privacy and Identity’ sub-element within the Health and Physical Education learning area (from ACARA, 2022c)..	50
Figure 10 Integrated Curriculum: A School-Wide Conceptual Model (from Moss et al., 2019, p. 36)	53
Figure 11 The Four Capacities, from Education Scotland (2019)	55
Figure 12 The four contexts for learning, from Education Scotland (2019)	56
Figure 13 Example of Experiences and Outcomes from the Sciences, extracted from Curriculum for Excellence: All Experiences and Outcomes (Scottish Government, n.d.)	57
Figure 14 Process of curriculum making in the refreshed narrative, from Education Scotland (2019)	58
Figure 15 Distribution of countries represented in this systematic review	68
Figure 16 Learning Areas examined in this systematic review	70
Figure 17 Graphic Representation of Interdisciplinary Content Knowledge (modified from An, 2017).....	88
Figure 18 Three Key Considerations for Curriculum Integration.....	103



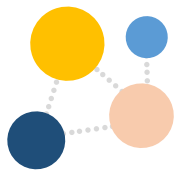
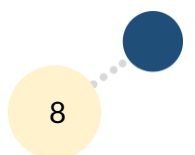


Table of Tables

Table 1 Fogarty's (1991) Continuum of Integration	27
Table 2 PIO Framework.....	40
Table 3 Inclusion/Exclusion Criteria	42
Table 4 Studies examining integration as a <i>general</i> concept (including with no disciplinary focus) or across multiple disciplines	71
Table 5 Stages of the Negotiated Integrated Curriculum in Fitzpatrick et al. (2018).....	72
Table 6 Studies studying Literacy Integration, listed by discipline and first author	73
Table 7 Studies examining Arts Integration, listed by discipline and first author	75
Table 8 Three Models of Arts Integration.....	77
Table 9 Studies examining STEM, STEAM, Science and Maths Integration listed by discipline and first author	78
Table 10 Models of STEM Education	81
Table 11 Studies examining Social Studies, Geography, History and Environmental Education Integration listed by discipline and first author	82
Table 12 Studies examining PE and SPHE integration listed by discipline and first author	85



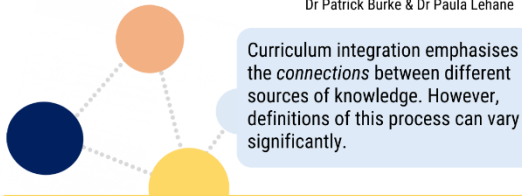


Visual Summary

Conceptualising Curriculum Integration

A Synthesis of Theory, Research and Practice

Dr Patrick Burke & Dr Paula Lehane



The balance between the knowledge offered by children's lives, disciplinary knowledge and other forms of knowledge should be carefully considered.



Connections between different knowledge forms can be discussed using the terms *multidisciplinary*, *interdisciplinary* and *transdisciplinary*.



Agency is an individual's capacity to respond to and shape their circumstances. Learner and teacher agency must be addressed when conceptualising curriculum integration.

Research Questions

- 1 How does the literature define and describe different conceptualisations of integration?
- 2 What are the barriers and challenges associated with the different conceptualisations of integration?
- 3 How might integration be best conceptualised in the context of a redeveloped primary curriculum that reflects child and teacher agency?

Research Approach



Case Study

Australia, Scotland, International Baccalaureate (IB)

Systematic Review

2012-2022



Empirical studies examining curriculum integration for primary aged students and their teachers

211 studies reviewed

Key Findings

Conceptualisations

Discussions on curriculum integration have a strong disciplinary focus in the empirical research.

No single conceptualisation captures the different ways curriculum integration can occur.

Agency: Learners & Teachers

Curriculum integration *can* support learner agency but this is not always a core focus in the research.

Meaningful opportunities for learners to exercise agency can be embedded within integrated teaching e.g. units based on their interests/concerns, use of certain pedagogies.

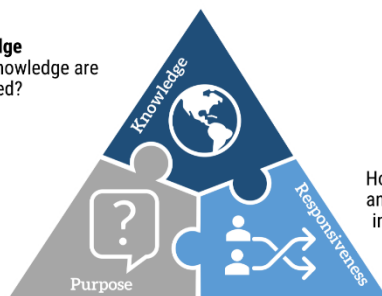
Curriculum integration requires teachers to make a range of decisions at a local level. Systemic factors (e.g. accountability measures, curriculum documents) all interact to influence teacher agency.

Barriers & Challenges

- Teacher Knowledge and Expertise
- Curriculum Structure and Guidance
- Time and Resources
- Perceived Subject Hierarchies

Considerations for Curriculum Integration

Knowledge
What sources of knowledge are integrated?



Purpose
Why do you want children to learn in an integrated manner?

Responsiveness
How do children, teachers and other concerns shape integration as it unfolds?

Moving Forward

A process for integrating the core components of the *Primary Curriculum Framework* should be outlined.

Initial Teacher Education (ITE) and Professional Development, clear curriculum guidelines and system supports must be addressed if curriculum integration is to be widely enacted.

Pedagogy and assessment must also be considered when planning for curriculum integration. A second report will address the evidence base for various approaches to curriculum integration.

Executive Summary

The use of disciplinary categories and subject areas to structure primary school curricula is common in education systems worldwide. Increasing attention has been afforded to the potential offered by blurring or removing these disciplinary boundaries through integrated curriculum frameworks. While no one definition of curriculum integration exists, shared across all definitions is a focus on connections. Exactly what is connected varies from scholar to scholar, researcher to researcher and teacher to teacher. Proponents of curriculum integration cite the need to break down subject boundaries in pursuit of a more holistic education that reflects children's experiences and supports skills such as critical thinking. Nevertheless, the rationale and evidence base for integration has been the subject of extensive critique. Key among these criticisms is a distinct ambiguity about what is meant by the term 'curriculum integration'. The current review provides an extensive analysis of the theoretical, conceptual, curricular, and empirical literature to better address what curriculum integration is and what it looks like when implemented. Report 2 addresses the practicalities and efficacy of implementation in terms of pedagogy and assessment. Both reports have been commissioned by the National Council for Curriculum and Assessment (NCCA) to inform the ongoing development of Ireland's *Primary Curriculum Framework*.

Conceptual and Theoretical Insights

The theoretical literature on curriculum-making makes clear that, as a basic principle, a curriculum framework's organising structure must be **coherent**. Without this coherence, any high-level ideal – such as curriculum integration – is unlikely to make it from a curriculum document to a lived reality in classrooms. In particular, clarity concerning the role of knowledge in a curriculum framework is vital if meaningful curriculum integration is to occur.

Knowledge can be conceptualised in different ways, but much of the debate in the scholarly literature has focused on whether knowledge should be represented in subjects (disciplines) or other organising structures. Debate has also centred around the extent to which the knowledge offered by *children* (as opposed to traditional disciplines) should be a key focus of teaching and learning. However, there are risks involved in marginalising the knowledge associated with traditional school subjects. Equally, there are also risks involved in marginalising children's lived experiences, interests and concerns. The curriculum should set out a clear vision for how these forms of knowledge are

represented. Rather than being wholly devolved to teachers to establish, the curriculum itself should inform the balance of knowledge sources.

Models of curriculum integration draw heavily on distinctions between **multidisciplinary, interdisciplinary and transdisciplinary** approaches. Some models place these on a continuum, implying a hierarchy of approaches. These models tend to address the reality that most national curriculum documents require attention to a variety of subjects and learning outcomes. Other models sidestep this consideration and place children's interests front and centre. The latter view places a high premium on children's involvement as decision-makers in a democratic classroom. In the literature, no one model is universally accepted as optimal. This is driven to a large extent by educational values.

The concept of **agency** – a person's capacity to act on, shape and influence the world around them – provides important insights for how curriculum integration can be enacted. Agency is influenced by many factors, including a person's past experiences, current considerations and future aspirations. Within primary classrooms, learner and teacher agency require careful consideration. Learner agency can be supported by viewing children as active collaborators and contributors to their learning in the classroom, allowing space for them to express their preferences and opinions and building on their out-of-school experiences. Supporting teacher agency requires consideration of individual teacher influences (e.g. knowledge, values) and wider contextual considerations (e.g. school culture, availability of resources, prevailing conditions in an education system).

Research Questions

To better understand the potential role that curriculum integration could occupy in a redeveloped Irish primary curriculum that values teacher and learner agency, three research questions guided this desk-based research:

- How does the literature define and describe different conceptualisations of integration?
- What are the barriers and challenges associated with the different conceptualisations of integration?
- How might integration be best conceptualised in the context of a redeveloped primary curriculum that reflects child and teacher agency?

Methodology

The report relies on two main methodological approaches. The first, a **case study** analysis, examined curriculum documentation and literature on enactment in three curriculum frameworks that endorse integrated learning to various degrees: the

Australian Curriculum, the Scottish Curriculum for Excellence and the Primary Years Programme of the International Baccalaureate. The second, a **systematic review**, involved a detailed search, screening and analysis of the empirical literature on curriculum integration offered by research databases in the past ten years. This process identified a total of 211 studies.

Findings

Case Study Findings

Curriculum integration is represented in different ways across the frameworks analysed. Each framework delineates specific learning areas (e.g. mathematics, science) in addition to setting out a vision for integrated learning. The **Australian Curriculum** identifies general capabilities, such as literacy and intercultural understanding, while also outlining cross-curricular priorities, e.g. sustainability. The **Scottish Curriculum for Excellence** signals four overall capacities that span the entire curriculum while also outlining 'interdisciplinary learning' as one context in which the curriculum can be enacted. The **International Baccalaureate** embodies a transdisciplinary approach to integration, in which themes and concepts are used to tie together learning from across multiple subject areas. The case studies highlight the need for clarity in how the various parts of a curriculum should interact in order to inform integrated teaching in the classroom. Without this clarity, a vision for integrated curriculum is unlikely to be realised. Other conditions also require consideration, including the broader policy landscape, the influence of accountability measures, and the availability of professional development, exemplars and resources.

Findings from the Systematic Review

Analysis of the 211 studies revealed significant variation in what integration looks like in practice, particularly in relation to what subjects or disciplines were involved. This variation was found in the number of 'subjects' included in an integrated unit of work - if subjects were even used as an organising unit. The literature reveals potential **synergies** between disciplines to support integration (e.g. noting the 'natural' connections between different subjects such as science and literacy or music and maths) but also the possible **tensions** (e.g. arts subjects being 'sidelined' if used purely as a vehicle for learning about another curriculum area). A tabulation of all studies included in the review can be found in the accompanying Annex.

Across the 211 studies, prime **barriers** to curriculum integration included: teacher knowledge and expertise, curriculum structure and guidance, time and resources, and perceived subject hierarchies. The studies revealed that the position occupied by **learner**

agency in integrated units of work varies. While sometimes it can be given a central focus, other times it is afforded very little, if any, attention. **Teacher agency** for curriculum integration was found to be influenced by a range of factors. Accountability and curriculum requirements as well as insufficient access to professional learning and collaboration were significant barriers that constrained teachers' capacity to act in an agentic manner. The degree to which integration was a shared value with a common understanding within a school and the availability of appropriate time and resources also emerged as important issues that helped or hampered teacher agency.

Conclusions

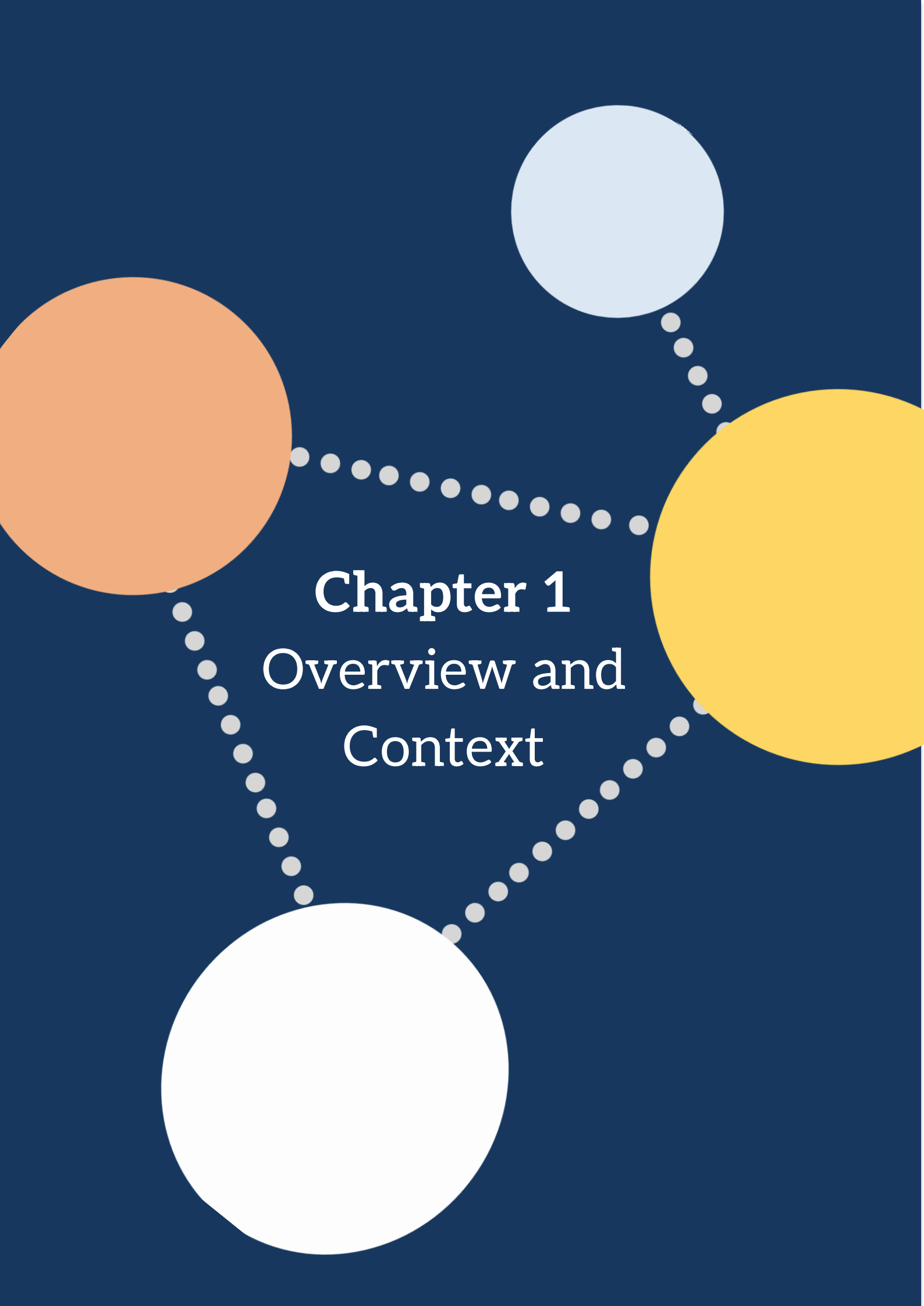
Based on the synthesis of the literature and research reviewed, it is proposed that curriculum integration should be examined according to the following considerations:

- **Purpose:** *Why do you want children to learn in an integrated manner?*
- **Sources of Knowledge:** *What sources of knowledge are integrated?*
- **Responsiveness:** *How do children, teachers and other concerns shape integration as it unfolds?*

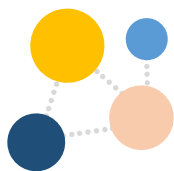
The research evidence does not definitively conclude that one purpose is 'better' than another. Neither can the research conclude the precise balance needed between the sources of knowledge involved such as the number of subjects included and children's own knowledge contributions. The degree to which children should drive the focus of an integrated unit of learning is also a matter for debate within the literature. However, all instances of curriculum integration address these considerations in one way or another.

Moving Forward

The *Primary Curriculum Framework* does not lend itself to one form of, or approach to, curriculum integration. Ongoing work on curriculum development must exemplify the precise inter-relationship between the core components of the curriculum including what role integration should play within the framework. If this is not present, evidence from other jurisdictions suggests that this can be a major stumbling block for the implementation of integrated teaching practices. It is necessary to outline a curriculum-making process for how the various curriculum components should be integrated. A vision for a more integrated curriculum in primary schools will only be realised if significant thought and investment is given to Initial Teacher Education and Professional Development, if curriculum guidelines clearly exemplify how curriculum integration can occur in practice and if the system more broadly supports this endeavour (e.g. supportive school leadership, shared understanding amongst inspectors and other educational professionals).



Chapter 1
Overview and
Context



Chapter 1 Overview and Context

While no one definition of curriculum integration has been agreed upon in the literature, it is often described as a way of *forging connections* between different sources of knowledge. Instead of organising learning experiences in a highly disciplinary or subject-specific manner, the boundaries between disciplines may be blurred. Learning in literacy supports inquiry in science. Arts and history intertwine. Children connect their understandings with pressing global issues.

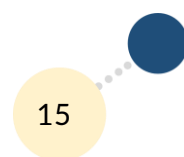
Interest in curriculum integration has waxed and waned over time. Throughout the first half of the twentieth century, curriculum integration was synonymous with progressive educators like Dewey and experienced a later ‘surge’ in popularity in the 1980s and 1990s. Several influential scholars emerged during this period to further advance thinking on this approach (Beane, 1997; Drake, 1993; Fogarty, 1991; Jacobs, 1989). While literature on this topic often emanates from the United States (see Drake & Reid, 2020), other jurisdictions have also embraced the idea of curriculum integration. This includes Ireland, where curriculum integration was endorsed in both the 1971 and 1999 primary curricula:

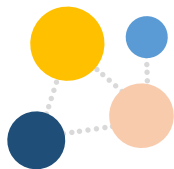
The young child is not conscious of subject barriers; he views knowledge as a key to life and his questions concerning the world around him range over the whole field of knowledge. (Department of Education, 1971, p. 19)

For the young child, the distinctions between subjects are not relevant: what is more important is that he or she experiences a coherent learning process that accommodates a variety of elements. (Department of Education and Science, 1999, p. 16)

Clearly, the idea of curriculum integration is not new.

The role of curriculum integration has continued to be explored and considered in Ireland, as demonstrated in the recent *Primary Curriculum Framework*. While this framework embraces many of the same principles as its predecessors, integration has now been afforded a more central role in teaching, learning, and assessment. The National Council for Curriculum and Assessment (NCCA; 2020) asserts that “children live their lives in an integrated world” and should be able to “apply knowledge and skills from multiple areas” to solve “real-world problems” (p. 22). The NCCA therefore states children should engage with “integrated learning experiences” while at school (2020, p. 22). Yet, realising this statement is challenging. A range of practical and theoretical obstacles has hindered Irish teachers’ use of integrated curriculum over the past half-century. For example, Phase 1 of the Primary Curriculum Review highlighted that “the integrated

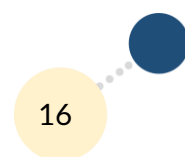




nature of the Primary School Curriculum should be exemplified for teachers to a much greater extent than it currently is in the curriculum documents” (NCCA, 2005, p. 22). The most recent Chief Inspector’s Report (Department of Education Inspectorate, 2022) also signalled the need to further extend cross-curricular learning activities for children.

It should be noted that curriculum integration is not without its detractors. Critics of integrated curriculum advance their argument on a number of fronts, including the ambiguity of what is meant by the term; the high levels of teacher knowledge and planning needed for its implementation; the challenge of assessment; its wide-ranging implications for teacher education; its potential disconnect with the disciplines that help us to learn and think about the world; and the smaller body of research evidence on integrated approaches when compared to disciplinary approaches (Badley, 2009). Discipline specialists, in particular, have noted concerns about the potential ill effects of integrated teaching. Addressing their area of specialism, Haas and Laughlin (1999, p. 305) ruefully remarked that some instances of integration are “better described as *invasion* of social studies than *integration* with social studies.” In the case of STEM, which integrates science, technology, engineering and mathematics, some assert that a discipline specific approach is preferable, particularly given arguments that this grouping emerged primarily for economic rather than educational reasons (see Breiner et al., 2012; Williams, 2011). Integrated approaches to curriculum are sometimes lauded as an ideal vehicle for promoting “21st century skills” (Drake & Reid, 2020). However, others caution that this runs contrary to evidence pointing to the need for *domain-specific* knowledge for such skills e.g. critical thinking, problem-solving (Willingham, 2019). Despite the popularity of the term ‘integration’ in educational circles, it is a curricular concept that requires testing and careful thought.

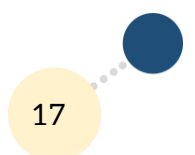
Therefore, if the Irish primary education system is to provide a clear statement of how an integrated primary curriculum should be conceptualised and implemented, robust engagement with empirical evidence on curriculum integration is required. It also necessitates that we learn from education and jurisdictions that have already embraced integrated approaches to teaching and learning. These include the core practices of pedagogy and assessment as well as the newly elevated principles of teacher and child agency (NCCA, 2020). While these have been discussed as discrete elements in recently commissioned reports (see Bacon, 2018; Lysaght et al., 2019; Volante, 2018), they are all highly interdependent in practice. To examine the relationship between these elements, the NCCA has posed three key questions for this first report to address:

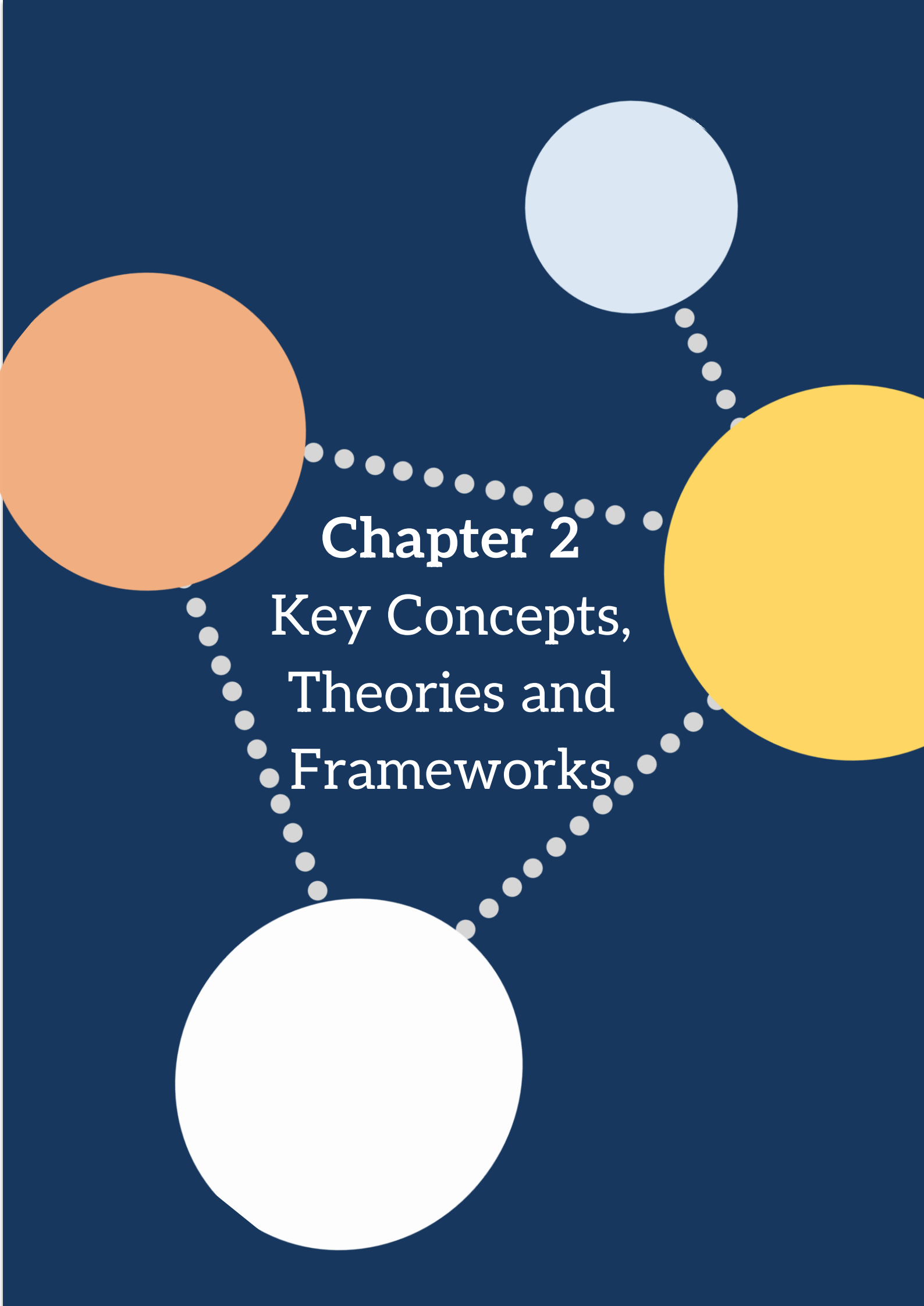




- How does the literature define and describe different conceptualisations of integration?
- What are the barriers and challenges associated with the different conceptualisations of integration?
- How might integration be best conceptualised in the context of a redeveloped primary curriculum that reflects child and teacher agency?

Following a general overview of the key concepts, theories, and frameworks (Chapter 2) associated with curriculum integration, a description of the overall research design used to answer the above research questions will be outlined (Chapter 3). This design involved (i) a case study analysis of key policy and curricular documentation on integration evidenced in international jurisdictions and (ii) a systematic review capturing the last ten years of empirical research on integration in primary contexts. Chapter 4 contains the three case studies involved in this research (Scotland, Australia and schools adopting the International Baccalaureate Primary Years Programme). Chapter 5 outlines the findings from the systematic review and addresses conceptualisations, barriers and implications for teacher and learner agency. This interim report concludes with a synthesis of key findings and charts potential implications for the ongoing development of the Primary Curriculum Framework.





Chapter 2

Key Concepts,
Theories and
Frameworks



Chapter 2

Key Concepts, Theories and Frameworks

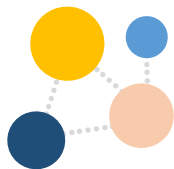
Introduction

A wide range of related and sometimes competing ideas and principles underpin the practice of curriculum integration. Such conflicts generally arise due to differing beliefs on the nature of knowledge and the 'structure' of the world (Stein et al., 2008). This chapter analyses important theories and concepts that require consideration in the current review. It begins with a brief overview of curriculum models, followed by important perspectives on subjects, disciplines and knowledge. It then turns to prominent frameworks for curriculum integration. The chapter concludes with a focus on agency, with specific reference to learner and teacher agency.

Curriculum Models

Theoretical writing on how best to craft a curriculum is extensive. The seminal Tyler (1949) model of curriculum planning envisaged four key considerations: identifying what we wish to achieve (e.g. aims, objectives), the experiences needed to get there (e.g. teaching approaches, learning activities), the best way to organise these experiences (e.g. sequencing of teacher instruction) and how best to evaluate whether the learning has taken place (e.g. assessment strategies). Though the model captures many of the important considerations of a complex design process and continues to prove influential, it oversimplifies the nature of curriculum-making. Later writing (Kelly, 2009) placed Tyler's model within one of three overarching ways of starting curriculum planning. The first starts with *content*, in which desirable knowledge is identified and provides the basis for curriculum decisions. The second, the *objectives* model, encapsulates Tyler's thinking and begins by setting out desirable outcomes that a curriculum should achieve. The third, the *process* model (e.g. Stenhouse, 1975), sets out a vision and principles for what a learner should become (e.g. an active democratically-minded citizen) and entrusts decision-making about how this should be achieved to teachers. This model is often associated with school-based curriculum development (Marsh et al., 1990; Skilbeck, 1984). Though these models are not mutually exclusive, they do provide somewhat separate starting points. Curricular confusion is likely if a framework unknowingly mixes and matches between these starting points (Priestley & Humes, 2010). This conflation may widen the gap between what has been referred to as the 'planned curriculum' (i.e. what it says in a national curriculum framework) and the 'received curriculum' (i.e. what learners actually experience; Kelly, 2004). While this report does not set out to conduct an in-depth





examination of the theory associated with curriculum development, this brief overview highlights that clarity is necessary for the successful implementation of any curriculum framework. A curriculum framework must be 'set up' in a way that makes sense to teachers if any of its high-level goals, such as curriculum integration, are to be translated into practice.

Knowledge, Disciplines and Curriculum Integration

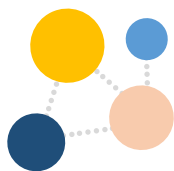
Regardless of model or starting point for a curriculum, it must provide opportunities for new learning. It is challenging to think about curriculum integration without first thinking of what *knowledge* is being integrated. In the context of curriculum-making, Wyse and Manyukhina (2018) define knowledge as "understanding of something acquired through learning, guidance and practice" (p.2) and note that it includes not just facts and skills, but a 'holistic appreciation' of an area of learning. They highlight that knowledge can come from many places, including traditional disciplines or school subjects but also more 'everyday' or 'non-disciplinary' sources. Despite its focus on competencies, the OECD (2019) has also delineated different forms of knowledge that should be addressed in a curriculum. Their categorisation includes:

- **Disciplinary knowledge:** Subject-specific content and concepts
- **Interdisciplinary knowledge:** Concepts or big ideas that cut across disciplines
- **Epistemic knowledge:** Understanding how to think and act like an expert in a discipline (e.g. how to think/work like a historian)
- **Procedural knowledge:** Understanding "how a task is formed" (p.4), e.g. using design-thinking

Notably, the OECD recognises that the opportunity to learn disciplinary knowledge is "fundamental to equity" (p.2). These provide high-level ways of thinking about *what* children should learn.

Many critical questions about curriculum integration revolve around whether knowledge should be arranged around subjects, combinations of subjects or if subjects should be referenced at all. Furthermore, although there may be a tendency to use the term 'subject' and 'discipline' interchangeably in education, they have different connotations. *Disciplines* involve specialised knowledge, concepts, ways of thinking and inquiring that have been adopted by a community of people with a shared interest. Gardner (2004, p. 233) refers to them as "important human achievements" that are "the best answers that human beings have been able to give to fundamental questions about who we are, physically, biologically, and socially". Though they may be informed by the structure of disciplines (Bruner, 1960), *subjects* tend to be school-based representations of





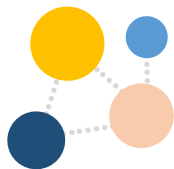
these disciplines that have been selected and constructed for presentation to students (Bernstein, 1971; Deng & Luke, 2008; Rogers, 1997). While some school subjects may have a close relationship with traditional disciplines (e.g. science, history), others may not (e.g. social, personal and health education) (Stengel, 1997). Within the field of curriculum theory, considerable attention has been paid to the value (or otherwise) of organising schooling around subjects (Kelly et al., 2008; Rogers, 1997), a concern that also naturally arises in writing on curriculum and curriculum integration. The boundaries between disciplinary and non-disciplinary knowledge have been given particular attention in scholarly literature.

Boundaries such as these are often captured in curricular time allocations and how subjects are ‘carved up’ in a curriculum document. Referring to curriculum as the “principle by which units of time and their contents are brought into a special relationship with each other” (p.157), Bernstein’s (1971, 1999) offers concepts that help us to better understand integration. The following concepts are of particular relevance:

- **Classification:** Within a curriculum, a subject can be ‘strongly classified’, meaning it has clearly circumscribed boundaries, or ‘weakly classified’, meaning that its boundaries are less well-defined and porous.
- **Framing:** When a subject is strongly framed, there is less room for child or teacher input in the knowledge that is explored. When weakly framed, there is potential for the child or teacher to shape what is learned. For example, a weakly framed curriculum might set out content at a *broad* level but allow significant scope for teachers (and children) to determine exactly what they will learn and how they will learn it.
- **Discourse and knowledge structures:** A distinction can be drawn between ‘everyday’ or ‘common-sense’ discourse and the discourse associated with conceptual development in a discipline. According to Bernstein, disciplines organise their knowledge in different ways. Hierarchical knowledge structures (e.g. physical sciences) involve the careful layering of concepts towards more abstract and advanced understandings. Horizontal knowledge structures (e.g. humanities, and social sciences) involve concepts that emerge in parallel, and are not necessarily layered on top of each other.

Drawing on these concepts, Bernstein outlines two ways of thinking about curriculum. A ‘collection’ type curriculum presents areas of learning as closed entities that do not relate to each other, while an ‘integrated’ curriculum involves the inverse. The latter centres teaching around a ‘relational idea’ that blurs boundaries. Bernstein’s differentiation of





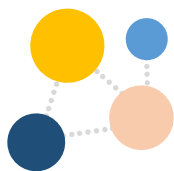
discourse suggests that the role of everyday knowledge and traditional 'school knowledge' should be carefully considered. McPhail's (2016) argues that if a curriculum is too concerned with 'everyday' knowledge, children will not be exposed to new ideas and concepts that would enhance their understanding of the world. Bernstein's ways of thinking about knowledge, discourse and curriculum have proven highly influential.

The relationship between knowledge and equity drives a significant body of sociological writing on how knowledge should be constructed in the curriculum. Informed by the work of scholars like Bernstein (1971), and in response to global movements towards competence-based curricula, curriculum theorisation has recently underscored the importance of knowledge in the curriculum. Referred to as the 'knowledge turn', scholars have argued that curricula focusing excessively on social-constructivist underpinnings and local knowledge risk depriving children of the concepts associated with centuries of scholarly advancement in the disciplines. In this vein, Young and Muller (Muller & Young, 2019; Young & Muller, 2010) outline the case for 'powerful knowledge'. Powerful knowledge refers to concepts and ways of thinking, drawn from the disciplines, which support learners to go beyond their everyday knowledge and contribute meaningfully to society¹. It includes an understanding that knowledge is dynamic rather than static, as it is constantly advanced through human activity (McPhail & Rata, 2016). Young and Muller distinguish between powerful knowledge and 'knowledge of the powerful' (i.e. fixed, traditional academic disciplines used primarily to reproduce social inequality through stratified school structures) and 'over-socialised' knowledge (i.e. knowledge drawn primarily from the everyday knowledge of learners, with blurred or unclear disciplinary boundaries).

The concept of 'powerful knowledge' has important implications for integration. Young and Muller (2010) argue that integrated approaches may "render the contours of knowledge and learning invisible to the very learners that the pedagogy was designed to favour - namely the learners, invariably but not always those from low income homes, who fall behind their peers" (p.18/19). In their view, overly integrated approaches may strip learners of the structure that helps them to make sense of new learning. They argue for a model of curriculum that *maintains* disciplinary boundaries so that these boundaries can be *crossed* in pursuit of the generation of new knowledge. 'Conceptual progression' requires particular attention in integrated approaches to subjects like maths and sciences

¹ Three criteria for powerful knowledge are outlined by Young et al. (2014): (i) It is not the same as 'common-sense' knowledge which does not need to be taught; (ii) It is systematic, draws on disciplines and allows for generalisation beyond a given context; (iii) It is specialised, having been developed by experts in a given area.



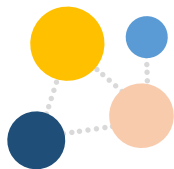


(McPhail & Rata, 2016). Therefore, how a curriculum is structured and organised is of particular significance. Though Priestley and Sinnema's (2014) do not wholly endorse the idea of powerful knowledge, their analysis of the Scottish and New Zealand curricula found partial evidence for the idea that knowledge had been 'downgraded'. This was explained by the introduction of other curriculum components that had led to ambiguity in how knowledge might manifest at the site of practice. The forerunning viewpoints do not necessarily mean that curriculum integration will not work. Rather, it highlights that a *curriculum* must outline *how* and *when* boundaries can be crossed between disciplinary areas rather than leaving this 'figuring out' to "teachers and students alone" (Niemelä, 2021, p. 359).

It is important to note that this view of knowledge is not without critique. The distinction between powerful knowledge and everyday knowledge is unlikely to be clear cut, and may set up an unhelpful 'stand-off' between the formal knowledge associated with disciplines on one hand, and the knowledge offered by learners on the other (Alderson, 2020; Priestley & Sinnema, 2014; White, 2018). There are other ways of thinking about knowledge in the context of the curriculum. For example, Biesta (2014) draws on Deweyan pragmatism to argue that it is in the *transaction* between a learner and the world that knowledge can be located. It does not exist independently of the child or the curriculum. Rennie et al.(2012) offer a 'worldly perspective' on curriculum integration, which suggests that a holistic view must draw on student experiences, relationships and contexts while *also* incorporating disciplinary knowledge. Ultimately, questions of knowledge cannot be decided in isolation. Work on foregrounding or backgrounding various forms of knowledge is likely to be influenced to a large degree by the *values* that influence curriculum making: "in making decisions about the content of the curriculum we are dealing in ideologies rather than in eternal truths" (Kelly, 2009, p. 33). Biesta (2009) argues that we should not consider education through the lens of the knowledge captured and measured in standardised assessments alone. This runs the risk of "measuring what we can easily measure" and thus "valuing what we (can) measure" (p.35). Rather, we must consider the *purpose* of education in making decisions, be this providing the knowledge needed to perform a task or job, supporting children to become aware of cultural values and norms or helping children to grow individually and think critically². The process of curriculum-making at a national level is crucial in determining the balance of knowledge representations (Wyse & Manyukhina, 2018).

² According to Biesta (2009), education can serve three functions: *qualification* (providing knowledge, skills, dispositions need for a particular goal, task or profession), *socialisation*





Multi-, Inter- and Transdisciplinarity in Curriculum Integration

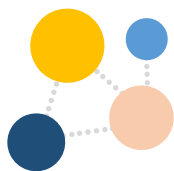
The literature on curriculum integration draws extensively on terms that use the word 'discipline' as a root. The terms 'multidisciplinary', 'interdisciplinary' and 'transdisciplinary' are particularly common, though they are also joined by a host of similar terms (e.g., 'supradisciplinary', 'crossdisciplinary', 'pluridisciplinary'). Their ubiquity requires that they are briefly explained in turn (see also Bacon, 2018). The following explanations draw on a synthesis of conceptual models of integration that refer to similar concepts (Beane, 1997; Drake & Burns, 2004; Fogarty, 1991; Jacobs, 1989).

- **Multidisciplinary** approaches rely on firm boundary lines between subjects. The subjects are brought together to examine a common topic or theme, but the content of the subjects drives the selection of learning activities to examine the theme.
- **Interdisciplinary** approaches also bring subjects together to examine a common topic or theme, but the boundary lines between subjects are less clear. Interdisciplinary approaches are more likely to examine common concepts across disciplines (e.g. change, relationships), which allow for commonalities and contrasts across subjects to be explored. This also means that new knowledge or skills learned in the context of one subject may be applied in the context of another subject.
- **Transdisciplinary** approaches pay less attention to subjects, drawing on all relevant knowledge to address important, contemporary, and complex problems (Fam et al., 2018; Nicolescu, 2008). These problems tend to be chosen by learners and explored collaboratively in educational settings. Learning activities will often 'dip in' to subjects, but they will also draw on knowledge available outside of a traditional disciplinary structure. This reflects the idea that the knowledge needed in modern society is not wholly captured in traditional disciplines (Albright, 2016).

Though the literature draws distinctions between these forms of integration, the reality, in practice, is unlikely to be so clear cut. Though multi/inter/trans-disciplinary approaches provide one way of thinking about curriculum integration, their broad brush strokes require further elaboration for meaningful educational application. The following section reviews frameworks and guidance that expand on these conceptions.

(supporting children in becoming familiar with cultural norms and values) and *subjectification* (supporting children to explore individual growth and thinking, separate from or in spite of whatever the cultural or societal norm might be).





Frameworks for Curriculum Integration

Many scholars have attempted to design overarching frameworks or models that can explicate the process of integration for both researchers and practitioners. The conceptualisations of Jacobs (1989), Fogarty (1991, 2009), Beane (1997), and Drake (2012; Drake & Burns, 2004) are widely cited and consequently deserve attention in their own right.

The risk that integration will lead to a sampling of bits of knowledge from many disciplines without any coherent structure (the ‘potpourri’ problem) or that an either/or, disciplines versus integration stance will be taken (the ‘polarity problem’) caused Jacobs and colleagues (1989) to assemble pedagogical advice for teachers. Though she drew attention to the concepts of multidisciplinary, interdisciplinarity and transdisciplinarity (see the previous section), she noted that their use was “cumbersome, if not esoteric” (p.8) when used with practitioners. Consequently, she outlined a more practical continuum (see Figure 1) that provided integrative options for teachers.

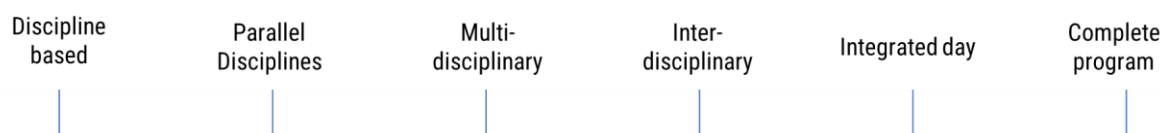
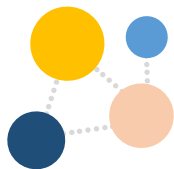


Figure 1 Continuum of integrative design options, modified from Jacobs (1989)

The continuum moves from *discipline-based* teaching, through to *parallel teaching* (where disciplinary teaching is re-ordered so that pre-existing links between subjects are taught at the same time but remain separate), through *multi-* and *inter-disciplinary* conceptions, into the *integrated day* (“a full-day program based primarily on themes and problems emerging from the child's world”, p.17) and the *complete program* (“students live in the school environment and create the curriculum out of their day-to-day lives”, p.18). Jacobs provides a pragmatic view of integration, referred to primarily as ‘interdisciplinary curriculum’, in stating that it should only be used where relevant and appropriate for learning. Jacobs outlines an interdisciplinary concept model which provides four steps for developing integrated units:

1. Select an organising centre (e.g. a subject, theme, issue, concept, event)
2. Brainstorm associations between disciplines
3. Establish guiding questions to break down the unit and provide a scope and sequence
4. Write activities for implementation





Jacobs' work provides practical guidance on integration, even if some of the options outlined to the right of the continuum are unlikely to be implemented regularly, if at all. It should be noted that, though the work draws on school-based experience, it does not cite empirical evidence or systematic trialling as a foundation.

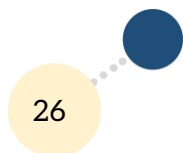
Another example of a 'continuum' approach to integration is provided by Fogarty (1991, 2009), who outlines an elaborate array of integration models premised on subtle differences between each. These models are summarised in Table 1; see also Bacon (2018). The first levels dwell primarily on connections that happen *within* a discipline, while the middle levels involve the integration of concepts, topics or themes *across* disciplines. The later levels, which happen 'inside the mind of the learner' are typified by choice, where, for example a child chooses a topic of interest and then explores it through the lens of multiple disciplines themselves (immersed) or reaches out to disciplinary experts to gain further perspectives (networked). Her 2009 book provides suggestions for planning and enacting each of these models.

Fogarty also provides five key criteria or characteristics on which integrated teaching should be evaluated:

1. **Relevance:** the extent to which the work is meaningful for children and allows for connections with 'real life'
2. **Richness:** the extent to which the work is multi-layered, with a variety of skills, concepts, perspectives; Fogarty refers to Gardner's (1983) theory of multiple intelligences to justify this³
3. **Relatedness:** the level of coherence established in making genuine connections across disciplines
4. **Rigour:** the depth of knowledge and higher-order thinking associated with the work
5. **Recursion:** the extent to which key ideas/concepts re-occur in a unit of work, suggestive of genuinely worthy themes

Fogarty's work provides one of the more complex manifestations of curriculum integration, but like Jacobs (1989) above, it does not cite a strong empirical research base.

³ Note that the theory of multiple intelligences has been subject to strong critique due to its limited empirical support (Waterhouse, 2006); this also applies to allied concepts such as 'learning styles' (Kirschner & van Merriënboer, 2013).



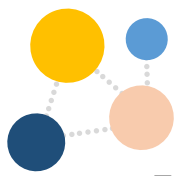
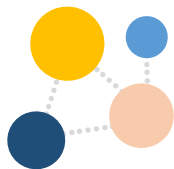


Table 1 Fogarty's (1991) Continuum of Integration

	Model	Explanation
	Cellular	The separate content of each subject is the focus
Intradisciplinary (connections within a discipline)	Connected	Opportunities used to make connections within a subject
	Nested	Multiple skills and concepts are 'nested' within one lesson
Across multiple disciplines	Sequenced	Topics are taught in a sequence such that topics with connections across disciplines are taught at the same time
	Shared	A concept or skill from one discipline is used in learning in another discipline
	Webbed	A theme is used to tie together multiple disciplines
	Threaded	Tools and strategies that can be used across disciplines are taught and learned
	Integrated	Patterns and concepts across multiple disciplines are taught and learned
'Inside the mind of the learner'	Immersed	An individual integrates information from across a range of disciplines, based on a particular topic/interest
	Networked	Experts from across disciplines interact to explore a common topic/concept

Another widely cited scholar in this area, Drake (1993, 2012; Drake & Burns, 2004) like Jacobs, places store in multi-, inter- and trans-disciplinary ways of thinking about integration. In her 2012 book, she precedes these conceptualisations with a focus on 'fusion', a form of integration that adds a new concept, skill or piece of knowledge to an already existing curriculum, e.g. embedding the teaching of environmental awareness into other subjects. Drake, who also uses the terms 'integrated' and 'interdisciplinary'





interchangeably, holds that integrated teaching must balance both relevance for children and accountability to national curricula/standards. She proposes a 'Know/Do/Be' framework that provides an overarching focus for the integration of multiple disciplines. Though this framework is presented somewhat differently across publications (Drake, 2012; Drake & Burns, 2004), it includes a focus on:

- **Know:** Big ideas and 'enduring understandings' that span disciplines
- **Do:** Important skills ('21st century skills') that apply within and across disciplines
- **Be:** Desirable attributes and attitudes that will be fostered by the integrated work

Drake outlines a process for integrating curriculum in the context of discipline-specific learning outcomes/standards that involves *backwards design*⁴ (Wiggins & McTighe, 2005) and curriculum mapping of common concepts/skills/knowledge across subjects (horizontal mapping) and grade levels (vertical mapping). Drake relies on examples from her own practice and particular contexts (e.g. Ontario) to illustrate and substantiate this model of integration.

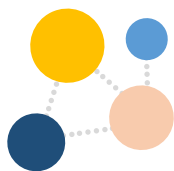
Though the forerunning frameworks all allow *some* scope for child-led learning, this is firmly balanced with the reality of jurisdictional curriculum documents, standards and policies. Beane (1997) tilts this balance in a fundamentally more learner-centred direction. Asserting that many more modern conceptualisations of integration ignore its progressive roots, he argues that integration is only integration if it is substantially grounded in learners' concerns and preferences. Curriculum integration is, in his view (emphasis added):

...concerned with enhancing the possibilities for personal and social integration through the organization of curriculum around significant problems and issues, collaboratively identified by educators and young people, *without regard for subject-area boundaries* (p. xi)

While the transdisciplinary models referenced by the preceding authors allow for this, Beane's argument implies that other forms of integration (e.g. fused, multidisciplinary, webbed etc.) are not, in reality, integration as they presuppose subject boundaries and may not be initiated by children's concerns. He also objects strongly to the idea of a *continuum* of integrative practices, particularly when approaches that focus primarily on subjects are positioned alongside approaches that focus on *learners*. His philosophy is grounded in democratic values. It is more than a mere 'technique' that involves "cleverly

⁴ Backwards design, also called 'backward mapping' (Wiggins & McTighe, 2005), is a form of planning that begins with the desired learning outcomes (e.g. what learners should know or be able to do). It then identifies how these outcomes may be demonstrated in a specific assessment (e.g. a test, project). Only then does work begin on designing and sequencing learning experiences that will support learners in achieving these outcomes. It can be contrasted with a form of planning that begins with learning activities or learning content.





rearranging lesson plans” (p.58). Though he argues strongly against the dominant role held by subject disciplines (and their proponents) in organising the curriculum, he maintains that they are “not the enemy” but “a useful and necessary ally” (p.38) that naturally arise when exploring topics of concern to learners. Young peoples’ values and dignity are foregrounded, in line with principles of diversity and democracy. The starting point for the curriculum in this view of integration is learner concerns (not learner ‘interests’, topics, or subjects). Through cooperation with learners, activities are planned that will address their concerns. Importantly, there is no “intermediate step in which attempts are made to identify what various subject areas might contribute to them” (p.44). Beane acknowledges that his vision for curriculum integration runs contrary to the organising structures of most education systems and schools, and that it therefore faces significant challenges in implementation.

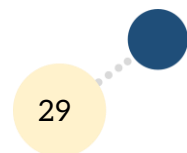
These models and ways of thinking about integration do not necessarily afford equal attention to learners’ thoughts and preferences. Some afford greater weight to the concerns of teachers (e.g. how to cover the curriculum; Drake, 2012). Others argue that student concerns should take centre stage (Beane, 1997). The literature on agency further illuminates the role that learners (and teachers) can play in shaping curriculum integration.

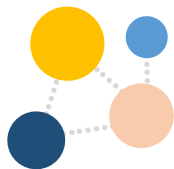
Agency

Before addressing the concept of *learner* and *teacher* agency, it is important to consider what agency means in a general sense. Though definitions vary, agency involves “being able to intervene in the world” and to “‘make a difference’ to a pre-existing state of affairs or course of events” (Giddens, 1984, p. 14). When we have a sense of agency, we have a “feeling of being in the driving seat when it comes to our actions” (Moore, 2016, p. 1). Agency is the subject of extended theorisation and, like curriculum integration, can be conceptualised in a plethora of different ways (Ferrero, 2021). In an influential contribution to the academic literature on agency, Emirbayer and Mische (1998, p. 970) define it as:

the temporally constructed engagement by actors of different structural environments—the temporal relational contexts of action—which, through the interplay of habit, imagination, and judgment, both reproduces and transforms those structures in interactive response to the problems posed by changing historical situations

Therefore, based on this definition, a person’s capacity to shape their response in a given situation is influenced by *past* experiences (*iterational dimension*), practical considerations in the present (*practical-evaluative*), and their thoughts and aspirations on future





outworkings (*projective dimension*). These three dimensions are referred to as the ‘chordal triad’. Emirbayer and Mische’s (1980) conceptualisation draws heavily on sociological thinking, but it is important to note that agency is informed by research and theorisation from multiple disciplines including philosophy and psychology.

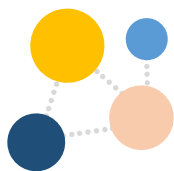
Educational interest in the concept of agency has spiked in recent years. This is witnessed in its inclusion in a range of newly updated curricula internationally (Sinnema et al., 2020), its centrality in supranational position papers on education (Organisation for Economic Co-operation and Development [OECD], 2018) and a growing volume of academic publications that tease out its theoretical and practical implications (Cong-Lem, 2021). Despite this trend, the term ‘agency’ is unlikely to be commonly used in the vernacular of everyday teaching and learning. The next sections focus on conceptualisations of agency most relevant in an *educational* context.

Learner Agency⁵

Traced to the 1970s, the recognition that children are social actors who meaningfully and intentionally influence the world around them has been one of the most important theoretical advancements in the study of childhood (James, 2011). Reflecting the thinking on agency more broadly, conceptualisations of learner agency vary considerably (Vaughn et al., 2020) and are informed by different theoretical underpinnings (Varpanen, 2019). Learner agency has been framed as necessary for heightened engagement and, consequently, learning, but has also been framed as an imperative for children’s psychological well-being and human rights (Goodman & Eren, 2013).

Theoretical writing on learner agency provides insights into its core dimensions and processes. Manyukhina and Wyse (Manyukhina, 2022; Manyukhina & Wyse, 2019) draw on critical realist theory to identify two core dimensions of learner agency: a learner’s *sense* of agency and the actual *exercising* of *agentic behaviour*. The former refers to a learner’s individual and personal *beliefs* about whether they can exercise agency, while the latter refers to the *actuality* of influencing their circumstances. They present a view of learner agency that is “contextually, interpersonally, intra-personally, and temporally situated” (p.288). Touching on some similar considerations, Vaughn (2020) presents a model of learner agency that relies on three related dimensions (see Figure 2):

⁵ The terms child (or children’s) agency, learner agency, student agency and pupil agency are used interchangeably and with little distinction in the literature reviewed in this section. For this report, the term ‘learner agency’ is adopted as a natural partner for the term ‘teacher agency’. It also recognises the fact that a child’s agency is exercised in locations other than the school setting.



(i) the *dispositional*, which refers to a learner's understanding of themselves, their intentions and their purpose; (ii) the *motivational*, which drawing on Bandura's work on self-efficacy, refers to a learner's capacity to regulate and reflect on their actions and (iii) the *positional*, which refers to the relational aspects of a learner in school and how they interact and negotiate with others.

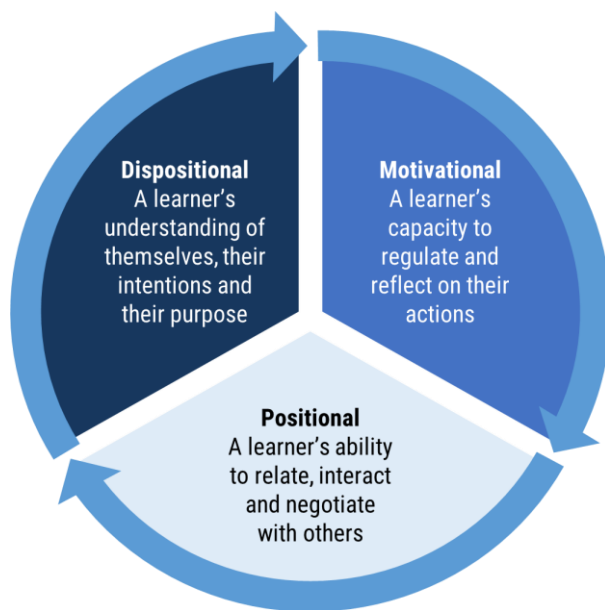


Figure 2 A Model of Learner Agency, modified from Vaughn (2020)

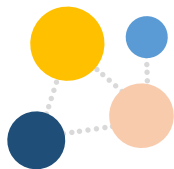
The OECD presents a wide-ranging conceptualisation of learner agency. The organisation's 2030 Framework⁶ (2018, p. 4) characterises learner agency as:

a sense of responsibility to participate in the world and, in so doing, to influence people, events and circumstances for the better. Agency requires the ability to frame a guiding purpose and identify actions to achieve a goal.

This definition looks beyond immediate classroom applications to how learners interact with and shape the world around them, consistent with the focus on learners being *agents of change* (Leadbeater, 2017). This is further highlighted in the OECD's foregrounding of the moral, social, economic, and creative contexts in which agency can be exercised. In their concept note on learner agency (Organisation for Economic Co-operation and Development, 2019b), they distinguish between agency and the related concepts of autonomy, voice and choice. They emphasise the importance of affording learners an opportunity to shape *what* and *how* they learn. They extend the focus beyond the individual to include the reciprocal relationship between a learner's agency and the

⁶ The 2030 Learning Framework, or 'OECD Learning Compass 2030', is the organisation's attempt to capture and define the "knowledge, skills, attitudes and values that learners need to fulfil their potential and contribute to the well-being of their communities and the planet."





agency of other learners, teachers, parents and the wider community. This is referred to as 'co-agency'. The centrality of learner agency in the OECD's vision reflects broader moves to foreground this aspect of curriculum design internationally.

The literature on learner agency indicates that barriers exist to its realisation in formal educational settings. In her analysis of the National Curriculum in England, Manyukhina (2022) problematises the fact that agency is neither explicitly endorsed nor consistently exemplified (even if implicitly) in the curriculum. She states:

It [the curriculum] represents a domain where affordances for agency are created – or not. A rigid curriculum with no room for creativity and innovation is unlikely to instil in children positive perceptions of their capacity to act as independent agents who have control over their learning. For the curriculum to be conducive to agency, it needs both to support students in developing a sense of agency as well as to provide them with real, well defined opportunities for its exercise

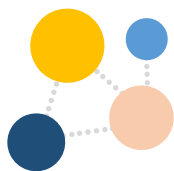
Curriculum that is overly-wedded to strict, traditional and disciplinary representations of knowledge may limit opportunities for the development of learner agency (Manyukhina & Wyse, 2019). Highly scripted or “too-tight” curricula (Dyson, 2020), driven by accountability to performance measures (e.g. standardised tests), may also limit opportunities for learner agency to develop (Kirby, 2020; Vaughn, 2020).

Notwithstanding these potential curricular pitfalls, classroom practice can support learner agency. Vaughn (2020) highlights the potential of several practices:

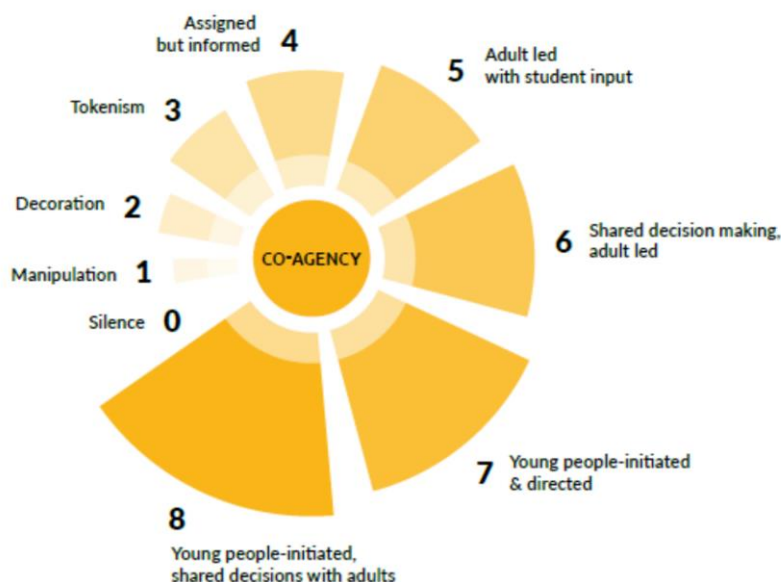
- Dialogic interactions which offer assistance and choices to learners;
- Flexibility and adaptability to learner needs and interests;
- Valuing and building on learners' home and out-of-school experiences (including linguistic and cultural resources);
- Linking new learning with learner interests and;
- Creating a culture that views learners as meaningful contributors and collaborators.

The OECD has outlined the 'Sun Model of Co-Agency' (see Figure 3) to illustrate the graduated nature of learner involvement in classroom decision-making. Importantly, the model was generated by the OECD in collaboration with young people. The Sun model, and the forerunning suggestions, provide high-level advice on how to support a young person's agency. While this model can be applied to educational contexts, it should be acknowledged that, due to the complexity of learner agency and the reality that learners will naturally vary, “simple pedagogical ‘recipes’” require careful consideration (Mercer, 2011, p. 435). Nonetheless, these ideas are all premised on the idea (or ideal) that we





should respect children’s judgement and competence when it comes to shaping their own education (Ruscoe et al., 2018).



0. Silence	Neither young people nor adults believe that young people can contribute, and young people remain silent while adults take and lead all initiatives and make all decisions.
1. Manipulation	Adults use young people to support causes, pretending the initiative is from young people.
2. Decoration	Adults use young people to help or bolster a cause.
3. Tokenism	Adults appear to give young people a choice, but there is little or no choice about the substance and way of participation.
4. Assigned but informed	Young people are assigned a specific role and informed about how and why they are involved, but do not take part in leading or taking decisions for the project or their place in it.
5. Adult led with student input	Young people are consulted on the projects designed, and informed about outcomes, while adults lead them and make the decisions.
6. Shared decision making, adult led	Young people are a part of the decision-making process of a project led and initiated by adults.
7. Young people-initiated and directed	Young people initiate and direct a project with support of adults. Adults are consulted and may guide/advise in decision making, but all decisions are ultimately taken by young people.
8. Young people-initiated, shared decisions with adults	Young people initiate a project and the decision making is shared between young people and adults. Leading and running the project is an equal partnership between young people and adults.

Figure 3 Sun Model of Co-Agency Developed by OECD Student Focus Group

Teacher Agency

How a teacher responds to and shapes their work in the classroom, school (and more broadly) is influenced by a wide range of factors. In this context, agency has been characterised as the notion that “teachers have the power to act, to affect matters, to make decisions and choices, and take stances, for example, in relation to their work and professional identities” (Vähäsantanen, 2015, p. 1). Given the crucial role that teachers play in mediating the curriculum (Kelly, 2009; Priestley, Biesta, Philippou, et al., 2015), the affordances and constraints placed on teacher agency require careful consideration.





In light of the forerunning sections, it is unsurprising that agency in the context of teaching has been conceptualised in different ways, drawing on different underpinning theoretical frameworks. However, the ecological approach to teacher agency (Biesta & Tedder, 2006; Priestley et al., 2013; Priestley, Biesta, & Robinson, 2015a) is one of the most commonly cited in the literature (Cong-Lem, 2021) and provides essential insights for the current review. This approach draws on the work of Emirbayer and Mische (1998) to conceptualise teacher agency as something that is not owned or held by the teacher, but “an emergent phenomenon of the ecological conditions in which it is enacted” (Priestley, Biesta, & Robinson, 2015b, p. 3). It is something that teachers ‘achieve’ or ‘do’ rather than something that they inherently ‘have’. This view is grounded in the chordal triad outlined previously – the idea that a teacher’s agency is influenced by past experiences, their orientation towards the future and their engagement with the present (see Figure 4). For example, a teacher’s agency for curriculum integration might be influenced by their own knowledge and skills regarding curriculum integration, developed through past experiences including professional development (iterational). It may also be impacted by their views about whether it will have a beneficial impact on learning for children in the classroom (projective) and the availability of time and supporting resources when they consider planning in this way (practical-evaluative). The ‘big picture’ must be considered *in addition* to individual teacher characteristics.

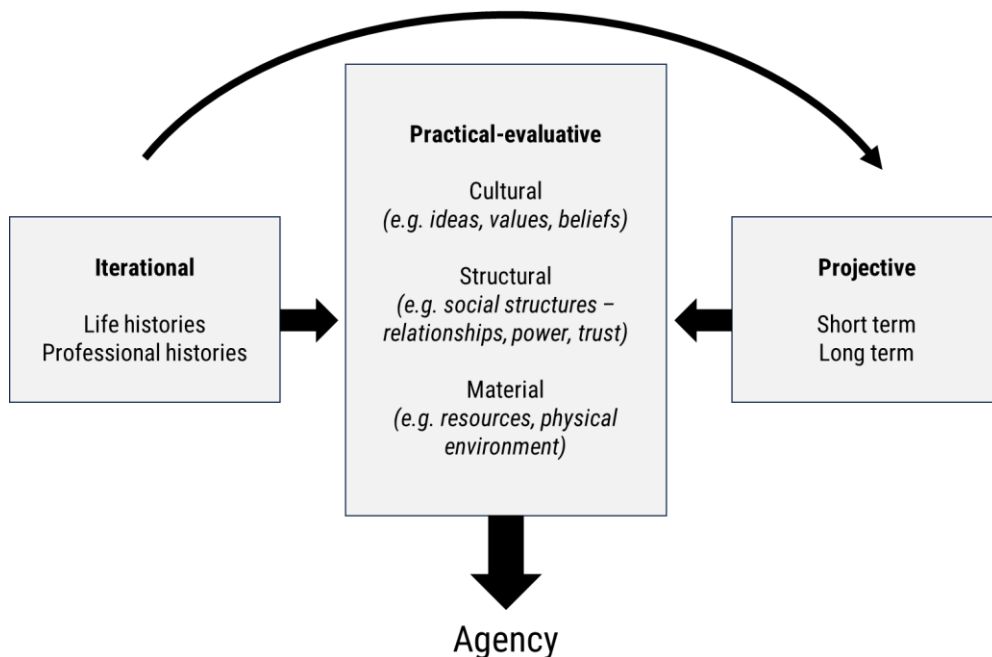


Figure 4 Ecological Model of Teacher Agency, modified from Priestley et al. (2015a)






An important distinction must be made between teacher agency and teacher autonomy, each of which should not be conflated. Autonomy is a necessary but not sufficient condition for agency to emerge. Affording a high level of autonomy to teachers in how they prepare, teach and assess does not necessarily mean that they will exercise agency. This is particularly true when this ostensible freedom is coupled with onerous accountability measures (e.g. through inspection, reporting of standardised tests) (Priestley, Biesta, & Robinson, 2015a). Similarly, it is not sufficient to merely state or expect teachers to act agentially without giving due consideration to the conditions that are needed to support agency. To genuinely foreground teacher agency, efforts at reform must focus on multiple layers within an educational system. This would include an individual teacher's capacity (e.g. teacher knowledge) while also addressing the *cultural* (e.g. values in a school or a larger school system), *structural* (e.g. the nature of the relationships within schools) and *material* (e.g. availability of resources) dimensions of agency (Priestley, Biesta, & Robinson, 2015a).

Teacher agency is evidently a complex phenomenon that is influenced by an extensive range of factors. A wide-angle lens is needed when considering how it might be supported within a school curriculum that wishes to place a renewed emphasis on integration.

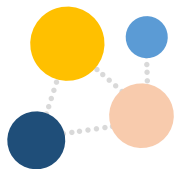
Conclusion

It is evident from the scholarly work reviewed in this chapter that a host of broad factors will influence the extent to which curriculum integration can be enacted in classrooms. A baseline requirement is that the overall structure of the curriculum must make sense. Careful consideration must be afforded to how knowledge is represented in an integrated curriculum, ensuring that learner-centred interests and concerns are elevated but do not erode access to the knowledge needed for conceptual advancement and engagement in society. Within a curriculum, varying priorities manifest in different 'versions' of integration, which have been described in the various frameworks reviewed in this chapter. The literature on agency offers insights on how a variety of conditions influence children's and teachers' capacity to shape their learning.





Chapter 3
Methodology



Chapter 3 Methodology

Introduction

Though the literature on curriculum integration reviewed in Chapter 2 is instructive, it provides little guidance on the realities of implementation. This chapter outlines the overall research design adopted to examine how curriculum integration is conceptualised *in practice*, focusing on case study analysis and a systematic review of empirical evidence.

Research Questions and Research Design

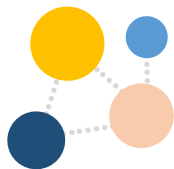
This research aimed to gather information about the different conceptualisations of curriculum integration from its implementations in relevant contexts. In examining this data, the research study also considered some of the fundamental concepts highlighted in Chapter 2. The specific research questions addressed were as follows:

- How does the literature define and describe different conceptualisations of integration?
- What are the barriers and challenges associated with the different conceptualisations of integration?
- How might integration be best conceptualised in the context of a redeveloped primary curriculum that reflects child and teacher agency?

To answer the stated research questions, the overall research design was broadly underpinned by the key principles of systematic review. Newman and Gough (2020) define systematic reviews as a “family of research approaches that are a form of secondary level analysis (secondary research) that brings together the findings of primary research to answer a research question” (p.4). Much of the literature on systematic reviews affords a premium to quantitative studies, often in the form of randomised controlled trials (RCTs). While researchers affirm the value of this form of evidence, broader methods of inquiry can also provide important insights into pedagogical practice. A systematic review on the concepts of integration, pedagogy and assessment was carried out. In brief, this involved:

- A systematic review of the literature published between 2012 and 2022, capturing the last ten years of empirical research on integration (and related concepts).
- A *case study analysis* of key policy and curricular documentation on integration evidenced in international jurisdictions.





Salient features of the overall design and research process are summarised in visual form in Figure 5.

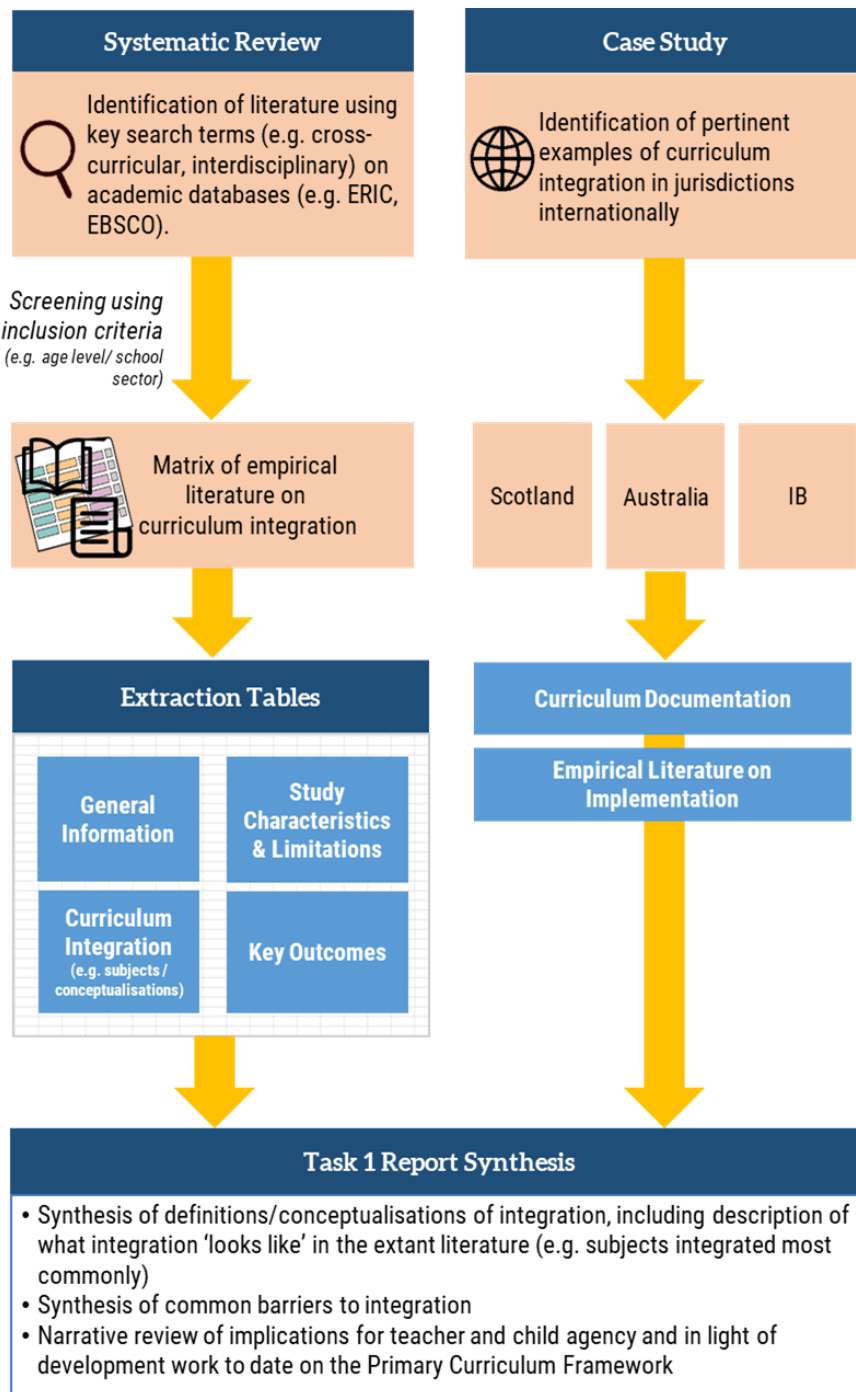
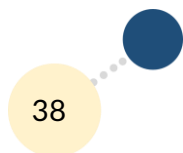
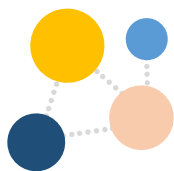


Figure 5 Summary of Research Approach





Part 1: Case Study

Three case studies were selected for examination by the research team in consultation with the NCCA: Scotland, Australia and the International Baccalaureate (IB) school system. These cases were selected for analysis as they were considered to capture key dimensions of variation regarding the role and implementation of curriculum integration in primary education (e.g. different approaches outlined in curriculum documents) while still maintaining a level of similarity to Ireland that would allow for comparability (e.g. language of instruction, teacher qualification). Other jurisdictions were also considered (e.g. New Zealand, Northern Ireland, Korea) but insufficient access to curriculum documentation and other empirical literature regarding implementation experiences caused them to be disregarded. All information for the case studies originated from publicly available sources in the English language published by national agencies (e.g. curriculum documents from education ministries) or by international organisations (e.g. Organisation for Economic Co-Operation and Development; OECD). Literature in the form of peer-reviewed articles or research reports also informed this phase of the study.

Part 2: Systematic Review

The purpose of the systematic review was to identify and describe the experiences and outcomes associated with curriculum integration in settings involving primary school aged children or their teachers. Insofar as possible, this review was conducted in accordance with the recommendations outlined in the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) Statement (Page et al., 2021).

Search Strategy

A targeted, systematic approach to identifying relevant research literature was undertaken. This involved examinations of electronic databases and repositories of grey literature as well as hand searching techniques. All searches involved pre-agreed terms. To identify such terms, and in line with recent systematic reviews conducted within the field of education (see Leavy et al., 2022), a modified version of the 'PICO' framework (Population, Intervention, Comparison, Outcome) was employed. As the use of control or comparison groups is less common in educational research (Gopalan et al., 2020), their inclusion as a mandatory search criterion would have significantly limited the range of studies available for review. It would also have significantly curtailed the range of methodological and epistemological perspectives informing the study. Consequently, a PIO framework was utilised instead, where the 'Intervention' and 'Comparison' components were merged (see Table 2).

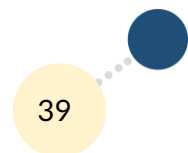




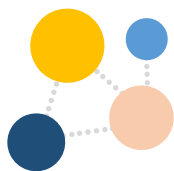
Table 2 PIO Framework

Component	Description
Population	Primary school children (4-12 years) In-Service/Pre-Service teachers of primary school aged children
Intervention	Any study that involved, at a minimum, the integration of two curricular areas/ disciplines (in line with NCCA (2020) conceptualisations). Studies that considered curriculum integration in a broader sense (e.g. transdisciplinary approaches to teaching that were not necessarily grounded in specific disciplines) were also included.
Outcomes	Knowledge Skills Attitudes/ Affect / Experiences

As seen in Table 2, the population of interest included in-service or pre-service primary school educators or their learners. Research related to curriculum integration involving these populations was required to have occurred in formal settings e.g. classrooms, initial teacher education programmes, involving at least two distinct disciplinary areas (aligning with the NCCA's *Primary Curriculum Framework*). Studies that examined curriculum integration using broader, non-disciplinary methods were also included. The collection of empirical data in either qualitative or quantitative forms was also a necessity for inclusion in this review. These data included knowledge, attitudes and skills arising from engagement with curriculum integration. Papers that focused solely on conceptual or theoretical considerations of curriculum integration were not included.

Search terms were informed by key words and phrases associated with seminal research in the field (e.g. Bacon, 2018; Beane, 1997), pilot searches, consultation with Dublin City University's librarians and an exploration of the thesaurus function across the selected databases. The final search was conducted in July 2022. Four indexed databases (Web of Science, Education Resources Information Center (ERIC), Education Research Complete (ERC) and Scopus) were systematically searched at this time. Supplementary secondary searches of relevant grey literature were also conducted via Google Scholar and the Dissertations and Theses Database (via ProQuest). The search strategy and search strings used for each database can be accessed in **Appendix A**. It should be noted that these searches were limited to return studies conducted in the last decade (2012-2022)





and published in English. To complement these searches, a manual search of *The Curriculum Journal* and *Irish Educational Studies* was undertaken given the relevance of these journals to the research topic.

Eligibility Criteria

The screening criteria to determine eligibility is presented in Table 3 (see page 42). In summary, studies were excluded on the basis of the following criteria: (1) the study was unavailable to the researchers; (2) the study was written in a language other than English or Gaelige; (3) the study did not include the equivalent of Irish primary school aged children or their educators; (4) where the study sought to integrate multiple disciplines/learning areas, at least two distinct disciplines were not named; (5) the study involved the integration of a second language (i.e. a language that is different to the one used in day-to-day teaching) with content instruction⁷; (6) curriculum integration (or its synonyms) were not included in the study's research aims; (7) the study did not gather or report empirical data; (8) the study failed to provide an adequate description of research context, sample sizes/characteristics, measures of research quality (trustworthiness, reliability, validity etc.) and analytic techniques; (9) the study was a dissertation/thesis at a level lower than a doctorate.

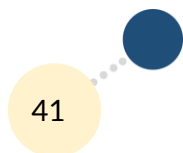
Screening Procedure

The results identified by the searches were transferred to *EndNote*⁸, where duplicates were removed. The remaining articles were then exported to *Covidence*⁹, a systematic review platform. Studies that fulfilled the inclusion criteria were identified through a careful screening process. The title/abstracts of all studies were screened by both members of the research team (N=1839), resulting in an inter-rater reliability score (Cohen's Kappa) of 0.73. Following title and abstract screening, 475 studies were identified by the authors as meeting eligibility criteria. The full text of these articles were then screened against the inclusion criteria. Full text screening was completed by both reviewers. This resulted in the identification of 211 full-text studies examining curriculum integration for primary school aged children and their educators. The reference lists of these studies were hand searched in order to identify any other relevant research. Conflicts between reviewers were resolved via discussion and consensus. The PRISMA flow is presented in Figure 6 (see page 43).

⁷ For a review of the literature on integrated approaches to language teaching, see Ó Duibhir and Cummins (2012).

⁸ See <https://endnote.com/>

⁹ See <https://www.covidence.org/>



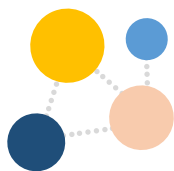
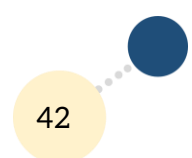


Table 3 Inclusion/Exclusion Criteria

Criterion	Inclusion	Exclusion
Availability	Full text was available from databases, authors etc.	Full text not available.
Language	Article was written in English or Gaeilge.	Written in a language other than English.
Sample	Study involved the equivalent of Irish primary school aged children(4-12 years) or their educators (including those in ITE).	Study did not include the equivalent of Irish primary school aged children or their educators.
Discipline	Where the study sought to integrate distinct disciplines, two or more curricular areas/ disciplines were involved.	Study did not involve the integration of two or more <i>distinct</i> curricular areas/disciplines.
Second Language	Study focused predominantly on learning in the first language of the school.	Study focused predominantly on the integration of a second language (i.e. a language that is different to the one used in day-to-day teaching) with content instruction.
Research Aims	Curriculum integration was included in the study's research aims.	Study did not include references to curriculum integration (or its synonyms) in its research aims.
Design	Quantitative and/or qualitative data on the impact of curriculum integration on the population of interest were gathered.	Study did not gather empirical data.
Reporting	Clear reporting of key research features.	Inadequate reporting of: context, sample characteristics, research quality (e.g. trustworthiness), analytic techniques.
Thesis	In the case of dissertations, the study was at doctoral level.	In the case of dissertations, the study was at a level other than doctoral level (e.g. masters).



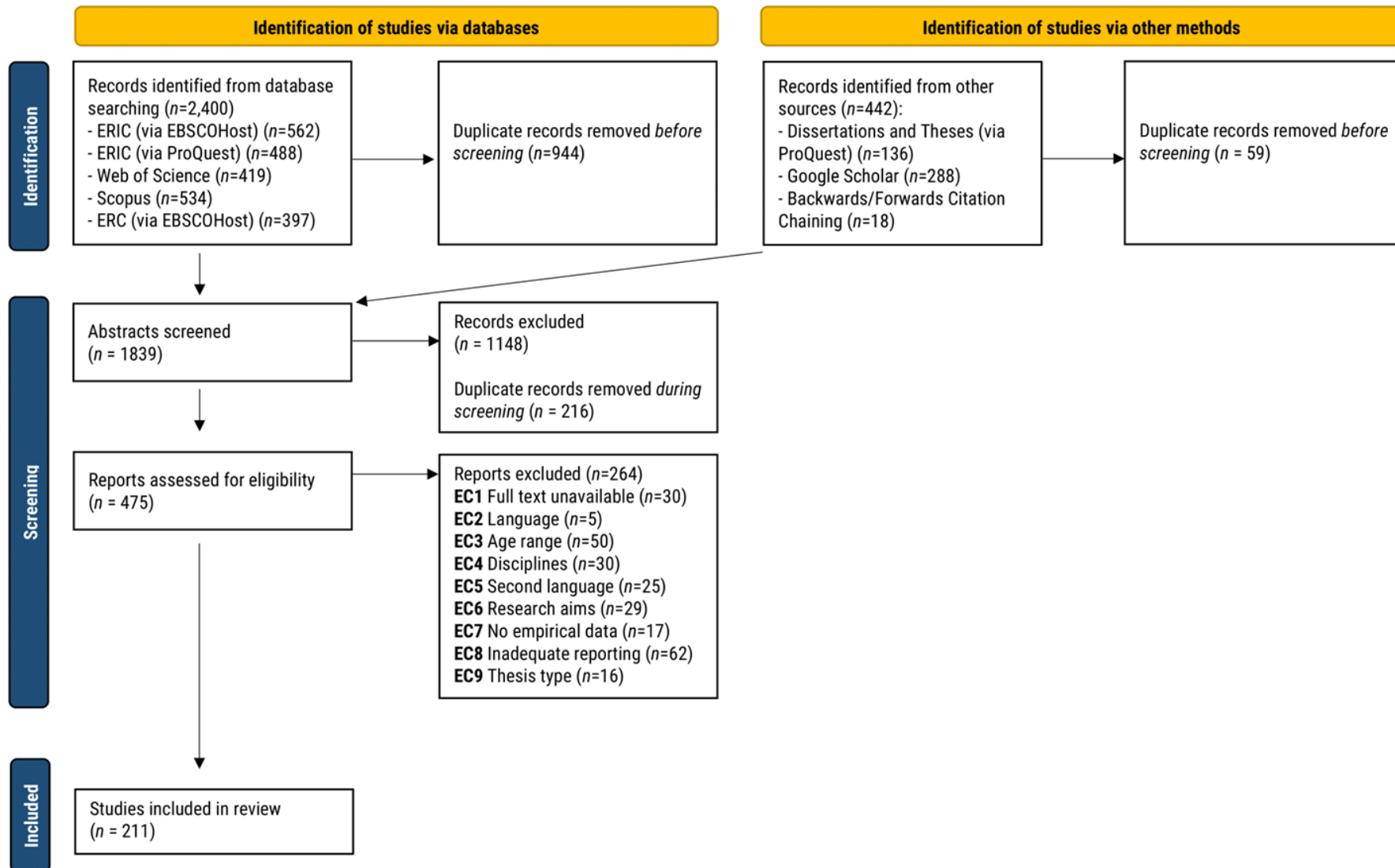
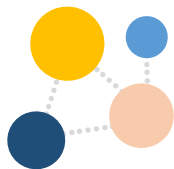


Figure 6 PRISMA Flow Diagram



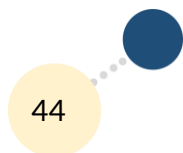
Data Extraction and Narrative Synthesis

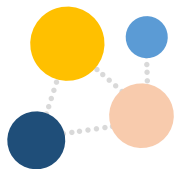
Data extraction was shared by both authors for the purpose of narrative synthesis. Data relating to the following were extracted: **general information** (e.g. title, author, year, publication type), **study characteristics and limitations** (e.g. research design, sample, study limitations), **curriculum integration** (e.g. conceptualisation, subjects/disciplines) and **key outcomes** (e.g. teacher perceptions, learner achievements, agency). Data were summarised in tabular form (see Annex 1 that accompanies this report) and a narrative synthesis of the extracted data was subsequently conducted.

Limitations

This review provides an insight into the implementation of curriculum integration in primary school classrooms and the potential challenges and benefits associated with this teaching approach. However, the research team recognises the methodological limitations of this desktop research. To begin, as with all systematic reviews, it is possible that relevant studies were excluded from this review. While every effort was made to identify relevant literature from database searches and other methods, this does not preclude the possibility that pertinent studies were omitted. Inconsistencies in terminology within the field of curriculum integration and the strict application of the exclusion criteria means that it was challenging to ensure that all relevant studies were included. Furthermore, systematic reviews tend to prioritise and examine formally published data. This means that reviews are susceptible to the risks posed by publication bias, i.e. that only studies that show significant results are published. While efforts were made to mitigate this by examining theses and grey literature databases, readers should bear this limitation in mind. It should also be noted that the requirement that studies be published in either English or Gaeilge means that empirical literature from non-English speaking jurisdictions (that might endorse curriculum integration) do not feature in the tabulated studies.

A diverse range of study designs (e.g. case studies, correlational studies etc.) were included in this systematic review. This allowed for a more comprehensive overview of the empirical literature associated with curriculum integration to date. It should be noted that the strength of evidence a study provides is underpinned by its research methodology. Due to the range of study designs included, it was not possible to assess study quality using a single appraisal tool. While studies that failed to report essential study characteristics (e.g. research context, sample characteristics) were excluded (see Exclusion Criterion 8), many studies included in the review had other methodological limitations (e.g. inadequate control of confounders, limited range of data). The specific

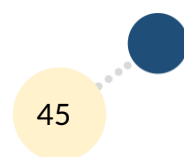




limitations of each study can be found in the relevant column in the Annex. These limitations are highlighted where appropriate, but interpretations on the findings of the current review should keep this caveat in mind. Moreover, the systematic review was limited to those studies written in English and Gaelge only. As a result, the nature of the settings of the included studies were somewhat homogenous and a large proportion of the included studies were conducted in the United States ($n=122$). Finally, an equivalent level of detail was not available for every aspect of a jurisdiction's approach to curriculum integration for the case study element of this research.

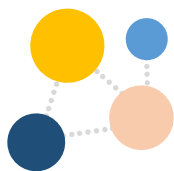
Summary of the Methodological Approach

This chapter has outlined how the research questions were addressed by drawing on two primary research methods. The first approach, case studies from the Scottish, Australian and International Baccalaureate contexts, provides exemplification of how curriculum integration is conceptualised and enacted across school systems. The second approach, a systematic review, provides insights on how curriculum integration is implemented in practice through a diverse body of empirical literature. The next chapter turns to findings from the former approach.





Chapter 4
International
Case Studies



Chapter 4

Curriculum Integration: International Case Studies

Introduction

Looking to other jurisdictions and school systems helps to illuminate the varying curricular structures that can support or hinder the enactment of curriculum integration. This chapter examines experiences from Australia, Scotland and the International Baccalaureate (IB). The Australian and Scottish curriculum informs teaching throughout schools in the respective nations, while the IB curriculum is offered in select schools internationally¹⁰.

Australia

Overview

Although Australia does not have a single education system unifying its eight states and territories, central authorities have specified the national curriculum standards there since 2010 (Knowles & Hillman, 2022). In May 2022, a streamlined, 'up-to-date' curriculum was released after an intense review period (Australian Curriculum, Assessment and Reporting Authority [ACARA], 2022a). While a number of changes were introduced¹¹, the structure and approach of 'Version 9.0' of the Australian Curriculum (ACARA, 2022a) is quite similar to its previous iteration (Version 8.4; ACARA, 2016). For example, the Australian national curriculum is still organised around three key 'dimensions': discipline-based learning areas, general capabilities, and contemporary cross-curriculum priorities (Figure 7). Within the curricular documents, each of these elements is organised and presented as a developmental sequence of learning from Foundation (age 5/6 years old) to Year 10 (age 15/16 years old) (ACARA, 2022a).

¹⁰ In interpreting the information in the case study on the IB it is crucial to note the significant contextual difference between a national curriculum offered in nearly all schools in a jurisdiction and one available primarily in select international schools that, in many cases, charge fees to attend. It is unlikely that the school-going population in the former and latter categories are fairly comparable. Though the IB curriculum offers conceptual guidance on how a curriculum framework might be structured to support integration, the studies on the realities of implementation may be less instructive. It would be unwise to rely on or over-extend learning from the IB without affording appropriate weight to this important contextual note. See Dickson et al. (2017) for a discussion of access to the IB, drawing on the Australian context.

¹¹ See School News Australia (April 5th); <https://school-news.com.au/news/new-australian-curriculum-gets-go-ahead/>



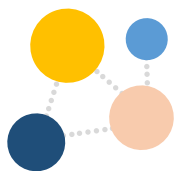
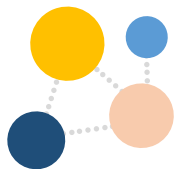


Figure 7 The 3-Dimensional Design of Australia's Foundation-Year 10 Curriculum (from ACARA, 2022b)

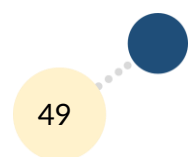
The learning areas identified in Australia's national curriculum organise the “essential knowledge, understanding and skills that students should learn” (ACARA, 2022a). The learning areas of *English*, *Mathematics*, *Science*, and *Health and Physical Education* each consist of a single subject. The learning areas of *Humanities and Social Sciences (HASS)*, *The Arts*, *Technologies* and *Languages* each contain multiple subjects. The general capabilities refer to a ‘mix’ of knowledge, skills, behaviours and, dispositions considered necessary to support the development of successful lifelong learners. These appear to relate closely to the idea of ‘21st Century Skills’ and include: *literacy*, *numeracy*, *information and communication technology (ICT) capability* (now called ‘*Digital Literacy*’ in V9), *critical and creative thinking*, *personal and social capability*, *ethical understanding* and, *intercultural understanding*. These general capabilities are addressed through the contexts of the different learning areas, with ACARA (2022) noting that “some general capabilities are essential to, and best developed within, specific learning areas; others support learning in any learning area”. Development of the third element of this curriculum, the cross-curriculum priorities, also occurs through engagement with learning area content. The three cross-curriculum priorities in the Australian curriculum are: *Aboriginal and Torres Strait Islander histories and cultures*, *Asia and Australia's engagement with Asia* and *sustainability*. The cross-curriculum priorities give learners the opportunity to “focus on content with regional, national and global significance” (ACARA,



2022a). Individual jurisdictions and states decide how the curriculum is implemented in their schools and schools have significant autonomy in determining curriculum details, textbooks, and teaching methodologies (Knowles & Hillman, 2022).

Role of Curriculum Integration

The intended curriculum for Australian primary school children is structured according to different learning areas, with an expectation that the general capabilities and cross-curriculum priorities are ‘embedded’ or ‘integrated’ within the content described for each learning area. Therefore, an integrated approach to teaching and learning is a central pillar within Australia’s curricular framework. This has been consistently communicated in the curriculum documents throughout the past decade of reform, with ACARA noting in 2013 that a “discipline-based curriculum should allow for cross-disciplinary learning that broadens and enriches each student’s learning” (p. 22). To support teachers’ work in this endeavour, the online curriculum documents use icons to show where the general capabilities or cross-curriculum priorities can be incorporated in learning area content descriptions and elaborations. For example, the ‘*Digital Literacy*’ general capability contains 4 elements that teachers should address with learners, with a number of sub-elements associated with each (ACARA, 2022c). For each sub-element, teachers can review the relevant content objectives and when they can be addressed in a particular learning area (denoted by different icons; see Figure 8 where ‘T’, ‘A’ and ‘HPE’ represent the *Technologies*, *The Arts* and *Health and Personal Education* learning areas respectively). Further guidance as to how these objectives can be addressed is available by clicking on the relevant learning area (Figure 9). These details can also be accessed within each learning area’s online curriculum documents.





<p><u>Level 1 (Foundation)</u></p> <ul style="list-style-type: none">recognise their personal data and that data (including text, images, and video) can be seen by others when shared online <p>T</p>
<p><u>Level 2 (Years 1-2)</u></p> <ul style="list-style-type: none">recognise that online tools (website and apps) store their personal data, which may give an impression of them <p>T A</p>
<p><u>Level 3 (Years 3-4)</u></p> <ul style="list-style-type: none">identify their digital footprint (personal data stored by online tools)recognise their digital identity represents them online and can give a negative impressiongive and seek consent before sharing online with peers and trusted adults <p>HPE T A</p>

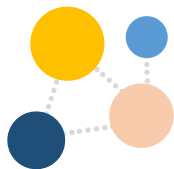
Figure 8 Content objectives for the ‘Managing Digital Privacy and Identity’ sub-element (from ACARA, 2022c)

<p>Health and Physical Education</p>	<p>Technologies</p>	<p>The Arts</p>
<p>Years 3 and 4</p>	<p>Students have opportunities to develop the sub-element in the following content description and elaborations:</p>	
	<p>AC9HP4P07</p> <p>rehearse and refine strategies for seeking, giving and denying permission respectfully and describe situations when permission is required</p> <p>Elaborations</p> <ul style="list-style-type: none">practising and refining strategies for seeking and giving consent; for example, giving consent for their photo to be sharedexploring actions they can take if someone has done something hurtful or disrespectful to them without their permission or consent including in online environmentsexploring actions they can take when they or others are unsafe, such as saying no, leaving the situation and reporting the incident, and discussing how to use these strategies in situations in which someone posts an embarrassing picture online without permission, touches private parts of their body, or uses violence against them	

Figure 9 Guidance on how to address the ‘Managing Digital Privacy and Identity’ sub-element within the Health and Physical Education learning area (from ACARA, 2022c)

Exemplars called ‘Illustrations of Practice’ also accompany the curriculum guidelines to demonstrate how an integrated unit of work can be planned according to relevant curriculum objectives. While these have yet to be updated to reflect V9 of the





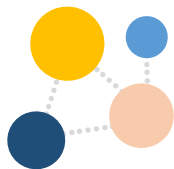
Australian Curriculum, they offer teachers valuable guidance nonetheless. One illustration of practice ([‘What do a humanoid robot and the recently awakened Narungga language have in common?’](#)) shows how teachers embedded a local Aboriginal language (in line with the *Aboriginal and Torres Strait Islander Histories and Cultures* cross-curriculum priority) into the teaching of the *Technologies* and *Languages* learning areas whilst simultaneously developing children’s skills across two key general capabilities (*ICT Capability, Critical and Creative Thinking*). The exemplar shows how key curricular objectives were selected and connected to support an integrated approach to curriculum delivery. Individual territories and states also have samples of integrated units of work that align with their own unique contexts and priorities, e.g. [Great Barrier Reef, Queensland Studies Authority](#).

Experiences of Implementation

While positive experiences of curriculum integration have been noted within Australian research, most studies also reported significant challenges. A small-scale study by Follong et al. (2022; 2020) examined how nutrition focused content objectives (derived from the *Health and Physical Education* learning area) could be integrated into lessons addressing volume, weight and capacity (in line with the *Mathematics* learning area). The three teachers involved noted the positive learning outcomes that emerged from the integrated lessons including children’s improved understanding about healthy portion sizes. The teachers and children (n=15) enjoyed the lessons due to the use of ‘real-life contexts’ and the resources used. However, while the teachers welcomed this integrated approach, they indicated that the lessons lacked sufficient ‘depth’ for mathematics. While the lessons addressed multiple aspects of mathematics (e.g. operations, problem-solving), the teachers felt that these integrated lessons could not fully replace explicit, discipline-specific teaching on volume and capacity. Furthermore, the teachers reported that their ability to engage with integrated teaching was heavily supported by the availability of ‘ready-to-go’ materials, including thorough lesson plans. They noted that the absence of these resources would have significantly inhibited their engagement with the integrated lessons.

A qualitative ethnographic case study by Kuzich et al. (2015) which examined the challenges experienced by eleven primary school teachers as they integrated the *sustainability* cross-curriculum priority into their planning, teaching and assessment also offers some interesting insights. In this study, one teacher noted that the Australian Curriculum and the Western Australian Department of Education syllabus was “...not very explicit at the moment for me” and “...very airy fairy” (p. 186). Consequently,

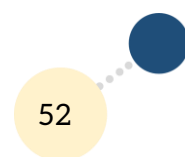




translating a curriculum document that advocated integration into classroom practice was difficult for teachers in this study. Furthermore, it seems that the lack of guidance in relation to pedagogy interfered with their ability to design effective learning experiences. Systemic issues related to assessment also appeared to influence their engagement with this cross-curriculum priority. NAPLAN¹² (National Assessment Program - Literacy and Numeracy) is an annual national assessment taken by Australian children in Years 3, 5, 7, and 9 that allows authorities to monitor learner progress. The teachers involved in Kuzich et al.'s (2015) study noted that these mandated assessments justified their decisions to focus on those areas of the curriculum with the greatest consequence i.e. literacy, numeracy. As there were no equivalent assessments for the cross-curriculum priorities, teachers felt that they were, ironically, not a priority. Such findings have been replicated in several other studies from Australia including Barnes et al. (2018), Ferguson-Patrick et al. (2018) and Lasen et al. (2017).

Other factors have also been found to affect Australian teachers' approaches to curriculum integration. Based on their study of how an Australian primary and secondary school engaged with integrated curricular instruction over two school terms, Moss et al. (2019) found that teachers experienced a number of challenges, many of which related to their navigation of Australia's complicated curricular structure. In analysing how the teachers involved in their study overcame this challenge, Moss et al. (2019) constructed a school-wide conceptual model to describe the planning layers involved with integrated units of work (see Figure 10).

¹² See <https://www.nap.edu.au/naplan>



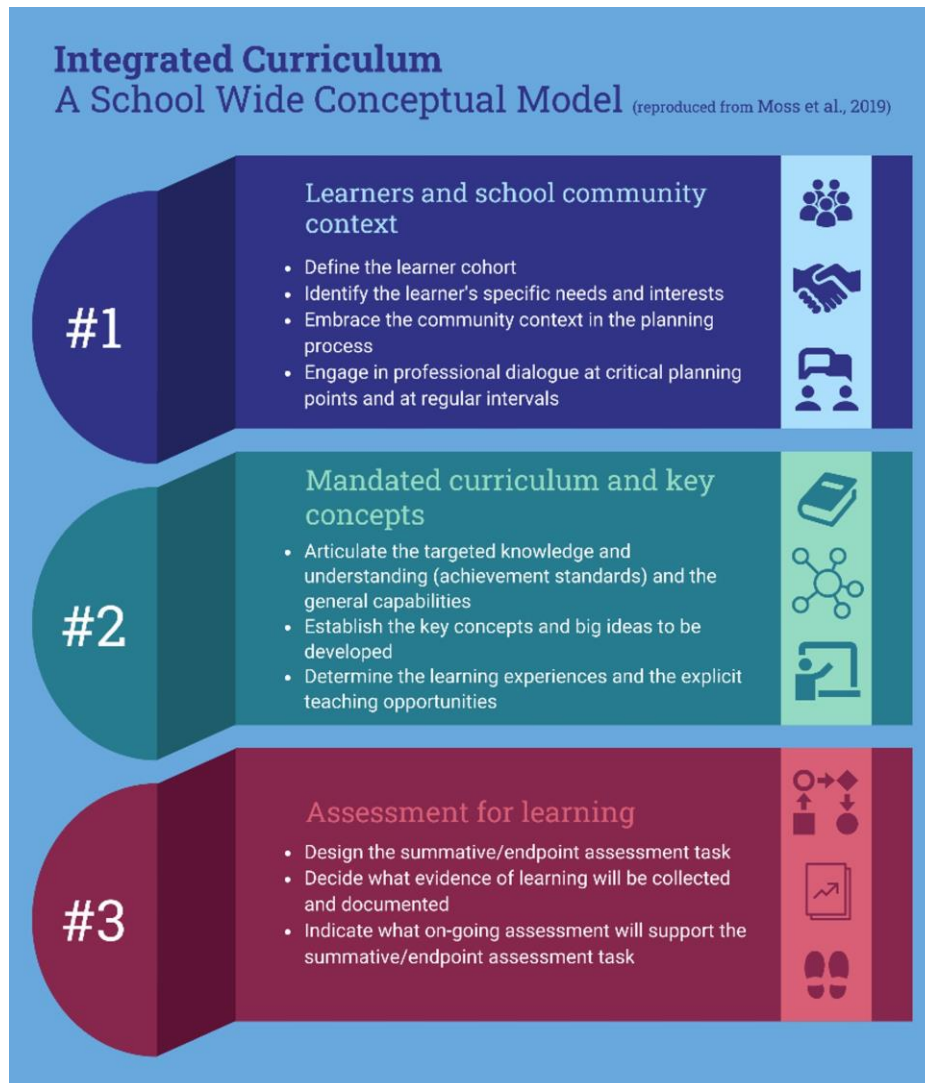
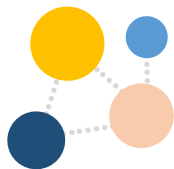


Figure 10 Integrated Curriculum: A School-Wide Conceptual Model (from Moss et al., 2019, p. 36)

As demonstrated by Moss et al.'s (2019) model, consideration of the learner's needs and interests as they can be addressed in a particular school context is central to the planning process. Doing so allows teachers to then identify the mandated curriculum connections that are relevant to their learners. Assessment should also be considered at the initial design stages. According to the authors, "once these three layers of the framework are established, the learning experiences can then be planned" (Moss et al., 2019, p. 37). This approach is aligned with a "backward design approach" whereby the learning outcomes and assessment tasks are identified *before* considering the learning experience sequence and pedagogies (Drake, 2012; Wiggans & McTighe, 2005). While the utility and efficacy of this proposed framework has yet to be fully established, it offers a potential starting point for teachers wishing to plan integrated units of work. However, it is interesting to note the vital role that assessment and pedagogy plays in this framework, underlying the symbiotic relationship between curriculum, assessment and pedagogy.





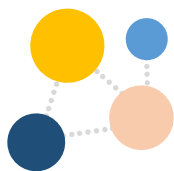
Regarding teacher and learner agency, very little is known about these constructs in relation to curriculum integration. This is particularly true for learner agency, even though it has recently been a key topic for conversation in the country especially concerning assessment (see Adie et al., 2018). Other work that was not directly related to teachers' experiences of curriculum integration but that involved teacher agency in the context of Australia's recent curricular reforms was examined instead. Poulton's (2020) work explored primary teachers' reported experiences of agency and identified potential enablers and constraints to the same in top-down, bottom-up curriculum reforms involving assessment practices using a case study approach. This research found that teacher agency was somewhat constrained by the mandated assessment tools recommended for use in Queensland state schools. However, other teachers demonstrated agency by supplementing or replacing these assessments with other forms or experiences. This work illustrates the 'fine line' that must be walked when supporting teachers to act as curriculum agents. While resources and professional development must be provided, the dynamic and context-driven nature of teachers' classroom based practices, regardless of the curricular change involved, must be acknowledged and respected.

Implications and Key Learning from the Australian Experience

Taking all of these points into consideration, the following are considered to be the key implications and learning from the Australian experience:

- The Australian curriculum outlines the content that must be taught to learners. However, it does not indicate how this content must be taught and assessed. Despite the exemplars highlighted above, a lack of guidance on effective pedagogy and assessment for integrated teaching and learning has been highlighted by Australian teachers as a barrier to their practice (see Kuzich et al., 2015).
- Teachers highly value 'ready-to-go' resources and materials that support their classroom practice. While 'best practice' exemplars are valuable, more fine-grained resources may be required to ensure teacher engagement with integrative teaching approaches (see Moss et al., 2019; Follong et al., 2022). They must also be supported in knowing *how* to use these resources; availability of resources is not sufficient in its own right. Use of materials such as these should be *optional*, as mandated tools or assessments may also act as a barrier to teacher agency (see Poulton, 2020). Careful balancing is needed.





- Guiding principles (such as those proposed by Moss et al., 2019) for teachers undertaking integrated approaches to curriculum design should be provided. These can support the *process* of curriculum-making in schools.
- Many of the preceding points have implications for teacher agency. Agency for curriculum integration may be curtailed by an overly complex curriculum framework, accountability measures, the material conditions (e.g. availability of resources) and teacher knowledge.

Scotland

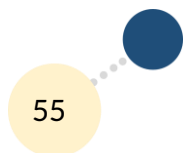
Overview

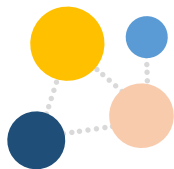
Scotland's *Curriculum for Excellence* (CfE) is the product of an extensive, consultative curriculum design that took place over a relatively lengthy period of time. It details national-level guidance on teaching and learning for the entirety of the education system from pre-school through to the end of secondary education. Though it is currently undergoing review (Scottish Government, 2021), and had a 'refreshed narrative' presented in 2019, the framework's broad structure, aims and purpose has remained largely unchanged since implementation first began in the 2010/2011 school year. Prior to this year, the CfE was fleshed out over a number of years, beginning in 2004. The most important communications on the vision for the CfE were captured in the *Building the Curriculum* series, issued in five volumes, which addressed key concerns such as curriculum learning areas (Scottish Executive, 2006), teaching and learning approaches (Scottish Government, 2008) and the role of assessment (Scottish Government, 2011).

The CfE curricular architecture consists of several related parts, each of which informs curriculum-making at a local level. At the core of the CfE is the **four capacities** – akin to competencies in other frameworks (Priestley & Minty, 2013) – which set out a vision that children will become *successful learners, confident individuals, responsible citizens* and *effective contributors* (see Figure 11).



Figure 11 The Four Capacities, from Education Scotland (2019)





These capacities are realised throughout the various components of the CfE. That the curriculum is viewed as the totality of a learner's experiences is recognised in the four main **contexts** for realising the curriculum: *opportunities for personal development, interdisciplinary learning, ethos and life of the school as a community* and *curriculum areas and subjects* (see Figure 12). These contexts acknowledge the totality of the experiences and opportunities offered by participation in school.

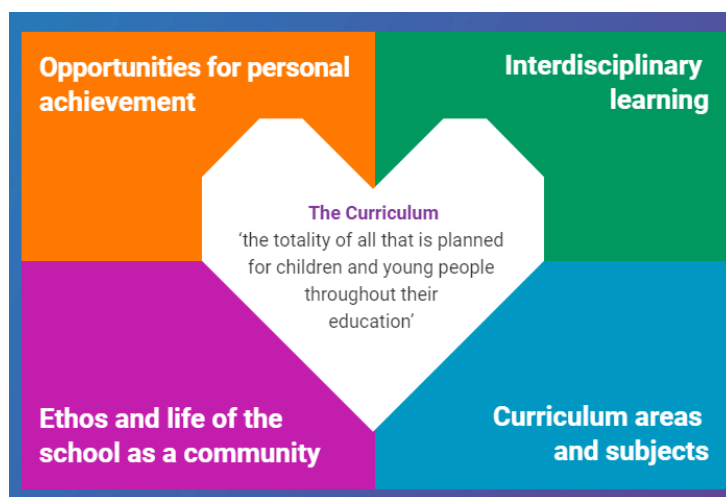


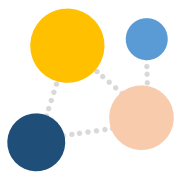
Figure 12 The four contexts for learning, from Education Scotland (2019)

The CfE outlines eight **curriculum areas**:

- Expressive arts
- Health and wellbeing
- Languages
- Mathematics
- Religious and moral education
- Sciences
- Social studies
- Technologies

Each curriculum area is elaborated in a series of **experiences and outcomes** (Es and Os) that are delineated by levels (early, first, second, third, fourth) that align with three years of schooling. These experiences and outcomes are stated from a learner's perspective (see Figure 13). In addition to the eight curriculum areas, the CfE outlines three **cross-curricular responsibilities** that must be enacted by all practitioners at every level: *health and wellbeing across learning, literacy across learning* and *numeracy across learning*. Furthermore, several important themes such as sustainable development, creativity and citizenship are "built in" to the experiences and outcomes, which "reduces the need for





other layers of planning across the curriculum” (Scottish Government, 2008, p. 23). Interestingly, the question of time allocations is devolved entirely; the national-level CfE documentation does not set out minimum time allocations for the various learning areas.

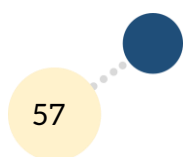
	Early	First	Second	Third	Fourth
<p>Electricity</p> <p>The learner’s knowledge about electricity begins with knowing how to use it safely and this aspect is reinforced throughout their learning. They develop their understanding of electricity as a means of transferring energy by investigating circuits and building chemical cells. Learners develop their understanding of series and parallel circuits and of electrical and electronic components and apply their knowledge to the process of designing, constructing, testing and modifying.</p>	<p>I know how to stay safe when using electricity. I have helped to make a display to show the importance of electricity in our daily lives.</p> <p>SCN 0-09a</p>	<p>I can describe an electrical circuit as a continuous loop of conducting materials. I can combine simple components in a series circuit to make a game or model.</p> <p>SCN 1-09a</p>	<p>I have used a range of electrical components to help to make a variety of circuits for differing purposes. I can represent my circuit using symbols and describe the transfer of energy around the circuit.</p> <p>SCN 2-09a</p>	<p>Having measured the current and voltage in series and parallel circuits, I can design a circuit to show the advantages of parallel circuits in an everyday application.</p> <p>SCN 3-09a</p>	<p>Through investigation, I understand the relationship between current, voltage and resistance. I can apply this knowledge to solve practical problems.</p> <p>SCN 4-09a</p> <p>By contributing to investigations into the properties of a range of electronic components, I can select and use them as input and output devices in practical electronic circuits.</p> <p>SCN 4-09b</p> <p>Using my knowledge of electronic components and switching devices, I can help to engineer an electronic system to provide a practical solution to a real-life situation.</p> <p>SCN 4-09c</p>

Figure 13 Example of Experiences and Outcomes from the Sciences, extracted from Curriculum for Excellence: All Experiences and Outcomes (Scottish Government, n.d.)

The process of local curriculum building was to be informed by seven design principles originally set out in *Building the Curriculum 3* (Scottish Government, 2008): *challenge and enjoyment, breadth, progression, depth, personalisation and choice, coherence and relevance*. These principles have been folded into the refreshed CfE issued in 2019 (see Figure 14), to include a focus on:

- **Understanding the learners**, inclusive of an explicit focus on learner agency;
- **Knowing the big ideas**, such as the four capacities, the knowledge and skills; associated with various curriculum areas;
- **Being clear on practical approaches**, such as effective pedagogies and how the design principles (outlined above) inform planning;
- **Using meaningful learning networks**, which focus on collaboration in the broadest sense (e.g. between teachers, between schools/local authorities, involving the school/parent community) and;
- **Knowing your own learning and support needs**, including a commitment to professional learning and development.

A large degree of responsibility for the enactment of the CfE takes place at the local authority level. However, there is wide variation in exactly how this enactment happens (OECD, 2021).



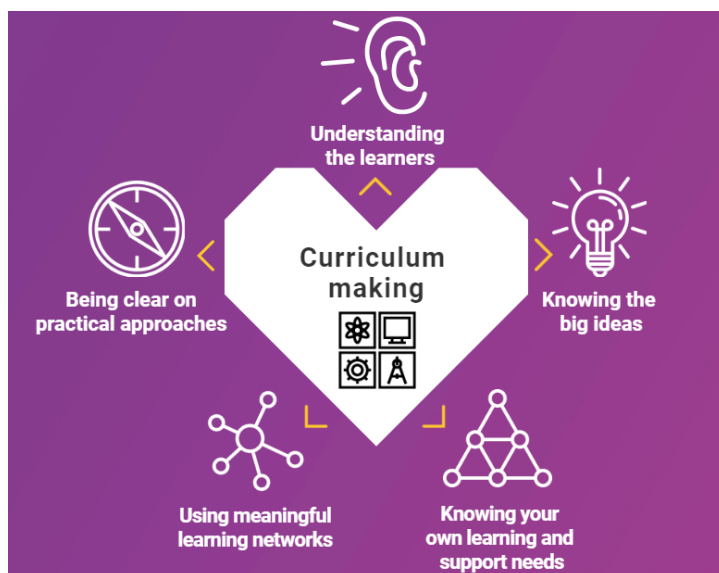
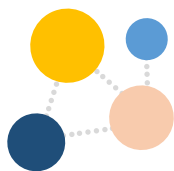


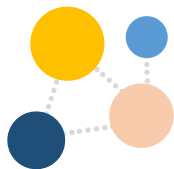
Figure 14 Process of curriculum making in the refreshed narrative, from Education Scotland (2019)

Role of Curriculum Integration

Curriculum integration is most clearly represented in one of the four contexts for realising the CfE: interdisciplinary learning. The CfE outlines that interdisciplinary learning should support children to make connections across the various curriculum areas. It outlines that effective interdisciplinary learning comes in many forms, including ‘one-off’ projects or ‘longer courses’ of study. The *Experiences and Outcomes* from two or more curriculum areas should be reflected in this work, and its planning should detail a clear purpose.

Rather limited guidance is provided in the curricular documentation for exactly how interdisciplinary learning should happen. No specific *Building the Curriculum* document adds depth or nuance to the vision for interdisciplinary learning. In fact, references to this form of learning are relatively cursory. For example, *Building the Curriculum 5* (Scottish Government, 2011), which focuses on assessment, contains a mere four sentences on how learner progress in this complex and multifaceted construct can be evaluated. It states that assessment of this part of the curriculum “requires careful planning to ensure validity and reliability” (p.31), but does little to elucidate what this might involve. A similarly limited level of detail or guidance is found in the other series that underpin the CfE.

Guidance on interdisciplinary learning, over and beyond that issued in the original CfE, as published by Education Scotland in 2012. Based on early enactment of the CfE, the guidance outlines two main approaches to putting interdisciplinary learning into practice:



- Developing awareness or understanding of how curriculum areas are similar or different through, for example, teaching a concept that is represented in two curriculum areas (the teaching of probability in mathematics and science [focusing on DNA/genetics] is proffered as an example).
- Drawing on multiple curriculum areas to “explore a theme or an issue, meet a challenge, solve a problem or complete a final project” (p.2).

Of note is guidance on what schools should *avoid*, including thematic days or weeks that are not carefully planned or forms of interdisciplinary learning that are grounded in tenuous curricular/conceptual links. The guidance foregrounds the importance of learner agency, noting that interdisciplinary learning is most effective “when it is tailored to and meets learners’ needs” (p.3) and when learners are fully involved in planning. This means that they do not merely choose a topic for learning but that they are also involved in planning for how it is explored. The guidance continues the recommendation that interdisciplinary learning is located within carefully selected Experiences and Outcomes from across curriculum areas.

Experiences of Implementation

The CfE has come under considerable scrutiny in recent years. One of the more notable reviews of its implementation is found in a 2021 OECD report entitled *Scotland’s Curriculum for Excellence: Into the Future*, which was carried out at the invitation of the Scottish Government. While the report’s authors broadly endorse the vision and overall purpose of the CfE, they underscore a number of shortcomings and associated recommendations. These include:

- The need to provide a clearer articulation of how *knowledge* is represented in the curriculum (e.g. balance of knowledge and skills, breadth and depth of knowledge, forms of knowledge)
- Ensuring a more specific delineation of roles and responsibilities for curriculum enactment at a variety of levels
- Supporting the curriculum planning process through the provision of more dedicated time for teachers to plan and clarification of the somewhat labyrinthine and ‘fragmented’ policy documents that have a bearing on teaching and learning.

Notably, interdisciplinary learning is given relatively little attention in the OECD’s review, though this may have been due to the relative infrequency with which it was invoked: “In discussions with stakeholders from primary schools, interdisciplinary studies were

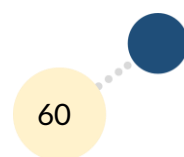


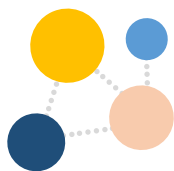


mentioned but as a marginal activity in curriculum making and student learning” (p. 56). It should be noted that this OECD review was based solely on a desk-based review of relevant policy documentation and interviews with a variety of Scottish educational stakeholders. This said, the findings are broadly consistent with the broader literature on the CfE. For example, Priestley and Minty (2013) had previously raised concerns about how knowledge is represented in the curriculum as well as the potential for a lack of curricular clarity to generate dissonance between national aspirations and local practice.

A more thorough empirical and theoretical interrogation of interdisciplinary learning can be found in a number of other sources that directly examine the CfE context. An early interview and questionnaire-based study of the implementation that took place in one Scottish local authority indicated that the focus on interdisciplinary learning was broadly welcomed by teachers, in particular teachers who had experienced early success in its implementation, but that its enactment was more likely to take place at primary than secondary level (Priestley & Minty, 2012, 2013). Later studies were somewhat less positive in their findings. Reporting on case studies in two schools, Harvie (2018) offers examples of what teachers consider to be interdisciplinary learning, but which, in her analysis, fall short of true or deep interdisciplinary integration. She concludes that this superficial integration may be an outworking of the lack of clarity or poor conceptualisation of interdisciplinary learning in the CfE documentation. Other reviews of the CfE have noted similar concerns. Humes (2013) also outlined the lack of theoretical clarity on what interdisciplinary learning in the CfE entails, indicating that its conceptualisation reflects poor engagement with the extant academic literature in the area. The need for more guidance on the practical enactment of interdisciplinary learning has also been noted (Humes, 2013; Thorburn, 2017).

More recent publications have aimed to close some of these gaps. Publications from Education Scotland (2020) and the Royal Society of Edinburgh (2020) both note that the vision for interdisciplinary learning set out in the CfE has not been realised. It is somewhat unfortunate that in attempting to clarify and elucidate interdisciplinary learning, both publications set out somewhat varying explanations and examples of what it entails. The Royal Society of Edinburgh indicates that far more attention needs to be given to its practical exemplification and that its assessment requires further attention. Both documents underscore the potential for interdisciplinary integration to deepen and broaden learning, citing the need for thinking and learning that can address the complex demands of the 21st century.



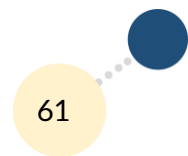


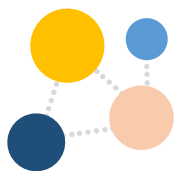
Much of the writing from Priestley, Biesta and Robinson – important scholars on teacher agency – has been based on examples from the Scottish experience. Though their publications (e.g. Priestley et al., 2015) do not place a headline focus on curriculum integration, they highlight the complexities that are encountered in enacting the visions and principles of a national curriculum at a local level. For example, teachers in the Scottish context have been found to welcome the big ideas of the curriculum *in theory*, while largely sticking to business-as-usual approaches in *practice* (Priestley & Minty, 2013). Harvie (2018) draws on the ecological perspective on teacher agency to explain how a variety of factors, such as a lack of clarity in curriculum documentation and competing interests (e.g. covering the curriculum versus following learner preferences), can negatively impact teacher agency for curriculum integration. She notes that enacting integrated approaches “is not dependent on the capacity of individual teachers alone, but is also affected by external factors such as school structures, traditions, physical resources as well as iterational and projective dimensions” (p. 188).

Implications and Key Learning from the Scottish Experience

The following implications can be drawn from the forerunning review:

- Conceptual clarity on what curriculum integration means is crucial; in the absence of this clarity, varying (and competing) manifestations of integration may occur within and between schools, if at all (Harvie, 2018).
- Recent moves to further exemplify interdisciplinary learning have been spurred by a lack of implementation in the first decade of the CfE. This suggests that clear exemplars of curriculum integration in practice should be provided from early on in the roll-out of a curriculum; the complexity of curriculum integration is such that it requires high levels of support and demonstration (Humes, 2013; Thorburn, 2017)..
- The role of knowledge and skills, as represented in discrete subjects or in more integrated learning, needs to be well-balanced and explicitly elucidated; a perceived over-focus on skills is now the focus of review in the Scottish context (OECD, 2021)
- Curriculum integration must be considered within the broader curricular and policy context in which it is emphasised. The proliferation of policy documentation in Scotland, noted in the OECD (2021) review, has created a complex landscape of paperwork through which teachers must sift. Arguably, a similar level of policy documentation and initiatives are also present in Irish





schools. A vision for an integrated curriculum must bear this context in mind, including, in particular, its implications for teacher agency.

- The Scottish case highlights the importance of having a clear vision (and practical support) for how integrated learning will be assessed; in its absence, it is less likely to be valued and practised.

International Baccalaureate (IB)

Overview¹³

Unlike the national curriculum frameworks reviewed in the previous case studies, the International Baccalaureate (IB) is offered on a transnational basis. Provision of the IB has expanded since the International Baccalaureate Organisation (IBO) was first registered in 1968 and is now offered in over 5,600 schools across over 160 countries¹⁴. IBO is registered as a non-profit organisation in Geneva that, through its curriculum framework, seeks to support the development of “inquiring, knowledgeable and caring young people” who are “internationally minded” (IBO, 2009, p. v). The IB curriculum is offered across a continuum, including the Primary Years Programme (PYP, 3-12 year olds), the Middle Years Programme (11-16 year olds), the Diploma Programme (16-19 year olds) and the Career-Related Programme (16-19 year olds). The current review focuses on the PYP.

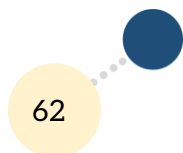
The PYP has a number of inter-related structural components. Foundational to learning across all levels is the **IB Learner Profile** (IBO, 2013), which details ten attributes associated with successful individuals who can contribute to life within and beyond the school. These attributes underpin learning at all levels of the IB curriculum continuum from ages three to 19. The 2007 framework, which was revised in 2009 (IBO, 2009) outlined five essential, interrelated elements: knowledge, concepts, skills, attitudes and action. This PYP framework underwent a substantial update in 2018 to include a more streamlined focus on a smaller number of curricular elements, with a view to making the programme more flexible and easier to implement. The adopted structure includes:

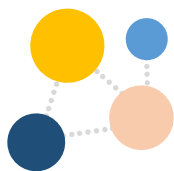
- **The learner:** What outcomes should be achieved
- **Learning and teaching:** How teaching can support learning outcomes
- **The learning community:** The social dimension of learning

In the updated framework, attitudes are no longer a standalone element, while skills have been folded into *approaches to learning*. More detailed information is available on the [IBO website](#).

¹³ All information contained in this section references publicly available information on the IBO website. This website should be consulted for more specific details on the IBO PYP programme.

¹⁴ For further statistics on the IB, see <https://www.ibo.org/about-the-ib/facts-and-figures/>





Role of curriculum integration

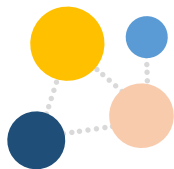
A hallmark feature of the IB PYP is its focus on transdisciplinary learning. Units of inquiry at every grade level are driven by this focus on transdisciplinarity. Information on the themes, concepts and ideas that guide this inquiry are available on the [IBO website](#). Teachers working in IB schools have access to a range of resources to support their transdisciplinary teaching. IB provides exemplar planner templates with scaffolds and prompts to support the planning of units of inquiry. They are also supported by materials and exemplars available solely to IB schools online. Though the focus on transdisciplinary learning is important, the IB PYP also allows scope for subject-specific teaching and lines of inquiry that may not fit within the overall unit of inquiry at a given time.

Experiences of Implementation¹⁵

That IB provides a framework rather than a full curriculum means that a large degree of local curriculum planning is needed in its enactment. McKenney and colleagues (2022) investigated how IB schools went about school-based curriculum development, drawing on two surveys with representatives from IB schools (survey 1 = 680 schools; survey 2 = 395 schools) and case studies conducted remotely (online) with five schools from different countries. On the whole, school respondents indicated that they had a large degree of autonomy in planning the curriculum for their school, with minimal external influence. The vast majority of respondents were content with how school-based curriculum development worked in their school (though it should be noted that the respondents were typically IB coordinators or school leaders), with a high level of teachers agreeing that the school generated its own curriculum-related materials (e.g. teaching resources, assessment materials). Teachers also broadly agreed that “there is a strong focus on subject integration” (p.64). This led the authors to conclude that there was a high degree of ownership for this endeavour within the schools. A cross-case analysis of the five case study schools indicated that schools had prioritised learner agency as a focus for further development and also highlighted the importance of having a shared vision for how the curriculum would be enacted. Survey results highlighted challenges associated with school-based curriculum development for the IB, including a lack of time for individual and collaborative planning, a need for more professional development, for

¹⁵ It is important to note that many of the papers cited in this section involve research that was funded by the International Baccalaureate Organization and subsequently hosted on their website. Though this research was conducted by independent teams of researchers with appropriate expertise and experience, readers should bear this contextual information in mind.

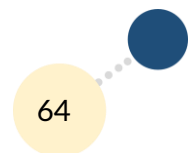


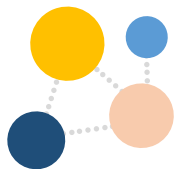


greater clarity in concepts (and associated 'jargon') included in the IB, for greater support with resources and for greater collaboration between schools.

Other recent studies have examined learner outcomes associated with the IB. Tan's (2021) analysis of student scores ($N= 179,198$) on the Australian Council for Educational Research (ACER) International Schools' Assessment indicated more favourable outcomes for IB students at some grade levels in writing, reading, mathematics and science, when compared with students participating in non-IB schools. However, these findings are based on comparisons solely with students in *international schools* and thus cannot be generalised to a national sample containing a broader representation of students. In a study of learner wellbeing in Australian schools, Dix and Sniedze-Gregory (2020) found significant but small differences (effect size less than 0.20 across measures) on the ACER Social-Emotional Wellbeing survey using a propensity matched sample of IB and non-IB learners. Though this study included learners from *outside* international schools, learners from lower socioeconomic backgrounds were omitted from the analysis to ensure fair comparisons. The IBO hosts a range of other independently conducted research reports on their website that illuminate the experience and effects of participation in the programme (e.g. Boal & Nakamoto, 2020; Gough et al., 2014; McGuinness et al., 2016).

In a direct examination of how transdisciplinarity is enacted in the IB Drake and colleagues (Drake et al., 2015; Savage & Drake, 2016) conducted in-depth, online interviews with 24 IB educators, using an empirical phenomenology approach. Four of these 24 teachers taught in public schools, 13 taught in international schools and seven taught in private schools. The findings provide important insights. Teachers valued the freedom provided by the *framework* approach adopted by the IB, yet this was also accompanied by expressions of vagueness and confusion in some of its fundamental concepts. Several conditions were highlighted as being important for the success of the IB PYP approach, for example: teachers indicated that their personal philosophy needed to align with transdisciplinary ways of thinking and teaching; leadership is needed to fully embrace this form of teaching; time for collaborative planning and professional development was deemed crucial. The PYP planner, a document that supported the planning of units of inquiry premised on backwards design, received mixed feedback. Some valued the process of curriculum-making using this process while others indicated that it was time-consuming and ultimately produced an *archival* rather than a *living* document. Teachers indicated that learners benefited from rich performance tasks as a form of meaningful assessment. Opportunities for learner-directed learning were



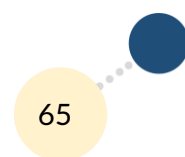


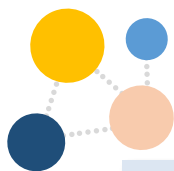
considered the 'epitome' of transdisciplinary learning. This study, which predated the 2018 revision of the PYP, indicated that planning needed to be simplified (see above).

Implications and Key Learning from the International Baccalaureate Primary Years Programme

It is possible to identify the following implications based on the available evidence on the IB PYP:

- Integrated curriculum can be supported by a curriculum framework that articulates a clear vision and practical clarity for how integrated learning might happen while allowing scope for local interpretation (McKenney et al., 2022).
- Commitment to integrated planning and teaching requires 'buy-in' that should not be presumed (Savage & Drake, 2016).
- If integration is to be foregrounded, the IB case would suggest that a curriculum framework needs to be deliberately and carefully designed to support this endeavour. The curriculum-making process for transdisciplinary learning is inherent in the IB PYP framework. How best to achieve such a curriculum structure requires careful consideration. Previous versions of the IB that articulated many inter-related components led to some confusion for teachers (Savage & Drake, 2016). The updated PYP presents a more streamlined framework. Crucially, the PYP framework supports teachers to think and plan in transdisciplinary ways by identifying core themes and concepts that span across all disciplines. Unnecessarily jargonistic terminology should be avoided as it complicates interpretation for teachers (McKenney et al., 2022).
- Supports and exemplars for curriculum integration are necessary. Transdisciplinary learning is supported by access to resources and planning scaffolds available to teachers in IB schools. However, the use of scaffolds such as planning templates should not be *mandated* (Drake et al., 2015).
- The available evidence suggests that inquiry-based approaches are favourably perceived in IB schools (Drake et al., 2015; Savage & Drake, 2016).
- Teacher knowledge of how to integrate the curriculum is crucial and takes time and support to develop. School-based curriculum making in a transdisciplinary context requires structural support such as time for individual and collaborative planning as well as professional development (McKenney et al., 2022). The time-burden associated with this process, including the design of units of inquiry, should not be underestimated.



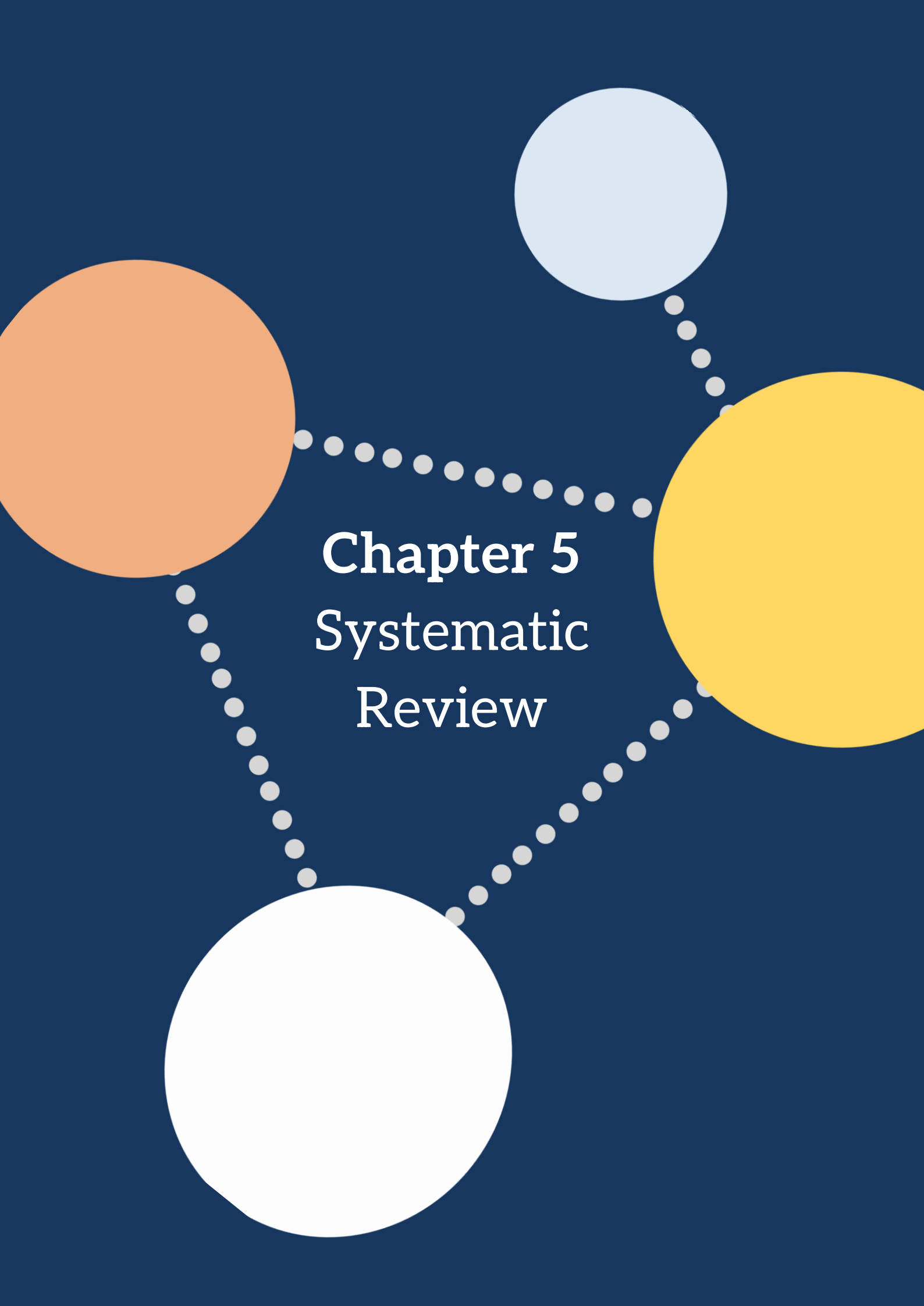


Cross-Case Summary

Curriculum integration was represented in different ways within the curriculum documents reviewed. Despite assertions on the value of an integrated curriculum, each of the frameworks included specific learning areas e.g. maths. Furthermore, Australia and Scotland 'gathered' groups of subjects under an umbrella heading e.g. 'The Arts'. When the role of integration within the curriculum documents was analysed, the explicit attention afforded to this element varied. By mapping out the relationships between different learning outcomes and key skills across their eight learning areas, Australia's curriculum documents identified where the general capabilities (e.g. literacy, personal and social capability) and the cross-curricular priorities (e.g. sustainability) could be addressed using an integrated approach. In contrast, Scotland afforded little attention within their documentation as to how their eight learning areas could be 'linked' to support the development of their four overall capacities. In advocating for a transdisciplinary approach to integration, the IB school system provided the most in-depth guidance as to how the themes and concepts outlined in their curriculum can be enacted in practice. The level of exemplification and direction on the role and use of curriculum integration within this framework, when compared to the Scottish curriculum in particular, was notable and may go some way in explaining the differences in teachers' experiences between districts.

In examining experiences of implementation, commonalities were evident. These mainly related to adequate access to high-quality resources and professional development. For example, the Scottish and Australian cases highlighted the need for high levels of support for integrated teaching. Recent publications in Scotland have highlighted the need for further exemplification if interdisciplinary learning is to be realised on a wider scale. While exemplars and 'ready to use' materials were available in the Australian context, teachers highlighted that these did not address the range of issues that should be addressed when implementing curriculum integration, e.g. the need for flexible assessment approaches, guidance on pedagogy. The use of planning templates and guidance on pedagogy (e.g. use of inquiry-based approaches) supports integrated teaching in IB schools.

The three case studies highlight the importance of clarity in curriculum documentation in order to guide teachers in their work on curriculum integration. Inadequate consideration of how curriculum integration can be translated into practice can cause significant difficulty for teachers when they attempt to engage in school-based curriculum making. These difficulties can be compounded by a range of other factors such as accountability measures (e.g. standardised testing requirements).



Chapter 5
Systematic
Review



Chapter 5 Curriculum Integration: Systematic Review

Introduction

The systematic review methods outlined in Chapter 3 uncovered a large number of studies that gathered data on the enactment of integrated curriculum approaches. Overall, a total of 211 full-text studies were identified following the application of the inclusion and exclusion criteria. Data on study characteristics were extracted from eligible studies and are now reported in narrative form. They are also available in tabular form in Annex 1.

Demographic Characteristics of Research Studies

Of the 211 publications analysed for this systematic review, 149 were articles in peer reviewed journals, 50 were doctoral theses and 9 were published conference proceedings. The remainder were professional reports and book chapters. Almost half of these were published in the past five years (2018-2022; 46%). Overall, 122 of the studies originated from the United States, 19 from Australia, seven from Turkey with Spain, Slovenia, Canada and Great Britain all providing six papers each. The remaining papers came from a range of other countries including, among others, New Zealand, Singapore and South Africa (see Figure 15). Four studies were conducted in the Republic of Ireland and one study was conducted in Northern Ireland.

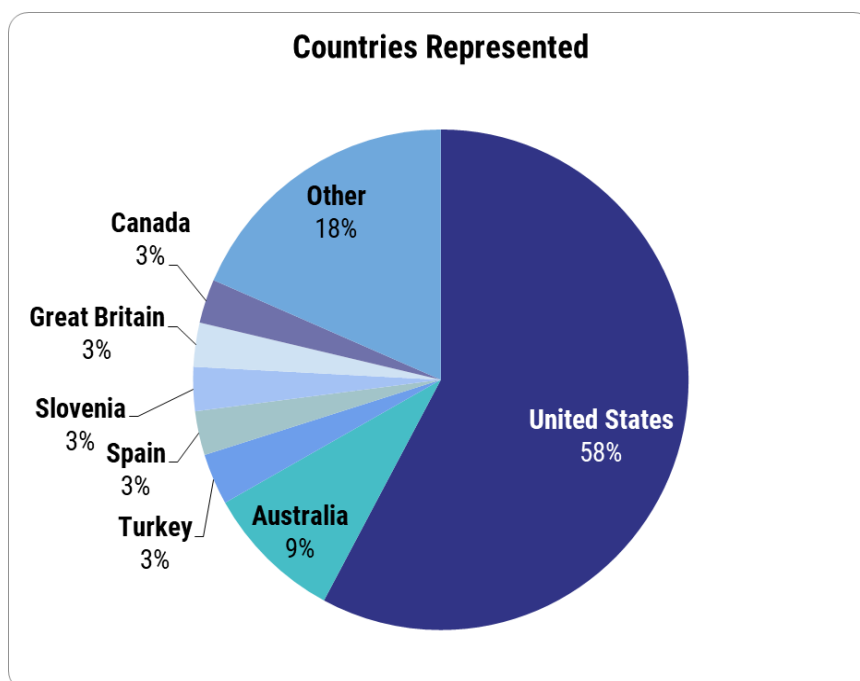
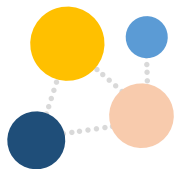


Figure 15 Distribution of countries represented in this systematic review



In relation to the participants involved in these studies, the majority involved in-service teachers ($n=120$ studies) and/or children ($n=72$ studies). While all age groups were represented in those studies involving children, a large proportion of them did involve learners from upper primary. Studies involving pre-service teachers were also represented ($n=28$ studies). The perspectives of school leaders and other ancillary or support staff were also present in some studies but usually alongside one or more of the previous participant categories.

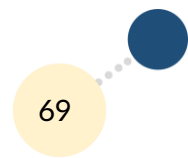
Analysis of the research methods employed indicated that both qualitative and quantitative methodologies were used, with a slight preference for qualitative methods noted. In terms of specific research design types, experimental/quasi-experimental designs involving control groups or pre-post data collection, and survey approaches were most frequently mentioned as the quantitative research design types applied. Approximately 26% ($n=54$) of the studies involved a classroom intervention that collected outcome data (usually in the form of test scores or affective/attitudinal data). Case studies were most commonly mentioned as the qualitative research design types often involving interviews, observations and artefact analysis (e.g. reflective journals, lesson plans etc.).

The key concepts and themes contained throughout the three research questions were used to guide the analysis of the extracted data. Consequently, the subsequent sections are organised by the following headings:

- Conceptualisations of Curriculum Integration
- Barriers and Challenges to Curriculum Integration
- The Role of Learner Agency
- The Role of Teacher Agency

Conceptualisations of Curriculum Integration

Though the review drew on broad, discipline-agnostic search terms for integration, the literature returned, in most cases, had a strong disciplinary foundation as seen in Figure 16. Key details from each of the studies were extracted. Studies that examined integration in a general sense without a strong disciplinary influence or that drew on a wide base of disciplines are grouped under one category. Other studies were organised according to the following broad disciplinary areas: *Literacy/Language*, *Arts*, *STEM*, *Social Studies/Environmental Education* and *Wellbeing*. It should be noted that some studies overlapped across multiple disciplinary areas. This underscores the fact that integrated teaching can happen outside of the learning areas that follow. This organising structure is used to enable the clear presentation of findings; in practice, integration need not be restricted to these groupings.



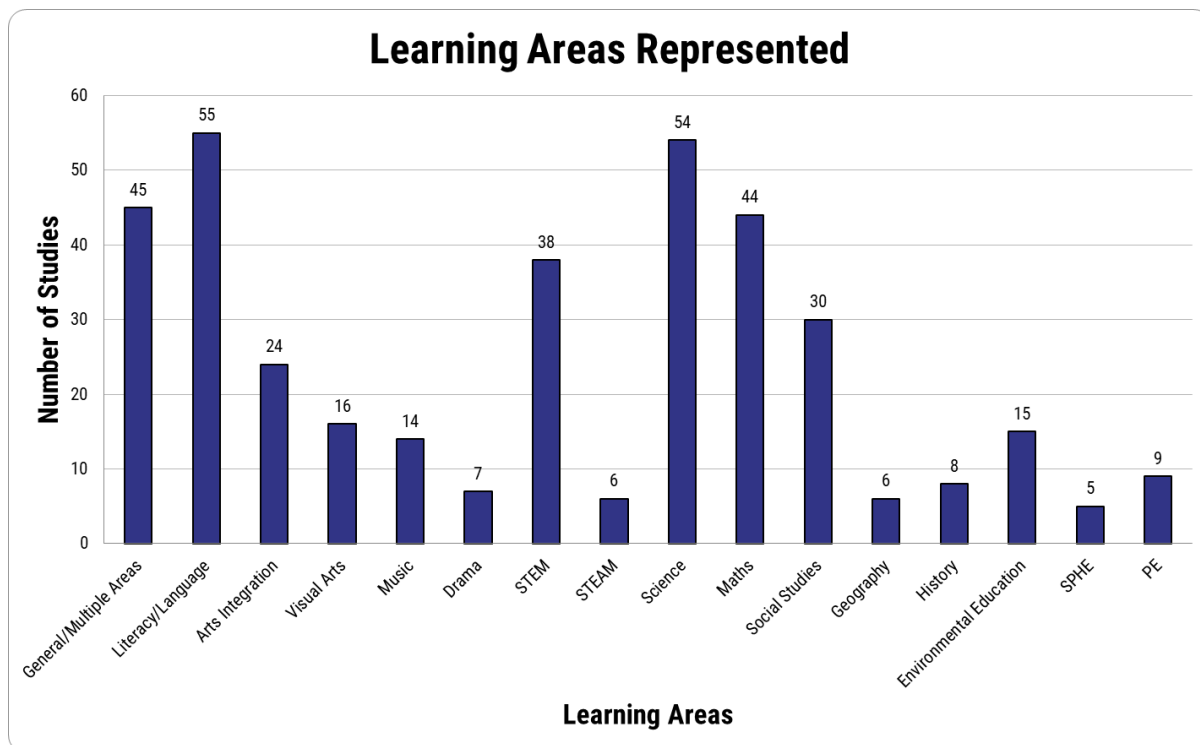


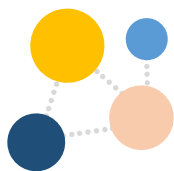
Figure 16 Learning Areas examined in this systematic review

Curriculum Integration: General

The studies that examined integration in a broad sense, either by avoiding a focus on any one discipline, or by examining multiple disciplines together, are outlined in Table 4.

No one conceptualisation of integration was apparent in these studies. The studies were informed by a range of ways of thinking about integration, but also included a substantial proportion that were *not* informed by any particular conceptualisation. Studies in the latter category often defined integration (e.g. “a design where different related disciplines provide the basis for the topics which are relevant to a student’s life” (Shin, 2020, p. 50), but did not ground its practice in models or conceptualisations of how it might work. Interdisciplinary conceptions of integration were common in this set of studies, particularly (though not exclusively) when they emanated from middle school contexts in the US (Betton, 2018; Penchalk & Crawford, 2015; Trinter & Hughes, 2021). A small number of studies adopted a multidisciplinary approach (e.g. Collins & Wickersham-Fish, 2016) or reviewed a range of approaches without adopting or endorsing any particular one. A variety of terms for integration were used in the studies (e.g. “theme-based”; Penna-Baskinger, 2018) and often interchangeably (e.g. ‘cross-curricular’ and ‘integrated’; Greenwood, 2013). One study specifically focused on transdisciplinary conceptualisations of integration in the context of the International Baccalaureate (Savage





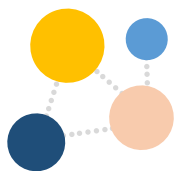
& Drake, 2016; see case studies) while another reported the use of transdisciplinary integration in an Australian primary school (Moss et al., 2019). A number of key scholars and conceptual models were cited in some of the studies (e.g. Beane, 1995; Drake & Burns, 2004; Fogarty, 1991; Jacobs, 1989), though no one scholar's interpretation was predominant. In sum, these studies do not present a consensual view on how integration should be conceptualised.

Table 4 Studies examining integration as a *general* concept (including with no disciplinary focus) or across multiple disciplines

Studies involving general curriculum integration	
n=45	
Anderson (2019)	Kirsten (2019)
Baptiste (2022)	Kuzich (2015)
Betton (2018)	Lau (2018)
Birchinall (2013)	Maitles (2012)
Birsa (2018)	Martin (2021)
Boche (2021)	McDowall (2019)
Brough (2012)	Monteiro (2021)
Calder (2013)	Moss (2019)
Collins (2016)	Nollmeyer (2016)
DeLuca (2015)	Nugent (2018)
DePaola (2022)	Öztürk Yılmaztekin (2016)
Dogan (2019)	Penchalk (2015)
Dowden (2014)	Penna-Baskinger (2018)
Fitzpatrick (2018)	Rismiati (2012)
Fu (2017)	Rosenthal (2020)
Greenwood (2013)	Savage (2016)
Halimah (2021)	Shin (2022)
Halimah (2021)	Simmons (2015)
Hammond (2017)	Smith-Gayle (2014)
Harris (2019)	Trinter (2021)
Heimer (2015)	Yoshida (2016)
Hieu (2019)	Zhang (2012)

The degree to which integrated curriculum should be led by learner interest and concerns is the focus of a small number of these studies. This is a core consideration of Fitzpatrick et al.'s (2018) study on the Negotiated Integrated Curriculum in two classrooms from two disadvantaged schools in Limerick. Informed by scholars such as Beane (1997) on curriculum integration and Boomer et al. (1992) on learner voice and curriculum negotiation, Fitzpatrick's study supported teachers and children in navigating ten stages of





joint curriculum construction (see Table 5). They emphasise the *democratic* nature of this endeavour, and go on to define Negotiated Integrated Curriculum as (p.459):

a form of thematically linked curriculum. Its central and distinctive features are a theme based on students' expressed concerns in relation to themselves and global issues; continuous negotiation with students about their questions, learning activities and their appropriate assessment methods to address these concerns; and the integration of traditionally discrete subject boundaries

In practice, children expressed an interest in School A exploring health-related issues such as smoking, while children in School B wished to explore animal welfare. Based on analysis of the qualitative data collected (e.g. focus groups, interviews, children's reflections), the researchers conclude that learner voice was afforded an elevated status, leading to heightened ownership and engagement. The focus on issues of relevance, rather than discrete disciplines, places this study in the transdisciplinary category (though this label is not explicitly adopted by the study authors). A similar focus on democratic, 'power sharing' pedagogies and the co-construction of curriculum is reported by Brough (2012) and Calder and Brough (2013) in the New Zealand context. Though these studies provide classroom-based illustrations of a form of integration that foregrounds children's interests, the small sample size and highly specific natures of both studies must be borne in mind when extrapolating findings for broader curriculum reform.

Table 5 Stages of the Negotiated Integrated Curriculum in Fitzpatrick et al. (2018)

Stage 1	Children indicate personal concerns that they would like to investigate.
Stage 2	Children share these concerns in small groups and present them to the class
Stage 3	Children indicate broader concerns they have about the world
Stage 4	Children share their world concerns in small groups and present them to the class
Stage 5	Themes are drawn from the concerns shared as a class, connecting personal and world concerns
Stage 6	Themes are presented to the class
Stage 7	Children vote on themes to decide which will be investigated further
Stage 8	Children generate questions based on the themes in small groups
Stage 9	Children decide on activities in which they would like to engage in exploring themes
Stage 10	Teachers plan the unit of work based on the forerunning steps; some 'non-negotiables' may be included (e.g. curriculum content that the teacher must cover)

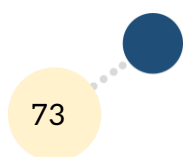


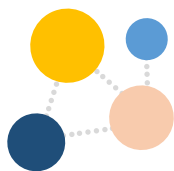
Curriculum Integration: Literacy/Language

Research involving the integration of literacy represented a substantial proportion of the studies that met the criteria for inclusion in this review. As in most learning areas, studies on literacy integration were underpinned by varying conceptualisations and models or indeed a *lack* of such underpinning structures. Table 6 outlines the studies included in this section, including the disciplines associated most commonly with this integration.

Table 6 Studies studying Literacy Integration, listed by discipline and first author

Literacy and multiple disciplines / General Literacy integration (n=20)	Literacy and Arts (n=8)	Literacy and Science (n=14)	Literacy and social studies/ sciences (n=8)
Bazemore (2015)	Anderson (2015)	Bravo (2014)	Duke (2021)
Bergen-Cico (2015)	Batic (2020)	Cervetti (2012)	Huck (2018)
Betton (2018)	Bryant (2012)	Fazio (2018)	Huck (2019)
Brand (2012)	Feldwisch (2014)	Fazio (2019)	Jordan (2016)
Brugar (2012)	Frankel (2015)	Gallagher (2019)	Leckie (2016)
Casady (2015)	Peppler (2014)	Gray (2022)	Powell (2018)
Cunnington (2014)	Saraniero (2014)	Hall-Kenyon (2013)	Revelle (2019)
Edsall (2012)	Tucker (2017)	Liston (2018)	Revelle (2020)
Eli (2020)		Luna (2015)	
Gomez Zwiép (2016)		Marshall (2018)	
Hubbard (2020)		Nesmith (2017)	
Kirsten (2019)		Ødegaard (2014)	
Mard (2022)		White (2014)	
Pendergast (2012)		Wright (2017)	
Samuels (2019)			
Schugar (2017)			
Swan (2013)			
Talbert (2019)			
Van't Hooft (2012)			
Volk (2017)			
Literacy and PE n=1	Literacy and STEM n=2	Literacy and Mathematics n=2	
Makopoulou (2020)	Tank (2014) Wendell (2014)	Akbar (2012) Hawley (2022)	

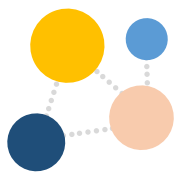




A large number of these studies did not draw on a clearly identifiable model of *curriculum integration*. An example of this can be seen in Schugar and Dreher's (2017) secondary analysis of US National Assessment of Educational Progress (NAEP) data to determine the impact that reading across different disciplines would have on overall reading achievement scores; while the study reports positive effects for this practice, it is not framed within the sphere of curriculum integration or models of curriculum integration. A further example can be seen in Duke et al.'s (2021) extensive study of project-based learning integrating both literacy and social studies; though this study provides robust evidence for integrating these forms of learning, it makes no reference to the larger literature on curriculum integration.

A substantial portion of these studies invoke *interdisciplinary* conceptions of integration, involving the integration of literacy (framed as a discipline) with one or more other areas of learning. For example Akbar (2012) and Hawley (2022) highlight how concepts and pedagogical approaches more commonly associated with literacy (e.g. explicit vocabulary instruction) can be applied in the context of mathematics. A large number of studies focused on science-literacy integration. Some of these studies were framed as being interdisciplinary, but many relied on conceptualisations of integration that were particular to science and literacy that are not necessarily generalisable to the integration of other subjects. This literature (Cervetti & Pearson, 2012; Pearson et al., 2010) emphasises the synergistic relationships between first-hand inquiry in science, learning through reading informational text, communicating scientific learning in writing and related oral language work (e.g. Wright & Gotwals, 2017). It highlights the importance of balancing attention to both science and language/literacy curriculum outcomes or standards. A related form of integration, *disciplinary literacy* (Shanahan & Shanahan, 2008), emphasises how literacy concepts and skills that are particular to a discipline can be embedded in its teaching in order to advance learning in both literacy and the particular learning area. Disciplinary literacy was invoked as a conceptual lens in a variety of studies from the kindergarten level (Wright & Gotwals, 2017b) through to middle school (Leckie & Wall, 2016). Only one of these studies explicitly drew on a *transdisciplinary* framing (Jordan, 2016), but a closer reading of the study revealed that it only involved two disciplines (English language arts and social studies). One study was categorised as being *multi-disciplinary* by its authors (Mård & Hilli, 2022), but it included many of the features associated with other forms of integration (e.g. themes relevant to students, transversal competences). Coming to a shared understanding that fairly represents the disciplines in literacy integration is not an easy task; relatedly, there is the





potential for imbalanced integration (Hall-Kenyon & Smith, 2013; Huck, 2019; Makopoulou et al., 2020).

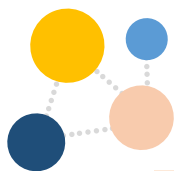
Literacy can be readily integrated with many if not all disciplines represented on the primary curriculum. There are particularly strong conceptualisations for integration with some disciplines (e.g. science and literacy) but not for all (e.g. literacy and PE). Notwithstanding these findings, it should be noted that many of the critical, foundational components of early literacy instruction (e.g. phonics, phonological awareness) were not a prime focus of the studies on literacy integration. Consequently, caution is warranted in extrapolating these findings for the teaching of early literacy skills. It should also be noted that a large body of research on approaches related to second and additional language instruction (e.g. content and language integrated learning) did not form part of this analysis (see exclusion criteria in Chapter 3).

Curriculum Integration: Arts

Data related to arts integration were obtained from those studies included in Table 7. Within these studies, 'arts integration' was commonly used to describe the integration of a range of arts subjects or methodologies into other curricular areas. However, some focused on a specific subject (e.g. Visual Arts, Music, Drama) in their research on arts integration. Consequently, a number of studies were classified into multiple learning areas, depending on the operational definitions used by the author(s).

Table 7 Studies examining Arts Integration, listed by discipline and first author

Arts Integration (n=24)	Visual Arts (n=16)	Music (n=14)	Drama (n=7)
Byrd (2019)	Batic (2020)	An (2012)	Anderson (2015)
Chand O'Neal (2017)	Birsa (2018)	An (2014)	Edsall (2012)
Colton (2016)	Björklund (2017)	An, Tillman (2014a)	Inoa (2014)
Coudriet (2013)	Brugar (2012)	An, Tillman (2014b)	Kneen (2020)
Doyle (2014)	Cunnington (2014)	Bryant (2012)	Samuels (2019)
Feldwisch (2014)	Duggan (2021)	Coudriet (2013)	Saraniero (2014)
Fragakis (2019)	Edsall (2012)	Edsall (2012)	Tam (2021)
Hahn (2020)	Kneen (2020)	Huang (2012)	
Hardiman (2019)	Mård (2022)	Kneen (2020)	
Hipp (2019)	Öztürk Yilmaztekin (2016)	Lau (2018)	
Inoa (2014)	Parker (2012)	Lovemore (2021)	
Khanna (2021)	Potocnik (2021)	Samuels (2019)	
Kneen (2020)	Sáez-López (2016)	Simmons (2015)	
LaMotte (2018)	Saraniero (2014)	Viñas (2021)	
LaJevic (2013)	Vacca (2022)		



Landley (2017)
Lara (2017)
Panagopulos (2015)
Peppler (2014)
Rule (2012)
Saraniero (2014)
Snyder (2014)
Trent (2018)
Tucker (2017)

As in the broader field of curriculum integration, there was a plurality of definitions offered by the extracted studies to summarise arts integration. Given the number of studies originating from the United States, it was hardly surprising that many of them (e.g. Byrd 2019; Doyle et al., 2014; Feldwisch et al., 2014) used the definition of arts integrated education advocated by *The John F. Kennedy Center for the Performing Arts* (2022), the American institution responsible for presenting, producing, and curating world-class art. Here, arts integration is considered “an approach to teaching in which students construct and demonstrate understanding through an art form... [involving] a creative process, which connects an art form and another subject area and meets evolving objectives in both” (John F. Kennedy Center for the Performing Arts, 2022). This definition also outlines how the arts can be employed in school settings using three key approaches:

- **Arts as Curriculum**, involving national or state learning standards
- **Arts-Enhanced Curriculum**, where the arts are a strategy to support learning in another curricular area)
- **Arts-Integrated Curriculum**, where learners meet ‘dual’ learning objectives with the arts and at least one other subject area).

As demonstrated by this definition, there appears to be varying levels of integrated practice involving the arts. These levels create a continuum on which degrees of integration can be found. This idea is a consistent one within studies exploring arts integration - albeit with differing models and frameworks to explain it. For example, three studies (Fragakis & Hytten, 2019; Doyle et al., 2014; Inoa et al., 2014) used Burnaford et al.’s (2007) tripartite model to classify their perspectives on arts integration. Others used Eisner’s (2002) categorisation of arts integration, which outlined four classroom contexts in which it could occur. The most popular model applied in the extracted studies was Bresler’s (1995) typology of arts integration with five studies aligning their work with this conceptual framework. Table 8 offers a brief summary of these three frameworks.



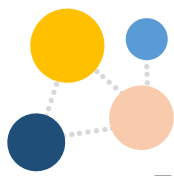
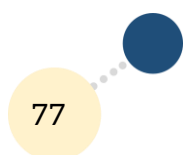
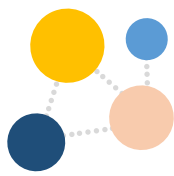


Table 8 Three Models of Arts Integration

Author (Year)	Description	Aligned Studies
Burnaford et al. (2007)	<p>(i) learning ‘through’ or ‘with’ the arts</p> <p>(ii) a process of ‘curricular connections’</p> <p>(iii) arts integration as a way to foster collaborative engagement</p>	<p>Fragakis & Hytten, 2019</p> <p>Doyle et al., 2014</p> <p>Inoa et al., 2014</p>
Eisner (1970)	<p>(i) Historical/Cultural (e.g. arts to understand a particular period or culture)</p> <p>(ii) Within the arts (understanding how a topic can be expressed in similar or different ways between art forms)</p> <p>(iii) Other subjects (Exploring a common theme in arts and non-arts subjects)</p> <p>(iv) Problem Solving (Using arts, and other subjects, to solve a particular problem)</p>	<p>Landley & Smith, 2017</p> <p>Lara & Rhoads, 2017</p> <p>Snyder et al., 2014</p>
Bresler (1995)	<p>(i) Affective Integration (emphasis on the ‘feelings’ evoked by and attitudes towards art, as well as student-centred learning and initiative, creativity and self-expression)</p> <p>(ii) Co-Equal Integration (arts as an ‘equal partner’ integrating the curriculum with arts-specific contents, skills, expressions, and modes of thinking).</p> <p>(iii) Social Integration (how arts can be used to foster a sense of ‘community and identity’)</p> <p>(iv) Subserving Integration (arts ‘serve’ the basic academic curriculum in its contents, pedagogies, and structures).</p>	<p>Lovemore et al., 2021</p> <p>Landley & Smith, 2017</p> <p>Panagopulos et al., 2015</p> <p>Coudriet & Tananis, 2013</p> <p>Huang, 2012</p>

As demonstrated by the above models and frameworks, there are a variety of ways in which arts integration can occur. Based on the content of Burnaford et al.’s (2007), Eisner’s (2002) and Bresler’s (1995) models, it appears that on one end of the





spectrum are practices involving art production as a strategy for teaching academic content (e.g. ‘Subservient Integration’; Bresler, 1995). At the other end are those practices where arts integration transcends disciplinary boundaries (e.g. ‘Problem Solving’; Eisner, 2002). While other models and frameworks were cited, this idea that arts integration can occur along a continuum was a key theme across the extracted studies (e.g. Mård & Hilli, 2022; Duggan et al., 2021; Birsa, 2018). Even studies that proposed subject-specific models of integration such as An’s (An & Kulm, 2012; An et al., 2014a; An et al., 2014b; An & Tillman, 2014) five-phase model for music-mathematics integrated lessons endorsed this idea. In this model, for example, each phase has varying levels of focus on music and mathematics, depending on the needs of the class, the skill of the teacher and the content being taught.

Eisner (2002, p. 42) asserted that arts integration should be “practical and principled, creating the appropriate mix for the particular occasion”. This explains why a continuum to arts integration is evident in discussions on its conceptualisation. However, many of the studies (e.g. . Chand O’Neal, 2017; Cunnington et al., 2014) noted that such an approach can support an ‘instrumentalist’ approach to arts education. In using the arts as a strategy to support learning in another subject, their own intrinsic value becomes obscured. When promoting arts integration and conceptualisations of the same, Cunnington et al. (2014) advocated that the arts should never be *solely* justified in terms of what they can ‘do’ for other subjects. Where possible, authentic arts integration should be prioritised when attempting to conceptualise the arts in an integrated curriculum. This integration should avoid placing the arts in a subservient role.

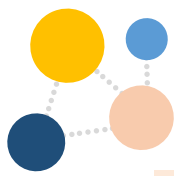
Curriculum Integration: STEM

A large number of studies captured in the review involved STEM disciplines. These are outlined in Table 9.

Table 9 Studies examining STEM, STEAM, Science and Maths Integration listed by discipline and first author

STEM (n=38)	Science (n=54)	Maths (n=44)
Aranda (2020)	Aguirre-Munoz (2021)	Kim, M.K. (2015)
Atalay (2015)	Alghamadi (2017)	Kik (2014)
Baker (2017)	An (2017)	LaMotte (2018)
Cannon-Ruffio (2020)	Aranda (2020)	Lehrer (2021)
Capobianco (2014)	Bazemore (2015)	Leszczynski (2014)
Cassidy (2022)	Brand (2012)	Levy (2018)
		Liston (2018)
		Aguirre-Munoz (2021)
		Akbar (2012)
		Alghamadi (2017)
		An (2017)
		An (2013)
		An (2014)



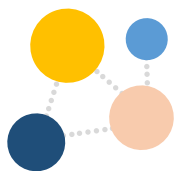


Convertini (2020)	Bravo (2014)	Luna (2015)	An, Tillman (2014a)
Dan (2018)	Casady (2015)	Mård (2022)	An, Tillman (2014b)
Delahunty (2021)	Cervetti (2012)	Marshall (2018)	Baptiste (2022)
Ensign (2012)	Collins (2015)	Miller (2019)	Björklund (2017)
Evans (2015)	Corlu (2014)	Nesmith (2017)	Brand (2012)
García-Carrillo (2021)	Cotič (2021)	Ødegaard (2014)	Bungum (2014)
García-Carrillo (2021)	Duggan (2021)	Öztürk Yilmaztekin (2016)	Calder (2013)
Havice (2018)	Edsall Giglio (2012)	Pendergast (2012)	Cecchini (2020)
Hourigan (2021)	Eli (2020)	Potocnik (2021)	Corlu (2014)
Kloser (2017)	Evans (2015)	Sáez-López (2016)	Cotič (2021)
Kok (2014)	Fazio (2018)	Santaolalla (2020)	Cunnington (2014)
Kurup (2019)	Fazio (2019)	Sen (2017)	Dogan (2019)
Lamb (2015)	Gallagher (2019)	Stapp (2020)	Duggan (2021)
Lehrer (2021)	Gray (2022)	Swan (2013)	Edsall Giglio (2012)
López-Leivaa (2016)	Hall-Kenyon (2013)	Talbert (2019)	Eli (2020)
McFadden (2017)	Hardiman (2019)	Van't Hooft (2012)	Follong (2022)
Mildenhall (2021)	Harris (2019)	Volk (2017)	Follong (2020)
Miller (2019)	Hastie (2013)	White (2014)	Fragakis (2019)
Miller-Ray (2019)	Heiu (2019)	Wright (2017)	Harris (2019)
Monteiro (2021)	Hubbard (2020)	Zhang (2012)	Hawley (2022)
Nadelson (2014)	Israel (2020)		Hraste (2018)
Nadelson (2012)			Israel (2020)
O'Neal (2017)			Kim, M.K. (2015)
Rico (2020)			Lehrer (2021)
Robinson (2021)			Leszczynski (2014)
Schellinger (2021)			Lovemore (2021)
Speldewinde (2022)			Luo (2022)
Tank (2014)			Magdas (2017)
Tytler (2021)			Mård (2022)
Vallera (2015)			Pendergast (2012)
Wendell (2014)			Samuels (2019)
Wieselmann (2021)			Santaolalla (2020)
			Sen (2017)
			Swan (2013)
			Vacca (2022)
			Van't Hoft (2012)
			Vinas (2021)
			Volk (2017)

STEAM
(n=6)

Graham (2016)	Kim, D. (2017)
Jamil (2017)	Kim, M.K., Cho (2019)
Jia (2021)	Quigley (2019)

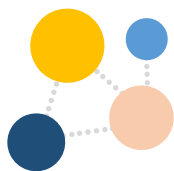




In line with the broader literature on curriculum integration, there was considerable divergence between studies as to how integration involving the sciences ($n=54$) and/or mathematics ($n=44$) should be conceptualised. Some studies such as Casady (2015), Cecchini and Carriedo (2020) and Pendergast et al. (2012) examined the integration of science and/or mathematics with other disciplines using general models of integration i.e. Drake (2012), Fogarty (1991), Beane (1997). Depending on the subjects involved, other models of integration were also applied (e.g. Arts Integration: Lovemore et al., 2021; Fragakis, 2019; LaMotte, 2018). Other studies developed 'dyad' models of integration for science and/or mathematics. Such models emphasised the connections between the two disciplines of interest before suggesting frameworks to represent and realise these connections in classrooms. Science and mathematics were frequently 'paired' in these dyad based frameworks (e.g. Lehrer & Schauble, 2021; Tytler et al., 2021; Leszczynski & Munakata, 2014) but there was little consistency into how these frameworks were discussed or conceptualised. For example, Alghamdi (2017) proposed that the integration of these two disciplines involves balance, continuity, learner-centeredness, flexibility, continuity, and functionality. Achieving these standards requires planning, organisation, work-life activities, evaluation, and real activities; 'POWER'. In contrast, Kim and Cho (2015) introduced the Convergent Concept Model to support the integration of science and mathematics with a three-phase inquiry-based model for the understanding of concepts within these subjects. Other dyad models of integration beyond science and mathematics were noted within the studies reviewed e.g. music and mathematics (see An et al., 2014). Science and literacy was another common pairing (see Fazio & Gallagher, 2019; Talbert, 2019; Liston & Hennessy, 2018; Marshall, 2018; Nesmith et al., 2017; Wright & Gotwals, 2017; Bravo & Cervetti, 2014; Ødegaard et al., 2014) within the studies reviewed as well. The use of dyad type approaches to curriculum integration offers an accessible and practical insight into how such a process can be realised in classrooms. Unfortunately, it is unclear if conceptualisations of integration for two disciplines can be applied when more than two disciplines are involved.

A number of studies ($n=36$) used the term 'STEM' to indicate their use of integrative approaches in the teaching of science, technology, engineering and mathematics. If the arts were involved, the acronym 'STEAM' was used ($n=6$). Studies involving STEM/STEAM usually advocated 'connection-making' between the relevant disciplines in order to develop twenty-first century skills (e.g. Lamb et al., 2015) using 'real-life scenarios' (e.g. Jamil et al., 2018). While there was consensus on these two elements of STEM/STEAM education, analysis of the studies involved in this review





indicated that such agreements were rare. Instead, there were a wide range of conceptualisations for integrated STEM/STEAM education with many studies disagreeing on key ideas e.g. the role of engineering (see Quigley et al., 2019; Schellinger et al., 2021), the purpose of the arts in education (see Graham & Brouillette, 2017; Quigley et al., 2019). Consequently, there is a distinct lack of clarity around the core characteristics of high-quality STEM/STEAM instruction. This is acknowledged by the field itself (see Hourigan et al., 2021) and goes some way in explaining why many of the studies involved in this review did not offer any in-depth discussion on the theoretical underpinnings of STEM/STEAM integration (e.g. Miller-Ray, 2019; Nadelson et al., 2012; Robinson et al., 2021).

Those studies that did provide discussions on how STEM integration should be considered (e.g. Cassidy & Puttick, 2022; Hourigan et al., 2021; Schellinger et al., 2021; Wieselmann et al., 2021; Baker & Galanti, 2017; Kloser et al., 2018; LópezLeiva et al., 2016) tended to cite work by Moore et al. (2014) and/or Vasquez et al. (2013). These are summarised in Table 10. Within the field of STEAM, Jamil et al. (2018) drew on earlier work by Quigley et al. (2019) to offer a description of effective STEAM education which involves teachers drawing on a set of desirable knowledge ('Instructional Content') and pedagogy ('Learning Context') in order to achieve learning outcomes. Quigley et al. (2019) further expanded this initial STEAM framework by incorporating social practice theory into its most recent iteration to ensure that the arts are an integral component in their own right and are not 'subservient' to STEM.

Table 10 Models of STEM Education

Model/Approach	Explanation
Moore et al. (2014) <i>Six tenets for quality K-12 STEM education</i>	<ol style="list-style-type: none"> 1) A motivating and engaging context 2) The inclusion of mathematics and/or science content 3) Learner-centred pedagogies 4) An engineering design 5) An emphasis on teamwork and communication 6) Learning from failure through redesign
Vasquez et al. (2013) <i>A continuum of STEM approaches to curriculum integration</i>	<p>This model proposes a continuum of increasing levels of connection between the STEM disciplines:</p> <p>Disciplinary: Concepts/skills are presented separately within each discipline</p> <p>Multidisciplinary: Concepts/skills are presented by discipline but are connected by a common theme</p> <p>Interdisciplinary: Concepts/skills from two or more disciplines are closely linked to deepen understanding.</p> <p>Transdisciplinary: Authentic, 'real world' problems are used to apply knowledge and/or skills from two or more disciplines.</p>



In relation to the two models of STEM education that were extracted from the small number of studies that mentioned them, Vasquez et al.'s (2013) work applies a 'STEM lens' on established concepts within the field of curriculum integration whereas Moore et al.'s (2014) framework is highly specific to STEM education. Interestingly, Moore et al.'s (2014) tenets for STEM education unintentionally reflects a key tension within STEM, and indeed STEAM, education. Within Moore et al.'s (2014) six tenets, the role of three disciplines (science, maths, engineering) when designing integrative STEM approaches for classrooms is clearly delineated. Technology is not explicitly mentioned, despite it being a key discipline within the acronym. The equitable inclusion of the four disciplines in STEM integration is a major issue within the field with Irish teachers recently querying if all four disciplines are needed in every lesson and to what extent 'fully integrated' STEM lessons should be present in a weekly or monthly timetable (see Delahunty et al., 2021; Hourigan et al., 2021). Furthermore, while studies categorised themselves within the field of STEM research, they often focused on only one or two disciplines e.g. Lehrer & Schauble, 2021 (science, mathematics); Robinson et al., 2021 (mathematics, engineering); Schellinger et al., 2021 (engineering, science); Aranda et al., 2020 (science, engineering); Bartels et al., 2019 (science, maths); Capobianco & Rupp, 2014 (science, engineering).

Curriculum Integration: Social Studies/Environmental Education

This section addresses research on integration in social studies (including geography and history) before turning to research that focused specifically on environmental education (including education for sustainability). Relevant studies are documented in Table 11.

Table 11 Studies examining Social Studies, Geography, History and Environmental Education Integration listed by discipline and first author

Social Studies (n=30)	Geography (n=6)	History (n=8)	Environmental Education (n=15)
Atalay (2015)	Greenwood (2013)	Brugar (2012)	Barnes (2018)
Bazemore (2015)	Harris (2015)	Edsall Giglio (2012)	Da Silva-Branco (2021)
Brand (2012)	Lorger (2019)	Harris (2015)	Dyment (2014)
Brugar (2017)	Smith (2016)	Lackovic (2015)	Dyment (2015)
Brugar (2012)	Trent (2018)	Samuels (2019)	Edwards (2016)
Casady (2015)	Vlcek (2018)	Smith (2016)	Eli (2020)
Coudriet (2013)		Talbert (2019)	Ferguson-Patrick (2016)
Duke (2021)		Trent (2018)	Ichinose (2017)
Edsall Giglio (2012)			Kennelly (2012)
			Kuzich (2015)





Eli (2020)	Lasen (2017)
Evans (2015)	Lee (2018)
Fragakis (2019)	Magdaş (2017)
Hubbard (2020)	Rico (2020)
Huck (2018)	Shumacher (2012)
Huck (2019)	
Jordan (2016)	
LaMotte (2018)	
Leckie (2016)	
Mård (2022)	
Ollila (2016)	
Pendergast (2012)	
Powell (2018)	
Revelle (2019)	
Revelle (2020)	
Rule (2012)	
Santaolalla (2020)	
Swan (2013)	
Uyar (2018)	
Van't Hooft (2012)	
Zhang (2012)	

There was little consensus from the studies included in Table 11 regarding conceptualisations of integration as they related to the disciplines of history, geography and the broader umbrella term of 'social studies'. This is unsurprising given that definitions of 'social studies' have considerable variation as discussed by Coleman (2021) in their recent review of the subject. Within the studies extracted for this review, a significant proportion of the studies offered no real model or conceptualisation to summarise how an integrated approach to social studies, or its core disciplines of history and geography, could be organised or structured (e.g. Lorger & Braičić, 2019; Jordan, 2016; Smith et al., 2016; Rule et al., 2012; Van't Hooft et al., 2012). While widely cited general models of integration were cited such as those proposed by Drake (2012), Beane (1996) and Jacobs (1991; 1989) (see Vlcek et al., 2019; Uyar, 2018; Casady, 2015; Brugar & Whitlock, 2017; Pendergast et al., 2012), other studies relied on models of integration associated with those discussed in other disciplinary areas e.g. arts integration (see Fragakis, 2019; LaMotte, 2018; Coudriet, 2013), STEM/Science (see Evans and Wilkins 2015; Zhang and Campbell, 2012), literacy (see Leckie & Wall, 2016; Talbert, 2019). Four studies stated that their integration practices were heavily informed by Project Based Learning (PBL) principles (see Revelle, 2020; Revelle, 2019; Ollila & Macy, 2019; Atalay &



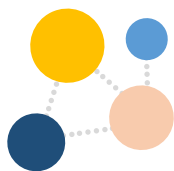


Kahveci, 2015). Another four studies noted that their application of curriculum integration were aligned constructivist principles and pedagogies (see Harris et al., 2015; Lackovic et al., 2015; Bazemore, 2015; Brand & Triplett, 2012).

There appears to be no single unifying approach to the integration of those disciplines associated with 'social studies'. However, Brugar and Whitlock (2017) note that earlier work by Hinde (2015) may be particularly useful in describing how social studies integration occurs in elementary classrooms within the United States. Under this framework, 'healthy' integration occurs when social studies has explicit connections to other subjects and to the students' lives. In contrast, 'fractured' integration can be seen when shallow forms of integration are enacted e.g. when social studies are only mentioned to enhance instruction in another subject or discipline. 'Stealthy' integration can be seen when social studies content is taught but the key learning and lesson targets are derived from other subjects like literacy. While Brugar and Whitlock (2017) noted the value of both stealthy and healthy integration in their observations of elementary classrooms, the authors caution that the quality of social studies instruction may be at risk if 'stealthy' forms of integration are the only forms of integration practised.

The literature on environmental education varied in the terminology used, though the studies included in the review tended to focus on 'education for sustainability'. Studies that focused on how this concept could be integrated into the broader curriculum tended to emphasise the value of using multiple perspectives (offered by multiple disciplines) to learn about complex and contemporary phenomena. Eli et al. (2020, p. 797) refer to 'interdisciplinary learning' as "the integration and interaction of subjects involved in solving a shared problem", which moves beyond disciplinary boundaries to form a "coordinated and coherent whole". Integration is framed as being *necessary* to address sustainable development so that it is "not understood as a discrete set of skills and knowledge, but rather as a way of thinking and doing that transcends subject boundaries" (Kuzich et al., 2015, p. 5). The importance of integrated approaches for sustainable development has influenced national curriculum documentation in many of the jurisdictions captured by these studies. For example, Lee et al. (2018) outline how 'permeative instruction' is used to embed sustainability concepts across the curriculum in Korea, Eli et al. (2020) outline the inclusion of sustainable development as a cross-curricular theme in Norway, while several authors outline a similar cross-curricular 'priority' in the Australian national curriculum (Barnes et al., 2018; da Silva-Branco & Woods-McConney, 2021; Dymont & Hill, 2015; E. Dymont et al., 2014; Lasen et al., 2017).





Broader conceptual models of integration (e.g. Fogarty, Beane) are rarely invoked in the studies on environmental education.

*Curriculum Integration: Wellbeing*¹⁶

A small number of studies examined integration in relation to topics, knowledge or skills that would normally be aligned with the Irish representations of PE and SPHE. The conceptualisations found within these studies have been considered together under the title of 'Wellbeing' and are summarised in Table 12.

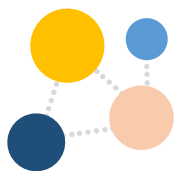
Table 12 Studies examining PE and SPHE integration listed by discipline and first author

PE n=9	SPHE n=5
Bergen-Cico (2015)	Edwards (2015)
Cecchini (2020)	Follong (2022)
Coudriet (2013)	Follong (2020)
Hastie (2013)	Stapp (2020)
Hraste (2018)	Vacca (2022)
Lorger (2019)	
Makopoulou (2020)	
Smith (2016)	
Vlcek (2018)	

Four of the five studies classified under the subject of SPHE failed to cite any theoretical framework or model as one that informed their approach to curriculum integration. In the case of Follong et al. (2020), only a passing reference is made to any literature on integration, whereby a definition by Beckmann (2009) is used to describe cross-curricular mathematics teaching. It is interesting to note that nutrition was the most common issue considered for integration amongst this small sample of studies. Edwards et al. (2015), for example, used 'food packaging' to design an integrated unit of work that explored healthy eating (as in SPHE) and recycling (Environmental Education). Concerning those studies for PE, models or frameworks for integration were referenced more frequently, if not consistently. Vlcek et al. (2019) referenced work by Drake and Burns (2004) and Jacobs (1989) to describe how the subjects of PE and Geography had interdisciplinary 'synergies'. Cecchini and Carriedo (2020) aligned their approach with Fogarty's (1991) 'shared' model of integration, whereas Coudriet (2013) used Bresler's (1995) models of arts integration to describe PE, music, and visual arts teachers'

¹⁶ Given the comparatively small number of studies returned in this area, caution is warranted in over-interpreting the findings presented in this section.





perceptions of curriculum integration. Hastie (2013) used Ackerman's (1989) criteria for judging the quality of integration to evaluate their integrated unit of work involving PE and Science. The remaining five studies had no clear conceptualisations of curriculum integration.

Conceptualisations of Curriculum Integration: Summary

Although discipline-agnostic terms for curriculum integration were used to search for relevant studies, a strong disciplinary focus still emerged from the studies reviewed. While some studies explored a general approach to integration, the vast majority examined curriculum integration in relation to a particular disciplinary area, i.e. Literacy/Language, Arts, STEM, Social Studies/Environmental Education, and Wellbeing. The studies indicated that specific models or frameworks were common within a given area, e.g. Bresler's (1995) typology of arts integration. However, no one model, approach, framework, or conceptualisation of integration emerged as a unifying force across the disciplines. Indeed, models of integration that were highly specific to the subjects or disciplines involved were frequent e.g. science-literacy, science-mathematics, music-mathematics. While the terms 'multidisciplinary', 'interdisciplinary' and 'transdisciplinary' were used across all disciplines, definitions for each were inconsistent. It should be noted that many of the studies returned could be analysed according to the extent to which the approach to curriculum integration was led by the teacher or learner(s). In examining the prevalence of teacher-led or learner-led approaches to conceptualising curriculum integration, other issues hindering its definition or practical implementation began to surface.

Barriers and Challenges to Curriculum Integration

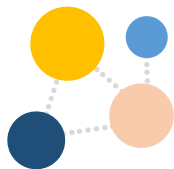
The challenges and barriers related to integration in primary contexts can be organised into four broad categories: *Teacher Knowledge and Expertise*, *Curriculum Structure*, *Time and Resources*, and *Perceived Subject Hierarchies*.

Teacher Knowledge and Expertise

Insufficient content and/or pedagogical knowledge to support integrated teaching approaches is regularly reported as a major barrier to successful integration by teachers.

Successful integration requires a deep knowledge of the relevant disciplines in terms of content. If teachers believe they have inadequate subject matter knowledge, they may be reluctant to use integrated teaching and learning approaches. For example, insufficient teacher knowledge of a particular arts subject or discipline was associated with an unwillingness or inability to engage in high-quality arts integration (e.g. Hipp &

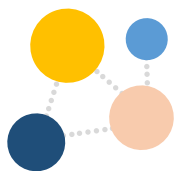




Sulentic Dowell, 2019; Kneen et al., 2020; Potocnik et al., 2022; Rismiati, 2012). In Kneen et al.'s (2020) qualitative study of Welsh primary teachers' experiences of arts integration, the participants reported that they were often dissatisfied with their knowledge of the content required to teach and integrate arts subjects like music or dance. This lack of knowledge made it difficult for them to plan, teach and assess arts-integrated lessons and units. Furthermore, teacher knowledge and comfort varies from discipline to discipline (Jordan, 2016). In their small-scale study involving six Irish teachers, Delahunty et al. (2021) noted that teachers believed they lacked subject matter knowledge concerning technology and engineering which made them unsure of their ability to create authentically integrative STEM lessons. While concerns regarding content knowledge were a relatively common finding within studies reporting teacher readiness for integrating STEM, science, and mathematics (e.g. Hourigan et al., 2021; Kurup et al., 2019; Gomez Zwiép, 2016) it was not unique to those disciplines. Perceived and/or actual lack of content knowledge concerning literacy, sustainability, and social studies were also seen as consequential barriers to the use of integration in primary classrooms (see Brugar & Whitlock, 2017; Cunnington et al., 2014; Edsall Giglio, 2012; Fazio & Gallagher, 2018; Hall-Kenyon & Smith, 2013; Kennelly et al., 2012; Lasen et al., 2017; Leckie & Wall, 2016; Talbert, 2019; Tank, 2014; Wendell, 2014).

Integration also requires a sophisticated understanding of *how* to integrate and a number of issues here may affect teachers' willingness to engage with the process (An, 2017; Brugar, 2012; Feldwisch et al., 2014; Gallagher & Fazio, 2019). Jamil et al. (2018) worked with early childhood educators to determine their attitudes towards STEAM integration after attending a conference. While the educators were positively disposed towards STEAM, the authors noted that they were concerned about the logistics of classroom instruction and management, particularly given the role of learner centred instruction in STEAM activities. However, learner centred instruction involving 'authentic' contexts is considered a core component of successful integration for many disciplines according to the studies in this review (see Anderson, 2019; Baker & Galanti, 2017; Atalay & Kahveci, 2015; Bravo & Cervetti, 2014; Bungum et al., 2014; Calder & Brough, 2013; Fitzpatrick et al., 2018; Greenwood, 2013; Gomez Zwiép, 2016; Hourigan et al., 2021; Lehrer & Schauble, 2021; Robinson et al., 2021; Tytler et al., 2021). Teachers often reported feeling unsure how to manage this fundamental shift away from teacher-led to learner-led instruction and whether such a shift is always valuable (see Capobianco & Rupp, 2014; Delahunty et al., 2021; Follong et al., 2020, 2022; Hourigan et al., 2021). Given the relative scarcity of research on the efficacy and utility of integrated





approaches, this is a valid concern. It also highlights broader issues within the field. Discussions as to *what* learning should be measured and prioritised in education have dominated the field for decades.

Issues surrounding the role of pedagogy and pedagogical content knowledge and how they relate to integration and its successful implementation in classrooms were noted throughout the studies reviewed (e.g. Brugar, 2012; Feldwisch et al., 2014; Gallagher & Fazio, 2019). An (2017) created the 'Interdisciplinary Pedagogical Content Knowledge' model to demonstrate how pedagogical knowledge (PK) and content knowledge (CK) in different subjects are required for the successful design and implementation of an integrated approach to teaching (see Figure 17). The authors note that this model describes the capacity of teachers to accomplish the following: (1) understand the representation of concepts across curriculum boundaries; (2) apply pedagogical methods to effectively and simultaneously address content areas from multiple subjects; (3) identify knowledge connections within and between particular subjects, and develop lessons based on such connections; and (4) support interdisciplinary explorations where learners link existing knowledge across curricula and present that new knowledge through contexts from multiple subjects (p. 239).

As demonstrated by An et al.'s (2017) model, deep teacher knowledge of multiple disciplines, while essential, is not enough to support integrated teaching. Knowledge of how the disciplines relate to each other ('Interdisciplinary Content Knowledge') and the pedagogies that can address such content ('Interdisciplinary Pedagogical Content Knowledge') are also necessary. Until teachers feel they have such knowledge, their use of curriculum integration across various subjects and disciplines may be somewhat limited.

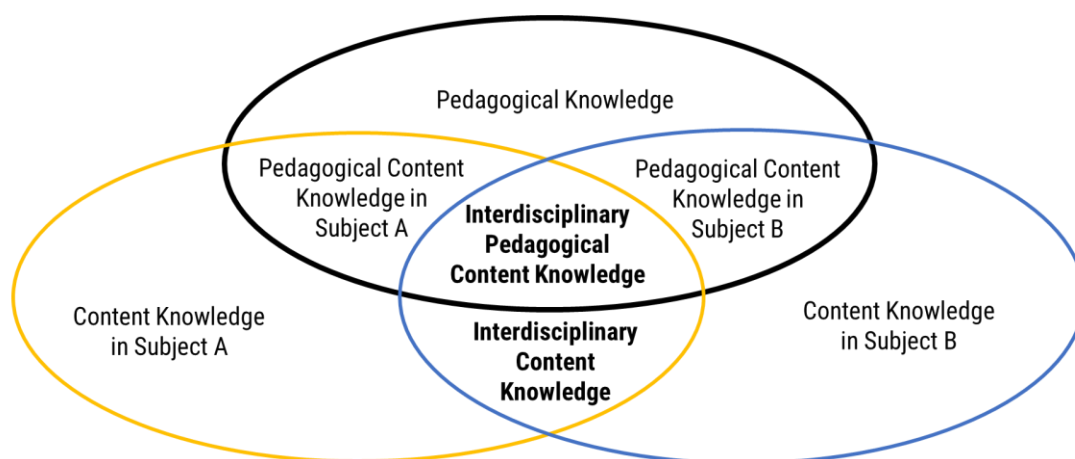
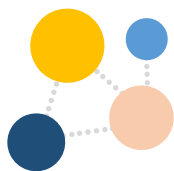


Figure 17 Graphic Representation of Interdisciplinary Content Knowledge (modified from An, 2017)



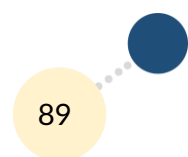


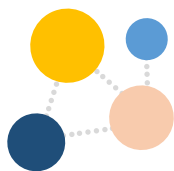
Curriculum Structure and Guidance

Inflexible or incoherent curriculum documents and limited guidance within such documents as to how integration can be achieved make its implementation in classrooms challenging.

Studies from different jurisdictions highlight the potential for a curriculum structure to complicate or impede teacher planning for integration. In particular, a 'traditional' curriculum organised by subject disciplines may be a barrier to integration (Hawley, 2022; Pendergast et al., 2012). Strong discipline boundaries can make curriculum integration challenging, particularly if those disciplines have a 'hierarchical' knowledge structure. Teachers working with McDowall and Hipkins (2019) stated that it was often difficult to regularly integrate maths and science due to the hierarchical nature of the knowledge development in these areas and the need to teach concepts in a specific order. Consequently, teachers often reported difficulties with their role as 'curriculum makers' in integrative teaching (see Delahunty et al., 2021; Moss et al., 2019). Ineffectual guidelines from curriculum documents on where and when integrated approaches would be most beneficial were considered to hamper teachers' work in this area (e.g. Dan & Gary, 2018; Delahunty et al., 2021). While teachers can often make these connections themselves, having them available for teachers helps to reduce workload as well as an over-reliance on "incidental" integration (see Brugar & Whitlock, 2017; da Silva-Branco & Woods-McConney, 2021; Huck, 2019; Kloser et al., 2018; Levy, 2018).

Highlighting such connections would expedite and support teachers' efforts with curriculum integration. However, this would need to be carefully done as it may make the curriculum documents unwieldy and unusable. For example, the complex structure of the International Baccalaureate led to some uncertainty in teachers' articulation of its components and how they informed integration (Savage & Drake, 2016). Australian studies reported similar findings (e.g. Kuzich et al., 2015). Unfortunately, there is little consensus within the research included in this systematic review as to how a curriculum should be structured, let alone one that prioritises curriculum integration. Lamb et al. (2015) argued that an integrated STEM curriculum should highlight 'cross-cutting ideas across the STEM disciplines as a whole' (p. 411). This aligns with the Australian approach to the cross-curriculum priorities (Barnes et al., 2018) but such 'ideas' need to be explicitly stated within and across curriculum documents with the natural, authentic connections between disciplines highlighted for teachers. Unfortunately, this is not a straightforward task given the range of partners required to create such statements.





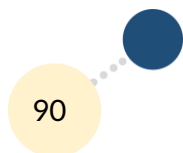
Time and Resources

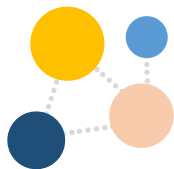
Studies show that inadequate planning time and a lack of easily accessible, high-quality resources are significant barriers to any initiatives involving curriculum integration.

While challenges relating to time came in several guises, they usually involved the availability of independent and/or collaborative planning time (Capobianco & Rupp, 2014; Collins & Wickersham-Fish, 2016; Delahunty et al., 2021; Fu & Sibert, 2017; Hipp & Sulentic Dowell, 2019; Jamil et al., 2018; Maitles & McAlpine, 2012; Ollila & Macy, 2019; Öztürk Yilmaztekin & Tantekin Erden, 2016). While integration can sometimes be seen as a ‘time-saving’ tool, it rarely leads to curricular expediency. For example, integrating literacy across multiple subject areas does not necessarily save time for teachers in terms of planning. It instead leads to several other time-related challenges (see Bravo & Cervetti, 2014; Brugar, 2012; Casady, 2015; Gomez Zwiep, 2016; Gray et al., 2022; Hubbard et al., 2020; Nesmith et al., 2017; Revelle, 2020; Tank, 2014; Tucker, 2017). Teachers often spent more time planning integrated units of work due to their efforts in identifying and designing relevant materials as well as the increased workload associated with planning bespoke and context-specific units of work. Time to collaborate with colleagues within their school setting (and with discipline-specific professionals where possible e.g. artists, scientists) was seen as highly valuable but difficult to achieve (see Byrd, 2019; Cunnington et al., 2014; DePaola, 2022; Levy, 2018; Simmons, 2015; Huang, 2012).

Timetabling was also seen as an issue in many of the studies reviewed (DePaola, 2022; Hastie, 2013; Marshall, 2018; Nesmith et al., 2017; Ødegaard et al., 2014; Stapp et al., 2021). Many studies noted that *additional* class time was frequently required for in-depth/integrated teaching across a range of subjects, particularly if long-term projects were involved (Feldwisch et al., 2014; Ødegaard et al., 2014; Revelle, 2019; Saraniero et al., 2014). Inflexible timetabling arrangements such as minimum/maximum subject teaching times rendered integration more challenging (Brugar, 2012; Delahunty et al., 2021; Huck, 2019; Jordan, 2016; Kok & van Schoor, 2014; Marshall, 2018; Nesmith et al., 2017). While this was highly relevant for middle school teachers in the United States (which can involve timetabling and teaching arrangements similar to Irish post-primary schools), it was still noted in other contexts. Teachers in Delahunty et al.’s (2021) study noted that without more nuanced curriculum guidelines on time, it is difficult to determine and justify what emphasis an integrated unit of work should be assigned if minimum teaching time requirements for single subjects are stated.

A further challenge for schools wishing to engage in integration is ensuring adequate resourcing. Difficulties regarding access to resources to support integration

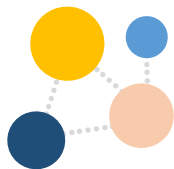




manifested in highly specific ways depending on the subjects being integrated. However, they broadly fell under three categories: *physical resources*, *exemplars* and, *assessment tools*.

- **Physical Resources:** For arts integration, these included resources like art supplies or musical instruments (Coudriet, 2013; Feldwisch et al., 2014; Gallagher & Fazio, 2019; Kneen et al., 2020; Lara, 2017). Monteiro et al.'s (2021) study of how 28 pre-school teachers integrated coding across the curriculum noted the challenges posed by a lack of IT infrastructure. Insufficient access to technology was also cited as a barrier to STEM integration (see Miller, 2019; Monteiro et al., 2021; Sen & Ay, 2017).
- **Exemplars:** Sample lesson plans and units of work were also highly valued by teachers, particularly in relation to literacy integration (see Bravo & Cervetti, 2014; Bryant, 2012; Cervetti et al., 2012; Duke et al., 2021; Edsall Giglio, 2012; Fazio & Gallagher, 2018, 2019, 2019; Feldwisch et al., 2014; Frankel et al., 2015; Gray et al., 2022; Ødegaard et al., 2014; Revelle, 2019; Tank et al., 2014; Volk et al., 2017; Wright & Gotwals, 2017b). Collins and Wickersham-Fish (2016) also found that teacher comfort is enhanced when a resource contains most of the information required to teach science (thus reducing the amount of research required and preparation time for science). While such findings were replicated in other studies across a range of disciplines, access to such high-quality materials outside of the context of a research study was rare (see Brugar, 2012; Duke et al., 2021; Follong et al., 2020, 2022; Huck, 2019; Ollila & Macy, 2019) and, if present, usually linked to financial support (Hubbard et al., 2020). Admittedly, the use of textbooks for integrated teaching may support teachers in their work on integration and in providing them with ideas as to how integration can occur in their classrooms (e.g. Magdaş et al., 2017; Shin, 2020) . However, the rigid use of any textbook has the potential to be a key barrier to integrated approaches (Brand & Triplett, 2012; Jordan, 2016; Schugar & Dreher, 2017).
- **Assessment Tools:** Teachers also noted that a lack of quality assessment tools made it difficult for them to engage in integrated teaching (see Barnes et al., 2018; Cervetti et al., 2012; Kuzich et al., 2015; Moss et al., 2019). Inadequate access to adaptable formative and summative assessments was considered a resource-related barrier to the planning process.





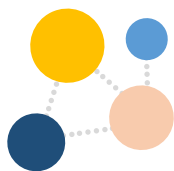
Perceived Subject Hierarchies

The studies warn that an imbalanced approach to integration as a result of perceived subject hierarchies is a substantial obstacle to effective integration.

The primary teachers involved in the reviewed studies tended to have positive views on integrated teaching. However, Kneen et al. (2020) argued that primary teachers are often working within “a curriculum of competing priorities” where core subjects like English, mathematics, and science are considered to be “more important” than other subjects like the arts (p. 268). This creates a perceived subject hierarchy among teachers (see Coudriet, 2013). Greenwood (2013) highlighted this well by drawing on survey and interview data with teachers in Northern Ireland to paint a picture of curriculum integration. Teachers agreed that integration in primary contexts was beneficial but warned of the “danger of contrivance and artificiality” (p.452). They suggested that content and learning in one subject or discipline could be relatively shallow to make way for “more important” content. This was also illustrated in Potocnik et al.'s study (2022) involving the analysis of 30 lesson plans submitted as examples of interdisciplinary teaching for fine arts and science. The authors identified many shortcomings in these lesson plans but highlighted the inadequate attention allocated to art-based content, knowledge, and skills in favour of the science-based equivalents. Many studies noted that the arts are at risk of being marginalised in primary contexts and may be used for ‘decoration’ or in service of other subjects (see LaJevic, 2013; Tam, 2021).

While the arts subjects appear to be at particular risk for ‘imbalanced’ integration, it is not a challenge unique to that discipline. Within the fields of science, mathematics, and STEM, the literature has several examples of researchers and practitioners admitting the challenges associated with equitably addressing each of the four disciplines when using integration (e.g. Israel & Lash, 2019; Lovemore et al., 2021). For example, some studies noted that science content can ‘dominate’ other subjects in integrated units of work (e.g. Aranda et al., 2020; Bartels et al., 2019; Leszczynski & Munakata, 2014). In Hourigan et al.'s (2021) study involving expert and novice STEM teachers, one participant asserted that “it’s very difficult to do all the four” (p. 16), with expert teachers appearing to deploy a high level of pragmatism when deciding how to integrate each discipline in their work. While such pragmatism and flexibility should be welcomed, it demonstrates how unclear conceptualisations of integration can directly impact on classroom practice e.g. the role of engineering in STEM (see Hourigan et al., 2021; Quigley et al., 2019; Schellinger et al., 2021). Similar findings concerning imbalanced integration can also be seen in Social Studies research (e.g. Huck, 2019). Studies on education for sustainability in





the Australian context noted that its presentation as a cross-curricular 'priority' rather than a subject in its own right often led to it receiving diminished attention (Barnes et al., 2018; Lasen et al., 2017).

Further evidence of the risk of imbalanced integration comes from research regarding literacy integration. It should be noted that many of the studies involved in this review report data to demonstrate how integrated approaches improve achievement in literacy learning (Bryant, 2012; Cervetti et al., 2012; Cunnington et al., 2014; Duke et al., 2021; Fazio & Gallagher, 2019; Frankel et al., 2015; Gray et al., 2022; Luna et al., 2015; Pepler et al., 2014; Schugar & Dreher, 2017; Talbert, 2019; Tank, 2014; Tucker, 2017; Wright & Gotwals, 2017). Unfortunately, learning in the 'other' discipline was not always reported. This is unsurprising given that many of the countries, districts, and contexts reviewed were subject to local or national accountability measures for literacy and/or numeracy. Teachers consequently felt that they should prioritise learning and achievement in these subjects accordingly (see *Australia* case study for a more in-depth example involving sustainability). Mandatory reporting of standardised test results in literacy and numeracy may pose a significant challenge to a genuine focus on curriculum integration. Teachers often 'trade' one subject against another to prioritise teaching and learning in those areas (e.g. (Delahunty et al., 2021; Dowden, 2014; Hammond, 2017; Kuzich et al., 2015; Penna-Baskinger, 2018; Powell, 2018; Simmons, 2015).

Barriers and Challenges to Curriculum Integration: Summary

Based on the empirical literature returned, the challenges and barriers related to integration in primary contexts can be organised into four broad categories. The first of these relates to *Teacher Knowledge and Expertise*. The provision of an integrated curriculum in primary contexts is closely associated with teachers' perceived and actual content knowledge concerning the disciplines involved. Insufficient knowledge in this area, or regarding the pedagogical content knowledge needed to support curriculum integration, can act as a barrier to curriculum integration. This barrier can be further compounded by a *Curriculum Structure* that is overly complex or rigid. Curriculum documents that fail to give practical guidelines make curriculum integration challenging for teachers. Inadequate *Time* for planning and a lack of high-quality *Resources* such as exemplars and assessment tools are obstacles commonly reported by teachers who wish to engage in curriculum integration. Finally, effective curriculum integration is often hampered by *Perceived Subject Hierarchies*. Primary teachers appear to be positively predisposed to curriculum integration but focusing on each discipline or subject equitably





is difficult due to other systemic issues e.g. reporting of literacy and numeracy test scores causing teachers to prioritise work in these areas.

The Role of Learner Agency

With some notable exceptions, learner agency was rarely an explicit concern of the empirical literature on curriculum integration captured in the systematic review. Learners' agency will have been undoubtedly influenced throughout all of the studies, but the degree to which researchers *valued, measured or reported* data on learner agency would suggest it was rarely a high-level priority for researchers. Taking this into consideration, two main themes are discernible: *the varying degrees to which learner agency informed integration* and the use of *practices that enable learner agency*.

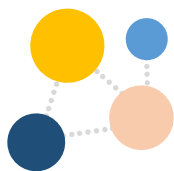
Emphasis on Learner Agency

Curriculum integration, as reported in practice, does not always include learner agency as a core or primary consideration. This said, approaches to curriculum integration that build in learner preferences as a starting point for integration have the propensity to support a high degree of learner agency.

Though some scholars (most notably Beane, 1997) foreground the importance of learners' interests and concerns as a starting point for curriculum integration, the examples of integration *in practice* detailed in this systematic review rarely embraced this principle. Though this may be traced to the nature of a research article (which by necessity focuses on a select number of concepts), the fact that the influence of learner preferences was not a major theme in the studies is noteworthy. This is not necessarily a value judgement on the researchers or research; rather, it paints a picture of the integration research that actually happens and how it contrasts with some of the more progressive conceptualisations in the area.

A small number of studies included in the review explicitly embrace learner concerns as the fulcrum for curriculum integration. In doing so, they chart benefits for learner agency. Reporting on a study that involved 386 lesson observations in 18 case study schools in Australia, Pendergast et al. (2012) highlight that lessons integrated in line with Beane's (1997) framework (which emphasises the importance of conducting curriculum integration in line with learner concerns) consistently scored higher on a number of measures of pedagogical quality, when compared to lessons organised around disciplines/subjects. The Productive Pedagogies Observation Framework (Mills et al., 2009) measured intellectual quality (e.g. higher order thinking), connectedness (e.g. links with learner background knowledge), supportive classroom environment (e.g. learner





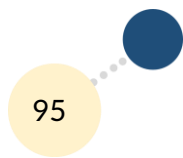
direction of activities) and valuing/working with difference (e.g. recognition of minority cultures). Fitzpatrick et al.'s (2018) study on the negotiated integrated curriculum, conducted in an Irish setting, placed a high status on learner agency and, based on qualitative findings, reported higher levels of ownership and engagement for learners. Other studies adopting this conceptualisation of agency report similar findings (Brough, 2012; Calder & Brough, 2013). While such studies may be particularly prone to the Hawthorne effect given their novelty to the learners, their findings nonetheless provide an illustration of the impact that strongly learner-focused manifestations of curriculum integration can have.

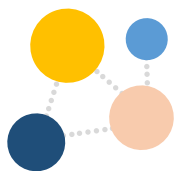
Opportunities for exercising agency

Meaningful opportunities for children to exercise agency can be embedded within integrated teaching, even if the starting point for integration is driven by teachers, curriculum documents, or other concerns.

Though curriculum integration that is planned in collaboration with learners may be the pinnacle of learner agency, this is not to say that agency cannot be embedded in forms of curriculum that are planned by teachers. Pedagogical choices that supported learner agency were discernible in the accounts of practice detailed in individual studies. However, the examples that follow are based on a careful reading of studies that did not necessarily measure or study learner agency as a construct.

In studies involving literacy integration, this included opportunities to share opinions and thoughts as part of instructional activities (e.g. Batic & Kac, 2020), affording weight to learner voice as part of the research/evaluation process (e.g. Casady, 2015), providing choice within learner activities (e.g. Duke et al., 2021) and including learner interests in deciding the focus for a unit of integrated work (e.g. Mård & Hilli, 2022). Arts integration can support this if learners are given sufficient latitude to engage in creative projects (e.g. Birsa, 2018; Chand O'Neal, 2017) and when teachers pay attention to learner interests in building integrated units of work (Doyle et al., 2014). Given the central role child-centred inquiry is often afforded in STEM studies, it is surprising that explicit representations of learner agency are rarely discussed. However, certain inferences can be drawn regarding the role of learner agency within science, maths, STEM and STEAM research. For example, learner agency literature asserts that learners should be encouraged to generate ideas to direct their own learning (see Vaughn et al., 2020). This was evident in Mård & Hilli's (2022) case study whereby learner interests guided integrated modules of work over a one-week or eight-week period. However, despite the positive learning that can arise from such an approach, it can be an inefficient way of





structuring learning experiences that can advance learner knowledge in a particular discipline (see Calder & Brough, 2013). Teachers who participated in McDowall and Hipkin's (2019) study stated that the degree of choice they grant their learners about their topics of inquiry within an integrated unit of work ranged from almost total free choice through to a narrow range of choice within teacher predetermined topics and with criteria that needed to be met to ensure coverage. To better balance learner agency with the requirements of teaching disciplinary knowledge, instead of allowing learners choice in project topics, other studies encouraged learners to be "generative" in their solutions to open-ended, authentic problems or in the activities they engaged with (e.g. Graham & Brouillette, 2017; Lehrer & Schauble, 2021; Schellinger et al., 2021; Tam, 2021). However, this can be challenging for teachers to manage. An in-depth case study of an integrated science/maths unit for 1st and 2nd graders by Lehrer and Schauble (2021) illustrated this very effectively. Within this study, the authentic, open-ended maths and science tasks inspired solutions that "disrupted the teacher's mathematical agenda" (p. 1; e.g. difficulties the children had in coming to a consensus about what units of measurement to use).

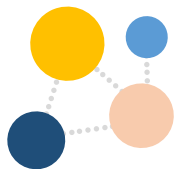
The Role of Learner Agency: Summary

As mentioned previously, learner agency, as conceptualised by scholars in the area (e.g. Vaughn, 2020), was rarely directly considered in empirical studies of curriculum integration. Analysis of these studies, however, did indicate that approaches to curriculum integration that incorporated learner preferences and concerns did tend to support the conditions necessary for learner agency. Furthermore, integrated teaching approaches can allow learners to exercise their agency in various ways depending on the pedagogical approach, e.g. child-centred inquiry.

The Role of Teacher Agency

The vast majority of studies on curriculum integration analysed in the systematic review make no *explicit* reference to teacher agency. However, a number of influencing factors can still be discerned by examining the roles played by teachers, challenges and opportunities reported by teachers in their work and the broader context in which the studies took place. This broad focus is consistent with a conceptualisation of agency that looks within, beyond and around a teacher to determine how they respond to and shape their work in the classroom (Priestley et al., 2015). This section outlines issues relating to accountability and curriculum requirements, professional learning and collaboration, shared understandings and values, local curriculum-making and supporting resources.





Accountability and curriculum requirements

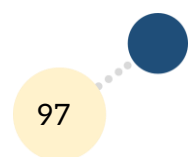
Rigid accountability measures, coupled with strictly regimented curriculum expectations, may hinder a teacher's agency for curriculum integration.

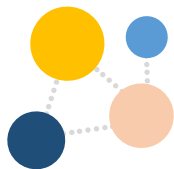
As noted previously, one of the prime barriers to integration cited across studies is the need for teachers to meet accountability requirements associated with a discipline-based curriculum, with tests of literacy and numeracy most likely to be mentioned (e.g. Brand & Triplett, 2012; Huck, 2018; Kneen et al., 2020; Lara, 2017; Rule et al., 2012; Simmons, 2015). From a teacher agency perspective, this is a particularly potent barrier as it curtails the number of genuine pedagogical options and priorities available to teachers (Poulton, 2020; Priestley, Biesta, & Robinson, 2015a). Despite this, the studies reveal examples of teachers exercising agency *in spite of* or in an effort to *circumvent* such accountability measures. Literacy integration, in particular, was often motivated by a desire to teach *more* of the learning areas that had been 'squeezed' by strict testing requirements (e.g. Brugar, 2012; Bryant, 2012). Despite good intentions, this form of "stealth integration" (Brugar & Whitlock, 2017) may not provide genuine opportunities for learning in the other area. It nonetheless highlights the vital role played by teachers in mediating curricular priorities.

The importance of professional learning and collaboration

Tailored and sustained professional learning opportunities can support a teacher's knowledge and consequently their capacity to enact integrated curriculum. Collaboration between teachers (and researchers/external professionals) enhances this endeavour.

A large number of studies highlighted the value of tailored professional learning opportunities to support teachers' capacity to integrate the curriculum. For example, in the context of arts education, Colton and Shelton (2016), Coudriet and Tananis (2013), and Doyle et al. (2014) all noted that tailored professional development increased teachers' knowledge and self-efficacy. Notably, many of the successful professional development projects incorporated collaboration between teachers (e.g. Hahn, 2020; Marshall, 2018) and/or between teachers and external professionals (e.g. Graham & Brouillette, 2017; Snyder et al., 2014) or researchers (Fazio & Gallagher, 2018). Professional development also tended to be sustained in duration and regularly supported teachers with exemplar instructional materials (see below).





Developing shared understanding and values

Though primary teachers generally report that they value and enact curriculum integration, shared understandings of integration in a school (or education system) cannot be taken for granted. School leaders can play an important role in this regard.

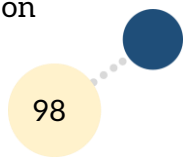
Within the ecological approach to teacher agency, a teacher's capacity to be an agentic professional depends on their beliefs, knowledge of and interpretations of particular policies or practices (see Biesta et al., 2015; Cong-Lem, 2021; Hadar & Benish-Weisman, 2019). Studies on STEM (and STEAM) education illustrate that positive teacher beliefs and values about this form of integration appear to enhance their support of and engagement with STEM curriculum and pedagogy (e.g. Havice et al., 2018; Hourigan et al., 2021; McFadden & Roehrig, 2017). For example, Baptiste's (2022) doctoral dissertation examined teachers' beliefs, instructional activities and curricular practices ($n=13$) when teaching mathematics as a single subject and through an interdisciplinary curriculum. These teachers (and HEI instructors) felt strongly about helping students value learning and to see themselves as capable problem solvers. Such beliefs influenced their instructional practices and the extent to which they used interdisciplinary or disciplinary approaches to respond to the specific needs of their learners. However, as suggested by Jamil et al.'s (2018) findings, educators may have beliefs or concerns that act as barriers to their use of STEAM.

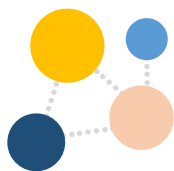
Even in schools that embrace integrated approaches to curriculum, there is a necessity to continue the discussion on why this endeavour is warranted and valued. Savage and Drake's (2016) study of teachers adopting a transdisciplinary curriculum in IB schools highlighted the potential for practice to deviate and diverge across the school, particularly in the case of newly appointed teachers. This study also highlighted the importance of the school leader in supporting this vision. The potentially positive or negative influence of a school leader on creating a school culture that supported integration was noted in many studies (Birchinall, 2013; Dan & Gary, 2018; Hubbard et al., 2020; Lau & Grieshaber, 2018; Shumaker et al., 2012).

Enabling teachers to make decisions about curriculum at a local level

Some of the literature depicts the potential for school-based curriculum making to support teachers in shaping the curriculum in their schools and classrooms.

An emphasis on school-based curriculum development can enable teachers to shape and mould the curriculum at a local level (Priestley, Biesta, & Robinson, 2015a). This form of curriculum development is illustrated in Mard and Hilli's (2022) case study of integrated teaching in two Finnish schools, in which teachers constructed curriculum on





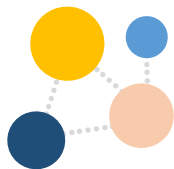
the topics of the Renaissance and entrepreneurship in ways that suited their specific contexts. Studies in which teachers played a large role in the planning of curriculum integration highlight the value of a backward design process to support school-based curriculum-making (Moss et al., 2019; Savage & Drake, 2016; Trinter & Hughes, 2021). Trinter and Hughes (2021) worked with six teachers over the course of ten months to plan interdisciplinary units on social issues (e.g. race and equity). Teachers encountered 'productive struggle' in planning interdisciplinary units, but eventually noted the value in this design process. This form of planning was a significant departure for teachers and highlighted the time investment required to make this form of planning work. This time is crucial if genuine and meaningful change is needed for integrated curriculum planning to happen and if 'strategic compliance' (Priestley, Biesta, Philippou, et al., 2015) is to be avoided. It should also be noted that overly rigid planning, even at a more local level, may restrict teachers' ability to respond to learner interests, with a consequent knock-on effect for learner agency. Studies from the US identified how curriculum integration may be supported by local, district-level plans (Bazemore, 2015), but if the scope and sequence outlined in these plans is overly-prescriptive, teachers and learners, in turn, will have little say in what they learn.

Supporting materials and resourcing

A teacher's agency for curriculum integration is highly influenced by the availability of sufficient time and resources.

Aligned with the previous theme, the studies on curriculum integration repeatedly underscored the importance of providing appropriate resources for teachers. High amongst these was the need for time, which was repeatedly noted as a challenge (see previous section). As noted previously, the availability or scarcity of relevant resources also influenced the degree to which teachers integrated the curriculum. Studies on literacy illustrate that it was common for teachers' integrative practice and knowledge to be supported by *instructional materials* that had been developed by or in collaboration with researchers (Bravo & Cervetti, 2014; Duke et al., 2021; Volk et al., 2017; Wright & Gotwals, 2017). Interestingly, some of these studies highlight the fine line between exemplification (which may support teachers) and prescription (which may be curtailing). Studies involving measures of fidelity (e.g. Duke et al., 2021) actively measured the degree to which teachers followed units of work on literacy/social studies designed by researchers. Though this study reported impressive results for literacy and social studies learning, it would appear that teachers were not involved in shaping the curriculum to any great extent. This runs contrary to Priestley et al. (2015a)'s recommendation that





exemplar materials and professional development should allow scope for local decision-making. In contrast, a different study that involved the mandatory use of integrated textbooks in Korea (Shin, 2020) highlighted teacher dissatisfaction with this approach. Adherence to scripted discipline-based curriculum (Heimer & Winokur, 2015; Huck, 2018) or textbooks (Brand & Triplett, 2012; Jordan, 2016) were regularly cited as a barrier to integration. It is possible for programmes and textbooks to support integration without necessarily supporting teacher agency.

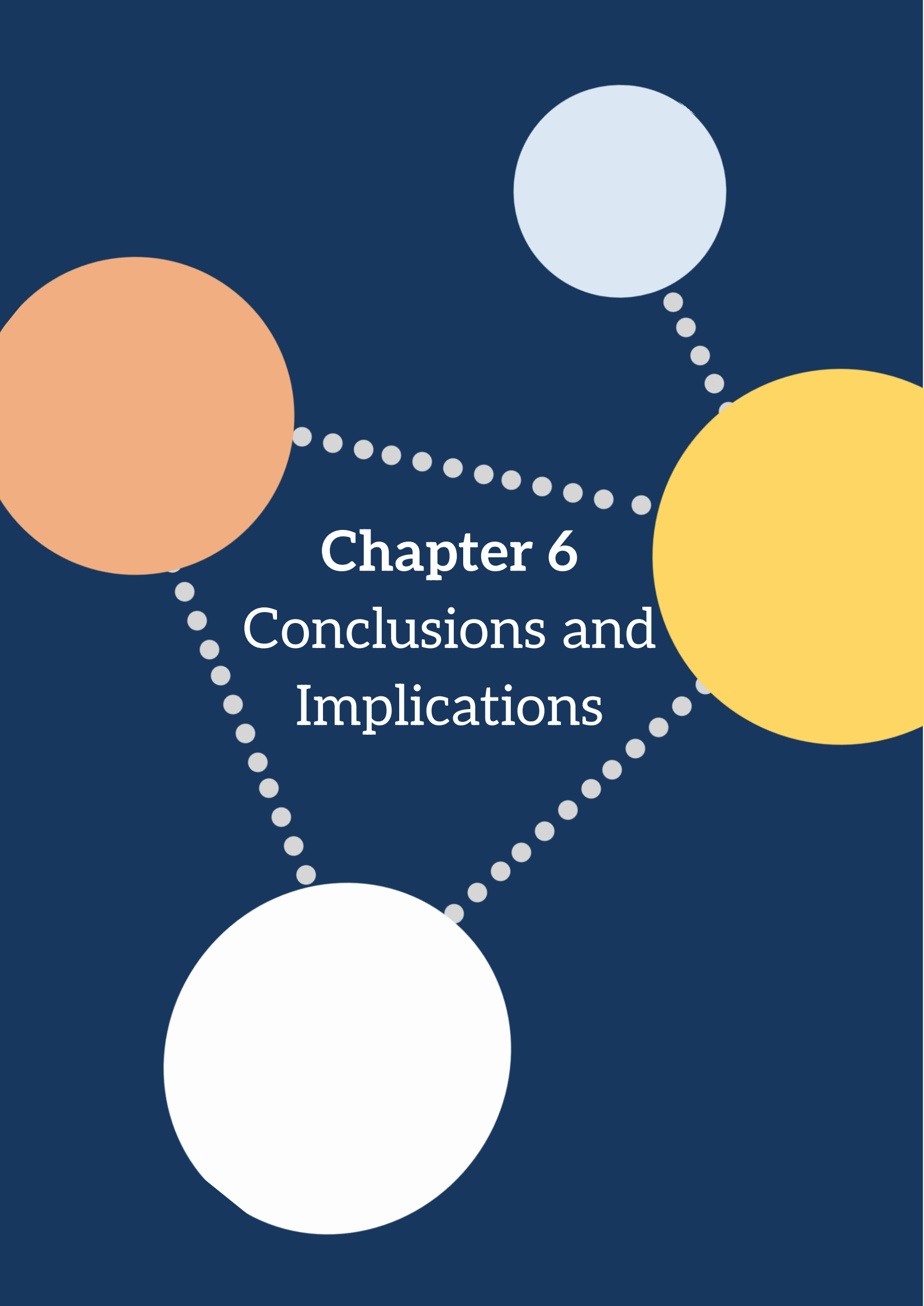
The Role of Teacher Agency: Summary

Explicit reference to teacher agency was rare in the empirical literature returned for this systematic review. However, examining the findings of this literature using Priestley et al.'s (2015) ecological perspective as a lens can allow certain inferences to be made on the relationship between teacher agency and curriculum integration. For example, rigid accountability measures can impact a teacher's likelihood to implement curriculum integration. It may make them less reluctant to engage with curriculum integration. Alternatively, it may encourage them to embrace it more to overcome rigid timetabling requirements. In line with the practical-evaluative component of Priestley et al.'s (2015) model, structural and cultural elements that support teacher agency also support curriculum integration. Sustained learning opportunities that prioritise professional collaboration can help realise curriculum integration. These professional learning opportunities can clarify teachers' beliefs and attitudes towards curriculum integration and allow them to develop a 'shared understanding' with their peers. This, alongside appropriate resources, can enable teachers to make the necessary decisions to enact curriculum integration locally. However, providing professional learning opportunities and systemic support is insufficient for teacher agency to emerge. Time to adapt to such changes is also needed.

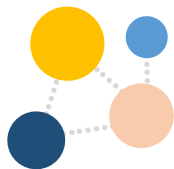
Conclusion

This chapter has presented key learning about how curriculum integration is conceptualised, the barriers experienced in its implementation and core considerations for both learner and teacher agency. To do this it has drawn on a novel data set of 211 empirical studies on curriculum integration. The next chapter synthesises these findings with the overall conceptual literature and information from case studies to signpost important implications for the presentation of integration in curriculum documentation.





Chapter 6
Conclusions and
Implications



Chapter 6 Conclusions and Implications

Introduction

This report has outlined the many ways that curriculum integration has been conceptualised in academic publications, international curriculum frameworks, and over two hundred empirical studies. Where possible and relevant, the interaction between curriculum integration and teacher and learner agency has also been mapped. This final chapter synthesises the literature reviewed to establish how curriculum integration can be conceptualised within a curriculum framework. It begins by outlining three key considerations that can be used to conceptualise curriculum integration. The implications for the Irish *Primary Curriculum Framework* are then provided. A discussion of possible enablers for curriculum integration in practice follows.

Conceptualising Curriculum Integration: Purpose, Knowledge and Responsiveness

When interrogating the literature on curriculum integration, it quickly becomes evident that there is tremendous variation in how it is conceptualised. This variation extends to representations of integration in curriculum documents and swells further when empirical examples of integration are examined. Many of the prevailing models contained within such documents rely on what Drake (1989) has referred to as the ‘cumbersome’ and ‘esoteric’ distinctions between multidisciplinary, interdisciplinary and transdisciplinary forms of integration. Use of the latter terms to describe curriculum integration is further complicated by the fact that they are often used interchangeably across the literature. What one person labels ‘transdisciplinary’ might be categorised by another as ‘interdisciplinary’ (or indeed something else). Given this lack of clarity and consistency, other ways of thinking about curriculum integration may be more productive.

As a result of this desk-based research, we now present three considerations that can be used to think about integration in a manner that can be applied across disciplines, areas of learning, and age groups. These considerations - *purpose*, *sources of knowledge* and *responsiveness* - are also cognisant of learner and teacher agency (see Figure 18). They capture the core qualities of any instance of curriculum integration. What follows is a description of how these three considerations can manifest in different ways when engaging with curriculum integration. As noted previously, the specifics of pedagogy and assessment will be addressed in the second report and are thus not discussed here.



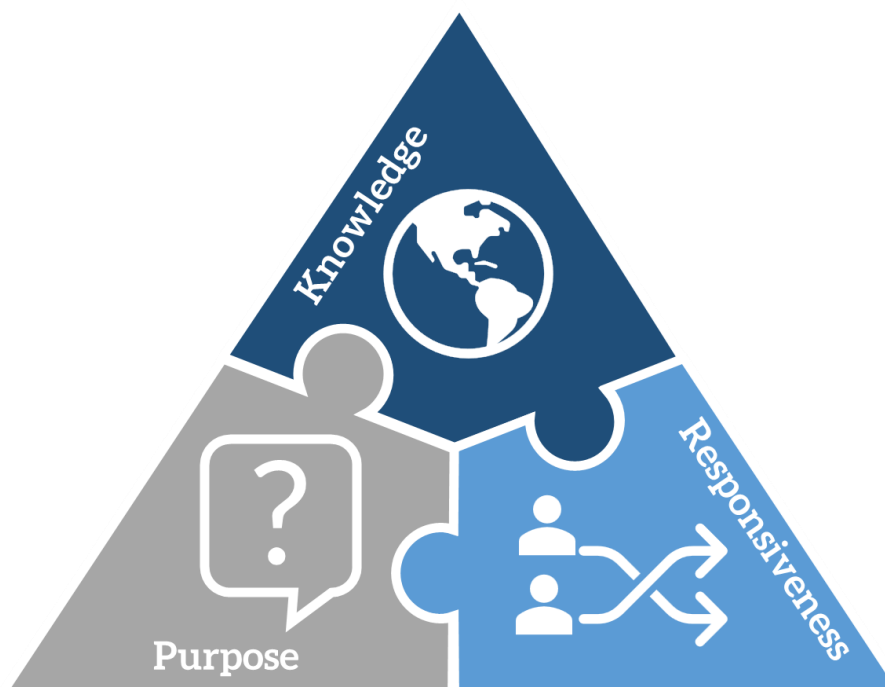
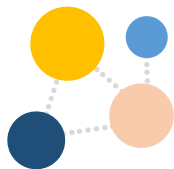


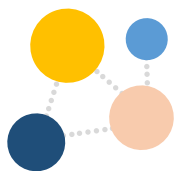
Figure 18 Three Key Considerations for Curriculum Integration

Purpose

Why do you want children to learn in an integrated manner?

Curriculum integration is sometimes framed as a tool that serves curricular expediency or as a way of ‘ticking the boxes’ for a specific initiative. This, alone, may not provide a solid foundation for meaningful learning. Furthermore, while curriculum integration may ease teacher concerns about ‘covering’ the curriculum, it may also cause apprehension among those who fear that they do not cover the curriculum in sufficient depth when using integrated approaches. Other times, curriculum integration is framed as a conduit for pursuing a big, complex idea that requires an in-depth exploration, drawing on multiple sources of knowledge. This is evidenced in the examination of concepts such as ‘relationships’ or pressing societal concerns like climate change. Such an approach may also help develop specific competences or dispositions. Curriculum integration has also been characterised as a value-based, democratic activity which centres teaching on children’s concerns rather than academic disciplines or curriculum handbooks. This view is most notable in Beane’s (1997) vision for curriculum integration but is also evident to a greater or lesser extent throughout the theoretical and some of the empirical literature. However, that it is *not* consistent in the empirical literature further underscores the finding that curriculum integration does not automatically afford learners with an increased sense of agency.





In reality, one or all of these purposes may drive curriculum integration and this cannot be divorced from how it is conceptualised. It can be tied with the overall vision and values set out in a given curriculum, alongside views on the purpose of education (Biesta, 2009). Thinking about purpose allows teachers to identify the different sources that help inform and frame curriculum integration: children's interests, teacher's interests, components of a curriculum document (e.g. subject/learning area, competencies). These sources can all inform the design of an integrated unit of work, but, pending contextual issues, these can be reprioritised or afforded more (or less) emphasis as required. Teachers need to weave child-led and curriculum-led concerns together to ensure that any integrated unit of work supports meaningful and valuable learning. While the empirical literature indicates that curriculum integration can happen without recourse to children's interests or concerns in any meaningful sense, a curriculum that enshrines child agency as a fundamental principle is unlikely to endorse this as a consistent classroom practice.

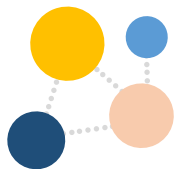
Purpose also relates to the question of whether learning should be integrated or not; the literature does *not* provide conclusive evidence or unanimous scholarly thinking that integration will always be a suitable way of teaching or learning. Contrived curriculum integration without a clear purpose for learning is unlikely to be beneficial. This is vividly captured by Dowden (2012, p. 29), who states that forced integration leads to: "farcical units where [children] might study dinosaur science, do dinosaur mathematics, write dinosaur poetry, create dinosaur art, carry out dinosaur social studies, and do dinosaur dancing". The *why* of integration is key. Articulating this from the outset can allow teachers to consider, in line with the principles of 'backwards design' (Wiggins & McTighe, 2005), what outcomes they hope to address.

Sources of Knowledge

What sources of knowledge are integrated?

In acknowledging that integration can come in many forms and guises, there is also a need to accept that many sources of knowledge exist. The 'traditional' approach of teaching associated with the disciplinary paradigm, i.e. teaching one discipline or subject in isolation, is one that dominates many educational systems worldwide. The integrated approach to arranging knowledge around topics, themes or concepts provides an alternative, albeit less conventional, structure. Teaching that includes two disciplines (e.g. science and maths), multiple disciplines (e.g. science, maths and visual arts) or no strong or identifiable discipline representation at all (e.g. transdisciplinary approaches) can all be characterised as *integration* according to the extant literature. While some of these forms of integration can draw heavily on disciplinary forms of knowledge, these can also be





informed by the knowledge children have from their own lives. Concepts or aspects of knowledge that have no clear representation in a single traditional academic discipline can also be represented in integrated teaching.

Teachers should draw on *all* sources to design compelling learning experiences for the children in their classrooms. When these sources are examined in an integrated manner, teachers and learners can build pathways and forge connections between different sources of knowledge. To do this in a meaningful manner, teachers and learners should assume some degree of agency over how and when different sources of knowledge can be used in their local contexts. Bernstein (1971) referred to this as the *framing* of educational knowledge, whereby teachers and learners assert some control over the selection and organisation of the knowledge being used in a curriculum. This also aligns with a 'worldly perspective' on curriculum integration (Pluim et al., 2021; Rennie et al., 2012). This view on curriculum integration encourages teachers to select their knowledge sources in line with traditional 'disciplinary' or integrative approaches (or a combination of both) when it is most suitable and beneficial to their learners. This places a high value – and high level of responsibility – on the professional decisions made by teachers in their classrooms day-to-day.

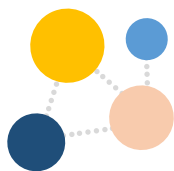
Cognisant of the focus on teacher agency, curriculum integration in the *Primary Curriculum Framework* may be best supported by allowing flexibility for teachers to determine how best to draw on multiple sources of knowledge and when it is appropriate to do so. However, this approach adds an increased layer of complexity to teachers' work especially in relation to planning and assessment. A high level of support is therefore required. This would require the provision of adequate exemplifications, professional learning opportunities and time for sense-making, with a view to increasing teacher knowledge for curriculum integration and how it can occur across a range of subjects and disciplines. It also requires that accountability measures do not run counter to a *genuine* expression of local-decision making on how integration might best work (e.g. requirement for strict adherence to disciplinary time allocations; high-stakes measurement of one subject that forces the elevation of one subject over another).

Responsiveness

How do children, teachers and other concerns shape curriculum integration as it unfolds?

Foregrounding learner agency has implications for how curriculum integration is conceptualised. Curriculum integration can follow highly structured units of work planned in advance and sometimes at some distance from the actual classroom. It is also possible for curriculum integration to unfold with less forward planning. Curriculum





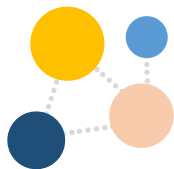
integration can be highly responsive to children when it is driven primarily by their concerns and planned with their active engagement. The direction of a unit of learning might deviate and diverge from the original path planned by the teacher, or it might not. Interpretations of integration in the literature suggest that integration can involve either (or both) more structured, teacher or curriculum-led units and endeavours that unfold more organically in response to children's concerns, interests and ongoing learning. Depending on a teacher's purpose, varying degrees of responsiveness may be more desirable. Genuinely endorsing teacher agency must allow for responsive local curriculum-making with meaningful supporting guidance. This can be contrasted with a reliance on stringent accountability measures or strict planning requirements that will influence teachers' capacity to follow the emergent direction of an integrated learning unit.

How can these considerations inform curriculum development?

Various forms of integration are premised on different purposes and attempt to address varying forms of knowledge. They can also differ significantly responding to child, teacher, or curriculum-led concerns. The empirical literature cannot decide the precise conceptualisation or instantiation of curriculum integration adopted by a curriculum framework. Research does not exist to show that one form of integration is more successful than another. Neither does the research provide conclusive insights on the benefits of integrated approaches over more disciplinary-aligned approaches. If decisions around curriculum were made based on the 'what works' literature alone, an inevitable outworking would be that some disciplinary areas would be marginalised, with consequent knock-on effects for curriculum integration.

The evidence offered throughout this report provides examples of integration that vary along the dimensions of *purpose*, *knowledge* and *responsiveness*. These considerations may inform curriculum planning and decision-making for different partners. Taking into account the literature reviewed, the authors recommend that any statements of curriculum integration for the Irish primary context should refer to these three considerations. This should support teachers with the *why* as well as the *what* of curriculum integration. A given curriculum framework may draw on these considerations to go further in endorsing one manifestation of integration over another. Ultimately, this is a decision that curriculum decision-makers must make in consultation with partners.





What are the implications of these considerations for the *Primary Curriculum Framework*?

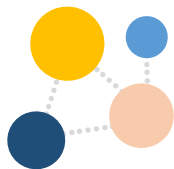
The structure of the current *Primary Curriculum Framework* does not necessarily lend itself to one form of integration or another. Nevertheless, a shared understanding of how curriculum integration can occur according to this framework will still be required. Achieving this will necessitate reflection on the three considerations identified. Taking each of the three considerations in turn, a shared understanding of how curriculum integration can occur according to the *Primary Curriculum Framework* will likely require that each of the following considerations are explicitly addressed. This will demand serious deliberation and debate informed by the values and broader considerations that the research literature alone cannot address.

Purpose

The rationale for curriculum integration within the *Primary Curriculum Framework* should be carefully articulated in line with the following:

- The framework should clearly outline *why* integration is foregrounded in the framework. This statement should sit 'above' and 'within' the specifications for various learning areas.
- Any rationale for practice in teaching is usually informed by core values and societal considerations, including the broader purposes for education. It should also be informed by the available empirical literature to support (or dissuade) use of integrated curriculum. The maxim that integration is automatically, inherently, or always a 'good idea' is not universally held in the empirical or conceptual literature. Given these potentially contrasting considerations, a shared understanding of the purpose of integration is essential. If the *why* of curriculum integration has an unstable foundation, it is unlikely to occur in practice. This underscores the importance of this characteristic for conceptualising curriculum integration.
- If the framework privileges integrated approaches above more discipline-specific ones, this should be made explicit. The rationale should acknowledge that, while integration may be offered as a solution for curriculum overload, this may not be the most meaningful premise for this form of teaching and learning. Other reasons (e.g. pursuit of a complex idea) should also be included.





Knowledge

Regardless of the balance sought between disciplinary and non-disciplinary knowledge, the crucial role of knowledge in a child's education should be explicit and bear the following in mind:

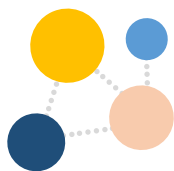
- The majority of the empirical literature on curriculum integration relies on subjects or disciplines. However, the literature that places the greatest emphasis on learner agency (and transdisciplinary approaches) allows for knowledge sources and structures that lie *outside* of formal disciplines. To endorse this form of knowledge, consideration needs to be given to where it 'sits' within a framework that relies on disciplines for content. If the framework does not foreground these forms of non-disciplinary knowledge, it should be clear that curriculum learning areas should provide the knowledge foundation for integrated learning. The role of flexible time may support non-disciplinary learning in the classroom, but clarity and support will be needed for good practice to emerge in this space.
- The literature provides many examples of integration that takes place outside or across the learning areas set out in the framework (e.g. arts and literacy; arts and science). Therefore, the framework should make clear that integration of knowledge sources (subjects in this case) can extend across the learning areas set out in the curriculum.
- The connecting thread for integrating multiple learning areas is often explicitly provided by curriculum frameworks or researchers (e.g. a concept, a theme). The framework currently does not offer such conceptual guidance. This may benefit from attention as development work continues.

Responsiveness

As curriculum integration unfolds, be it in terms of planning or implementation, the role of all those involved requires careful deliberation:

- There is wide variation in the literature on how much children influence the start and direction of integrated learning units. If the framework envisages a child-led form of curriculum integration, the implications for addressing discrete curriculum learning areas need to be addressed. Though child-led and subject/curriculum-led integration are not mutually exclusive, the teacher knowledge required to synchronise both is considerable. The framework should have a plan or guide to support teachers in this process.





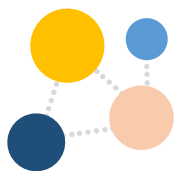
- If the framework seeks a ‘middle ground’, in which integrated learning is sometimes teacher-led and sometimes child-led, this should be explicitly stated and guidance on how such decisions can be made should be offered.

When it comes to practical implementation, the affordances for curriculum integration will likely be constrained by each additional structural component that must be addressed in the curriculum. For example, ‘ticking the box’ for all competencies, curriculum learning areas, and time allocations while also facilitating a high level of child agency, would require teachers to thread a very narrow curricular needle. Ongoing work on curriculum development must exemplify the precise inter-relationship between the core components of the curriculum. Evidence from other jurisdictions suggests that this can be a major stumbling block for the implementation of integrated practices. The curriculum structure must inherently support integration if it is to move from the envisaged to the enacted curriculum in all classrooms. Furthermore, systematic piloting is warranted before asking schools to engage with this aspect of curriculum planning at scale, nationally. This should inform work on developing a curriculum-making process that is fit for purpose for use at a local level in schools.

What are the implications for the enactment of an integrated curriculum?

If curriculum integration is to occupy a more central role in the Irish primary school system, then certain broader issues need to be tackled, reflecting the reality that “cross-curricular teaching is substantively, temporally and organisationally much more complex than traditional separate-subject teaching” (Volk et al., 2017, p. 5). This review identified some critical challenges and barriers influencing curriculum integration in primary contexts. *Teacher Knowledge and Expertise*, *Curriculum Structure*, *Time and Resources*, and *Perceived Subject Hierarchies* were the most prevalent obstacles. The studies in this review indicate that an integrated approach to the implementation of a primary curriculum requires teachers to have incisive and in-depth subject matter knowledge and an appropriate and broad pedagogical repertoire. Teachers often feel that the breadth and depth of understanding required for the number of disciplines involved in primary education can be a significant barrier to their work with curriculum integration. Importantly, this finding was reported in jurisdictions that had fewer curricular subjects than Ireland. Closely related to this challenge are the curriculum documents that teachers work with. The absence of clear guidelines on when, where and how integration should occur is also a major obstacle to effective integration. However, teachers who feel confident in planning and enacting curriculum integration encounter other time and resource-based barriers that interfere with their efforts. These include inadequate





planning time and a lack of easily accessible, high-quality resources. Perceived subject hierarchies can also interfere with curriculum integration in primary contexts whereby “more important” subjects are prioritised for integration. While this review has identified the range of barriers and challenges associated with curriculum integration, some of the studies reviewed captured the different ways some of these hurdles can be overcome. These included Initial Teacher Education (ITE), high-quality in-service professional development, clear curriculum guidelines, and school-based support.

Initial Teacher Education (ITE) and Professional Development

Well-organised professional learning opportunities for initial and continuing teacher education would facilitate greater use of curriculum integration.

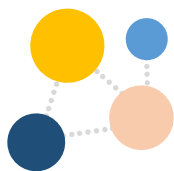
Planning and executing curriculum integration in classrooms is a complex task. To enhance teacher knowledge, confidence, and expertise, curriculum integration should play a more prominent role in ITE and in-service professional development. Small-scale studies suggested that explicit instruction on integration in ITE modules supported pre-service teachers’ practice on school placement and in their future careers. However, enhancing this element of ITE would pose significant challenges and may require the restructuring of programmes to move beyond disciplinary boundaries. Further research would be required to determine if this is both effective and desirable. For in-service professional development, professional learning communities or in-class support/coaching were highly valued by teachers. Moreover, sustained professional learning programmes occurring over prolonged periods or ones that involved ‘mentors’ were very well received by teachers. For example, teachers who worked with arts integration coaches and experts in Saraniero et al.’s (2014) study for one year (25 hours in total) reported greater confidence integrating the arts, produced higher-quality work samples and used arts-integration more frequently than those who participated in a traditional summer institute.

Curriculum Guidelines - Why, what, when and how

The provision of high-quality resources and guidelines would enhance teacher use, comfort and confidence with curriculum integration.

Considering the barriers highlighted in this review, providing teachers with a substantial range of high-quality exemplars would further support their work with curriculum integration. Materials to support the curriculum should outline a *curriculum-making process* to outline how the various curricular components and learning areas can be integrated in schools; it is not sufficient to state that they *should* be integrated. Exemplars should contain explicit references to relevant learning outcomes, pedagogies,





and assessment approaches. They should also involve multiple combinations of disciplines and forms of integration for different groups of learners (e.g. age, context, educational needs). Exemplars were used within the Australian context (see *Australia* case study) but greater discussion of pedagogy and assessment was needed to maximise their utility.

The development of exemplars and instructional materials by practitioners and researchers could also be beneficial. For example, it is notable that in a substantial number of the studies involving literacy integration, teachers were provided with exemplar instructional materials that outlined how literacy may be integrated with a given subject. These were significant supports to teachers. It should be acknowledged that these exemplars should bear a close relationship to the relevant curriculum documents and frameworks. The expectations for curriculum integration in terms of timetabling, pedagogies, assessments etc., should be explicated in these documents. That said, in their review of STEM integration, Margot and Kettler (2019) noted that this curriculum must still be “flexible enough to be used with various ability levels and educational environments”. A versatile approach where teachers can modify and adapt resources as their comfort with the recommended content and pedagogical approaches increases appears to be most appropriate, particularly in light of previous discussions on teacher agency. If designed to encourage teachers to use such exemplars as ‘models’ (e.g. with ‘guiding questions’ asking teachers to consider issues like child agency, knowledge etc.) from which they can develop and design their own resources, this would likely be a significant support to teachers.

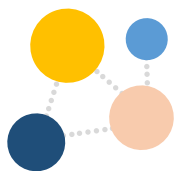
System Supports

National and local supports are necessary to support curriculum integration in classrooms.

Systemic support should also be considered to assist teachers in translating broad guidelines into good practice. The studies reviewed suggested that several school-based factors can support teachers’ enactment of an integrated curriculum. These include supportive principals, collaboration with colleagues¹⁷, and the provision of high-quality resources. However, schools cannot and should not bear sole responsibility for developing teachers’ work with curriculum integration. A coordinated, national approach should provide schools with the funding and guidance necessary to enact an integrated

¹⁷ While the studies reviewed often referred to ‘specialist’ teachers such as PE or Art teachers that are common in primary settings in other jurisdictions (e.g. Feldwisch et al., 2014; Gomez Zwiép, 2016), the finding is still applicable to Ireland where teachers often specialise in certain subject areas throughout their careers (see Hourigan et al., 2021).





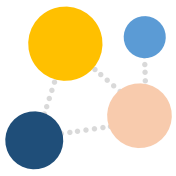
curriculum. All partners in the education system (including the Inspectorate, Support Services and other agencies, extending to members of the school community such as parents and the Board of Management) must have a shared understanding of what integration means, particularly in the early enactment of the curriculum. Within the Irish context, lessons learned from previous initiatives should guide stakeholders on how this can be best achieved. Research collaborations and systematic piloting that specifically focus on the enactment of curriculum integration would be beneficial in advance of a broader roll-out of the new curriculum. Exemplars emanating from such collaborations would be extremely valuable. Finally, realistic expectations as to the introduction of integrated teaching in Irish primary classrooms should be shared by all stakeholders. Teaching in an integrated manner is challenging and complex and will require a 'shift' in thinking for teachers. For example, it may be prudent to suggest that teachers explore curriculum integration on a small scale e.g. one or two units per year or term over a period of time. This would allow teachers the time necessary to become familiar, and adept, with integrated approaches to teaching.

The literature on teacher agency may provide a helpful way of identifying system supports and summarising the broader actions needed to support curriculum integration at scale. Priestley et al. (2015a) outline implications at the macro, meso and micro levels. At the macro level (i.e. national curriculum, national department of education) curriculum should form a “guiding framework” that supports *school-based* curriculum development. A narrow landing strip lies between a framework that over- or under-subscribes guidance for this activity. At the meso level (i.e. mid-level structures, such as a professional development organisation or local school authority) guidance should be provided to clearly explicate the curriculum and how it can be developed at school level, while still leaving scope for local interpretation. Supportive, rather than evaluative, inspection that takes place over a longer term (rather than ‘snapshots’) can aid this school-based work. Furthermore, these meso-level structures should support professional development (e.g. in the form of collaborative professional enquiry) and research engagement at the school level. At the micro-level (i.e. schools, classrooms), time and space must be made for dialogue and collaboration, particularly the types of interactions that explore contrasting opinions and approaches. As noted by Priestley et al. (2015a, p.163), “purposeful (and protective) leadership is essential” to enable a culture that supports this collaboration.

Concluding Comments

The prime task of this report was to provide a review of how integration is conceptualised in the literature while affording due attention to potential barriers and





considerations for learner and teacher agency. While successful curriculum integration cannot be viewed in isolation from the broad range of factors that influence its enactment in the classroom, this report highlights the core considerations that should be addressed. The next report will specifically focus on how the available evidence can inform pedagogy and assessment in an integrated curriculum.

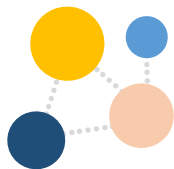




References

References

- Ackerman, D. (1989). Intellectual and practical criteria for successful curriculum integration. In H. H. Jacobs (Ed.), *Interdisciplinary curriculum: Design and implementation* (pp. 25–37). Association for Supervision and Curriculum Development.
- Adie, L. E., Willis, J., & Van der Kleij, F. M. (2018). Diverse perspectives on student agency in classroom assessment. *The Australian Educational Researcher*, 45(1), 1–12. <https://doi.org/10.1007/s13384-018-0262-2>
- *Aguirre-Munoz, Z., Yeter, I. H., Garro, E. S. L., & Koca, F. (2021). Building Teachers' Capacity to Integrate Science and Math Content: Implications for Professional Development and Learning. *Journal of Science Teacher Education*, 32(1), 62–84. <https://doi.org/10.1080/1046560x.2020.1789814>
- *Akbar, S. (2012). *Language arts concepts infusion for improved math learning*. Capella University.
- Albright, J. (2016). Transdisciplinarity in Curricular Theory and Practice. In D. Wyse, L. Hayward, & J. Pandya (Eds.), *The Sage Handbook of Curriculum, Pedagogy and Assessment* (Vol. 2, pp. 525–543). SAGE.
- Alderson, P. (2020). Powerful knowledge and the curriculum: Contradictions and dichotomies. *British Educational Research Journal*, 46(1), 26–43. <https://doi.org/10.1002/berj.3570>
- *Alghamdi, A. K. (2017). The effects of an integrated curriculum on student achievement in Saudi Arabia. *EURASIA Journal of Mathematics, Science and Technology Education*, 13(9), 6079–6100.
- *An, S. (2012). *The effects of music-mathematics integrated curriculum and instruction on elementary students' mathematics achievement and dispositions*. Texas A&M University.
- *An, S. A. (2017). Preservice teachers' knowledge of interdisciplinary pedagogy: The case of elementary mathematics-science integrated lessons. *ZDM-MATHEMATICS EDUCATION*, 49(2), 237–248. <https://doi.org/10.1007/s11858-016-0821-9>
- *An, S. A., Tillman, D. A., Boren, R., & Junjun, W. (2014). Fostering Elementary Students' Mathematics Disposition through Music-Mathematics Integrated Lessons. *International Journal for Mathematics Teaching & Learning*, 1–19.
- *An, S. A., Tillman, D., Shaheen, A., & Boren, R. (2014). Preservice Teachers' Perceptions about Teaching Mathematics through Music. *Interdisciplinary Journal of Teaching and Learning*, 4(3), 150–171.
- *An, S., & Tillman, D. (2014). Elementary teachers' design of arts based teaching: Investigating the possibility of developing mathematics-music integrated curriculum. *Journal of Curriculum Theorizing*, 30(2), 20–38.
- *Anderson, N. E. (2019). *Testing a Scale of Teacher Beliefs About Universal Curriculum Integration in the 21st Century (UCI21-T)*. Brigham Young University.
- *Anderson, A., & Berry, K. (2015). The Influence of Classroom Drama on Teachers' Language and Students' On-Task Behavior. *Preventing School Failure*, 59(4), 197–206.
- *Aranda, M. L., Guzey, S. S., & Moore, T. J. (2020). Multidisciplinary Discourses in an engineering design-based science curricular unit. *International Journal of*



- Technology and Design Education*, 30(3), 507–529.
<https://doi.org/10.1007/s10798-019-09517-5>
- *Atalay, Ö., & Kahveci, N. G. (2015). An Experimental Study on Effectiveness of Integrated Curriculum Model (ICM) in Social Studies Education for Gifted and Talented Learners. *Educational Research and Reviews*, 10(8), 1049–1062.
- Australian Curriculum, Assessment and Reporting Authority (ACARA). (2013). *Shape of the Australian curriculum (Version 4.0)*. Australian Curriculum, Assessment and Reporting Authority (ACARA).
https://docs.acara.edu.au/resources/The_Shape_of_the_Australian_Curriculum_v4_file.pdf
- Australian Curriculum, Assessment and Reporting Authority (ACARA). (2016). *Australian Curriculum. (Version 8.4)*. Australian Curriculum, Assessment and Reporting Authority (ACARA). <https://australiancurriculum.edu.au/f-10-curriculum/english/?year=11578&strand=Language&strand=Literature&strand=Literacy&capability=ignore&capability=Literacy&capability=Numeracy&capability=Information+and+Communication+Technology+%28ICT%29+Capability&capability=Critical+and+Creative+Thinking&capability=Personal+and+Social+Capability&capability=Ethical+Understanding&capability=Intercultural+Understanding&priority=ignore&priority=Aboriginal+and+Torres+Strait+Islander+Histories+and+Cultures&priority=Asia+and+Australia%E2%80%99s+Engagement+with+Asia&priority=Sustainability&elaborations=true&elaborations=false&scotterms=false&isFirstPageLoad=false>
- Australian Curriculum, Assessment and Reporting Authority. (ACARA). (2022a). *Australian Curriculum (Version 9.0)*. Australian Curriculum, Assessment and Reporting Authority (ACARA). <https://v9.australiancurriculum.edu.au/>
- Australian Curriculum, Assessment and Reporting Authority. (ACARA). (2022b). *The three dimensions of the Australian Curriculum*. Retrieved 19 November 2022, from <https://www.youtube.com/watch?v=p0VP33V3Dyw>
- Australian Curriculum, Assessment and Reporting Authority. (2022c). *Digital Literacy Curriculum*. <https://v9.australiancurriculum.edu.au/f-10-curriculum/general-capabilities/digital-literacy?element=0&sub-element=1>
- Bacon, K. (2018). *Curriculum integration*. National Council for Curriculum and Assessment.
- Badley, K. (2009). *Resisting Curriculum Integration: Do Good Fences Make Good Neighbors?* 27, 113–137.
- *Baker, C. K., & Galanti, T. M. (2017). Integrating STEM in elementary classrooms using model-eliciting activities: Responsive professional development for mathematics coaches and teachers. *International Journal of STEM Education*, 4(1), 10.
<https://doi.org/10.1186/s40594-017-0066-3>
- *Baptiste, D. (2022). *Analyzing Instructional Practices within Interdisciplinary and Traditional Mathematics: A Phenomenological Study (2658848442)*. Columbia University.
- *Barnes, M., Moore, D., & Almeida, S. (2018). Sustainability in Australian schools: A cross-curriculum priority? *Prospects*, 47(4), 377–392. <https://doi.org/10.1007/s11125-018-9437-x>
- *Bartels, S. L., Rupe, K. M., & Lederman, J. S. (2019). *Shaping Preservice Teachers' Understandings of STEM: A Collaborative Math and Science Methods Approach*.



- Journal of Science Teacher Education*, 30(6), 666–680.
<https://doi.org/10.1080/1046560x.2019.1602803>
- *Batic, J., & Kac, P. L. (2020). Cross-Curricular Analysis of Picture Books in the Fifth Grade of Primary School: A Case Study. *Center for Educational Policy Studies Journal*, 10(4), 165–185.
- *Bazemore, C. L. (2015). *Teachers' Perceptions of an Integrated Third Grade Curriculum's Effects on Students' Reading Achievement*. Walden University.
- Beane, J. (1997). *Curriculum integration designing the core of democratic education*. Teacher's College Press.
- Beane, J. A. (1995). Curriculum integration and the disciplines of knowledge. *Phi Delta Kappan*, 76(8), 616–622.
- Beane, J. A. (1997). *Curriculum integration: Designing the core of democratic education*. Teachers College Press.
- Beckmann, A. (2009). A conceptual framework for cross-curricular teaching. *The Mathematics Enthusiast*, 6(4), 1–58.
- *Bergen-Cico, D., Razza, R., & Timmins, A. (2015). Fostering Self-Regulation Through Curriculum Infusion of Mindful Yoga: A Pilot Study of Efficacy and Feasibility. *Journal of Child and Family Studies*, 24(11), 3448–3461.
<https://doi.org/10.1007/s10826-015-0146-2>
- Bernstein, B. (1971). *Class, codes and control* (Vol. 1). Routledge.
- Bernstein, B. (1999). Vertical and Horizontal Discourse: An Essay. *British Journal of Sociology of Education*, 20(2), 157–173.
- *Betton, S. (2018). *From Policy to Practice: Exploring Principals' Experiences in Facilitating the Implementation of Cross Curricular Literacy Standards to Early Adolescents*. University of Arkansas.
- Biesta, G. (2009). Good education in an age of measurement: On the need to reconnect with the question of purpose in education. *Educational Assessment, Evaluation and Accountability*, 21(1), 33–46. <https://doi.org/10.1007/s11092-008-9064-9>
- Biesta, G. (2014). Pragmatising the curriculum: Bringing knowledge back into the curriculum conversation, but via pragmatism. *The Curriculum Journal*, 25(1), 29–49. <https://doi.org/10.1080/09585176.2013.874954>
- Biesta, G., Priestley, M., & Robinson, S. (2015). The role of beliefs in teacher agency. *Teachers and Teaching*, 21(6), 624–640.
<https://doi.org/10.1080/13540602.2015.1044325>
- Biesta, G., & Tedder, M. (2006). *How is agency possible? Towards an ecological understanding of agency-as-achievement*. The Learning Lives Project.
- *Birchinall, L. (2013). Case Study of Trainee Teachers' Responses to the Impact on Engagement and Motivation in Learning through a Model of Cross-Curricular Context-Based Learning: 'Keeping Fit and Healthy'. *Curriculum Journal*, 24(1), 27–49.
- *Birsa, E. (2018). Teaching Strategies and the Holistic Acquisition of Knowledge of the Visual Arts. *Center for Educational Policy Studies Journal*, 8(3), 187–206.
- *Björklund, C., & Ahlskog-Björkman, E. (2017). Approaches to teaching in thematic work: Early childhood teachers' integration of mathematics and art. *International Journal of Early Years Education*, 25(2), 98–111.

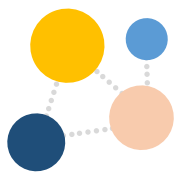
- <https://doi.org/10.1080/09669760.2017.1287061>
- Boal, A., & Nakamoto, J. (2020). *School Change: How Does IB Primary Years Programme Implementation Impact School Climate?* WestEd / International Baccalaureate Organization.
- *Boche, B., Bartels, S., & Wassilak, D. (2021). Reimagining an Elementary Teacher Education Preparation Program: Striving for Integrated Teaching. *Educational Considerations*, 47(1).
- Boomer, G., Onore, C., Lester, N., & Cook, J. (Eds.). (1992). *Negotiating the Curriculum: Educating for the 21st Century*. Routledge.
- *Brand, B. R., & Triplett, C. F. (2012). Interdisciplinary curriculum: An abandoned concept? *Teachers and Teaching*, 18(3), 381–393.
<https://doi.org/10.1080/13540602.2012.629847>
- *Bravo, M. A., & Cervetti, G. N. (2014). Attending to the Language and Literacy Needs of English Learners in Science. *Equity & Excellence in Education*, 47(2), 230–245.
- Breiner, J. M., Harkness, S. S., Johnson, C. C., & Koehler, C. M. (2012). What Is STEM? A Discussion About Conceptions of STEM in Education and Partnerships: What Is STEM? *School Science and Mathematics*, 112(1), 3–11.
<https://doi.org/10.1111/j.1949-8594.2011.00109.x>
- Bresler, L. (1995). The Subservient, Co-Equal, Affective, and Social Integration Styles and their Implications for the Arts. *Arts Education Policy Review*, 96(5), 31–37.
<https://doi.org/10.1080/10632913.1995.9934564>
- *Brough, C. J. (2012). Implementing the Democratic Principles and Practices of Student-Centred Curriculum Integration in Primary Schools. *Curriculum Journal*, 23(3), 345–369.
- *Brugar, K. (2012). *What Difference Does Curricular Integration Make? An Inquiry of Fifth Graders' Learning of History through the Use of Literacy and Visual Arts Skills*. Michigan State University.
- *Brugar, K., & Whitlock, A. M. (2017). *Stealth Integration: An Examination of Curricular Integration by Elementary School Teachers*.
<https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=ED599365&site=ehost-live>
- Bruner, J. (1960). *The Process of Education*. Vintage.
- *Bryant, K. G. (2012). *Effect of Music-Integrated Instruction on First Graders' Reading Fluency*. Liberty University.
- *Bungum, B., Manshadi, S., & Lysne, D. A. (2014). *Mathematical speech and practical action: A case study of the challenges of including mathematics in a school technology project*. 45(8), 1131–1145.
<https://doi.org/10.1080/0020739X.2014.914253>
- *Byrd, L. S. (2019). *A Study of an Arts Integration Curriculum and Its Impact on Academic Achievement*. University of South Alabama.
- *Calder, N., & Brough, C. (2013). Child-centred Inquiry Learning: How Mathematics Understanding Emerges. *International Journal for Mathematics Teaching & Learning*, December, 1–15.
- *Cannon-Ruffo, C. M., Reeves, T., & Xie, Y. (2020). *The Efficacy of Educational Robotics in an Integrated Stem Elementary Curriculum* (2487446692). 28261624, 134.

- *Capobianco, B. M., & Rupp, M. (2014). STEM Teachers' Planned and Enacted Attempts at Implementing Engineering Design-Based Instruction. *School Science and Mathematics*, 114(6), 258–270.
- *Casady, V. (2015). *Integrated Curriculum and Subject-based Curriculum: Achievement and Attitudes*. Missouri Baptist University.
- *Cassidy, M., & Puttick, G. (2022). 'Because Subjects Don't Exist in a Bubble': Middle School Teachers Enacting an Interdisciplinary Curriculum. *Journal of Science Education and Technology*, 31(2), 233–245. <https://doi.org/10.1007/s10956-021-09951-y>
- *Cecchini, J. A., & Carriedo, A. (2020). Effects of an Interdisciplinary Approach Integrating Mathematics and Physical Education on Mathematical Learning and Physical Activity Levels. *Journal of Teaching in Physical Education*, 39(1), 121–125. <https://doi.org/10.1123/jtpe.2018-0274>
- *Cervetti, G. N., Barber, J., Dorph, R., Pearson, P. D., & Goldschmidt, P. G. (2012). The impact of an integrated approach to science and literacy in elementary school classrooms. *Journal of Research in Science Teaching*, 49(5), 631–658. <https://doi.org/10.1002/tea.21015>
- Cervetti, G. N., & Pearson, P. D. (2012). Reading, writing, and thinking like a scientist. *Journal of Adolescent and Adult Literacy*, 55(7), 580–586. <https://doi.org/10.1002/JAAL.00069>
- *Chand O'Neal, I. (2017). *The Cognitive and Attitudinal Effects of Arts Integrated Instruction on 4th and 5th Grade Elementary School Students*. The Claremont Graduate University.
- Coleman, V. (2021). *What is (or are) social studies?* Cambridge University Press.
- *Collins, K. L., & Wickersham-Fish, L. (2016). *The Impact of Science Integrated Curriculum Supplements on Early Childhood Teachers' Attitudes and Beliefs towards Science while In-Service: A Multiple Case Study* (1805170180). 10118777, 345.
- *Colton, C. C. (2016). *Exploration of Transformational Leadership and Teacher Self-Efficacy in Integrated Arts Schools*. Grand Canyon University.
- Cong-Lem, N. (2021). Teacher agency: A systematic review of international literature. *Issues in Educational Research*, 31(3), 718–738.
- Convertini, J. (2021). An Interdisciplinary Approach to Investigate Preschool Children's Implicit Inferential Reasoning in Scientific Activities. *Research in Science Education*, 51(1), 171–186.
- *Corlu, M. S., Capraro, R. M., & Çorlu, A. (2015). Investigating the mental readiness of pre-service teachers for integrated teaching. *International Online Journal of Educational Sciences*, 7(1), 17–28.
- *Cotič, N., Cotič, M., Felda, D., & Krmac, N. (2021). The effect of cross-curricular integration on pupils' knowledge gained through experiential learning. *Cypriot Journal of Educational Sciences*, 16(6), 3133–3146. <https://doi.org/10.18844/cjes.v16i6.6512>
- *Coudriet, A. J. (2013). *A Multiple Case Study Examining Elementary School Art, Music and Physical Education Teachers' Perceptions, Attitudes and Beliefs Related to Interdisciplinary Teaching Practice*. University of Pittsburgh.
- *Cunnington, M., Kantrowitz, A., Harnett, S., & Hill-Ries, A. (2014). Cultivating Common Ground: Integrating Standards-Based Visual Arts, Math and Literacy in High-Poverty Urban Classrooms. *Journal for Learning through the Arts*, 10(1), 1–24.

- *da Silva-Branco, K., & Woods-McConney, A. (2021). Teachers' Experiences of Implementing Sustainability as a Cross-Curriculum Priority in Western Australian Schools. *Teaching Science*, 67(3), 39–50.
- *Dan, Z. S., & Gary, W. K. W. (2018). *Teachers' perceptions of professional development in integrated STEM education in primary schools*. 2018-April, 472–477. <https://doi.org/10.1109/EDUCON.2018.8363268>
- *Delahunty, T., Prendergast, M., & Riordain, M. N. (2021). Teachers' Perspectives on Achieving an Integrated Curricular Model of Primary STEM Education in Ireland: Authentic or Utopian Ideology? *FRONTIERS IN EDUCATION*, 6. <https://doi.org/10.3389/educ.2021.666608>
- *DeLuca, C., Ogden, H., & Pero, E. (2015). Reconceptualizing Elementary Preservice Teacher Education: Examining an Integrated-Curriculum Approach. *New Educator*, 11(3), 227–250.
- Deng, Z., & Luke, A. (2008). Defining and Theorizing School Subjects. In F. M. Connolly, M. Fang He, & J. Phillion (Eds.), *The SAGE Handbook of Curriculum and Instruction* (pp. 66–87). SAGE.
- *DePaola, L. (2022). *The Effects and Impact of Interdisciplinary Teaming on Teacher Practices and Efficacy* (2685025423) [St. John's University (New York)]. <https://www.proquest.com/dissertations-theses/effects-impact-interdisciplinary-teaming-on/docview/2685025423/se-2?accountid=15753>
- Department of Education. (1971). *Primary School Curriculum: Teacher's Handbook Part 1*. Department of Education.
- Department of Education and Science. (1999). *Primary School Curriculum: Introduction*. The Stationery Office.
- Department of Education Inspectorate. (2022). *Chief Inspector's Report: September 2016-December 2020*. Department of Education. <https://www.gov.ie/en/publication/611873-chief-inspector-reports/>
- Dickson, A., Perry, L. B., & Ledger, S. (2017). How accessible is IB schooling? Evidence from Australia. *Journal of Research in International Education*, 16(1), 65–79. <https://doi.org/10.1177/1475240917696037>
- Dix, K., & Sniedze-Gregory, S. (2020). *The impact of the IB Primary Years Programme (PYP) on student wellbeing and other related social-emotional learning outcomes*. Australian Council for Educational Research / International Baccalaureate Organisation.
- *Dogan, Z., & Arici, A. (2019). The Effect of Teaching Fractions with the Interdisciplinary Approach on 1st Graders' Learning in Elementary School. *International Online Journal of Educational Sciences*, 11(2), 1–19. <https://doi.org/10.15345/iojes.2019.02.001>
- Dowden, T. (2012). Implementing curriculum integration: Three easy lessons from past practice. *Research Information for Teachers*, 3, 25–31.
- *Dowden, T. (2014). Challenging, integrated, negotiated and exploratory curriculum in the middle years of schooling: Designing and implementing high quality curriculum integration. *Australian Journal of Middle Schooling*, 14(1), 16–27.
- *Doyle, D., Hofstetter, H., Kendig, J., & Strick, B. (2014). Rethinking Curriculum and Instruction: Lessons From an Integrated Learning Program and Its Impact on Students and Teachers. *Journal for Learning through the Arts*, 10(1), 1–16.

- Drake, S. M. (1993). *Planning integrated curriculum: The call to adventure*. Association for Supervision and Curriculum Development.
- Drake, S. M. (2012). *Creating Standards-Based Integrated Curriculum*. Corwin.
- Drake, S. M., & Burns, R. C. (2004). *Meeting Standards Through Integrated Curriculum*. Association for Supervision and Curriculum Development.
- Drake, S. M., & Reid, J. L. (2020). 21st Century Competencies in Light of the History of Integrated Curriculum. *Frontiers in Education*, 5, 122. <https://doi.org/10.3389/educ.2020.00122>
- Drake, S. M., Savage, M. J., Reid, J. L., Bernard, M. L., & Beres, J. (2015). *An Exploration of the Policy and Practice of Transdisciplinarity in the IB PYP Programme*. International Baccalaureate Organization / Brock University.
- *Duggan, G. L., Jarre, A., & Murray, G. (2021). Learning for Change: Integrated Teaching Modules and Situated Learning for Marine Social-Ecological Systems Change. *Journal of Environmental Education*, 52(2), 118–132.
- *Duke, N. K., Halvorsen, A. L., Strachan, S. L., Kim, J., & Konstantopoulos, S. (2021). Putting PjBL to the test: The impact of project-based learning on second graders' social studies and literacy learning and motivation in low-SES school settings. *American Educational Research Journal*, 58(1), 160–200. <https://doi.org/10.3102/0002831220929638>
- *Dyment, J. E., & Hill, A. (2015). You mean I have to teach sustainability too?: Initial teacher education students' perspectives on the sustainability cross-curriculum priority. *Australian Journal of Teacher Education (Online)*, 40(3), 21–35.
- *Dyment, J.E., Hill, A., & Emery, S. (2014). Sustainability as a cross-curricular priority in the Australian Curriculum: A Tasmanian investigation. *Environmental Education Research*, 21(8), 1105–1126. <https://doi.org/10.1080/13504622.2014.966657>
- Dyson, A. H. (2020). “This isn’t my real writing”: The fate of children’s agency in too-tight curricula. *Theory Into Practice*, 59(2), 119–127. <https://doi.org/10.1080/00405841.2019.1702390>
- *Edsall Giglio, L. (2012). *Imagication = imagination + education: What fifth graders think of arts integration in public elementary schools*. The University of San Francisco.
- Education Scotland. (2012). *CfE Briefing: Interdisciplinary Learning*. https://dera.ioe.ac.uk/17803/7/IDLBriefing_tcm4-732285_redacted.pdf
- Education Scotland. (2019). *Curriculum for Excellence (Refreshed Narrative)*. <https://scotlandscurriculum.scot/>
- Education Scotland. (2020). *Interdisciplinary learning: Ambitious learning for an increasingly complex world*. <https://education.gov.scot/media/mkomulen/interdisciplinary-learning-thought-paper.pdf>
- *Edwards, S., Skouteris, H., Cutter-Mackenzie, A., Rutherford, L., O’Conner, M., Mantilla, A., Morris, H., & Elliot, S. (2015). Young children learning about well-being and environmental education in the early years: A funds of knowledge approach. *EARLY YEARS*, 36(1), 33–50. <https://doi.org/10.1080/09575146.2015.1064099>
- *Eli, Munkebye, Scheie, E., Gabrielsen, A., Jordet, A., Misund, S., Nergård, T., & Øyehaug, A. B. (2020). Interdisciplinary primary school curriculum units for sustainable development. *Environmental Education Research*, 26(6), 795–811. <https://doi.org/10.1080/13504622.2020.1750568>

- Emirbayer, M., & Mische, A. (1998). What Is Agency? *American Journal of Sociology*, 103(4), 962–1023. <https://doi.org/10.1086/231294>
- *Ensign, T. I. (2017). *Elementary Educators' Attitudes about the Utility of Educational Robotics and Their Ability and Intent to Use It with Students*. West Virginia University.
- *Evans, E. M., & Wilkins, E. (2015). *Preparing elementary pre-service teachers to integrate STEM: A mixed-methods study* (1762585078). 10008846, 258.
- Fam, D., Neuhauser, L., & Gibbs, P. (Eds.). (2018). *Transdisciplinary Theory, Practice and Education: The Art of Collaborative Research and Collective Learning*. Springer International Publishing. <https://doi.org/10.1007/978-3-319-93743-4>
- *Fazio, X., & Gallagher, T. L. (2018). Bridging professional teacher knowledge for science and literary integration via design-based research. *Teacher Development*, 22(2), 267–280. <https://doi.org/10.1080/13664530.2017.1363084>
- *Fazio, X., & Gallagher, T. L. (2019). Science and Language Integration in Elementary Classrooms: Instructional Enactments and Student Learning Outcomes. *Research in Science Education*, 49(4), 959–976. <https://doi.org/10.1007/s11165-019-9850-z>
- *Feldwisch, R. P., Coker, K. L., Stuckey, S. M., Rittenhouse, A. A., Kite, K. K., & Smith, J. S. (2014). The impact of an arts-integrated curriculum on student literacy and engagement. *International Journal of Literacy, Culture, and Language Education*, 3, 95–111. <https://doi.org/10.14434/ijlcle.v3i0.26910>
- *Ferguson-Patrick, K., Reynolds, R., & Macqueen, S. (2018). Integrating curriculum: A case study of teaching Global Education. *European Journal of Teacher Education*, 41(2), 187–201. <https://doi.org/10.1080/02619768.2018.1426565>
- Ferrero, L. (2021). *The Routledge Handbook of Philosophy of Agency* (1st ed.). Routledge. <https://doi.org/10.4324/9780429202131>
- *Fitzpatrick, J., O'Grady, E., & O'Reilly, J. (2018). Promoting student agentic engagement through curriculum: Exploring the Negotiated Integrated Curriculum initiative. *Irish Educational Studies*, 37(4), 453–473. <https://doi.org/10.1080/03323315.2018.1512882>
- Fogarty, R. (1991). Ten Ways to Integrate Curriculum. *Educational Leadership*, 49(2), 61–65.
- Fogarty, R. (2009). *How to Integrate the Curricula* (3rd ed.). Corwin.
- *Follong, B. M., Prieto-Rodriguez, E., Miller, A., Collins, C. E., & Bucher, T. (2020). An Exploratory Survey on Teaching Practices Integrating Nutrition and Mathematics in Australian Primary Schools. *International Journal of Research in Education and Science*, 6(1), 14–33.
- *Follong, B. M., Prieto-Rodriguez, E., Miller, A., Collins, C. E., & Bucher, T. (2022). Evaluating an integrated nutrition and mathematics curriculum: Primary school teachers' and students' experiences. *Public Health Nutrition*, 1–12. <https://doi.org/10.1017/S1368980022000386>
- *Fragakis, E. V. (2019). *The Perceived Impact of an Arts-Integrated Curriculum on the Academic Achievement of Fifth- and Sixth-Grade Students with Disabilities*. The University of North Carolina at Greensboro.
- *Frankel, S. L., Olshansky, B., & Yang, J. (2015). *Picturing Writing/Image-Making Integrated Curriculum Model: Evaluation of an Alternative Art-and-Literature-Based Approach to Literacy Learning*. Grantee Submission.



- <https://files.eric.ed.gov/fulltext/ED590395.pdf>
- *Fu, Y., & Sibert, S. (2017). Teachers' Perspectives: Factors That Impact Implementation of Integrated Curriculum in K-3 Classrooms. *International Journal of Instruction*, 10(1), 169–186. <https://doi.org/10.12973/iji.2017.10111a>
- *Gallagher, T. L., & Fazio, X. (2019). Multiple Layers: Education Faculty Reflecting on Design-Based Research focused on Curricular Integration. *Qualitative Research in Education*, 8(1), 27–59. <https://doi.org/10.17583/qre.2019.3795>
- *García-Carrillo, C., Greca, I. M., & Fernández-Hawrylak, M. (2021). Teacher Perspectives on Teaching the STEM Approach to Educational Coding and Robotics in Primary Education. *Education Sciences*, 11(2), 64. <https://doi.org/10.3390/educsci11020064>
- Gardner, H. (1983). *Frames of Mind: A Theory of Multiple Intelligences*. Basic Books.
- Gardner, H. (2004). Discipline, understanding, and community. *Journal of Curriculum Studies*, 36(2), 233–236. <https://doi.org/10.1080/0022027032000135085>
- Giddens, A. (1984). *The constitution of society*. Polity Press.
- *Gomez Zwiép, S. (2016). *Integrated STEM-Problem-Based Learning Curriculum: Implications for Conceptualization and Practice from an Interdisciplinary Professional Development Program*. Annual Meeting of the American Educational Research Association, Washington, DC. <https://eric.ed.gov/?id=ED595538>
- Goodman, J. F., & Eren, N. S. (2013). Student agency: Success, failure, and lessons learned. *Ethics and Education*, 8(2), 123–139. <https://doi.org/10.1080/17449642.2013.843360>
- Gopalan, M., Rosinger, K., & Ahn, J. B. (2020). Use of Quasi-Experimental Research Designs in Education Research: Growth, Promise, and Challenges. *Review of Research in Education*, 44(1), 218–243. <https://doi.org/10.3102/0091732X20903302>
- Gough, A., Sharpley, B., Vander Pal, S., & Griffiths, M. (2014). *The International Baccalaureate Primary Years Programme (PYP) in Victorian Government Primary Schools, Australia*. International Baccalaureate Organization.
- *Graham, N. J., & Brouillette, L. (2017). Using Arts Integration to Make Science Learning Memorable in the Upper Elementary Grades: A Quasi-Experimental Study. *Journal for Learning through the Arts: A Research Journal on Arts Integration in Schools and Communities*, 12(1). <https://doi.org/10.21977/D912133442>
- *Gray, A. M., Sirinides, P. M., Fink, R. E., & Bowden, A. B. (2022). Integrating Literacy and Science Instruction in Kindergarten: Results From the Efficacy Study of Zoology One. *Journal of Research on Educational Effectiveness*, 15(1), 1–27. <https://doi.org/10.1080/19345747.2021.1938313>
- *Greenwood, R. (2013). Subject-Based and Cross-Curricular Approaches within the Revised Primary Curriculum in Northern Ireland: Teachers' Concerns and Preferred Approaches. *Education 3-13*, 41(4), 443–458.
- Haas, M. E., & Laughlin, M. A. (1999). *Meeting the standards: Social studies readings for K-6 educators*. National Council for the Social Studies.
- Hadar, L. L., & Benish-Weisman, M. (2019). Teachers' agency: Do their values make a difference? *British Educational Research Journal*, 45(1), 137–160. <https://doi.org/10.1002/berj.3489>
- *Hahn, N. G. (2020). *Arts Integration and Teacher Collaboration in an Unprecedented Era of Online Learning*. The University of Wisconsin - Milwaukee.



- *Halimah, L., & Abdillah, F. (2021). Developing Sundanese Local Culture Literacy in Elementary School: Cross-Curricular Learning Together with Indoor and Outdoor Environment Integration. *Interchange: A Quarterly Review of Education*, 52(3), 319–336.
- *Hall-Kenyon, K. M., & Smith, L. K. (2013). Negotiating a shared definition of curriculum integration: A self-study of two teacher educators from different disciplines. *Teacher Education Quarterly*, 40(2), 89–108.
- *Hammond, D. J. (2017). *An investigation into the impact of an integrated curriculum on learning in the primary school*. University of Durham.
- *Hardiman, M., JohnBull, R. M., & Carran, D. (2017). The Effects of Arts-Integrated Instruction on Students' Memory for Science Content: Results from a Randomized Control Trial Study. *Trends in Neuroscience and Education*, 14, 25–32. <https://doi.org/10.1016/j.tine.2019.02.002>
- *Harris, A. M., & Kuchar, M. (2019). *The Influence of an Interdisciplinary Elementary Curriculum on Student Outcomes: Providing Cognitive Student Learning through an Integrated Approach*. Seton Hall University.
- *Harris, L. M., Wirz, J. P., Hinde, E. R., & Libbee, M. (2015). Exploring Teachers' Use of Resources to Integrate Geography and History. *Journal of Geography*, 114(4), 158–167. <https://doi.org/10.1080/00221341.2014.959986>
- Harvie, J. (2018). *Interdisciplinary Learning: A Chimera of Scottish Education?* University of Stirling.
- *Hastie, P. A. (2013). The Biome Project: Developing a legitimate parallel curriculum for physical education and life sciences. *Education 3-13*, 41(5), 462–476. <https://doi.org/10.1080/03004279.2011.607173>
- *Havice, W., Havice, P., Waugaman, C., & Walker, K. (2018). Evaluating the Effectiveness of Integrative STEM Education: Teacher and Administrator Professional Development. *Journal of Technology Education*, 29(2), 73–90.
- *Hawley, L. A. (2022). *Elementary Teacher Candidates' Connections Between Mathematics and Literacy and the Contextual Factors that Encourage Connection-Making*. Michigan State University.
- *Heimer, L., & Winokur, J. (2015). Preparing Teachers of Young Children: How an Interdisciplinary Curriculum Approach Is Understood, Supported, and Enacted among Students and Faculty. *Journal of Early Childhood Teacher Education*, 36(4), 289–308.
- *Hieu, L. T., & Nam, N. D. (2019). The teacher's competence of integrated teaching at primary school science. *Proceedings of the International Annual Meeting on STEM Education*. 1340. <https://doi.org/10.1088/1742-6596/1340/1/012023>
- Hinde, E. (2015). The theoretical foundations of curriculum integration and its application to social studies instruction. In L. Bennett & E. Hinde (Eds.), *Becoming integrated thinkers: Case studies in elementary social studies* (pp. 21–29). National Council for the Social Studies.
- *Hipp, J., & Sulentic Dowell, M.-M. (2019). Challenges and Supports to Elementary Teacher Education: Case Study of Preservice Teachers' Perspectives on Arts Integration. *Journal for Learning through the Arts*, 15(1), 1–33.
- *Hourigan, M., O'Dwyer, A., Leavy, A. M., & Corry, E. (2021). Integrated STEM – a step too far in primary education contexts? *Irish Educational Studies*, 1–25.

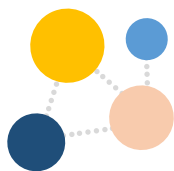
- <https://doi.org/10.1080/03323315.2021.1899027>
- *Hraste, M., De Giorgio, A., Jelaska, P. M., Padulo, J., & Granic, I. (2018). When mathematics meets physical activity in the school-aged child: The effect of an integrated motor and cognitive approach to learning geometry. *PLoS ONE*, 13(8), e0196024. <https://doi.org/10.1371/journal.pone.0196024>
- *Huang, Y.-T. (2012). *Music integration in the elementary school community: An investigation of integration styles and collaborative modes in Pennsylvania and Taiwan*. Pennsylvania State University.
- *Hubbard, J., Fowler, M., & Freeman, L. (2020). PreK-5 Teacher Views of Professional Development Integrating Common Core Language Arts with Science and Social Studies. *Journal of Educational Research and Practice*, 10(1), 1-25.
- *Huck, A. (2018). *Social Studies Curriculum Integration: Classification, Framing, and Teacher Autonomy*. State University of New York at Buffalo.
- *Huck, A. (2019). Elementary Social Studies Content Integration in CCLS: An Analysis of Content Integration. *The Social Studies*, 110(1), 1-16. <https://doi.org/10.1080/00377996.2018.1524359>
- Humes, W. (2013). Curriculum for Excellence and Interdisciplinary Learning. *Scottish Educational Review*, 45(1), 82-93.
- *Ichinose, T. (2017). An Analysis of Transformation of Teaching and Learning of Japanese Schools That Significantly Addressed Education for Sustainable Development. *Journal of Teacher Education for Sustainability*, 19(2), 36-50.
- *Inoa, R., Weltsek, G., & Tabone, C. (2014). A Study on the Relationship between Theater Arts and Student Literacy and Mathematics Achievement. *Journal for Learning through the Arts: A Research Journal on Arts Integration in Schools and Communities*, 10(1), 1-21. <https://doi.org/10.21977/D910123495>
- International Baccalaureate Organization. (2009). *Making the PYP happen: A curriculum framework for international primary education*. International Baccalaureate Organization.
- International Baccalaureate Organization. (2013). *IB Learner Profile*. International Baccalaureate Organization. <https://www.ibo.org/contentassets/fd82f70643ef4086b7d3f292cc214962/learner-profile-en.pdf>
- International Baccalaureate Organization. (2022b). *PYP: Learning and teaching*. International Baccalaureate. <https://www.ibo.org/programmes/primary-years-programme/curriculum/learning-and-teaching/>
- *Israel, M., & Lash, T. (2019). From classroom lessons to exploratory learning progressions: Mathematics + computational thinking. *Interactive Learning Environments*, 28(3), 362-382. <https://doi.org/10.1080/10494820.2019.1674879>
- Jacobs, H. H. (Ed.). (1989). *Interdisciplinary curriculum: Design and implementation*. Association for Supervision and Curriculum Development.
- James, A. (2011). Agency. In J. Qvortrup, W. A. Corsaro, & M.-S. Honig (Eds.), *The Palgrave Handbook of Childhood Studies* (Paperback, pp. 34-45). Palgrave Macmillan.
- *Jamil, F. M., Linder, S. M., & Stegelin, D. A. (2018). Early Childhood Teacher Beliefs About STEAM Education After a Professional Development Conference. *Early Childhood Education Journal*, 46(4), 409-417. <https://doi.org/10.1007/s10643-017-0875-5>

- *Jia, Y., Zhou, B., & Zheng, X. (2021). A Curriculum Integrating STEAM and Maker Education Promotes Pupils' Learning Motivation, Self-Efficacy, and Interdisciplinary Knowledge Acquisition. *Frontiers in Psychology*, 12, 725525. <https://doi.org/10.3389/fpsyg.2021.725525>
- *Jordan, D. (2016). *Investigating Teacher Learning and Change in a Professional Learning Community: Integrating ELA and Social Studies Curriculum*. University of Nevada - Las Vegas.
- Kelly, A. V. (2009). *The curriculum: Theory and practice* (6th ed). Sage Publications.
- Kelly, G. J., Luke, A., & Green, J. (2008). What Counts as Knowledge in Educational Settings: Disciplinary Knowledge, Assessment, and Curriculum. *Review of Research in Education*, 32(1), vii-x. <https://doi.org/10.3102/0091732X07311063>
- *Kennelly, J., Taylor, N., & Serow, P. (2012). Early Career Primary Teachers and Education for Sustainability. *International Research in Geographical and Environmental Education*, 21(2), 139-153.
- *Khanna, A., & Stephenson, R. (2021). *Different Ways of Knowing and Growing: A Case Study of an Arts-Integrated Pedagogy at an Urban Elementary Charter School* (2564896542). 28647524, 194.
- *Kim, D., & Bolger, M. (2017). Analysis of Korean Elementary Pre-Service Teachers' Changing Attitudes About Integrated STEAM Pedagogy Through Developing Lesson Plans. *International Journal of Science and Mathematics Education*, 15(4), 587-605. <https://doi.org/10.1007/s10763-015-9709-3>
- *Kim, M. K., & Cho, M. K. (2015). Design and Implementation of Integrated Instruction of Mathematics and Science in Korea. *Eurasia Journal of Mathematics Science And Technology Education*, 11(1), 3-14.
- Kirby, P. (2020). Children's Agency in the Modern Primary Classroom. *Children & Society*, 34(1), 17-30. <https://doi.org/10.1111/chso.12357>
- Kirschner, P. A., & van Merriënboer, J. J. G. (2013). Do Learners Really Know Best? Urban Legends in Education. *Educational Psychologist*, 48(3), 169-183. <https://doi.org/10.1080/00461520.2013.804395>
- Kirsten, N. (2019). Improving Literacy and Content Learning across the Curriculum? How Teachers Relate Literacy Teaching to School Subjects in Cross-Curricular Professional Development. *Education Inquiry*, 10(4), 368-384.
- *Kloser, M., Wilsey, M., Twohy, K. E., Immonen, A. D., & Navotas, A. C. (2018). 'We do STEM': Unsettled conceptions of STEM education in middle school S.T.E.M. classrooms. *School Science and Mathematics*, 118(8), 335-347. <https://doi.org/10.1111/ssm.12304>
- *Kneen, J., Breeze, T., Davies-Barnes, S., John, V., & Thayer, E. (2020). Curriculum integration: The challenges for primary and secondary schools in developing a new curriculum in the expressive arts. *Curriculum Journal*, 31(2), 258-275. <https://doi.org/10.1002/curj.34>
- Knowles, S., & Hillman, K. (2022). Australia. In Reynolds, K.A., Wry, E., Mullis, I.V.S., & von Davier, M. (Ed.), *PIRLS 2021 Encyclopaedia: Education Policy and Curriculum in Reading*. (pp. 1-16). Boston College, TIMSS & PIRLS International Study Center.
- *Kok, L., & van Schoor, R. (2014). A Science-Technology-Society Approach to Teacher Education for the Foundation Phase: Students' Empiricist Views. *South African Journal of Childhood Education*, 4(1), 95-110.

- *Kurup, P. M., Li, X., Powell, G., & Brown, M. (2019). Building future primary teachers' capacity in STEM: based on a platform of beliefs, understandings and intentions. *International Journal of STEM Education*, 6. <https://doi.org/10.1186/s40594-019-0164-5>
- *Kuzich, S., Taylor, E., & Taylor, P. C. (2015). When Policy and Infrastructure Provisions are Exemplary but still Insufficient: Paradoxes Affecting Education for Sustainability (EfS) in a Custom-designed Sustainability School. *Journal of Education for Sustainable Development*, 9(2), 179–195. <https://doi.org/10.1177/0973408215588252>
- *Lackovic, N., Crook, C., Cobb, S., Shalloe, S., & D'Cruz, M. (2015). Imagining technology-enhanced learning with heritage artefacts: Teacher-perceived potential of 2D and 3D heritage site visualisations. *Educational Research*, 57(3), 331–351. <https://doi.org/10.1080/00131881.2015.1058098>
- *LaJevic, L. (2013). Arts Integration: What is Really Happening in the Elementary Classroom? *Journal for Learning through the Arts: A Research Journal on Arts Integration in Schools and Communities*, 9(1), 1–28. <https://doi.org/10.21977/D99112615>
- *Lamb, R., Akmal, T., & Petrie, K. (2015). Development of a Cognition-Priming Model Describing Learning in a STEM Classroom. *Journal of Research in Science Teaching*, 52(3), 410–437. <https://doi.org/10.1002/tea.21200>
- *LaMotte, M. (2018). The Integrated Approach versus the Traditional Approach: Analyzing the Benefits of a Dance and Transportation Integrated Curriculum. *Journal of Dance Education*, 18(1), 23–32.
- *Landley, L. A. (2017). *Arts integration professional development: The Higher Order Thinking (HOT) schools approach*. Boston University.
- *Lara, T. V. (2017). *Arts Integration, Common Core, and Cultural Wealth: An Ethnographic Case Study of a Title I Elementary School*. University of California, Los Angeles.
- *Lasen, M., Skamp, K., & Simoncini, K. (2017). Teacher Perceptions and Self-Reported Practices of Education for Sustainability in the Early Years of Primary School: An Australian Case Study. *International Journal of Early Childhood*, 49(3), 391–410.
- *Lau, W. C. M., & Grieshaber, S. (2018). School-based integrated curriculum: An integrated music approach in one Hong Kong kindergarten. *British Journal of Music Education*, 35(2), 133–152. <https://doi.org/10.1017/S0265051717000250>
- Leadbeater, C. (2017). *Education 2030 Conceptual Learning Framework: Background Papers—Student Agency*. Organisation for Economic Co-operation and Development.
- Leavy, A., Carroll, C., Corry, E., Fitzpatrick, M., Hamilton, M., Hourigan, M., LaCumbre, G., McGann, R., & O'Dwyer, A. (2022). *Review of Literature to Identify a Set of Effective Interventions for Addressing STEM and the Arts in Early Years, Primary and Post Primary Education Settings*. Mary Immaculate College/Department of Education. <https://assets.gov.ie/228743/d1767675-a407-443c-be5a-fb9a43f82ae7.pdf>
- *Leckie, A., & Wall, A. (2016). Facilitating Middle Level Pre-Service Teachers' Literacy Integration in Early Field Experiences. *Current Issues in Middle Level Education*, 21(1), 6–14.

- *Lee, Y. J., Chu, H.-E., & Martin, S. N. (2018). Examining Factors that Influence on Elementary Teachers' Perceptions in a Graduate Level Interdisciplinary Environmental Education Program: Using ePCK as a Framework. *EURASIA Journal of Mathematics, Science and Technology Education*, 14(10), 1-23. <https://doi.org/10.29333/ejmste/92184>
- *Lehrer, R., & Schauble, L. (2021). Stepping Carefully: Thinking Through the Potential Pitfalls of Integrated STEM. *Journal for STEM Education Research*, 4(1), 1-26. <https://doi.org/10.1007/s41979-020-00042-y>
- *Leszczynski, E., & Munakata, M. (2014). *The study of middle school mathematics and science teachers' practices, perceptions, and attitudes related to mathematics and science integration* (1540757305). 3620431, 261.
- *Levy, A. R. (2018). *Investigating the Experience of Water: A Case Study of Teaching and Learning in Elementary School Science*. <https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=ED587303&site=ehost-live>
- *Liston, M., & Hennessy, N. (2018). An Integrated Approach in Promoting the Development of Literacy and Scientific Skills in the Primary Science Classroom. *Teaching Science*, 64(4), 22-31.
- *López Leiva, C., Roberts-Harris, D., & von Toll, E. (2016). Meaning Making with Motion Is Messy: Developing a STEM Learning Community. *Canadian Journal of Science, Mathematics and Technology Education*, 16(2), 169-182.
- *Lorger, M., & Braičić, Z. (2019). Orienteering as a Means of Promoting Cross - curricular in Teaching: Status and Perspectives / Orijentacijsko trčanje u funkciji interdisciplinarnosti u nastavi: stanje i perspektive. *Croatian Journal of Education - Hrvatski Časopis Za Odgoj i Obrazovanje*, 21. <https://doi.org/10.15516/cje.v21i0.3545>
- *Lovemore, T. S., Robertson, S. A., & Graven, M. (2021). Enriching the teaching of fractions through integrating mathematics and music. *South African Journal of Childhood Education*, 11(1), 1-14. <https://doi.org/10.4102/sajce.v11i1.899>
- *Luna, M. J., Rye, J. A., Forinash, M., & Minor, A. (2015). Gardening for Homonyms: Integrating Science and Language Arts to Support Children's Creative Use of Multiple Meaning Words. *Science Activities: Classroom Projects and Curriculum Ideas*, 52(4), 92-105.
- *Luo, F., Yan, W., Liu, R., & Israel, M. (2022). *Elementary Students' Understanding of Variables in Computational Thinking-Integrated Instruction: A Mixed Methods Study*. 1, 523-529. <https://doi.org/10.1145/3478431.3499323>
- Lysaght, Z., Scully, D., Murchan, D., O'Leary, M., & Shiel, G. (2019). *Aligning Assessment, Learning and Teaching in Curricular Reform and Implementation*. <https://ncca.ie/media/3925/aligning-assessment-learning-and-teaching-in-curricular-reform-and-implementation.pdf>
- *Magdaş, I.-C., Dulamă, M. E., Ilovan, O.-R., & Crişan, I. C. (2017). Primary School Teachers' Opinions About the Curricular Documents Used for Studying the Mathematics and Environmental Exploration Subject. *Romanian Review of Geographical Education*, 6(VI/2), 5-18. <https://doi.org/10.23741/rge220171>
- *Maitles, H., & McAlpine, C. (2012). 'I've Adopted a Tiger': Enhancing Teaching and Learning with Infants through an Active and Integrated Approach. *Education 3-13*, 40(5), 515-531.

- *Makopoulou, K., Neville, R., & McLaughlin, K. (2020). Does a dance-based physical education (DBPE) intervention improve year 4 pupils' reading comprehension attainment? Results from a pilot study in England. *Research in Dance Education*, 22(3), 269–286. <https://doi.org/10.1080/14647893.2020.1754779>
- Manyukhina, Y. (2022). Children's agency in the National Curriculum for England: A critical discourse analysis. *Education 3-13*, 50(4), 506–520. <https://doi.org/10.1080/03004279.2022.2052232>
- Manyukhina, Y., & Wyse, D. (2019). Learner agency and the curriculum: A critical realist perspective. *The Curriculum Journal*, 30(3), 223–243. <https://doi.org/10.1080/09585176.2019.1599973>
- *Mård, N., & Hilli, C. (2022). Towards a didactic model for multidisciplinary teaching—A didactic analysis of multidisciplinary cases in Finnish primary schools. *Journal of Curriculum Studies*, 54(2), 243–258. <https://doi.org/10.1080/00220272.2020.1827044>
- Margot, K. C., & Kettler, T. (2019). Teachers' perception of STEM integration and education: A systematic literature review. *International Journal of STEM Education*, 6(1), 2. <https://doi.org/10.1186/s40594-018-0151-2>
- Marsh, C. J., Day, C., Hannay, L., & McCutcheon, G. (1990). *Reconceptualizing school-based curriculum development*. Falmer Press.
- *Marshall, D. T. (2018). *Teachers' Perceptions of an Integrated Curriculum: An Action Research Study*. Concordia University (Oregon).
- *Martin, N. M., Stefanski, A. J., & Martin, L. E. (2021). Addressing Disciplinary Literacy: An Examination of Teachers' Instruction in First Grade. *Mid-Western Educational Researcher*, 33(2), 85–110.
- *McDowall, S., & Hipkins, R. (2019). *Curriculum Integration: What Is Happening in New Zealand Schools?* (2396838291; ED603702; pp. 1–66). New Zealand Council for Educational Research. <https://www.proquest.com/reports/curriculum-integration-what-is-happening-new/docview/2396838291/se-2?accountid=15753>
- *McFadden, J. R., & Roehrig, G. H. (2017). Exploring teacher design team endeavors while creating an elementary-focused STEM-integrated curriculum. *International Journal of STEM Education*, 4(1), 21. <https://doi.org/10.1186/s40594-017-0084-1>
- McGuinness, C., Swartz, R., & Sproule, L. (2016). *Student Thinking and Learning in the PYP Transdisciplinary Framework: Case Studies from PYP Schools*. PYP Thinking Skills Project / International Baccalaureate Organisation.
- McKenney, S., Nieveen, N., Hurenkamp, R., Wasserfuhr, V., & Balica, M. (2022). *School-based curriculum development in the International Baccalaureate Primary Years Programme*. University of Twente / International Baccalaureate Organisation.
- McPhail, G., & Rata, E. (2016). Comparing Curriculum Types: 'Powerful Knowledge' and '21st Century Learning'. *New Zealand Journal of Educational Studies*, 51(1), 53–68. <https://doi.org/10.1007/s40841-015-0025-9>
- Mercer, S. (2011). Understanding learner agency as a complex dynamic system. *System*, 39(4), 427–436. <https://doi.org/10.1016/j.system.2011.08.001>
- *Mildenhall, P., Sherriff, B., & Cowie, B. (2021). The Honey Bees Game: Engaging and Inspiring the Community with STEM. *Research in Science & Technological Education*, 39(2), 225–244.
- *Miller, J. (2019). STEM education in the primary years to support mathematical thinking:



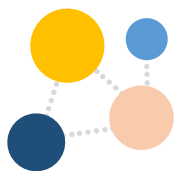
- Using coding to identify mathematical structures and patterns. *ZDM-MATHEMATICS EDUCATION*, 51(6), 915–927. <https://doi.org/10.1007/s11858-019-01096-y>
- *Miller-Ray, J. (2019). Investigating the Impact of a Community Makers' Guild Training Program on Elementary and Middle School Educator Perceptions of STEM (Science, Technology, Engineering, and Mathematics). *STEAM Education*, 79–100. https://doi.org/10.1007/978-3-030-04003-1_5
- Mills, M., Goos, M., Keddie, A., Honan, E., Pendergast, D., Gilbert, R., Nichols, K., Renshaw, P., & Wright, T. (2009). Productive pedagogies: A redefined methodology for analysing quality teacher practice. *The Australian Educational Researcher*, 36(3), 67–87. <https://doi.org/10.1007/BF03216906>
- *Monteiro, A. F., Miranda-Pinto, M., & Osorio, A. J. (2021). Coding as Literacy in Preschool: A Case Study. *Education Sciences*, 11(5), 198. <https://doi.org/10.3390/educsci11050198>
- Moore, J. W. (2016). What is the Sense of Agency and Why Does it Matter? *Frontiers in Psychology*, 7. <https://doi.org/10.3389/fpsyg.2016.01272>
- Moore, T. J., Stohlmann, M. S., Wang, H. H., Tank, K. M., Glancy, A. W., & Roehrig, G. H. (2014). Implementation and integration of engineering in K-12 STEM education. In *Engineering in Pre-College Settings* (pp. 35–60). Purdue University Press. <http://www.scopus.com/inward/record.url?scp=84905165875&partnerID=8YFLo gxK>
- *Moss, J., Godinho, S., & Chao, E. (2019). Enacting the Australian Curriculum: Primary and Secondary Teachers' Approaches to Integrating the Curriculum. *Australian Journal of Teacher Education*, 44(3), 24–41. <https://doi.org/10.14221/ajte.2018v44n3.2>
- Muller, J., & Young, M. (2019). Knowledge, power and powerful knowledge re-visited. *The Curriculum Journal*, 30(2), 196–214. <https://doi.org/10.1080/09585176.2019.1570292>
- *Nadelson, L. S., & Callahan, J. (2014). Where do we go from here? Conversations with K-6 principals following three years of engineering education professional development for their faculty. *360 Degrees of Engineering Education. Proceedings of the 121st ASEE Annual Conference and Exposition*. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-84905179258&partnerID=40&md5=51e96bd20cbef706e130935269cac607>
- *Nadelson, L. S., Seifert, A., Moll, A. J., & Coats, B. (2012). i-STEM Summer Institute: An Integrated Approach to Teacher Professional Development in STEM. *Journal of STEM Education: Innovations and Research*, 13(2), 69–83.
- National Council for Curriculum and Assessment (NCCA). (2005). *Primary Curriculum Review: Phase 1*. https://www.ncca.ie/media/1497/primary_curriculum_review_phase_1_final_report_with_recommendations_8.pdf
- National Council for Curriculum and Assessment (NCCA). (2020). *Draft Primary Curriculum Framework for Consultation*. <https://ncca.ie/media/4456/ncca-primary-curriculum-framework-2020.pdf>
- *Nesmith, S., Ditmore, E., Scott, L., & Zhu, T. (2017). 'This Is More about a Book than about Science!' Preservice Teachers' Perceptions toward Using Literacy Strategies in Inquiry-Based Science Lessons. *Electronic Journal of Science Education*, 21(5), 1–13.



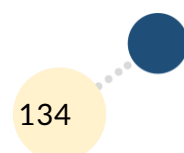
- Newman, M., & Gough, D. (2020). Systematic Reviews in Educational Research: Methodology, Perspectives and Application. In O. Zawacki-Richter, M. Kerres, S. Bedenlier, M. Bond, & K. Buntins (Eds.), *Systematic Reviews in Educational Research* (pp. 3–22). Springer. https://doi.org/10.1007/978-3-658-27602-7_1
- *Nollmeyer, G. E., Kelting-Gibson, L., & Graves, C. J. (2016). Mapping the Domain of Subject Area Integration: Elementary Educators’ Descriptions and Practices. *International Journal of Learning, Teaching and Educational Research*, 15(9), 1–27.
- Nicolescu, B. (Ed.). (2008). *Transdisciplinarity: Theory and practice*. Hampton Press.
- Niemelä, M. A. (2021). Crossing curricular boundaries for powerful knowledge. *The Curriculum Journal*, 32(2), 359–375. <https://doi.org/10.1002/curj.77>
- *Nugent, A., & Adams, C. (2018). *A Qualitative Case Study on Elementary Educators’ Experiences with Interdisciplinary Instructional Strategies*. Capella University.
- Ó Duibhir, P., & Cummins, J. (2012). *Towards an Integrated Language Curriculum in Early Childhood and Primary Education (3-12 years)*. National Council for Curriculum and Assessment.
- *Ødegaard, M., Haug, B., Mork, S. M., & Sørvik, G. O. (2014). Challenges and Support When Teaching Science through an Integrated Inquiry and Literacy Approach. *International Journal of Science Education*, 36(18), 2997–3020.
- *Ollila, J., & Macy, M. (2019). Social studies curriculum integration in elementary classrooms: A case study on a Pennsylvania Rural School. *The Journal of Social Studies Research*, 43(1), 33–45. <https://doi.org/10.1016/j.jssr.2018.02.001>
- *O’Neal, M. J., & Wang, J. (2017). *Defining the Relationship of Student Achievement Between STEM Subjects Through Canonical Correlation Analysis of 2011 Trends in International Mathematics and Science Study (TIMSS) Data*. California State University, Fresno.
- Organisation for Economic Co-operation and Development. (2018). *The Future of Education and Skills: Education 2030*. Organisation for Economic Co-operation and Development.
- Organisation for Economic Co-operation and Development. (2019). *Student Agency for 2030: Concept Note*. Organisation for Economic Co-operation and Development.
- Organisation for Economic Cooperation and Development. (2021). *Scotland’s Curriculum for Excellence: Into the Future*. OECD. <https://doi.org/10.1787/bf624417-en>
- *Öztürk Yılmaztekin, E., & Tantekin Erden, F. (2016). Pre-Service Early Childhood Teachers’ Views about Integrated Curriculum. *Journal of Kirsehir Education Faculty*, 17(2), 33–49.
- *Öztürk Yılmaztekin, E., & Erden, F. T. (2016). Investigating early childhood teachers’ views on science teaching practices: The integration of science with visual art in early childhood settings. *Early Child Development and Care*, 187(7), 1194–1207. <https://doi.org/10.1080/03004430.2016.1160899>
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., ... Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *Systematic Reviews*, 10(1), 89. <https://doi.org/10.1186/s13643-021-01626-4>
- *Parker, J., Heywood, D., & Jolley, N. (2012). Developing pre-service primary teachers’

- perceptions of cross-curricular teaching through reflection on learning. *Teachers and Teaching*, 18(6), 693–716. <https://doi.org/10.1080/13540602.2012.746504>
- *Panagopoulos, K. (2015). *Closing the Achievement Gap Through Arts Integration*. Notre Dame of Maryland University.
- Pearson, P. D., Moje, E., & Greenleaf, C. (2010). Literacy and Science: Each in the Service of the Other. *Science*, 328(5977), 459–463. <https://doi.org/10.1126/science.1182595>
- *Penchalk, M. M., & Crawford, L. (2015). *Middle School Teachers' Experiences with Cross-Curricular Connections at the Incident Level*. Walden University.
- *Pendergast, D., Nichols, K., & Honan, E. (2012). Integrated curriculum: Building an evidence-base of effectiveness in middle years classrooms. *Australian Journal of Middle Schooling*, 12(1), 12–21.
- *Penna-Baskinger, R. (2018). *Theme-Based Lessons: Teacher Perceptions of a Theme-Based Approach and Its Influence on Student Engagement in Grades 3-8*. Seton Hall University.
- *Peppler, K. A., Powell, C. W., Thompson, N., & Catterall, J. (2014). Positive Impact of Arts Integration on Student Academic Achievement in English Language Arts. *The Educational Forum*, 78(4), 364–377. <https://doi.org/10.1080/00131725.2014.941124>
- Plum, G., Nazir, J., & Wallace, J. (2021). Curriculum Integration and the Semicentennial of Basil Bernstein's Classification and Framing of Educational Knowledge. *Canadian Journal of Science, Mathematics and Technology Education*, 20, 715–735. <https://doi.org/10.1007/s42330-021-00135-9>
- *Potocnik, R., Košir, T., & Devetak, I. (2022). Slovenian Primary School Teachers' Opinion on Interdisciplinary Approach between Fine Art and Science Education. *European Journal of Educational Research*, 11(1), 435–443.
- Poulton, P. (2020). Teacher agency in curriculum reform: The role of assessment in enabling and constraining primary teachers' agency. *Curriculum Perspectives*, 40(1), 35–48. <https://doi.org/10.1007/s41297-020-00100-w>
- *Powell, R. L. (2018). *'We're Not Going to Talk about That': A Qualitative Case Study of Three Elementary Teachers' Experiences Integrating Literacy and Social Studies*. University of South Florida.
- Priestley, M., Biesta, G., Philippou, S., & Robinson, S. (2015). The Teacher and the Curriculum: Exploring Teacher Agency. In D. Wyse, L. Hayward, & J. Pandya (Eds.), *The SAGE Handbook of Curriculum, Pedagogy and Assessment: Two Volume Set* (pp. 187–201). SAGE Publications Ltd. <https://doi.org/10.4135/9781473921405.n12>
- Priestley, M., Biesta, G., & Robinson. (2013). Teachers as agents of change: Teacher agency and emerging models of curriculum. In M. Priestley & G. Biesta (Eds.), *Reinventing the Curriculum: New Trends in Curriculum Policy and Practice* (1st ed., pp. 149–164). Bloomsbury Publishing Plc. <https://doi.org/10.5040/9781472553195>
- Priestley, M., Biesta, G., & Robinson, S. (2015a). *Teacher agency: An ecological approach*. Bloomsbury Academic.
- Priestley, M., Biesta, G., & Robinson, S. (2015b). Teacher agency: What is it and why does it matter? In R. Kneyber & J. Evers (Eds.), *Flip the System: Changing Education from the Bottom Up* (pp. 1–11). Routledge.
- Priestley, M., & Humes, W. (2010). The development of Scotland's Curriculum for

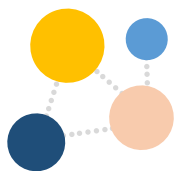
- Excellence: Amnesia and déjà vu. *Oxford Review of Education*, 36(3), 345–361.
<https://doi.org/10.1080/03054980903518951>
- Priestley, M., & Minty, S. (2012). *Developing Curriculum for Excellence: Summary of findings from research undertaken in a Scottish local authority*. University of Stirling.
https://dspace.stir.ac.uk/bitstream/1893/7075/1/Stirling%20CE%20research%20-%20report_March%202012.pdf
- Priestley, M., & Minty, S. (2013). Curriculum for Excellence: 'A brilliant idea, but...'. *Scottish Educational Review*, 45(1), 39–52.
- Priestley, M., & Sinnema, C. (2014). Downgraded curriculum? An analysis of knowledge in new curricula in Scotland and New Zealand. *The Curriculum Journal*, 25(1), 50–75.
<https://doi.org/10.1080/09585176.2013.872047>
- *Quigley, C. F., Herro, D., & Baker, A. (2019). Moving Toward Transdisciplinary Instruction: A Longitudinal Examination of STEAM Teaching Practices. *STEAM Education*, 143–164. https://doi.org/10.1007/978-3-030-04003-1_8
- Rennie, L. J., Venville, G. J., & Wallace, J. (2012). *Knowledge that counts in a global community: Exploring the contribution of the integrated curriculum*. Routledge.
- *Revelle, K. Z. (2019). Teacher perceptions of a project-based approach to social studies and literacy instruction. *Teaching and Teacher Education*, 84, 95–105.
<https://doi.org/10.1016/j.tate.2019.04.016>
- *Revelle, K. Z. (2020). *Opportunities and Challenges within Project-Based Learning: An Exploration of Integrated Civics and Literacy Instruction in Diverse Third-Grade Classrooms*. University of Michigan.
- *Rico, A., Agirre-Basurko, E., Ruiz-Gonzalez, A., Palacios-Agundez, I., & Zuazagoitia, D. (2021). Integrating Mathematics and Science Teaching in the Context of Education for Sustainable Development: Design and Pilot Implementation of a Teaching-Learning Sequence about Air Quality with Pre-Service Primary Teachers. *Sustainability*, 13(8). <https://doi.org/10.3390/su13084500>
- *Rismiati, C. (2012). *Teachers' Concerns Regarding the Implementation of Integrated Thematic Instruction: A Study of Primary Grade Teachers in Kanisius Catholic Schools in Yogyakarta, Indonesia*. Loyola University Chicago.
- *Robinson, L., Kirn, A., Guy-Gaytán, C., & Ellis, J. A. (2021). Fostering Student Beliefs About Engineering and Mathematics Through Integrated Instruction (RTP). *Proceedings of the 2021 ASEE Virtual Annual Conference Content*
 Access <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85124565872&partnerID=40&md5=5f2201bf5b0e2b05160fded0eee55a7f>
- Rogers, B. (1997). Informing the shape of the curriculum: New views of knowledge and its representation in schooling. *Journal of Curriculum Studies*, 29(6), 683–710.
<https://doi.org/10.1080/002202797183838>
- *Rosenthal, M. M. (2020). *Developing a Culture of Innovation: A Qualitative Case Study of a Massachusetts K-8 School*. William Howard Taft University.
- *Rule, A. C., Montgomery, S. E., Tallakson, D. A., Stichter, M. K., Barness, A., & Decker, K. M. (2012). Teacher Candidate Attitude Changes After Experiencing an Arts-Integrated Unit on Africa. *Social Studies Research and Practice*, 7(2), 15–31.
<https://doi.org/10.1108/ssrp-02-2012-b0002>
- Ruscoe, A., Barblett, L., & Barratt-Pugh, C. (2018). *Sharing Power with Children*:



- Repositioning Children as Agentic Learners. *Australasian Journal of Early Childhood*, 43(3), 63–71. <https://doi.org/10.23965/AJEC.43.3.07>
- *Sáez-López, J.-M., Román-González, M., & Vázquez-Cano, E. (2016). Visual programming languages integrated across the curriculum in elementary school: A two year case study using “Scratch” in five schools. *Computers and Education*, 97, 129–141. <https://doi.org/10.1016/j.compedu.2016.03.003>
- *Samuels, H. (2019). *The Impact of a Thematic Unit and Integration on Students’ Achievement in Social Studies*. University of South Carolina.
- *Santaolalla, E., Urosa, B., Martin, O., Verde, A., & Diaz, T. (2020). Interdisciplinarity in Teacher Education: Evaluation of the Effectiveness of an Educational Innovation Project. *Sustainability*, 12(17). <https://doi.org/10.3390/su12176748>
- *Saraniero, P., Goldberg, M. R., & Hall, B. (2014). ‘Unlocking My Creativity’: Teacher Learning in Arts Integration Professional Development. *Journal for Learning through the Arts*, 10(1), 1–22.
- *Savage, M. J., & Drake, S. M. (2016). Living Transdisciplinary Curriculum: Teachers’ Experiences with the International Baccalaureate’s Primary Years Programme. *International Electronic Journal of Elementary Education*, 9(1), 1–20.
- *Schellinger, J., Jaber, L. Z., & Southerland, S. A. (2021). Harmonious or disjointed?: Epistemological framing and its role in an integrated science and engineering activity. *Journal of Research in Science Teaching*, 59(1), 30–57. <https://doi.org/10.1002/tea.21720>
- *Schugar, H. R., & Dreher, M. J. (2017). U. S. Fourth Graders’ Informational Text Comprehension: Indicators from NAEP. *International Electronic Journal of Elementary Education*, 9(3), 523–552.
- Scottish Executive. (2006). *Building the Curriculum 1: The Contribution of Curriculum Areas*. Scottish Executive.
- Scottish Government. (n.d.). *Curriculum for Excellence: All Experiences and Outcomes*. <https://education.gov.scot/Documents/All-experiencesoutcomes18.pdf>
- Scottish Government. (2008). *Building the Curriculum 3: A Framework for Learning and Teaching*. Scottish Government.
- Scottish Government. (2011). *Building the Curriculum 5: A Framework for Assessment*. Scottish Government.
- Scottish Government. (2021). *Scotland’s Curriculum: Into the Future: Implementation framework for the OECD’s 2021 review of Curriculum for Excellence*. <https://www.gov.scot/publications/scotlands-curriculum-future-implementation-framework-oecd-2021-review-curriculum-excellence/documents/>
- *Sen, C., & Ay, Z. S. (2017). The Views of Middle School Mathematics Teachers on the Integration of Science and Technology in Mathematics Instruction. *International Journal of Research in Education and Science*, 3(1), 151–170.
- Shanahan, T., & Shanahan, C. (2008). Teaching disciplinary literacy to adolescents: Rethinking content-area literacy. *Harvard Educational Review*, 78(1), 40–60. <https://doi.org/10.1002/anie.200803420>
- *Shin, K. (2020). Examining Korean Teachers’ Experiences Teaching the Centrally Developed Integrated Curriculum. *The Asia-Pacific Education Researcher*, 31(1), 49–60. <https://doi.org/10.1007/s40299-020-00537-7>



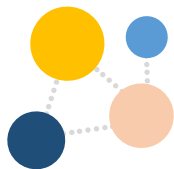
- *Shumaker, S., Fuhrman, N., & Duncan, D. (2012). The Influence of School Culture on Environmental Education Integration: A Case Study of an Urban Private School System. *Journal of Agricultural Education*, 53(4), 141-155. <https://doi.org/10.5032/jae.2012.04141>
- *Simmons, M. T. (2015). *Teachers' Perceptions of the Influence of Professional Development on Music Integration*. Walden University.
- Sinnema, C., Nieveen, N., & Priestley, M. (2020). Successful futures, successful curriculum: What can Wales learn from international curriculum reforms? *The Curriculum Journal*, 31(2), 181-201. <https://doi.org/10.1002/curj.17>
- Skilbeck, M. (1984). *School-based Curriculum Development*. Harper and Row.
- *Smith, K., Kulinna, P. H., Vissicaro, P., & Fredrickson, L. (2016). Anthropology, Dance, and Education: Integrated Curriculum in Social Studies. *Social Studies*, 107(1), 28-37.
- *Smith-Gayle, P., & Dippold, L. (2014). *The Impact of an Integrated Curriculum on the Achievement of Middle-School Boys*. Northcentral University.
- *Snyder, L., Klos, P., & Grey-Hawkins, L. (2014). Transforming Teaching through Arts Integration. *Journal for Learning through the Arts: A Research Journal on Arts Integration in Schools and Communities*, 10(1), 1-25. <https://doi.org/10.21977/D910119308>
- *Speldewinde, C. (2022). STEM Teaching and Learning in Bush Kinders. *Canadian Journal of Science Mathematics and Technology Education*, 22, 444-461. <https://doi.org/10.1007/s42330-022-00207-4>
- *Stapp, A. C., Lambert, L., Mann, G., & Wolff, K. (2021). Growing Healthy Minds, Bodies, and Communities: Early childhood teachers' perceptions of a nutrition-integrated pilot curriculum. *Public Health Nutr*, 24(10), 3100-3109. <https://doi.org/10.1017/S136898002100118X>
- Stein, Z., Connell, M., & Gardner, H. (2008). Exercising Quality Control in Interdisciplinary Education: Toward an Epistemologically Responsible Approach. *Journal of Philosophy of Education*, 42(3-4), 401-414. <https://doi.org/10.1111/j.1467-9752.2008.00655.x>
- Stengel, B. S. (1997). 'Academic discipline' and 'school subject': Contestable curricular concepts. *Journal of Curriculum Studies*, 29(5), 585-602. <https://doi.org/10.1080/002202797183928>
- Stenhouse, L. (1975). *An introduction to curriculum research and development*. Heinemann.
- *Swan, K., Vahey, P., van 't Hooft, M., Kratcoski, A., Rafanan, K., Stanford, T., Yarnall, L., & Cook, D. (2013). Problem-Based Learning across the Curriculum: Exploring the Efficacy of a Cross-Curricular Application of Preparation for Future Learning. *Interdisciplinary Journal of Problem-Based Learning*, 7(1), 91-110.
- *Talbert, S. K. (2019). *The Relationship of Reading Strategies and Content Knowledge in Models of Integrated Instruction*. Middle Tennessee State University.
- *Tam, P. C. (2021). Blurring the play-drama boundary: A case study investigating the teaching and learning of a drama-integrated curriculum in a Hong Kong kindergarten. *Contemporary Issues in Early Childhood*, 22(4), 328-341. <https://doi.org/10.1177/14639491211060559>
- Tan, L. (2021). *Performance comparison between IB and non-IB school students on the International Schools' Assessment*. Australian Council for Educational Research /



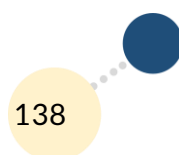
- International Baccalaureate Organisation.
- *Tank, K. M. (2014). *Examining the Effects of Integrated Science, Engineering, and Nonfiction Literature on Student Learning in Elementary Classrooms*. University of Minnesota.
- The John F. Kennedy Center for the Performing Arts. (2022). *What is Arts Integration?* The Kennedy Center. <https://www.kennedy-center.org/>
- The Royal Society of Edinburgh. (2020). *Embedding Interdisciplinary Learning in Scottish Schools: Advice Paper*. The Royal Society of Edinburgh. <https://rse.org.uk/wp-content/uploads/2022/04/RSE-AP-Interdisciplinary-Learning-in-Scottish-Schools-2020.pdf>
- Thorburn, M. (2017). Dewey, democracy, and interdisciplinary learning: A Scottish perspective. *Oxford Review of Education*, 43(2), 242–254. <https://doi.org/10.1080/03054985.2017.1284657>
- *Trent, A., & Moran, P. (2018). We Are Wyoming: An arts integrated teaching and inquiry project. *Education 3-13*, 46(2), 157–173. <https://doi.org/10.1080/03004279.2016.1208261>
- *Trinter, C. P., & Hughes, H. E. (2021). Teachers as Curriculum Designers: Inviting Teachers into the Productive Struggle. *RMLE Online: Research in Middle Level Education*, 44(3), 1–16.
- *Tucker, S. D. (2017). *The Effects of Arts Integration on Literacy Comprehension Achievement*. University of South Carolina.
- Tyler, R. (1949). *Basic Principles of Curriculum and Instruction*. University of Chicago Press.
- *Tytler, R., Mulligan, J., Prain, V., White, P., Xu, L. H., Kirk, M., Nielsen, C., & Speldewinde, C. (2021). An interdisciplinary approach to primary school mathematics and science learning. *International Journal of Science Education*, 43(12), 1926–1949. <https://doi.org/10.1080/09500693.2021.1946727>
- *Uyar, M. Y. (2018). Development of pre-service teachers' understanding of the nature of science through an interdisciplinary curriculum: A case study. *Journal of Baltic Science Education*, 17(4), 728–741.
- *Vacca, R., Desportes, K., Tes, M., Silander, M., Matuk, C., Amato, A., & Woods, P. J. (2022). 'I happen to be one of 47.8%': Social-Emotional and Data Reasoning in Middle School Students' Comics about Friendship. *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems*. <https://doi.org/10.1145/3491102.3502086>
- Vähäsantanen, K. (2015). Professional agency in the stream of change: Understanding educational change and teachers' professional identities. *Teaching and Teacher Education*, 47, 1–12. <https://doi.org/10.1016/j.tate.2014.11.006>
- *Vallera, F. L., & Bodzin, A. M. (2016). *Weaving more than just fibers: Integrating a fully STEM-focused, project-based agricultural literacy module into elementary curricula*. Lehigh University.
- *Van't Hooft, M., Swan, K., Cook, D., Stanford, T., Vahey, P., Kratoski, A., Rafanan, K., & Yarnall, L. (2012). A cross-curricular approach to the development data literacy in the middle grades: The thinking with data project. *Middle Grades Research Journal*, 7(3), 19–33.
- Varpanen, J. (2019). What is children's agency? A review of conceptualizations used in

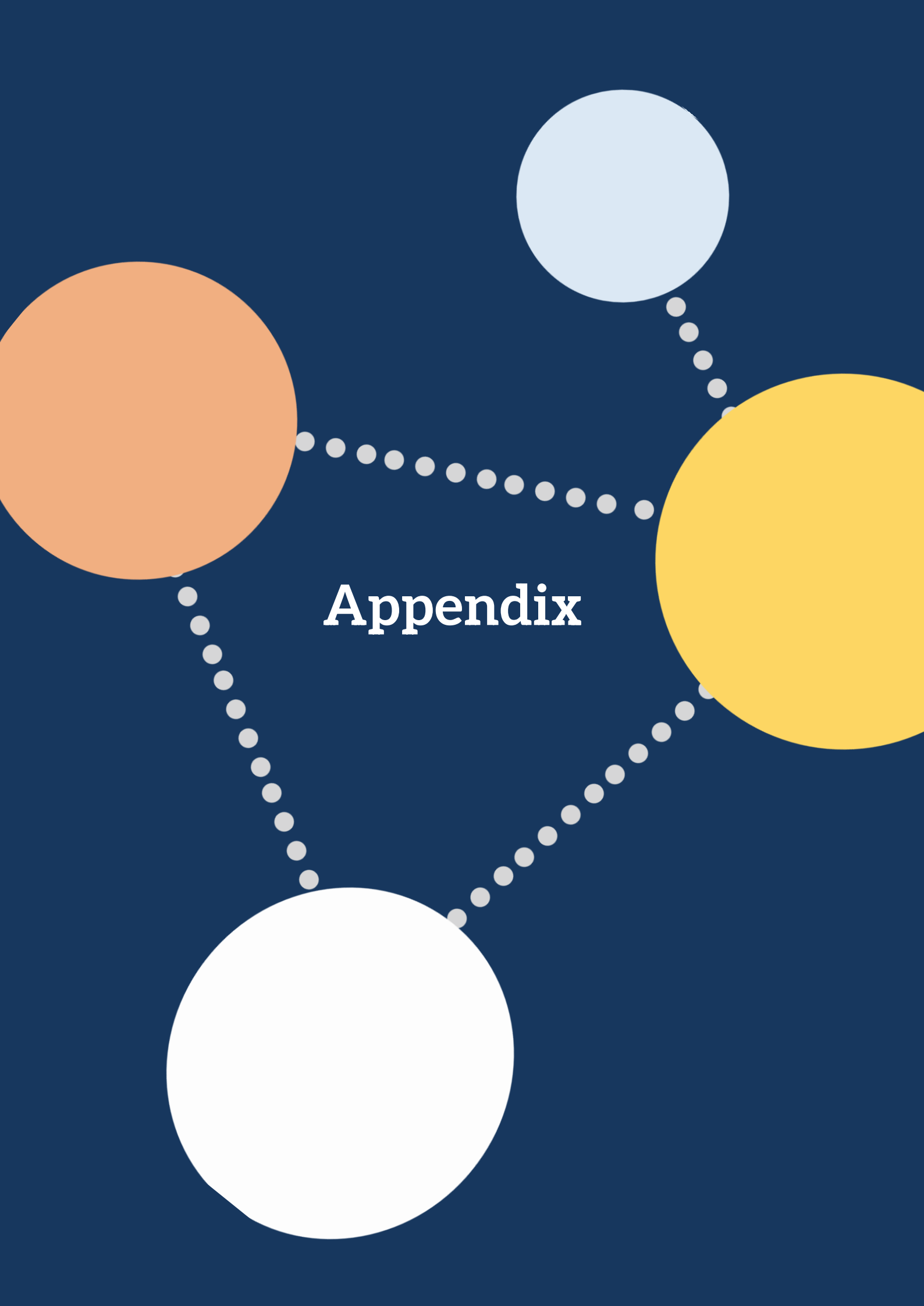


- early childhood education research. *Educational Research Review*, 28, 100288. <https://doi.org/10.1016/j.edurev.2019.100288>
- Vasquez, J. A., Sneider, C., & Comer, M. (2013). *STEM Lesson Essentials, Grades 3-8: Integrating Science, Technology, Engineering, and Mathematics*. Heinemann.
- Vaughn, M. (2020). What is student agency and why is it needed now more than ever? *Theory Into Practice*, 59(2), 109–118. <https://doi.org/10.1080/00405841.2019.1702393>
- Vaughn, M., Jang, B. G., Sotirovska, V., & Cooper-Novack, G. (2020). Student Agency in Literacy: A Systematic Review of the Literature. *Reading Psychology*, 41(7), 712–734. <https://doi.org/10.1080/02702711.2020.1783142>
- *Viñas, M. F., Casals, A., & Viladot, L. (2021). Emerging critical events in creative processes involving music, dance and mathematics in the school. *International Journal of Music Education*, 40(2), 228–243. <https://doi.org/10.1177/02557614211050996>
- *Vlcek, P., Svobodova, H., & Planinc, T. R. (2019). Integrating Physical Education and Geography in elementary education in the Czech Republic and the Republic of Slovenia. *Compare-A Journal of Comparative and International Education*, 49(6), 868–887. <https://doi.org/10.1080/03057925.2018.1466267>
- Volante, L. (2018). *Effective Pedagogies for a Redeveloped Primary School Curriculum*. https://ncca.ie/media/3501/seminar_two_volante_paper.pdf
- *Volk, M., Cotic, M., Zajc, M., & Starcic, A. I. (2017). Tablet-based cross-curricular maths vs. Traditional maths classroom practice for higher-order learning outcomes. *Computers & Education*, 114, 1–23. <https://doi.org/10.1016/j.compedu.2017.06.004>
- Waterhouse, L. (2006). Inadequate Evidence for Multiple Intelligences, Mozart Effect, and Emotional Intelligence Theories. *Educational Psychologist*, 41(4), 247–255. https://doi.org/10.1207/s15326985ep4104_5
- *Wendell, K. B. (2014). Design Practices of Preservice Elementary Teachers in an Integrated Engineering and Literature Experience. *Journal of Pre-College Engineering Education Research (J-PEER)*, 4(2), 29–46. <https://doi.org/10.7771/2157-9288.1085>
- *White, J., Shockley, D., Hutzler, M., & Wilson, N. (2014). Interdisciplinary Professional Development for Teaching Science and Reading. *The Ohio Journal of Science*, 114(2), 2–10. <https://doi.org/10.18061/ojs.v114i2.4391>
- White, J. (2018). The weakness of ‘powerful knowledge’. *London Review of Education*. <https://doi.org/10.18546/LRE.16.2.11>
- *Wieselmann, J. R., Dare, E. A., Roehrig, G. H., & Ring-Whalen, E. A. (2021). ‘There are other ways to help besides using the stuff’: Using activity theory to understand dynamic student participation in small group science, technology, engineering, and mathematics activities. *Journal of Research in Science Teaching*, 58(9), 1281–1319. <https://doi.org/10.1002/tea.21710>
- Wiggans, G., & McTighe, J. (2005). *Understanding by Design* (2nd ed.). Pearson.
- Wiggins, G. P., & McTighe, J. (2005). *Understanding by design* (2nd ed). Association for Supervision and Curriculum Development.
- Williams, J. (2011). STEM Education: Proceed with caution. *Design and Technology Education: An International Journal*, 16(1), 26–35.

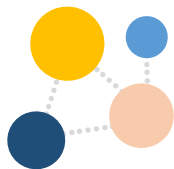


- Willingham, D. T. (2019). *Occasional Paper Series: How to Teach Critical Thinking*. Education: Future Frontiers.
- *Wright, T. S., & Gotwals, A. W. (2017). Supporting Kindergartners' Science Talk in the Context of an Integrated Science and Disciplinary Literacy Curriculum. *Elementary School Journal*, 117(3), 513–537. <https://doi.org/10.1086/690273>
- Wyse, D., & Manyukhina, Y. (2018). *The Place of Knowledge in Curricula: A Research-informed Analysis*. National Council for Curriculum and Assessment.
- *Yoshida, H. (2016). Active learning in curriculum management: A cross-curricular approach for the 'Period for Integrated Studies'. *Proceedings of INTED2016: 10th International Technology, Education and Development Conference*. <https://doi.org/10.21125/inted.2016.0416>
- Young, M. F. D., & Lambert, D. (2014). *Knowledge and the future school: Curriculum and social justice*. Bloomsbury Academic.
- Young, M., & Muller, J. (2010). Three Educational Scenarios for the Future: Lessons from the sociology of knowledge: European Journal of Education, Part I. *European Journal of Education*, 45(1), 11–27. <https://doi.org/10.1111/j.1465-3435.2009.01413.x>
- *Zhang, D., & Campbell, T. (2012). An Exploration of the Potential Impact of the Integrated Experiential Learning Curriculum in Beijing, China. *International Journal of Science Education*, 34(7), 1093–1123. <https://doi.org/10.1080/09500693.2011.625057>





Appendix



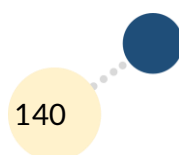
Appendix A

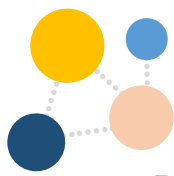
Bibliographic Literature Search

July 2022

Database Summary

Database	Hits
ERIC (via EBSCOHost)	562
ERIC (via ProQuest)	488
Web of Science	419
Scopus	534
Education Research Complete (via EBSCOHost)	397
Total	2400
Duplicates removed in Endnote	944
Total to screen from database searches	1456
Grey Literature	442
Duplicates removed in Endnote	59
Total to screen	1839
Duplicates removed in Covidence (prior to/during screening)	216
Total unique studies to screen	1623





Database Searches

Database: ERIC

Host: EBSCOHost

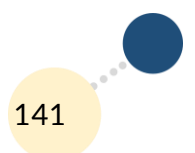
Parameters: None

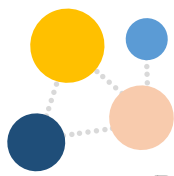
Date: 21-07-2022

Searcher(s): Paula Lehane, Patrick Burke

Search Strategy

#	Searches	Results
S1	TI "Curric* integra*" OR "Integrated curric*" OR "Interdisciplinary curric*" OR "Transdisciplinary curric*" OR "Multidisciplinary curric*" OR "cross-curric*" OR "cross curric*" OR "integra* instruc*" OR "Interdisciplinary approach" OR "Transdisciplinary approach" OR "Multidisciplinary approach" OR "integrated approach" OR "Integrated teach*" OR "integrated pedagog*"	1778
S2	AB "Curric* integra*" OR "Integrated curric*" OR "Interdisciplinary curric*" OR "Transdisciplinary curric*" OR "Multidisciplinary curric*" OR "cross-curric*" OR "cross curric*" OR "integra* instruc*" OR "Interdisciplinary approach" OR "Transdisciplinary approach" OR "Multidisciplinary approach" OR "integrated approach" OR "Integrated teach*" OR "integrated pedagog*"	6898
S3	KW "Curric* integra*" OR "Integrated curric*" OR "Interdisciplinary curric*" OR "Transdisciplinary curric*" OR "Multidisciplinary curric*" OR "cross-curric*" OR "cross curric*" OR "integra* instruc*" OR "Interdisciplinary approach" OR "Transdisciplinary approach" OR "Multidisciplinary approach" OR "integrated approach" OR "Integrated teach*" OR "integrated pedagog*"	135
S4	S1 OR S2 OR S3	8057
S5	S4 AND "Primary school" OR "Primary education" OR "Elementary school" OR "elementary education" OR "Middle School" OR "Middle edu*" OR "early child* edu*" OR "early years edu*"	2119
S6	Limiters applied to S5: English language; 01-01-2012 - present	562

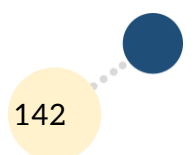


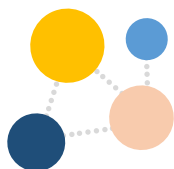


Database: ERIC
Host: ProQuest
Parameters: None
Date: 21-07-2022
Searcher(s): Paula Lehane, Patrick Burke

Search Strategy

#	Searches	Results
S1	TI "Curric* integra*" OR "Integrated curric*" OR "Interdisciplinary curric*" OR "Transdisciplinary curric*" OR "Multidisciplinary curric*" OR "cross-curric*" OR "cross curric*" OR "integra* instruc*" OR "Interdisciplinary approach" OR "Transdisciplinary approach" OR "Multidisciplinary approach" OR "integrated approach" OR "Integrated teach*" OR "integrated pedagog*"	1718
S2	AB "Curric* integra*" OR "Integrated curric*" OR "Interdisciplinary curric*" OR "Transdisciplinary curric*" OR "Multidisciplinary curric*" OR "cross-curric*" OR "cross curric*" OR "integra* instruc*" OR "Interdisciplinary approach" OR "Transdisciplinary approach" OR "Multidisciplinary approach" OR "integrated approach" OR "Integrated teach*" OR "integrated pedagog*"	6724
S3	KW "Curric* integra*" OR "Integrated curric*" OR "Interdisciplinary curric*" OR "Transdisciplinary curric*" OR "Multidisciplinary curric*" OR "cross-curric*" OR "cross curric*" OR "integra* instruc*" OR "Interdisciplinary approach" OR "Transdisciplinary approach" OR "Multidisciplinary approach" OR "integrated approach" OR "Integrated teach*" OR "integrated pedagog*"	137
S4	S1 OR S2 OR S3	7847
S5	S4 AND "Primary school" OR "Primary education" OR "Elementary school" OR "elementary education" OR "Middle School" OR "Middle edu*" OR "early child* edu*" OR "early years edu*"	1774
S6	Limiters applied to S5: English language; 01-01-2012 - present	488





Database: Education Research Complete (ERC)

Host: EBSCO

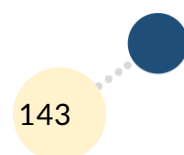
Parameters: None

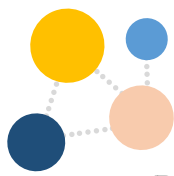
Date: 21-07-2022

Searcher(s): Paula Lehane, Patrick Burke

Search Strategy

#	Searches	Results
S1	TI "Curric* integra*" OR "Integrated curric*" OR "Interdisciplinary curric*" OR "Transdisciplinary curric*" OR "Multidisciplinary curric*" OR "cross-curric*" OR "cross curric*" OR "integra* instruc*" OR "Interdisciplinary approach" OR "Transdisciplinary approach" OR "Multidisciplinary approach" OR "integrated approach" OR "Integrated teach*" OR "integrated pedagog*"	1715
S2	AB "Curric* integra*" OR "Integrated curric*" OR "Interdisciplinary curric*" OR "Transdisciplinary curric*" OR "Multidisciplinary curric*" OR "cross-curric*" OR "cross curric*" OR "integra* instruc*" OR "Interdisciplinary approach" OR "Transdisciplinary approach" OR "Multidisciplinary approach" OR "integrated approach" OR "Integrated teach*" OR "integrated pedagog*"	5773
S3	KW "Curric* integra*" OR "Integrated curric*" OR "Interdisciplinary curric*" OR "Transdisciplinary curric*" OR "Multidisciplinary curric*" OR "cross-curric*" OR "cross curric*" OR "integra* instruc*" OR "Interdisciplinary approach" OR "Transdisciplinary approach" OR "Multidisciplinary approach" OR "integrated approach" OR "Integrated teach*" OR "integrated pedagog*"	780
S4	S1 OR S2 OR S3	7058
S5	S4 AND "Primary school" OR "Primary education" OR "Elementary school" OR "elementary education" OR "Middle School" OR "Middle edu*" OR "early child* edu*" OR "early years edu*"	864
S6	Limiters applied to S5: English language; 01-01-2012 - present	397

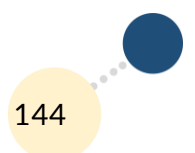


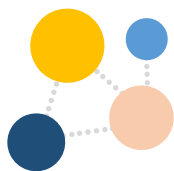


Database: Web of Science
Host: Clarivate
Parameters: None applied at outset
Date: 21-07-2022
Searcher(s): Paula Lehane, Patrick Burke

Search Strategy

#	Searches	Results
S1	TI "Curric* integra*" OR "Integrated curric*" OR "Interdisciplinary curric*" OR "Transdisciplinary curric*" OR "Multidisciplinary curric*" OR "cross-curric*" OR "cross curric*" OR "integra* instruc*" OR "Interdisciplinary approach" OR "Transdisciplinary approach" OR "Multidisciplinary approach" OR "integrated approach" OR "Integrated teach*" OR "integrated pedagog*"	16224
S2	AB "Curric* integra*" OR "Integrated curric*" OR "Interdisciplinary curric*" OR "Transdisciplinary curric*" OR "Multidisciplinary curric*" OR "cross-curric*" OR "cross curric*" OR "integra* instruc*" OR "Interdisciplinary approach" OR "Transdisciplinary approach" OR "Multidisciplinary approach" OR "integrated approach" OR "Integrated teach*" OR "integrated pedagog*"	47761
S3	Author KW "Curric* integra*" OR "Integrated curric*" OR "Interdisciplinary curric*" OR "Transdisciplinary curric*" OR "Multidisciplinary curric*" OR "cross-curric*" OR "cross curric*" OR "integra* instruc*" OR "Interdisciplinary approach" OR "Transdisciplinary approach" OR "Multidisciplinary approach" OR "integrated approach" OR "Integrated teach*" OR "integrated pedagog*"	2740
S4	S1 OR S2 OR S3	61963
S5	(#4) AND ALL= ("Primary school" OR "Primary education" OR "Elementary school" OR "elementary education" OR "Middle School" OR "Middle edu*" OR "early child* edu*" OR "early years edu*")	568
S6	Limiters applied to S5: English language; 01-01-2012 - present	419





Database: Scopus

Host: Elsevier

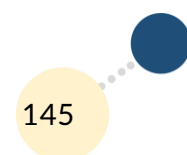
Parameters: None at outset

Date: 21-7-22

Searcher(s): Paula Lehane, Patrick Burke

Search Strategy

#	Searches	Results
S1	TITLE-ABS-KEY ("Curric* integra*" OR "Integrated curric*" OR "Interdisciplinary curric*" OR "Transdisciplinary curric*" OR "Multidisciplinary curric*" OR "cross-curric*" OR "cross curric*" OR "integra* instruc*" OR "Interdisciplinary approach" OR "Transdisciplinary approach" OR "Multidisciplinary approach" OR "integrated approach" OR "Integrated teach*" OR "integrated pedagog*")	117378
S2	S1 AND ("Primary school" OR "Primary education" OR "Elementary school" OR "elementary education" OR "Middle School" OR "Middle edu*" OR "early child* edu*" OR "early years edu*")	833
S3	Limiters applied to S2: English language; 01-01-2012 - present	534



B.3 Grey Literature

Portal/URL: Dissertations and Theses (via ProQuest)

Date: 21/07/2022

Search Terms: Limiters/ English only; 2012-2022

(ti("Curric* integra*" OR "Integrated curric*" OR "Interdisciplinary curric*" OR "Transdisciplinary curric*" OR "Multidisciplinary curric*" OR "cross-currice*" OR "cross curric*" OR "integra* instruc*" OR "Interdisciplinary approach" OR "Transdisciplinary approach" OR "Multidisciplinary approach" OR "integrated approach" OR "Integrated teach*" OR "integrated pedagog*") OR ab("Curric* integra*" OR "Integrated curric*" OR "Interdisciplinary curric*" OR "Transdisciplinary curric*" OR "Multidisciplinary curric*" OR "cross-currice*" OR "cross curric*" OR "integra* instruc*" OR "Interdisciplinary approach" OR "Transdisciplinary approach" OR "Multidisciplinary approach" OR "integrated approach" OR "Integrated teach*" OR "integrated pedagog*") OR diskw("Curric* integra*" OR "Integrated curric*" OR "Interdisciplinary curric*" OR "Transdisciplinary curric*" OR "Multidisciplinary curric*" OR "cross-currice*" OR "cross curric*" OR "integra* instruc*" OR "Interdisciplinary approach" OR "Transdisciplinary approach" OR "Multidisciplinary approach" OR "integrated approach" OR "Integrated teach*" OR "integrated pedagog*")) AND ("Primary school" OR "Primary education" OR "Elementary school" OR "elementary education" OR "Middle School" OR "Middle edu*" OR "early child* edu*" OR "early years edu*")

Results (Checked/Included): 808/ 136 brought forward for abstract screening

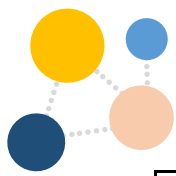
Notes: Screening shared between Co-PIs

Portal/URL: Google Scholar

Date: 25/07/2022

Search Terms: Limiters/ English only; 2012-2022

#	Search	Results Returned	Results Screened	Records Included for Abstract Screening
1	intitle:"Curricular integration" OR "Curriculum integration" OR "Integrated curriculum"	16800	200	77
2	intitle:"Multidisciplinary curriculum" OR "Interdisciplinary curriculum" OR "Transdisciplinary	9310	200	71



	curriculum"			
3	intitle:"cross-curricular" OR "cross-curriculum" OR "cross curricular" OR "cross curriculum"	17400	200	94
4	intitle:"integrated instruction" OR "Integrated teaching" OR "integrated pedagogy"	15900	200	46

