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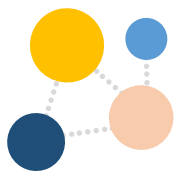
Ollscoil Chathair
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Dublin City University

**Weaving the Literature
on Integration, Pedagogy
and Assessment:
*Insights for Curriculum
and Classrooms***

REPORT 2

**Patrick Burke
Paula Lehane**

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



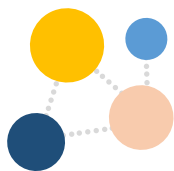
Note for the Reader

Readers should bear the following in mind:

- This is the second 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. This second report addresses the literature on pedagogy and assessment. Annex 2 contains the relevant methodological information for this report.
- A timeline for the development of this report can be seen on p. 2 of Report 1.
- This report is one of several commissioned by NCCA in 2022. We encourage readers to consult the reports on specific curriculum areas available on the NCCA website (e.g. Nohilly et al., 2023). We do not attempt to detail pedagogical or assessment advice for specific disciplines/subjects in this report.
- This report draws extensively on meta-analytic reviews. The box below provides guidance for readers on interpreting the effect sizes reported in such reviews.

Understanding Effect Sizes

To establish the efficacy of a particular practice, it is common to use experimental research designs. This usually involves one randomised group of children being taught using the practice of interest (e.g. Group 1= a new teaching strategy) and a comparison group (Group 2= traditional teaching strategy). The performance of each group is measured and an average score is calculated. The scores of each group of students are then statistically compared to see if there is meaningful difference. The effect size (ES) indicates the scale of this difference (if it exists). Effect size can be calculated in many ways, e.g. Cohen's *d*, Hedge's *g*. They can also be aggregated for the purpose of meta-analytic reviews. In educational research, an effect size of less than 0.05 is considered small, 0.05 to less than 0.20 is medium, and 0.20 or greater is large (Kraft, 2020). Different benchmarks exist, but in general, the larger the effect size the greater the impact on student learning. In this report, we use the original author's descriptors, e.g. if an author classified the effect of their intervention as 'medium', we report as such.



Weaving the Literature on Integration, Pedagogy and Assessment: *Insights for Curriculum and Classrooms*

Report 2

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

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May 2023

Authorship

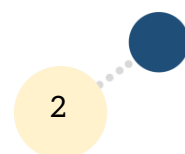
Authors are listed in alphabetical order. Both contributed equally to this report.

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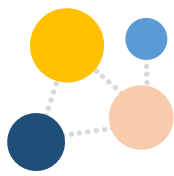


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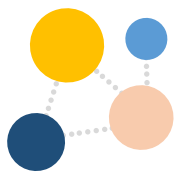
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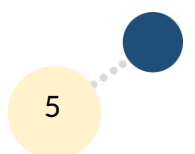


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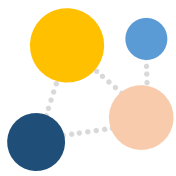
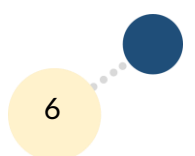


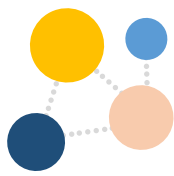
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Executive Summary

Curriculum integration is often described as a way of ‘forging connections’ between different sources of knowledge. However, whatever form a curriculum takes, be it integrated or not, pedagogy and assessment are two crucial components. A meaningful, enjoyable, purposeful education relies on a nuanced, thorough and collective understanding of both. Pedagogy involves the art, science, theories and values of teaching and how these interact with children’s learning and development. It should be informed by research evidence, but is also influenced by individual and collective values and goals. Assessment refers to the process of gathering and using information to pinpoint and advance children’s learning. It, too, should be guided by empirical evidence as part of a broader consideration of curriculum aspirations. This report weaves together the literature on pedagogy and assessment with the research on curriculum integration, identifying implications for teacher and learner agency in the process. It builds on the findings of Report 1.

Examining the Efficacy of Curriculum Integration

Curriculum integration is popular in policy and practice. Despite this, it is less commonly addressed in empirical research. Nonetheless, advantages of this approach can still be charted. Meta-analytic studies point to relatively strong evidence for the beneficial impacts of an integrated curriculum, particularly on literacy and, in some instances, numeracy. Individual studies on integration tend to be of relatively poor quality but signal the potential benefits for the affective dimensions of learning such as motivation, engagement and enjoyment. Many of the most robust studies of curriculum integration take place in particular contexts (e.g. in the United States) and with extensive supports for teachers (e.g. instructional programmes). More evidence is required to identify which forms of curriculum integration are comparatively more effective and if it is effective for learning beyond standardised measures for literacy and numeracy. Taken together, these findings suggest that curriculum integration is a worthy endeavour, but further research is required.

Pedagogy

Pedagogy, broadly conceptualised, involves a role for both the teacher and the learner. Many theoretical, conceptual and value-based perspectives influence pedagogy. These include the extent to which the learner is considered the ‘centre’, the influence of relationships, the role of dialogue and creativity, how diverse learners are included (and

their funds of knowledge embraced), and the extent to which pedagogy looks outward in a critical, democratic and socially just manner. Studies on teaching effectiveness signal the need to support teachers in becoming both deeply knowledgeable (e.g. subject knowledge; pedagogical content knowledge; knowledge of learners) and highly skilled (e.g. classroom management; modelling; questioning). The literature suggests that a research-informed repertoire of pedagogical approaches should be used to fulfil different purposes, learning outcomes and learning experiences. No one pedagogical approach should be privileged. This report reviews evidence on broadly applicable approaches including explicit teaching, play, project/problem/inquiry-based learning, scaffolding and technology-enhanced learning. All approaches can be applied in integrated contexts. Nuance and evidence is required to determine the most appropriate approach and simplistic messages about any approach should be avoided in professional communication and learning relating to the curriculum. The available evidence should guide curriculum messaging in this regard.

Assessment

Assessment is best considered the process of gathering information to make appropriate judgements about learners' progress. In the context of a classroom, this information can then support future learning. Adopting this approach affirms the role of assessment as an integral part of teaching and learning. Contemporary perspectives on pedagogy therefore also apply to assessment (e.g. culture, language) but include very specific issues such as those relating to authenticity, technology and inclusion. These considerations inform the design of purposeful, fair and reliable assessments. This ensures that valid inferences can be drawn about an individual's current learning and what 'next steps' should be taken. Effective assessment involves teachers drawing on a range of approaches. This report reviews the following approaches: classroom tests, feedback, observations, oral questioning/discussion, performance-based assessments, rubrics/shared success criteria, self-assessment, standardised assessments, and technology-facilitated assessments. All can play a role in assessing integrated units of learning. However, understanding how this can be done in classrooms that reflect learner agency while still upholding best practices for classroom assessment can be challenging.

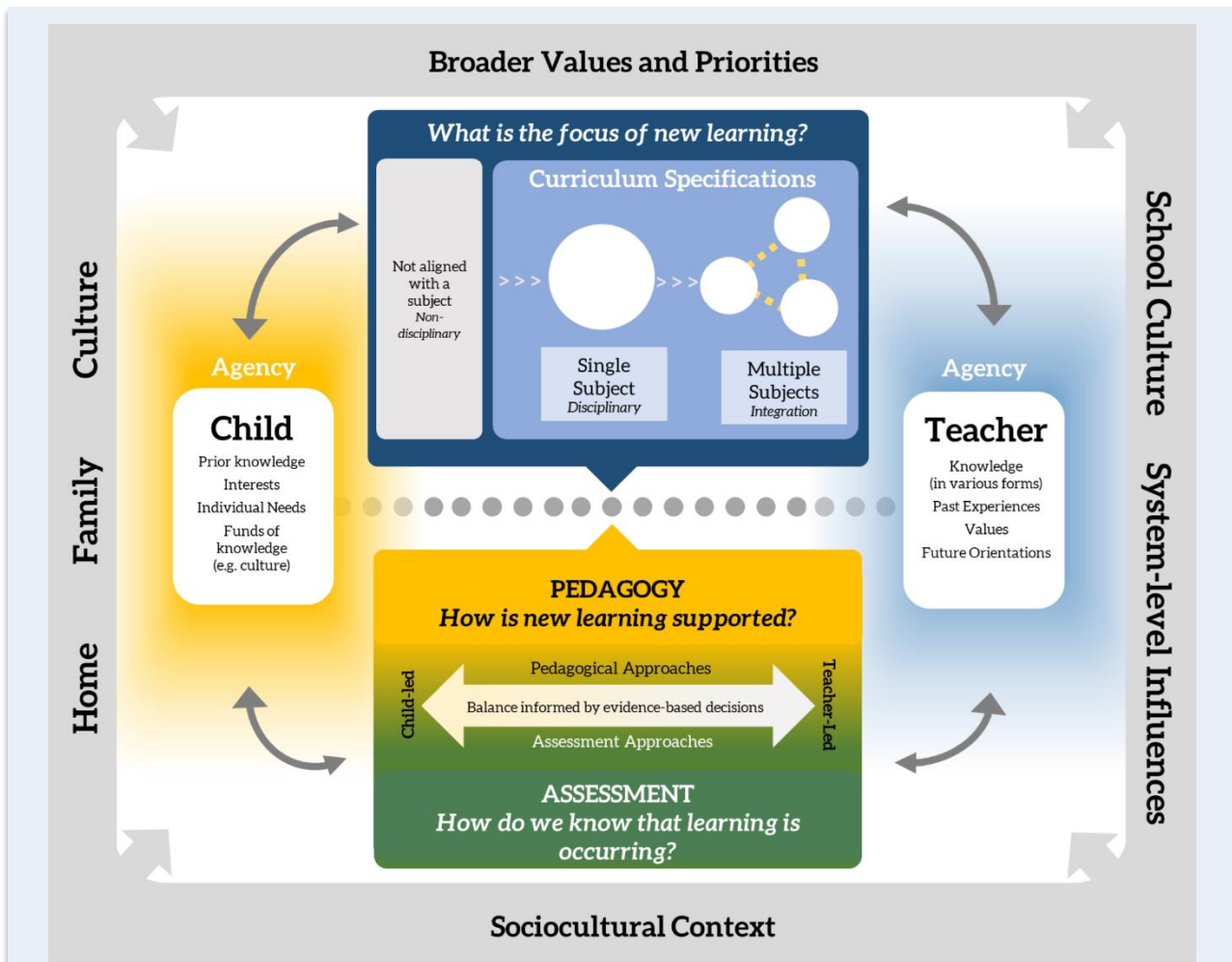
Weaving the Literature on Integration, Pedagogy and Assessment

Children's learning and development should be the foremost consideration when choosing whether or not to integrate, which pedagogical approaches should be used, and how progress can be assessed. When appropriate, curriculum integration that builds on

meaningful conceptual connections is a worthwhile exercise. These connections can take multiple forms, but a curriculum framework should go as far as possible in clearly explicating these connections for teachers. Many of the features of good pedagogy are in harmony with the literature on curriculum integration, including the focus on children's experience as a starting point for authentic learning. Principles of pedagogy - such as the need for fluency in explaining and modelling, the necessity of good relationships and the orchestration of well-organised classroom routines - apply for both integrated and non-integrated learning. Some pedagogical approaches are particularly common in the integration literature (e.g. inquiry), but all approaches, including those that are more teacher-led and child-led, can be applied to support integrated learning. It is necessary to note that tensions are evident when the features of good pedagogy and assessment are considered in the context of curriculum integration. The knowledge demands for teachers are more extensive; deep insights relating to all curriculum areas are needed if integration is to be both balanced and genuinely supportive of conceptual development in multiple domains. Structuring and sequencing learning - a core requirement of effective pedagogy - is likely to be considerably more complex. Assessing integrated learning is a more challenging task given that most empirical studies assess one subject or discipline despite multiple disciplines being involved. This difficulty in aligning assessment approaches with integrated teaching can make the design of purposeful, reliable, fair and valuable feedback a demanding task for teachers. However, if teachers have the flexibility and prerequisite knowledge to draw on a range of assessment approaches and use them as appropriate for the learners, the utility of assessment in supporting learning can be maintained.

Moving Forward

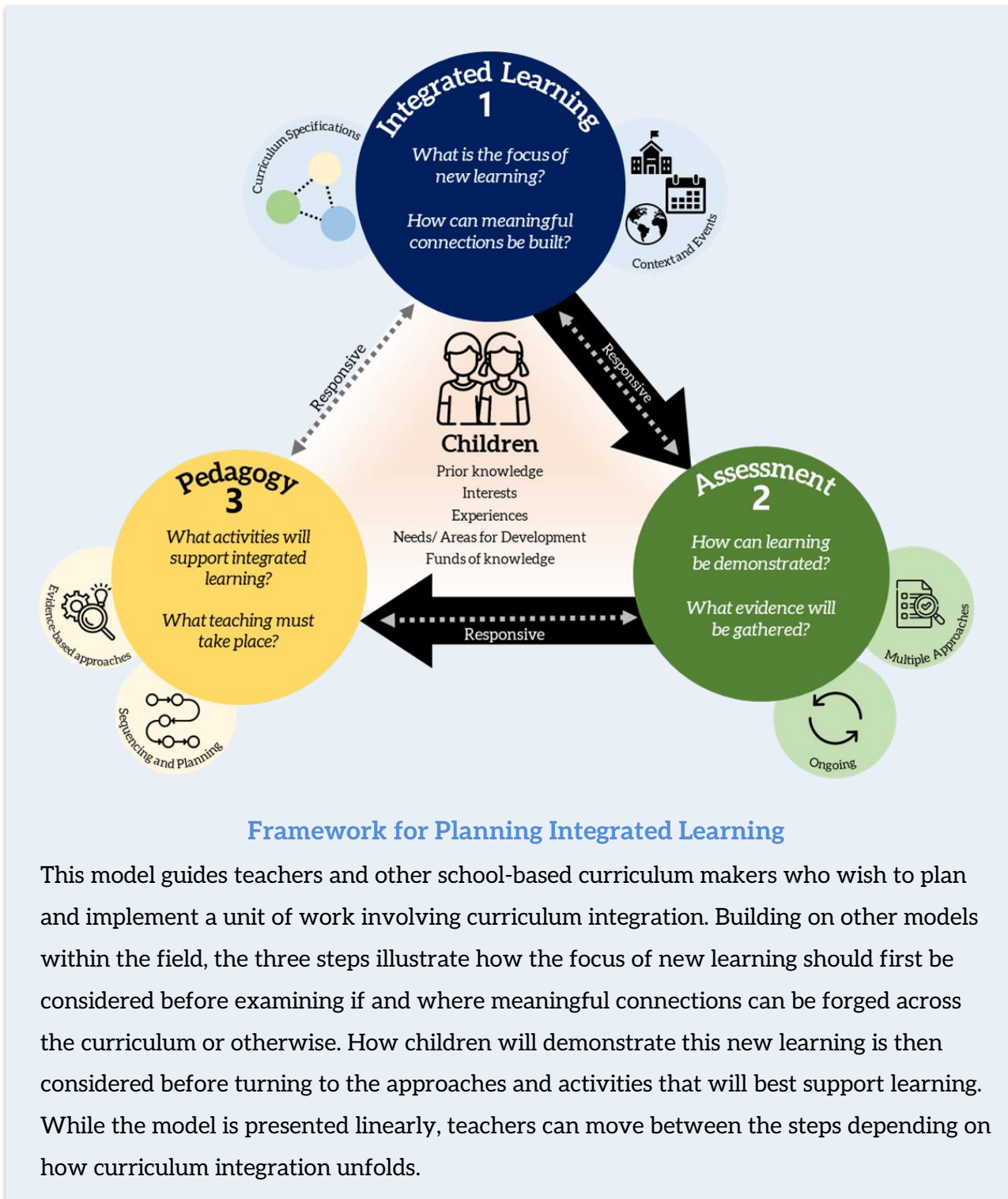
The accompanying visual summaries first outline a conceptual framework of the relationships between curriculum integration, pedagogy and assessment. They also outline a planning framework for curriculum integration that is recursive and which builds on children's prior knowledge, interests, experiences, areas for development and funds of knowledge. These frameworks may support school-based curriculum making, but significant attention needs to be given to the clear explication of potential conceptual connections within the curriculum framework and the provision of appropriate planning supports and examples. Attention must also be afforded to the development of teacher knowledge relating to the evidence base for various pedagogical and assessment approaches and understandings of child agency. Systematic piloting and additional research on how integration, pedagogy and assessment are linked in Irish classrooms is warranted in advance of wider scale implementation of a redeveloped curriculum.

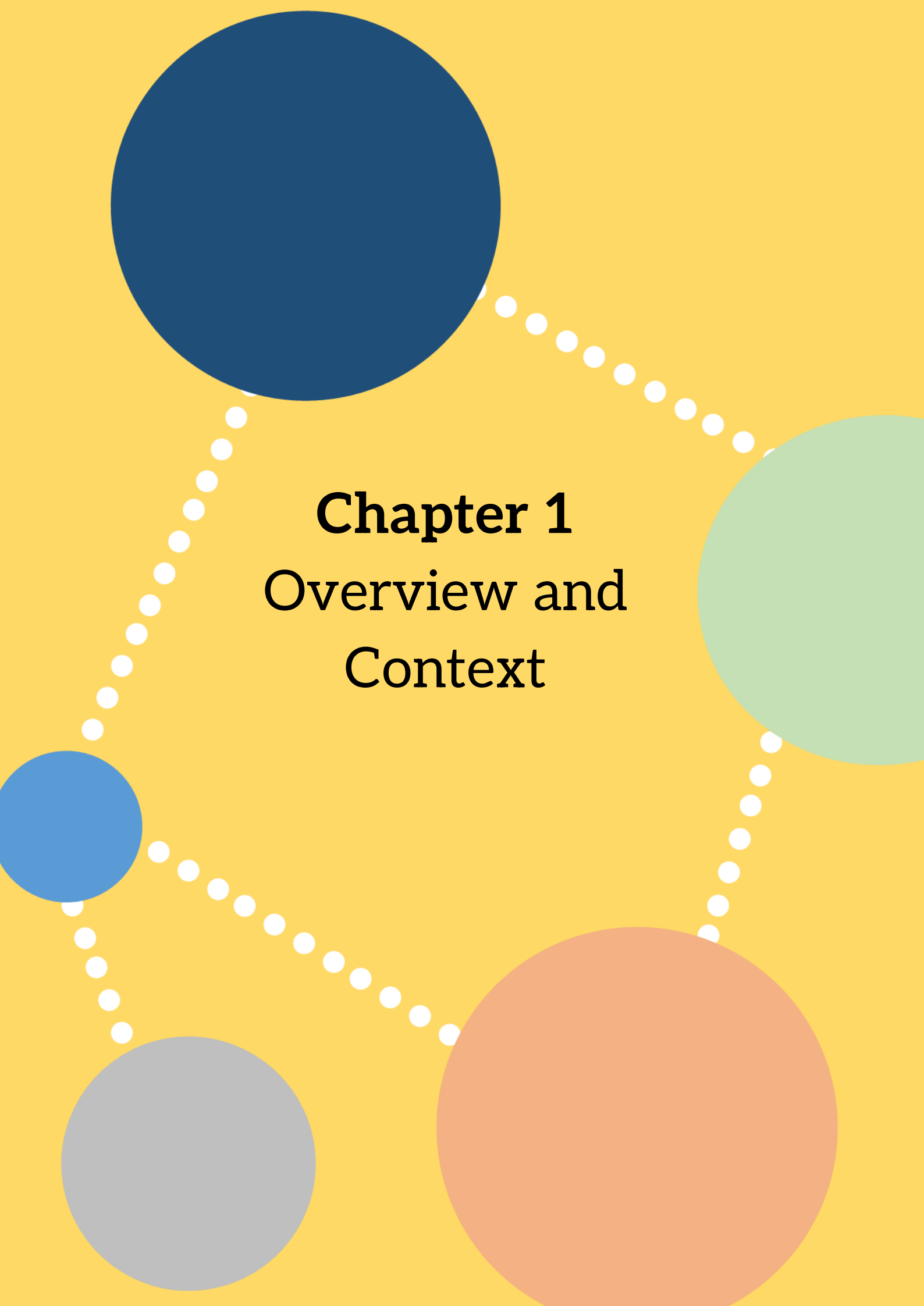


Conceptual Framework

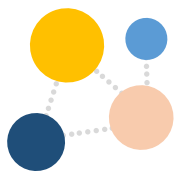
A conceptual framework demonstrating the relationships between integration, pedagogy and assessment was constructed based on the literature reviewed for Report 1 and Report 2. This framework also acknowledges that broad influences (e.g. Home, School Culture) can affect how the key actors in a classroom (teachers, children) exercise their agency. It is important to recognise that this framework aims to represent the proposed associations between the concepts examined in these reports. It is not meant to contain all of the possible factors that affect the work of teachers in classrooms, nor is it meant to be used as a guide to inform their day-to-day work.





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Chapter 1
Overview and
Context



Chapter 1

Overview and Context

The curriculum represents “the totality of experiences” of learners (Kelly, 2009, p. 15). Very little of what learners experience in the classroom is not bound by the concepts of pedagogy and assessment in some way. Through them, the richly woven tapestry of curriculum is enacted and enlivened. Teasing out the threads of pedagogy and assessment is a complex task. Teasing them out in the context of an integrated curriculum, while also affording due attention to teacher and child agency, is all the more complex. Bearing these intricacies in mind, this report aims to unravel the literature on pedagogy and assessment, building on the synthesis of literature on curriculum integration provided in Report 1¹.

The report is informed by the following research questions:

- *What does the literature say about the relationship between Integration, Pedagogy and Assessment?*
 - *Pedagogy: What approaches and considerations should inform a redeveloped primary school curriculum? How can these be enacted in an integrated context?*
 - *Assessment: What approaches and considerations should inform a redeveloped primary school curriculum? How can these be enacted in an integrated context?*
- *What are the associations or interdependencies between Integration, Pedagogy and Assessment in practice? What are the implications for child agency and teacher agency?*

This chapter provides an overview of key issues and the structure of this report.

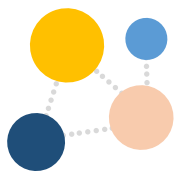
Pedagogy refers to the art, science, theories and values of teaching and how these interact with children’s learning and development (see Chapter 3 for more). As noted by Alexander (2010, p. 307):

Pedagogy is the heart of the enterprise. It gives life to educational aims and values, lifts the curriculum from the printed page, mediates learning and knowing, engages, inspires and empowers learners - or, sadly, may fail to do so.

What is considered ‘effective’ pedagogy is the subject of extensive debate. Indeed, some query if it is wise or even possible to spell out principles of generally effective pedagogy (Biesta, 2015; Bogotch et al., 2007). Evidence-based pedagogy has received significant attention in teaching, research and scholarly circles in recent years. Yet, pedagogical

¹ Burke, P. & Lehane, P. (2023). *Conceptualising curriculum integration: A synthesis of theory, research and practice*. National Council for Curriculum and Assessment. This report should also be consulted for the underpinning literature on teacher and learner agency.





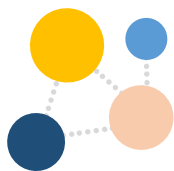
principles embraced by some are scorned by others. Though theorists such as Dewey greatly influenced child-centred pedagogical practice in Ireland and internationally in the past 100 years (Ávila et al., 2022; Ring et al., 2018), this vision is not accepted universally or unquestioningly. Constructivist learning principles advanced by Piaget and Vygotsky have proven influential in research, policy and practice in education, but the implications of their theories for teaching are not always accepted or understood (Kirschner, 2009; Tobias, 2009). Broad definitions of pedagogy afford central importance to the role of assessment. However, assessment is often a poor relation in research and practice. This is problematic. Pedagogy without assessment “can at best provide only a partial explanation of what is going on” (Black & Wiliam, 2018, p. 555).

Teaching is the subject of commonly shared maxims that may not bear out in practice or empirical research. That almost all teachers-to-be (and adults more generally) have spent a significant portion of their lives observing teachers as students can give rise to simplistic and difficult to change theories on how teaching works (commonly referred to as the *apprenticeship of observation*; Lortie, 1975). Hypotheses around good teaching in the 21st century can easily - and erroneously - take hold. For example, the idea that there is no longer any need to teach factual knowledge because we can ‘just look things up’ does not stand up to close scrutiny (Christodoulou, 2014; Willingham, 2009). Approaches that gain currency, such as learning styles, fail to demonstrate any benefit in empirical tests (Pashler et al., 2008). Children and teachers deserve a curriculum that is grounded in robustly debated - and, insofar as it is possible, shared - theories and values. It should also be informed by high-quality research evidence. This report seeks to synthesise important evidence on pedagogy while also attending to its implications for curriculum integration, teacher agency and child agency.

What can be considered ‘reliable’ evidence in educational research is debated. In line with other recent reviews in the Irish context (see Kennedy et al., 2023), this report affords particular attention to the evidence provided by meta-analyses and systematic reviews. These forms of research aim to identify and synthesise the findings of multiple single studies to facilitate the “translation” of knowledge to policy or practice (White, 2019, p. 4). Summarising the major findings and potential moderators² within a single study is a powerful and efficient way to understand how effective a particular practice is. However, ‘averaging out’ the effects of many studies results in a high degree of abstraction. This can make it difficult for them to yield “meaningful findings” that teachers

² These are factors that can influence the impact of a practice e.g. age, subject (Field, 2017).





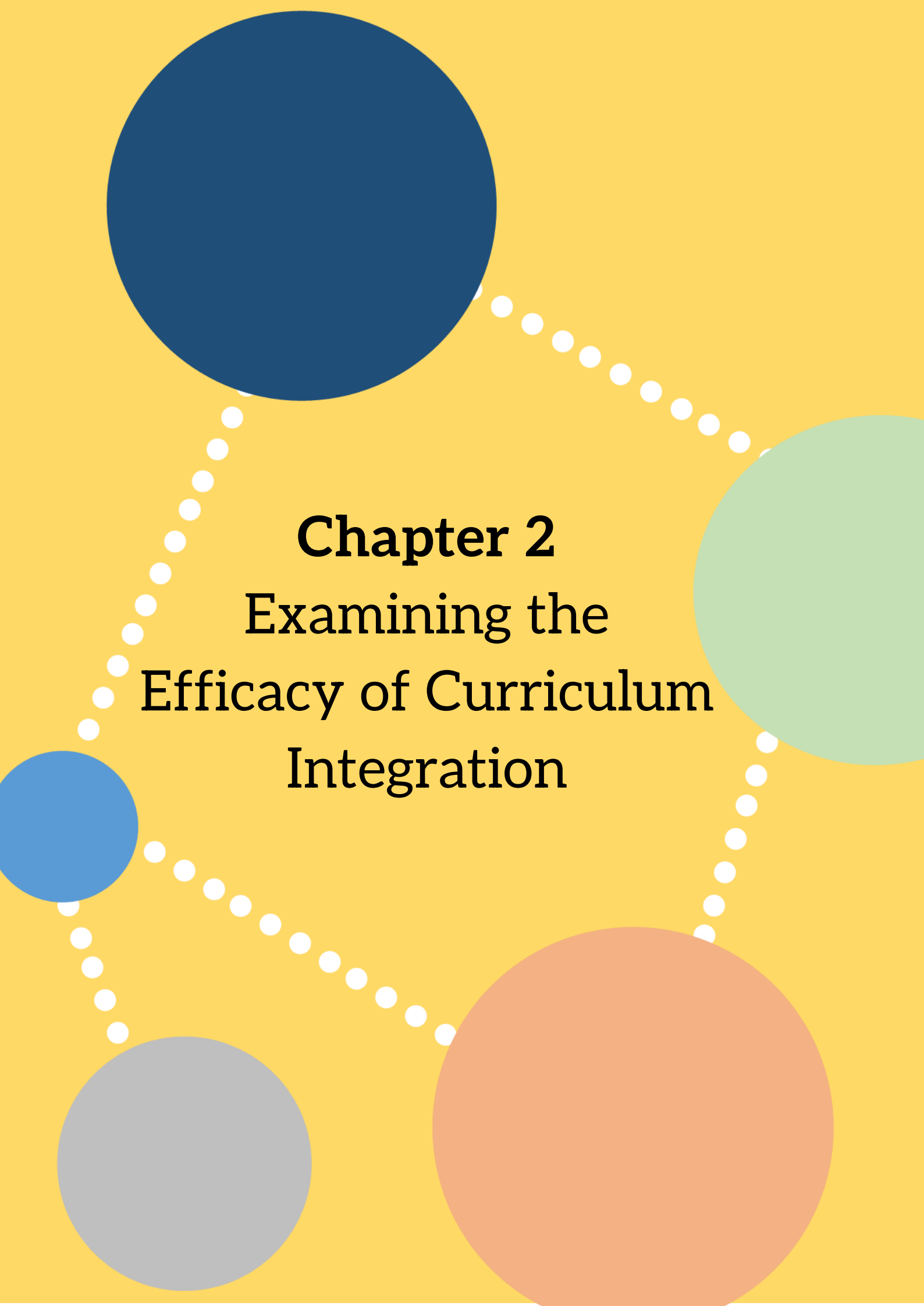
can apply to their specific classrooms (William, 2016, p. 96/97). Furthermore, depending on the analysis decisions of the researchers, simple summaries of a broad field of research can fail to take into account other variables, in particular out-of-school ones, that may account for the success or otherwise of some of their included studies e.g. family dynamics, school resources (Snook et al., 2009). Therefore, meta-analytic findings should be “treated cautiously, but taken seriously” (Higgins & Katsipataki, 2016, p. 237). Even with robust findings from large-scale reviews, local interpretation is required. Evidence-based practice involves the intersection of three components: (i) strong research evidence; (ii) teacher wisdom and skills and (iii) school and community culture (Hornby & Greaves, 2022). Although it is important, the evidence base for practice is not the only consideration of teachers and curriculum-makers. *How* research evidence should be used extends to questions about the value and purpose of education. In criticising the over-reliance on ‘evidence’ for educational decision-making and calling, instead, for value-based education, Biesta (2010, p. 493) notes that:

Calling the idea of value-based education an alternative, is not meant to suggest that evidence plays no role at all in value-based education but is to highlight that its role is subordinate to the values that constitute practices as educational practices

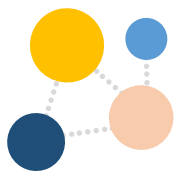
Our focus in this report is research evidence. We entrust broader debates about the values underpinning the curriculum to education partners and consultative processes.

To the best of our knowledge, and after extensive consultation with the extant literature, no empirical study adequately addresses each of the concepts of integration, pedagogy, assessment, teacher and child agency. It is not uncommon that a study might describe how two subjects are integrated, with brief pedagogical descriptions, while completely ignoring assessment and agency. Therefore, a bespoke methodological and analytic process was followed to conceptualise their inter-relationships. Chapter 2 provides a direct examination of the effectiveness of integrated curriculum for advancing children’s learning. Chapter 3 offers contemporary considerations for pedagogy in a general sense before examining in Chapter 4 multiple strands of evidence (e.g. theoretical literature, effectiveness studies, and review papers) regarding its efficacy and application. Chapters 5 and 6 adopt a similar approach concerning assessment methods. Chapter 7 provides a synthesis that juxtaposes the conceptualisations of pedagogy and assessment with what is known about curriculum integration, to identify synergies, tensions and possible steps forward. It also outlines potential implications for teacher and learner agency and proposes a model for planning and enacting pedagogy and assessment in an integrated curriculum.



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Chapter 2
Examining the
Efficacy of Curriculum
Integration



Chapter 2

Examining the Efficacy of Curriculum Integration

Introduction

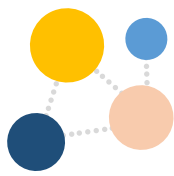
Proponents of curriculum integration laud its potential to provide authentic learning opportunities that connect discrete pieces of knowledge with each other and with children's lives. In this pursuit, curriculum integration can take on many varying manifestations, as detailed in the systematic review conducted for Report 1. Studies ranging from small action research projects to large scale quantitative analyses informed the previous synthesis of curriculum integration conceptualisations. However, it is important, at this juncture, to more specifically address the evidence base for curriculum integration: to what extent does it support children's learning? How reliable is this evidence? Building on the conclusions arising from Report 1, this chapter addresses these questions directly. This will be completed by analysing the sub-sample of Report 1 studies that specifically measured learning outcomes and by referring to other evidence reviews on the topic of curriculum integration.

Integrated Curriculum Programmes: Evidence from Meta-Analytic Studies

Following the increased interest in curriculum integration in the 1990s, two meta-analyses on curriculum integration were published in the early 2000s. These reviews documented the benefits of curriculum integration for a range of different learning outcomes. Meta-analyses conducted by Hartzler (2000) and Hurley (2001) in the United States provided some early evidence on the potential of curriculum integration to support learning. Hartzler's (2000) doctoral work investigated 30 studies that used an integrated curriculum and found differences in the magnitude of effects by subject, e.g. science ($d=0.61$), language arts ($d=0.42$)³. Thirteen of the studies involved learners in elementary classrooms. Overall, based on outcomes in cognitive and academic tests, an integrated curriculum was found to be significantly beneficial for learners with a large effect size noted ($d=0.56$). Hurley's (2001) work focused on integrated science and mathematics programmes across 31 studies. While positive outcomes were noted overall, the effects of an integrated curriculum on learning were higher in mathematics ($d=0.37$) than in science ($d=0.27$). The author concluded that integrating mathematics into science could benefit science, but the benefits for mathematics were likely tempered by how well teachers

³ Please see the note for the reader for an explanation of effect sizes on page 1.



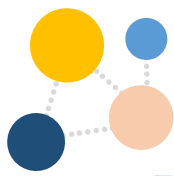


sequenced their instruction⁴. A more recent meta-analysis conducted by Hwang et al. (2021) analysed 35 experimental and quasi-experimental studies including literacy integration in elementary settings. These studies involved either integration with science, social studies or both. The researchers concluded that this form of integration had a large positive effect on vocabulary learning ($g=0.91$) and reading comprehension ($g=0.40$). Importantly, the analysis also demonstrated benefits for content-area learning ($g=0.89$). These findings indicate that integrated literacy and content-area instruction has the potential to expand vocabulary and enhance comprehension among primary-aged learners while also cultivating science and social studies knowledge.

The above studies offer some positive evidence in favour of integration on academic learning. Nevertheless, certain limitations should be acknowledged as they offer the context necessary for more appropriate interpretations. Most significantly, all of the studies cited were based on research conducted in the United States. Education within this country is highly decentralised and educational provision varies greatly from state to state. Therefore, it is challenging to understand if and when their findings can be applied to other countries or districts. While all the meta-analyses considered here were robust, they have some shortcomings. In Hurley's (2001) case, only a small number of studies involving elementary-aged learners were included ($n=7$) and not all of these reported the effect sizes necessary for a meta-analysis. Therefore, the findings for this study are more likely to be relevant for older learners. In Hartzler's (2000) review, several of the studies explored the integration of multiple subjects. However, the learning outcomes related to each subject were not always evaluated. Therefore, the extent or limits of learner achievement across *all* of the subjects involved in integration is difficult to determine. Furthermore, it appeared that highly structured programs devised by government or university bodies were found to be more effective by Hartzler (2000) than those initiated at a more local level by schools or teachers. The barriers to curriculum integration noted in Report 1 (e.g. time involved to prepare; the necessity for clear exemplar materials; teacher knowledge of how to integrate) were largely circumvented by the provision of detailed instructional programmes. In relation to Hwang et al. (2021), moderator analyses could not be conducted, which limits our understanding of *why* their findings emerged. Despite these limitations, the above studies provide a helpful overview of the evidence on curriculum integration.

⁴ Hattie's (2023) synthesis of these two meta-analyses ($n=61$ studies) resulted in an effect size of 0.39, indicating that curriculum integration can be a moderately effective practice in terms of academic outcomes. Hattie (2023) states that the evidence underlying this effect size is relatively robust; it received a rating of '3' in Hattie's (2023) five-point robustness scale where one is 'low' and five is 'high'.





Examining Learner Outcomes in Curriculum Integration

To determine what inferences can be drawn from more recent studies on curriculum integration, intervention studies from Report 1 were identified⁵. These studies all reported empirical research that involved single-case or group research designs that evaluated the impact of curriculum integration on learners using some outcome measure, e.g. academic, cognitive, motivational-affective⁶. Of the 211 studies from Report 1, 53 met this criterion. Five more studies were added to this list for closer examination: (Chand O'Neal, 2017; Harris, 2019; O'Neal, 2017; Schugar & Dreher, 2017; Smith-Gayle, 2014). These studies all engaged in secondary analyses of data derived from large-scale assessments (e.g. Programme for International Student Assessments [PISA]; National Assessment of Educational Progress [NAEP]) to investigate what role curriculum integration may have had on learner achievement. The authors considered these to be highly relevant to the overall goals of this chapter. The studies have been named in **Table 1** and are fully described in **Section 1** of the **Annex for Report 2**.

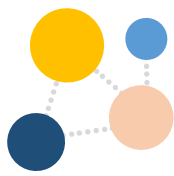
Table 1 Intervention Studies by First Author

Name (Year)	Name (Year)	Name (Year)	Name (Year)
Akbar (2012)	Cervetti (2012)	Inoa (2014)	Saraniero (2014)
Alghamdi (2017)	Chand O'Neal (2017)	Jia (2021)	Schugar (2017)
An (2014)	Cotič (2021)	Lamb (2015)	Smith (2016)
An (2013)	Cunnington (2014)	LaMotte (2018)	Smith-Gayle (2014)
Atalay (2015)	Doyle (2014)	Luna (2015)	Snyder (2014)
Bergen-Cico (2015)	Duke (2021)	Luo (2022)	Swan (2013)
Birsa (2018)	Fazio (2019)	Makopoulou (2020)	Talbert (2019)
Bravo (2014)	Feldwisch (2014)	Miller (2019)	Tank (2014)
Brugar (2012)	Frankel (2015)	O'Neal (2017)	Tucker (2017)
Bryant (2012)	Graham (2016)	Panagopulos (2015)	Vallera (2015)
Byrd (2019)	Gray (2022)	Peppler (2014)	van't Hooft (2012)
Cannon-Ruffo (2020)	Hardiman (2019)	Robinson (2021)	Volk (2017)
Casady (2015)	Harris (2019)	Sáez-López (2016)	White (2014)
Cecchini (2020)	Hraste (2018)	Samuels (2019)	Wright (2017)
		Santaolalla (2020)	Zhang (2012)

⁵ Please refer to Chapter 3 of Report 1 for specific details as to how these studies were initially identified and the potential limitations associated with the systematic review procedures followed.

⁶ In this review, the authors defined cognitive outcomes as those mental processes that are developed through learning (e.g., working memory, decision making, sustained attention, spatial awareness; e.g. Barz et al., 2023). Academic outcomes refer to knowledge and skills that are acquired through formal education such as reading, writing and mathematics (e.g. Rapport et al., 2013). Many outcomes can be classified as motivational-affective (e.g. Lesperance et al., 2022). For this review, such outcomes usually refer to learners' perceptions or their feelings (of enjoyment, motivation etc.).



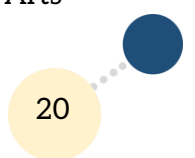


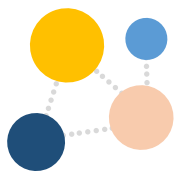
As illustrated by Section 1 of the Annex, a range of research designs were used to gather evidence on the impact of curriculum integration on learner outcomes. As this adds a layer of complication to the synthesis of the above studies' findings, an illustrative approach will be undertaken to offer some potential insights into the influence of curriculum integration on learning. The cognitive, academic and motivational-affective outcomes of the studies in Table 1 will now be summarised and considered.

Cognitive and Academic Outcomes

The majority of the studies reviewed evaluated the impact of curriculum integration using academic, school-related measures (e.g. literacy scores) or cognitive measures commonly used in psychological testing (e.g. visuospatial skills). The findings on cognitive and academic measures were somewhat mixed. Further analysis of these studies indicated that the impact of curriculum integration on learner outcomes also varied across ages, learner groups and subjects. Chand O'Neal's (2017) longitudinal study compared 4th/5th-grade learners' performance on standardised tests for English reading and mathematics across two school types in the United States: students in schools using an arts-integrated programme of instruction ($n=552$) and learners in schools using non-integrated teaching methods ($n=194$). No statistically significant differences were found in standardised test scores between the two non-randomised groups. Interestingly, and despite the fact that arts-integration was the integration form of choice, no measures of achievement in relation to arts subjects were gathered. Similarly, Smith-Gayle's (2014) doctoral research (also conducted in the United States) involving a secondary analysis of English Language Arts test scores ($n=3448$) also found no differences in the performance of middle-school-aged boys taught with an integrated curriculum than those taught with a traditional curriculum. Using a similar research design and methodology, doctoral research by Harris (2019) also used fourth graders' performance on standardised tests of ELA, maths and science to evaluate an integrated-interdisciplinary approach to teaching curriculum over a three-year period involving 100 schools in New Jersey. In contrast to the two previous studies, this author noted some positive effects for curriculum integration. This study found that the influence of an integrated-interdisciplinary curriculum ($n=50$ schools) over time shows a slight increase in scores for language arts and mathematics, but a slight decrease in science scores. It is worth acknowledging that while these studies do not show that integration automatically improves performance on traditional assessments, they also demonstrate that they do not have a negative impact.

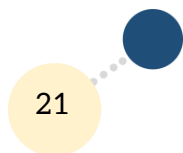
In their multi-stage cluster randomised trial, Inoa et al. (2014) investigated the impact of arts-integrated instruction on scores in standardised state English Language Arts

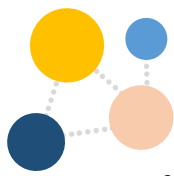




and mathematics tests. At the sixth-grade level, students in the arts integration group were significantly more likely to reach proficiency in state mathematics assessments but not in language arts; there was a significant difference in mean scores for literacy. In contrast, there were no significant findings at the seventh-grade level. Panagopulos (2015) found that mean reading change scores for the Maryland School Assessment of Reading showed that learners in arts-integrated schools significantly outperformed non arts-integrated schools only during the year they were in grade 3. While it was not statistically significant, they also found that using arts-integrated instruction had a particularly positive impact on literacy test scores for students from low socioeconomic backgrounds (as defined by their access to free and reduced meal benefits). From these single-study examples, it appears possible that arts-integrated instruction may support progress in literacy (and numeracy) but for what age group it is most optimised for is difficult to ascertain. Lamb et al.'s (2015) work from the field of STEM provides an interesting lens from which to analyse the inconsistencies that seem to emerge regarding the value of integrated instruction. While, overall, they found no difference in the content learned by those who did or did not participate in integrated instruction, an interaction effect was noted in measures of mental rotation and spatial folding. Post hoc tests indicated that the majority of the differences between the control and comparison groups happened in the 2nd or 5th grade, causing the authors to suggest that, based on some of the large effect sizes calculated, that access to STEM education at earlier ages can have 'pay-off' at later stages.

Stronger evidence emerges from single studies involving curriculum integration. Many of these studies demonstrated that embedding literacy throughout the curriculum benefits learning in the subjects with which it is integrated (see Casady, 2015; Cervetti et al., 2012; Cunnington et al., 2014; Duke et al., 2021; Fazio & Gallagher, 2019; Frankel et al., 2015; Talbert, 2019; Van't Hooft et al., 2012). For example, a convenience sample of forty-eight 2nd grade teachers and their learners were involved in Duke et al.'s (2021) study examination of literacy integration with social studies units. Classes that were randomly assigned to the experimental group scored significantly higher on researcher-designed measures of social studies knowledge (ES=0.48) and informational reading (ES=0.18). The authors of this study draw particular attention to the moderate and large effect sizes that were calculated. There was no significant difference in informational writing. Duke et al. (2021) indicated that teachers who enacted the integrated units with higher measures of fidelity resulted in improved scores on all pre-post tests: social studies (ES=0.27), reading (ES=0.58) and writing (ES=0.23). In contrast, Gray et al. (2022) found





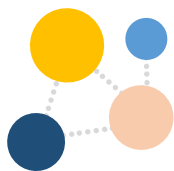
that the integrated science/literacy programme deployed by kindergarten teachers in their multi-site cluster-randomised control trial only positively impacted literacy measures associated with reading comprehension. Measures related to changes to science knowledge indicated no difference. However, not all literacy measures were positively impacted (e.g. word attack, word identification). Gray et al. (2022) did note that fidelity of implementation had varying effects on their measures. It must be recognised that the instructional support provided to teachers in the experimental group for both Duke et al. (2021) and Gray et al.'s (2022) research was significant.

To summarise, the previous studies appeared to find some evidence to demonstrate that curriculum integration can support learning. Disciplines and subjects that were most commonly involved in integration involved the arts (e.g. music and mathematics) and literacy (e.g. literacy and art, literacy and science). Those studies that involved programmes of literacy integration had some of the most robust evidence for the value of integration. However, the value of integration on learning in other subjects is less clear.

Motivational-Affective Outcomes

Some of the studies also evaluated the impact of curriculum integration in relation to common motivational-affective outcomes such as learner enjoyment, satisfaction, motivation or self-efficacy. Most of these outcomes were positive with some minor exceptions. A number of studies involving literacy integration reported the benefits for learner engagement or their reported levels of enjoyment (e.g. Brugar, 2012; Casady, 2015). Sáez-López et al. (2016) analysed the potential benefits that coding with a visual programming language (*Scratch*) may have on learners' affective and academic functioning when integrated with science- and art-based subjects. The study occurred over two years, where learners participated in 20 one-hour coding sessions integrated with science and art concepts. The responses of 107 5th-grade learners to a researcher-designed questionnaire revealed that this instructional approach cultivated “fun, motivation, enthusiasm, and commitment” (Sáez-López et al., 2016, p. 139). Only minor exceptions to the enjoyment that learners experienced in integrated learning programmes were noted (e.g. Bergen-Cico et al., 2015). Positive impacts were particularly noted for affective outcomes in arts-integration studies (Samuels, 2019). In Feldwisch et al.'s (2014) study, teachers reported that their students were highly engaged in arts-integrated lessons as evidenced by increased eye contact and decreased off-topic talk. Students also regularly reported enjoying learning through arts-integrated techniques with one study noting increased motivation for learning with these techniques (see Birsa, 2018).





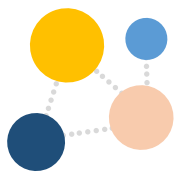
In China, Jia et al. (2021) employed an experimental approach to examine the impact of a novel unit of work aligned with STEAM education's interdisciplinary principles on learners' motivation, self-efficacy, and acquisition of interdisciplinary knowledge. Using an adapted version of a previously validated instrument, the authors found that the scores for the motivation dimensions of attention, relevance, and satisfaction were all >3 (where 5 is the highest score), indicating that learners were motivated to complete STEAM tasks. Learners' levels of self-efficacy to complete integrated STEAM tasks had significantly increased by the end of the intervention. Lamb et al. (2015) found that the 111 kindergarteners, 2nd graders and 5th graders who experienced an integrated STEM unit performed better than the 143 learners who experienced a more traditional, siloed approach to instruction on measures of self-efficacy ($d=1.27$) and science interest ($d=1.97$). Robinson et al. (2021) explored how an integrated STEM teaching model influenced 5th-grade learners' perceptions of their mathematics and engineering abilities. The teaching model used a 'real life' issue (access to clean water) as a learning context. Quantitative data indicated a decrease in mathematics self-efficacy but an improvement in perceived mathematics usefulness from mid-unit to post-unit. There was no statistically significant change in learners' engineering self-efficacy scores throughout the intervention. Previous experiences with mathematics appeared to influence learners' overall progress towards higher levels of self-efficacy. The authors assert that integrated teaching approaches can foster 'positive shifts' in learners' perceived STEM abilities but that past experiences with a subject/discipline in STEM may have a moderating influence.

Study Limitations

As outlined in Report 1, the methodological quality of these studies was assessed in a global manner, rather than using a specific checklist. Nevertheless, study limitations were outlined to assist the interpretation of findings (see Section 1 of Annex 2). In considering the above findings, the following limitations of the reviewed studies should be borne in mind:

- Overall, few studies had high levels of methodological rigour. For example, many studies were underpowered (e.g. Bryant, 2012) due to sampling issues. This means that probability errors may have affected the statistical analyses undertaken.
- The majority of studies relied heavily on researcher-designed materials (e.g. Luna et al., 2015; Tucker, 2017; Zhang & Campbell, 2012). The quality of these outcome measures were often difficult to determine and, therefore, may have been heavily susceptible to researcher-biases. However, studies that used more

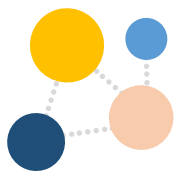




psychometrically reliable measures (e.g. Gray et al., 2022; Pepler et al., 2014; Wright & Gotwals, 2017) should not be automatically considered superior. Such studies assume that these tests are a viable form of assessing learner progress or achievement in general and after experiencing an integrated curriculum. The former is not a foregone conclusion in educational circles (see O'Leary et al., 2019; Murchan & Shiel, 2017) and the latter has not been sufficiently researched.

- Only a handful of studies gathered data that examined the long-term effects of curriculum integration (e.g. Hardiman et al., 2017). Consequently, it is unclear as to how long any potential positive effects of curriculum integration may last. For example, it is possible then that as the 'novelty' of curriculum integration wears off, a decline in positive motivational-affective learner outcomes may emerge. The alternative (that the benefits of curriculum integration emerge in the long term) may also be true.
- While some studies did report details on the intensity, fidelity and duration of the interventions for those studies contained within Table 1 (e.g. Alghamdi, 2017; Atalay & Kahveci, 2015; Bergen-Cico et al., 2015), they were not always clear (e.g. Chand O'Neal, 2017). These are crucial factors to consider when interpreting a study's results as intervention intensity and implementation can cause heightened effects that may not reflect reality or support generalisability. For example, in some studies teachers implementing an integrated curriculum were supported by 'outside' experts who had devised highly specific programmes of curriculum integration (e.g. Cunnington et al., 2014; Duke et al., 2021). These instructional materials and supports did much of the 'heavy-lifting' in figuring out curricular connections for teachers.
- Most of the studies cited in Table 1 were conducted in the United States. This is a highly specific educational context which, again, may limit the generalisability of the findings.
- Diversity in the operational definitions used for curriculum integration also makes it difficult to compare studies. Some studies considered integration from using an interdisciplinary perspective (e.g. An et al., 2014) whereas others adopted a transdisciplinary approach (e.g. Tank, 2014). Therefore, it is difficult to fully understand what forms of integration appeared to have the most success with learners.
- A number of the studies were quasi-experimental in nature and did not involve the randomisation of learners (e.g. Tank, 2014; Volk et al., 2017). Therefore, in studies





that evaluated the impact of curriculum integration, it is possible that other possible explanations would account for a finding, e.g. participant maturation, background demographics.

Summary

- Previous meta-analytic reviews provided evidence for the positive impact of curriculum integration on standardised measures of literacy and numeracy, usually in the form of highly structured instructional programmes. The studies included in Report 1 paint a more mixed picture, with some studies reporting positive effects and others more neutral effects across a broader range of measures.
- Secondary analyses of larger data sets that examined the impact of curriculum integration on performance in standardised tests of literacy and numeracy found limited evidence to suggest that this approach can significantly improve achievement on these measures. However, it also did not seem to have a negative impact.
- Individual studies provide some of the most reliable evidence in favour of the impact curriculum integration can have on academic outcomes, usually in relation to literacy.
- Overall, curriculum integration appears to have the most positive and consistent impacts on affective learner outcomes e.g. self-efficacy, interest, satisfaction. This is a noteworthy finding that must be given due attention in the context of children's holistic development.
- It is difficult to determine what aspects or approaches to curriculum integration (e.g. interdisciplinary, arts-integrated etc.) appear best placed to support academic or affective learner outcomes.
- The measures used in studies of curriculum integration tend to be highly constrained, often paying little attention to subjects other than English/mathematics; there is, consequently, a dearth of evidence for the effect of integration on learning in disciplines represented across the curriculum.
- Significant methodological limitations (e.g. measures used, research designs, vague descriptions) mean that any conclusions drawn from these studies regarding the efficacy of curriculum integration should be very carefully stated.

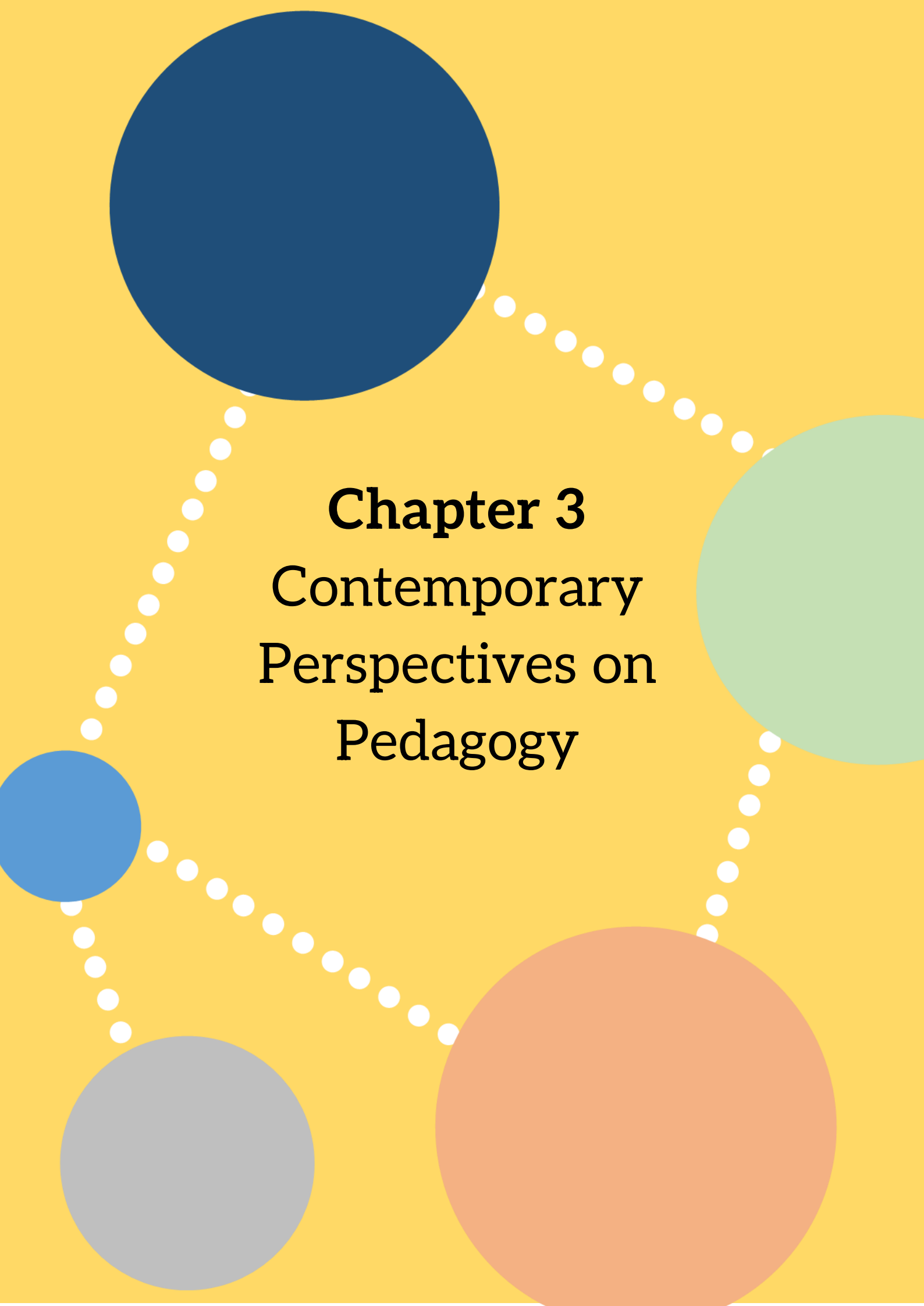
Conclusion

This chapter has outlined studies in which curriculum integration has proven successful, and instances in which more mixed results have been reported. There are

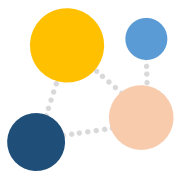


relatively consistent benefits for outcomes such as learner interest, but the research on academic outcomes paints a more complex picture. The methodological characteristics and limitations of the studies reviewed further complicate the interpretation of the research base. Further research is required to state what forms of integration and in what contexts it can be most beneficial for learners in terms of their academic learning or broader development. In deciding the degree to which integration is prioritised, curriculum design must balance the available evidence with wider priorities and values.





Chapter 3
Contemporary
Perspectives on
Pedagogy



Chapter 3

Contemporary Perspectives on Pedagogy

Introduction

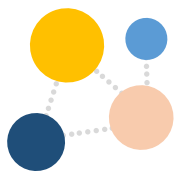
This chapter addresses important concepts that underpin classroom pedagogy. To do this, it draws on a wide range of theoretical, conceptual, and where relevant, empirical, literature. The chapter begins with broad accounts of what the term *pedagogy* means. It proceeds to outline important perspectives on pedagogy for both teachers and curriculum makers, including the necessity of certain cross-cutting practices (e.g. the role of dialogue in teaching and learning) and underpinning conditions (e.g. positive relationships). It also addresses broader considerations, such as the role of pedagogy in interrogating global and societal questions and the importance of inclusive and culturally sustaining practice.

What is 'pedagogy'?

Pedagogy can be defined in a variety of ways that vary in breadth and focus (Murphy, 2008). In a previous review for the NCCA, Volante (2018, p. 1) operationally defined pedagogy as “instructional techniques and strategies that enable ‘21st Century’ learning such as creativity, critical thinking, problem-solving, collaboration, and digital literacy to take place”. Others have proposed definitions that allow for broader interpretations. Notably, Alexander (2000) distinguished between teaching as an *act*, and pedagogy as the *wider discourse* that surrounds it, stating that pedagogy “encompasses the performance of teaching together with theories, beliefs, policies and controversies that inform and shape it” (p. 540). Its breadth is noted in the fact that Alexander’s conceptualisation of pedagogy *encapsulates* the concept of curriculum.

Pedagogy also captures the reciprocal link between teaching and learning, acknowledging the agency exerted by both actors in the educative relationship (Zyngier, 2016). Writing on pedagogy in the early years, Siraj-Blatchford (2014; 2002) draws on the work of Gage (1985) to define pedagogy as “instructional techniques and strategies which enable learning to take place and provide opportunities for the acquisition of knowledge, skills, attitudes and dispositions within a particular social and material context” (p. 28). Pedagogy is not static or perceived identically by all actors involved. In the context of curriculum reform, the three sociocultural features of pedagogy outlined by Nind and colleagues (2016) are particularly worthy of note:

- (i) pedagogy as *specified* (what might be indicated as an appropriate way to teach and learning a curriculum);



- (ii) pedagogy as enacted (how the educator “breathes life” [p. 11] into that which is specified) and;
- (iii) pedagogy as experienced (e.g. by learners).

Pedagogy involves how a teacher goes about teaching (and learners go about learning), but also the broader context and conditions in which this happens. It requires the consideration of the wider “history, values and ideas” that inform the act of teaching (Wyse et al., 2016, p. 3). As noted by Devine and McGillicuddy (2016, p. 440), pedagogy is “central to the translation of wider values and principles in practice, framing children’s identities and how ‘childhood’ is constructed and experienced”. Evidently, the term ‘pedagogy’ merits much unpacking.

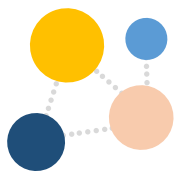
We interpret pedagogy as the practice and study of teaching and learning in the broadest sense. It involves the art, science, theories and values of teaching and how these interact with children’s learning and development. It is influenced by local, national and international factors that may or may not be obvious at any given moment in the cut and thrust of classroom life, but that nonetheless shape the experience of all therein. This chapter takes a wide-angle lens on pedagogy, but it is beyond the scope of the current review to fully examine the values and theories underpinning curriculum and teaching in the Irish context. We therefore encourage readers to consult previous papers published by the NCCA as part of the redevelopment of the primary curriculum (e.g. Irwin, 2018, on the values underpinning curriculum; Ring et al., 2018, on theories underpinning learning and development; Walsh, 2018, on broader curriculum trends and structure).

Contemporary Perspective on Pedagogy

This section addresses various perspectives on pedagogy. The specifics of particular pedagogical approaches (and their empirical research base) are given more attention in Chapter 4. Similarly, the specifics of fundamental teaching skills (e.g. questioning, modelling, classroom management) are also addressed in Chapter 4. Readers should note that capturing the full spectrum of views and nuances on the forthcoming concepts is a challenge the authors did not seek to undertake. Rather, this section provides an overview of various perspectives, in an effort to provide a broad canvas on which to paint a picture of contemporary pedagogy⁷.

⁷ The contemporary perspectives included in this chapter have been selected based on their relevance, feedback from peer reviewers and the researchers’ synthesis of *underpinning* principles that transcend any one given pedagogical approach (reviewed in chapter 4). We acknowledge that pedagogy can be characterised or catalogued in other ways. For example, the OECD provides a ‘compilation of innovative pedagogies’ including gamification, embodied learning, experiential learning, computational thinking, multi/critical literacies and blended learning. See: <https://www.oecd.org/education/ceri/innovative-pedagogies-for-powerful-learning-compilation-of-innovative-pedagogies.htm>





Child-centred

Child-centred approaches to education are regularly traced to Dewey (1900, p. 35), who wrote that in shifting the balance from traditional to more progressive pedagogy, the child becomes “the sun about which the appliances of education revolve; he is the center about which they are organized”. The philosophy that the child’s interests should be at the core of pedagogy have influenced curricula in Ireland since 1971. However, it is important to avoid overly-simplistic interpretations of what the term ‘child-centred’ means. As Irwin (2018, p. 13) notes, “too much emphasis on the child as such risks undermining the act of teaching, as well as the process of education itself”. This view is also echoed by Biesta (2022), who notes that pendulum swings between ‘child-centred’ and ‘curriculum-centred’ education are unproductive⁸.

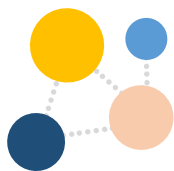
Considerations of child-centred pedagogy can be linked with children’s rights. The United Nations Convention on the Rights of the Child [UNCRC] (1989) recognises the child’s right to an education that is directed towards “the development of the child’s personality, talents and mental and physical abilities to their fullest potential”. More broadly, the UNCRC identifies that children will not be discriminated against (e.g. on the basis of race, language, religion, sex) and that they will have the right to have their views considered and afforded due weight in accordance with their age and maturity. Understanding, valuing and enacting pedagogic principles in line with these rights is a complex task. Writing on a study of teachers in Ireland, Devine and McGillicuddy (2016) identified potential mismatches between the thinking and values underpinning pedagogy, and what actually happens in the classroom, particularly as it relates to the social justice considerations. Furthermore, it is now acknowledged that giving children a ‘voice’ is not enough if it does not meaningfully impact decisions made about their experiences (Lundy, 2007). Children must have the *space* to offer a view, they must be *facilitated* to express this view, it must be heard by an appropriate *audience*, and the view should be *acted on*, where possible and appropriate (Lundy, 2007).

Relationships

Acknowledging the inherently social nature of education requires an attendant focus on relationships between all actors involved. A relational pedagogy is demonstrated by teachers “who are aware of and explicitly focus on the quality of their interactions with students to develop classroom communities that promote academic, social, and emotional growth” (Reeves, 2017, p. 86). Research on teacher-child relationships

⁸ Biesta (2022) argues for ‘world-centred’ education, which avoids this dichotomy.





highlights the significant positive influence that nurturing interactions can have on children's development, particularly for children classed as being 'at risk' (Osher et al., 2020; Pianta & Stuhlman, 2004). The inverse is also true; negative relationships are associated with poorer engagement and achievement (Roorda et al., 2011). The relationship between a teacher and child can also influence broader relationships. For example, negative interactions between a teacher and child have been found to harm a child's relationship with other children in the classroom (Endedijk et al., 2022; Hendrickx et al., 2017). The importance of relationships for pedagogy is reinforced by philosophical thinking (Sidorkin, 2000). For example, Noddings (2012) argues that an ethic of care should be a foundational component of educational practice. Classroom relationships are an important component of classroom climate, which has been found to impact a range of dimensions of development such as motivation, engagement and achievement (Wang et al., 2020). The importance of "positive, respectful, and nurturing" relationships as a feature of 'good' pedagogy has been noted by both children and teachers in Irish classrooms (Children's School Lives [CSL]; Devine et al., 2023, p.43).

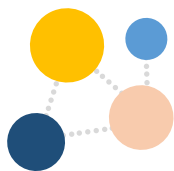
Dialogue

The importance of dialogue⁹ for children's learning is recognised across varying pedagogical approaches and philosophies. The importance of interactions, talk and language in advancing conceptual understanding is notable in sociocultural theory (Mercer, 2000; Vygotsky, 1978) and is a core feature of a range of pedagogical approaches reviewed later (e.g. play, inquiry-based learning). Various frameworks have been proposed to identify core features of a dialogic pedagogy. For example, Alexander (2018) emphasises five key dialogic principles:

- *Collective*: Teachers and children work in partnership to learn and inquire.
- *Reciprocal*: Classroom interactions foreground the sharing of ideas and viewpoints.
- *Supportive*: children feel that they can contribute without fear of retribution or embarrassment.
- *Cumulative*: Children's thoughts build on each other, leading to new understandings.
- *Purposeful*: Though there is freedom in contributions, clear learning goals guide the talk.

⁹ Dialogue is interpreted to include all forms of communication (including, for example, sign language), not just spoken language.





Other frameworks such as accountable talk (Resnick et al., 2018) emphasise similar principles. An emphasis on dialogue has been found to have a demonstrable impact on student learning. For example, Jay et al. (2017) investigated the impact of dialogic practice on learning in mathematics, English and science in a randomised controlled trial conducted with 4985 Year 5 pupils in England. Additional gains of two months' progress were reported across each subject, while qualitative data signalled improvements in the quality and quantity of learner talk. The teacher has a crucial role in orchestrating meaningful and purposeful talk to bolster learning across the curriculum (Webb, 2009), while also 'stepping back' and avoiding the initiation-response-evaluation pattern associated with closed questioning and limited meaningful contributions from children.

Creative Pedagogy

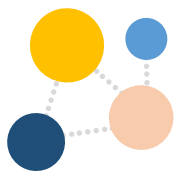
Creative pedagogy has been described as “both the imaginative and innovative arrangement of curricula and teaching strategies in school classrooms and the development of students' creative capacities” (Dezuanni & Jetnikoff, 2011, p. 264). The imaginative dimension has been framed as a prerequisite of pedagogy rather than a “desirable but dispensable frill” (Egan & Nadaner, 1988, p. ix). In defining imagination, Egan (1992, p. 43) describes it as “the capacity to think of things as possibly being so; it is an intentional act of mind; it is the source of invention, novelty, and generativity”. Within the field of creative pedagogy a distinction is drawn between teaching creatively and teaching *for* creativity. The former involves using imaginative approaches to support student learning in any domain, while the latter focuses on developing children's creative capacities (Lin, 2011; Jeffrey & Craft, 2004). Both are related.

It is not possible (nor desirable) to fully and finally capture the features of creative pedagogy, but several studies chart core characteristics that have been previously identified. In a systematic review of 35 studies on creative pedagogies¹⁰, Cremin and Chappell (2021) identify seven inter-related characteristics:

- *Generating and Exploring Ideas*: This relies on a climate of openness and acceptance of children's ideas.
- *Encouraging autonomy and agency*: This is associated with learner choice in a learner-centred classroom that affords decisional power to children.
- *Playfulness*: This involves, for example, playing with resources, exploration and adventure.

¹⁰ The authors argue that there is no 'one-size-fits-all' creative pedagogy, thus they refer to 'pedagogies'.



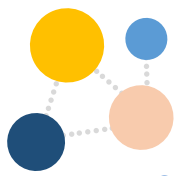


- *Problem-solving*: This includes the exploration of open-ended problems and the sharing of possible solutions.
- *Risk-taking*: Making and learning from mistakes is encouraged.
- *Co-constructing and collaborating*: This involves learners in developing curricular and instructional tasks, group work, and a focus on student-teacher relationships.
- *Teacher creativity*: A teacher's own creativity is considered influential.

Interestingly, the authors note that despite the focus on creative teaching in the studies under review, little attention was given to the impact of the various approaches on learner creativity. Furthermore, the studies tended to be largely qualitative and small scale in nature, relying to a great extent on self-report. In a systematic review of creative learning environments, Davies et al. (2013) identify supportive factors similar to Cremin and Chappell's (2021) review. Davies et al. (2013) note the importance of having a physical environment that supports creativity (e.g. flexible use of classroom space), relevant resources (e.g. art materials) and the use of the outdoors. They note the significance of giving learners some control over the pedagogical environment (e.g. choice of activities). Playful approaches, the flexible use of time and an enabling relationship between teachers and learners were also emphasised. They further underscored the need to extend learning beyond the classroom to include, for example, galleries and partnerships with the arts community (see also work in the Irish context, e.g. Morrissey, 2023). The notion of creative pedagogy is complex and can be supported or impeded by external factors such as national policy or curriculum (Craft, 2003).

Creative pedagogy is associated with the development of particular ways of thinking or habits of mind. These can be achieved through different approaches. For example, 'possibility thinking' is posited by Craft (2002) as a core feature of creative learning. It supports learners in taking an open and inquisitive stance by asking 'what if?' It involves posing questions, play, immersion, innovation, risk-taking, imagination and self-determination (Burnard et al., 2006). This involves the teacher 'standing back', providing opportunities for learners to exercise agency, and adopting a flexible use of time and space in the classroom (Cremin et al., 2006). Dispositions that support creativity are also emphasised by work emanating from the visual arts. For example, studio thinking (Hetland et al., 2007) involves eight 'habits of mind' that support creative development: (i) developing craft; (ii) engaging and persisting; (iii) envisioning; (iv) expressing; (v) observing; (vi) reflecting; (vii) stretching and exploring; and (viii) understanding the art world. Data from the CSL (Devine et al., 2023) study suggests that Irish teachers place a high premium on children's creative thinking.





Self-Regulated Learning

Research on self-regulation helps us to understand the cognitive, motivational, and emotional aspects of learning. According to Panadero's (2017) analysis of the literature, self-regulation generally comprises a range of strategies (e.g. rehearsal, elaboration, organisation) and processes (e.g. goal setting, task analysis, time management, help-seeking, self-evaluation) that are cyclical and iterative. Learners incorporate self-feedback and external feedback (e.g. from peers, teachers) to help them to 'adjust' their plans to support their progress towards a particular goal. Consequently, this pedagogical approach heavily relies on classrooms being 'set up' in a way that supports the provision of regular feedback. It also requires that learners be considered active participants in their learning who can 'study' how to learn better. Self-regulated learning is closely associated with metacognition which can be understood as 'thinking about thinking' (e.g. Flavell, 1987).

Self-regulatory learning strategies can support academic success in primary and post-primary contexts (e.g. Dignath et al., 2008; Dignath & Büttner, 2008). However, it should be noted that there are differential effects of self-regulated learning in light of differences in learners' developmental stages or educational levels. Theories of self-regulated learning should be modified to suit the age group of interest. Considering Panadero's (2017) review of recent meta-analyses in the field, it is best to think of it as a learnable ability that grows as individuals age and mature. For primary school aged learners, self-regulated learning is best considered through a socio-cognitive approach. It can be promoted using direct approaches (e.g. explicit instruction on a particular strategy; see Quigley et al., 2021¹¹) or indirect approaches (e.g. learning environments that promote self-directed learning; Benick et al., 2021). Teachers play a crucial role in fostering self-regulated learning as "they decide what instructions they give and the learning environments they provide" (Benick et al., 2021, p. 327). Teachers should know how to support their learners best to become more aware of their strengths and weaknesses, the strategies they use to learn and how to best motivate themselves to engage in learning (Muijs & Bokhove, 2020). However, knowledge of how to do this in an age-appropriate manner would be necessary for this to occur.

¹¹ Quigley et al. (2021) recommend a seven-step process for teaching metacognition: (i) activating prior knowledge, (ii) explicit strategy instruction, (iii) modelling of the strategy, (iv) memorisation of the strategy, (v) guided practice, (vi) independent practice and, (vii) structured reflection. They further recommend metacognitive classroom talk that promotes reflection on, for example, 'how we learn' or 'how we might approach challenging tasks'.



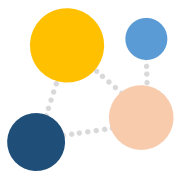
Inclusion

While there is a wealth of literature regarding the attitudes, beliefs and values associated with an inclusive education system, how an inclusive pedagogy should be enacted in a classroom has received somewhat less attention (Florian & Spratt, 2013). Common frameworks for inclusive pedagogy emphasise the idea that, rather than being perceived as a problem, human diversity should be valued as a strength (Florian & Spratt, 2013). Furthermore, it is argued that an inclusive pedagogical approach prioritises the provision of “rich learning opportunities that are sufficiently made available for everyone, so that all learners are able to participate in classroom life” (Florian & Black-Hawkins, 2011, p. 14). Rix and Sheehy (2014) support the idea that there is significant evidence to suggest that most common teaching approaches are suitable for all learners but with the option of providing more “intensive and explicit” versions as required (p. 460). Others have argued that certain groups of learners require specialist approaches (McLinden & Douglas, 2016). It is important to acknowledge though that these need not be completely independent ideas. They can intersect to strike an “appropriate balance for an individual child over a given developmental time frame” (McLinden & Douglas, 2016, p. 185)¹². This aligns well with the ideals of **Response to Intervention (RTI)**¹³. RTI relies on the screening of children using appropriate assessment tools, monitoring children who indicate particular challenges on these screeners and providing increasingly tailored and intensive teaching to target identified needs (Fletcher & Vaughn, 2009). RTI is well-supported in a number of large-scale reviews (Gersten, Beckmann, et al., 2009; Gersten, Compton, et al., 2009; Gersten et al., 2020; Wanzek et al., 2013, 2016).

Other approaches have also been adopted to support the inclusion of all learners. **Differentiation** emphasises the modification of “curricula, teaching methods, resources, learning activities, and student products to address the diverse needs of individual students and small groups of students to maximise the learning opportunity for each student in a classroom” (Tomlinson et al., 2003, p. 120). Definitional, conceptual and implementational variation in what constitutes differentiation has proven problematic, particularly when it is interpreted to involve variation of teaching to suit different ‘learning styles’ (e.g. visual, auditory, kinaesthetic), which have been discredited (Graham et al., 2021). As a result, the research evidence on differentiation is somewhat mixed. A scoping review conducted by Graham and colleagues (2021) found positive effects on

¹² The nexus between inclusive and special education, and the tensions associated with them, is the subject of significant debate (Florian, 2019; Hornby, 2015), which is beyond the scope of the current review.

¹³ Teachers in Ireland will be familiar with many of the features of RTI from the Continuum of Support guidance offered by the National Educational Psychological Service (2007).

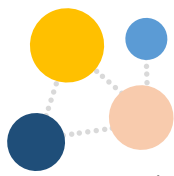


learning outcomes in some studies, with others reporting inconclusive or indeed negative effects. A further meta-analysis of differentiated literacy programmes, provided more supportive evidence, suggesting that tailored instruction supports literacy achievement (Puzio et al., 2020). In contrast, a broader meta-analytic review indicates that grouping students by ability to support differentiation (within or across classes) does not support student learning at primary level, and in fact had a negative effect on the achievement of students in lower-ability groups (Deunk et al., 2018). Research conducted in the Irish context also highlights the potentially negative psychosocial effects of ability grouping adopted in the service of academic learning (McGillicuddy, 2021; Devine et al., 2023). Differentiation, like many other educational practices, cannot be simply defined or easily implemented. Recently, **Universal Design for Learning (UDL)** has also received significant attention at all levels of the education system as another way to support inclusion by increasing accessibility. Pedagogy informed by UDL emphasises three core features to proactively include all learners: multiple means of engagement, multiple means of representation and multiple means of expression (Centre for Applied Special Technology [CAST], 2018). While UDL appears to be a conceptually promising approach to inclusion, there have been calls for further studies on its effectiveness. For example, Murphy's (2020) asserts that "the policy changes called for by UDL advocates lack an evidentiary basis of success in prior applications" (p. 9). A recently published meta-analysis (including learners within and beyond primary school) involving 20 experimental and quasi-experimental studies on UDL (King-Sears et al., 2023) reported a moderate positive effect ($g=.43$) for UDL on learner achievement. Although this seems promising, closer inspection of the included studies suggested that they were of poor methodological quality, particularly in relation to the operational definitions used for UDL (see Zhang et al., 2023). Further research on its wider efficacy and practical application for primary-aged learners is necessary.

Cultural and Linguistic Diversity

Diversity comes in many forms. The increasing diversity represented in classrooms nationally and internationally has implications for pedagogy. Culturally responsive teaching values cultural differences as assets that can be leveraged to support student engagement and achievement in the classroom (Gay, 2013). It valorises and builds on the experiences and cultural insights developed in home communities, often referred to as 'funds of knowledge' (Moll et al., 1992). This form of pedagogy is premised on the idea that all students can achieve academic success *and* build an understanding of their own (and others') culture, while also engaging critically with broader socio-political issues such as





inequality (Ladson-Billings, 1995). More recently the term *culturally sustaining pedagogy* has been used to reinforce the need to not just relate or respond to children's cultures, but to 'perpetuate and foster' them (Paris, 2012). Though culturally responsive pedagogy cannot ever be fully and finally 'pinned down', a number of important characteristics are identifiable (Carter & Darling-Hammond, 2016):

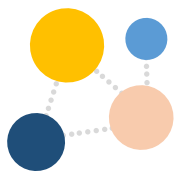
- *Cultural competency*: A teacher's understanding of their own and their learners' cultural practices; this should involve dynamic and nuanced insights that avoid stereotypic, static or monolithic portrayals.
- *An ethic of deep care*: A genuine concern for and commitment to their learners- their wellbeing and their achievement.
- *Awareness of knowledge as socially constructed*: An understanding of constructivist views of knowledge, which is influenced by many factors (historical, social, political, cultural etc.).
- *Sense of efficacy*: Teachers feel a sense of efficacy about their ability to make a difference in their learners' learning; furthermore, they convey to their students a sense that they will not 'give up on them'.
- *Development of socio-political consciousness*: An awareness of political and social influences on education, including a capacity to challenge prevailing narratives and the reproduction of inequalities.

In their review, Carter and Darling-Hammond (2016) also identify potential practices to support culturally responsive teaching, including the use of culture as a resource for learning, the explicit teaching of skills and critical thinking and the use of cooperative learning strategies. The research on culturally responsive pedagogy is bolstered by interpretivist research methods involving small samples, with less large-scale evidence available (Carter & Darling-Hammond, 2016). Though the literature on culturally responsive pedagogy is heavily influenced by US-based scholars, it has particular implications for teaching in the Irish context. For example, the inclusion of Traveller culture requires careful consideration if it is to happen in a meaningful way (Kavanagh & Dupont, 2021).

Given the fundamental role of language in all learning, attention to linguistic diversity is an important pedagogical consideration. Contemporary thinking emphasises the importance of learners drawing on their full linguistic repertoire to support their learning, rather than 'boxing off' their home (or other) languages (Hélot, 2012).

Plurilingualism refers to the idea that (Council of Europe, 2001, p. 4):





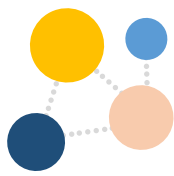
an individual person's experience of language in its cultural contexts expands, from the language of the home to that of society at large and then to the languages of other peoples (whether learnt at school or college, or by direct experience), he or she does not keep these languages and cultures in strictly separated mental compartments, but rather builds up a communicative competence to which all knowledge and experience of language contributes and in which languages interrelate and interact

Pedagogies that draw on this view are grounded in principles of social justice (providing equitable recognition and inclusion of home languages while setting high expectations for all) and social practice (emphasising the importance of interactions for learning; adopting collaborative approach; García & Flores, 2012). Writing in the Irish context and endorsing a plurilingual approach, Little and Kirwan (2019) outline five principles worthy of consideration: starting from students' existing knowledge; use of home languages; emphasis on literacy skills; pedagogical explicitness; and teacher autonomy. In addition to providing a general environment that is inclusive of varying languages, teachers should be conscious of providing supports that enable full participation in the curriculum. In a review of the research on supporting English (language) learners/emergent bilinguals, Baker et al. (2014) recommend the explicit teaching of academic language, the integration of both written and oral language activities into teaching across the curriculum, the provision of structured writing activities and the provision of small-group support based on assessed needs.

Critical, Democratic, Global and Socially Just Perspectives

Critical pedagogy has a firm foundation in the values of social justice and equality and, in recognising that education is not neutral, encourages the questioning of norms and received wisdom (Kincheloe, 2008). Critical approaches challenge power dynamics, namely who is (and is not) represented, who is foregrounded (or marginalised) which ideas are given prominence (or ignored), and so on. Critical pedagogy has been significantly influenced by Freire (1970), who popularised the idea that traditional schooling involved 'banking' knowledge in such a way that it is perceived as immutable. Contesting this view, he argued that "knowledge emerges only through invention and re-invention, through the restless, impatient, continuing, hopeful inquiry human beings pursue in the world, with the world, and with each other" (p. 72). It follows from this idea that the construction of knowledge must involve genuine dialogue, so that 'received' knowledge (from the oppressors) can be critically analysed (by the oppressed). Critical pedagogy shifts the focus from viewing pedagogy as "simply a set of strategies and skills to use in order to teach pre-specified subject matter" (Giroux, 2011, p. 4). Instead, it involves learners in



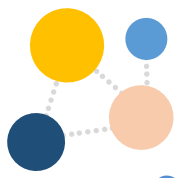


constructing their own understandings through, for example, inquiry approaches that develop students' ability to research, interpret, analyse and challenge knowledge and knowledge structures within disciplines, with a view to empowerment as active citizens (Kincheloe, 2008).

A broad constellation of literatures informs how pedagogy relates to societal and global structures that directly and indirectly influence teaching and learning. Like many contemporary educational concepts, **democratic pedagogy** can be traced to the work of Dewey. Democratic education requires that children not only develop the knowledge and attitudes needed for participation as an active citizen, but they are also enabled to participate in democratic pedagogies that value their voice and agency. In the context of curriculum integration, Beane¹⁴ (1997) notes that embracing democratic values in the classroom requires a teacher to take children's "ideas, hopes, aspirations, and lives seriously" (p. 68). According to UNESCO (United Nations Educational, Scientific and Cultural Organization), **global citizenship education** aims to "empower learners of all ages to assume active roles, both locally and globally, in building more peaceful, tolerant, inclusive and secure societies" (n.d.). The literature on global citizenship education is complex and overlaps in many ways with a variety of related concepts (Goren & Yemini, 2017). To avoid overly simplistic views, global citizenship education should ensure that the complex histories, structures and assumptions underpinning global inequality are critically analysed (Andreotti, 2006). Considered through the lens of a social justice orientation, global citizenship also requires that issues relating to sustainability (e.g. biodiversity loss, climate breakdown) are given clear attention (Mallon, 2021). **Social justice education**, is, itself, underpinned by three key principles (Ayers et al., 2009): *equity*, including equal access to high-quality education and equitable outcomes; *activism*, involving the development of children's agency to make a difference to the world and; *social literacy*, including the development of deep understanding of issues of inequity, such as racism, and inter-relatedness. Waldron and colleagues (2021) point out that teachers who engage children with issues like social justice and global citizenship education must be able to critically reflect on their own biases, assumptions and knowledge. They note that "for this kind of teaching and learning to thrive, we need to provide opportunities for authentic learning in meaningful contexts that are rooted in children's experiences, but not limited by them" (p. 233).

¹⁴ See Report 1 for further information on Beane's (1997) conceptualisation of curriculum integration.

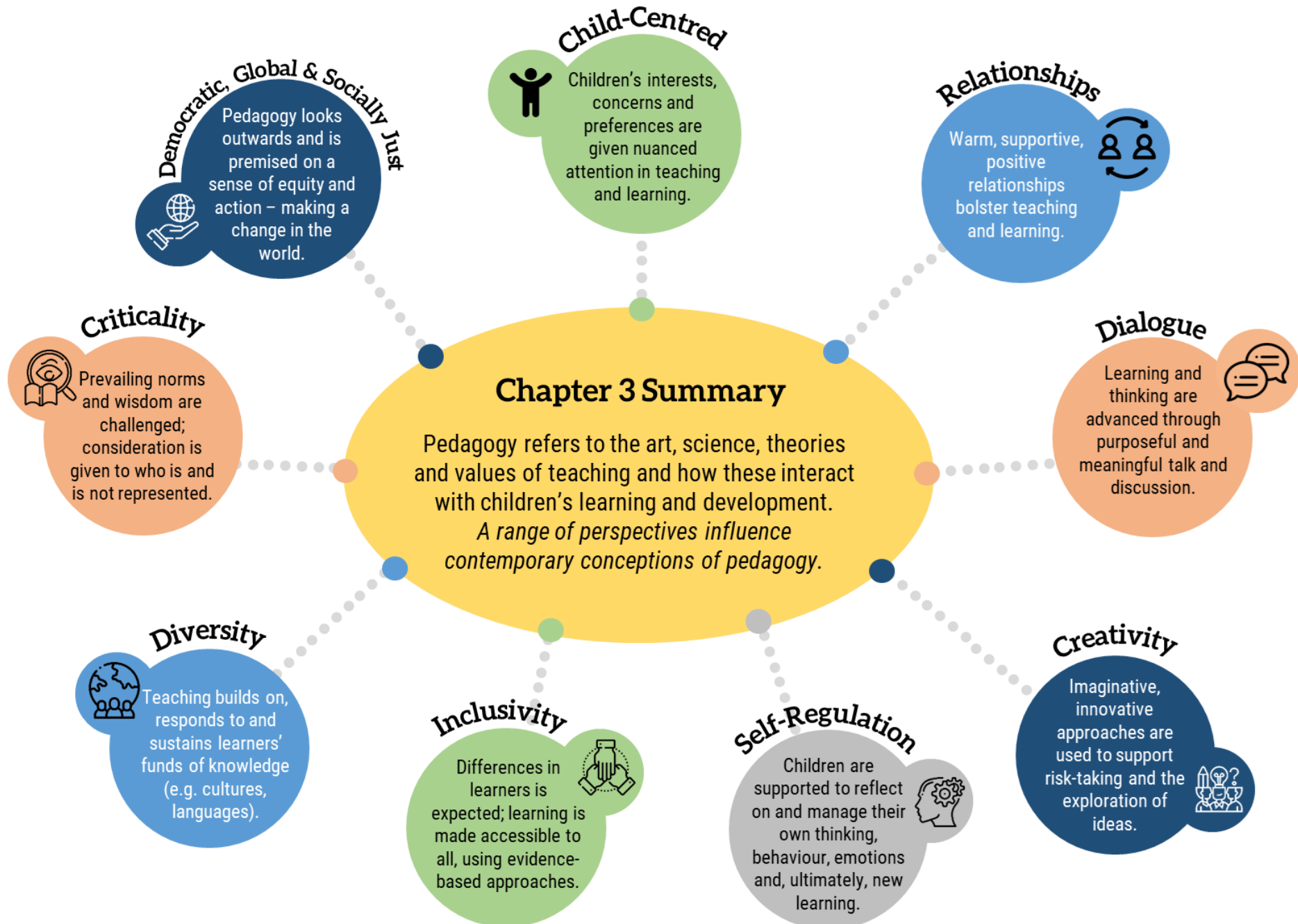
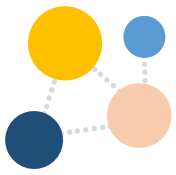


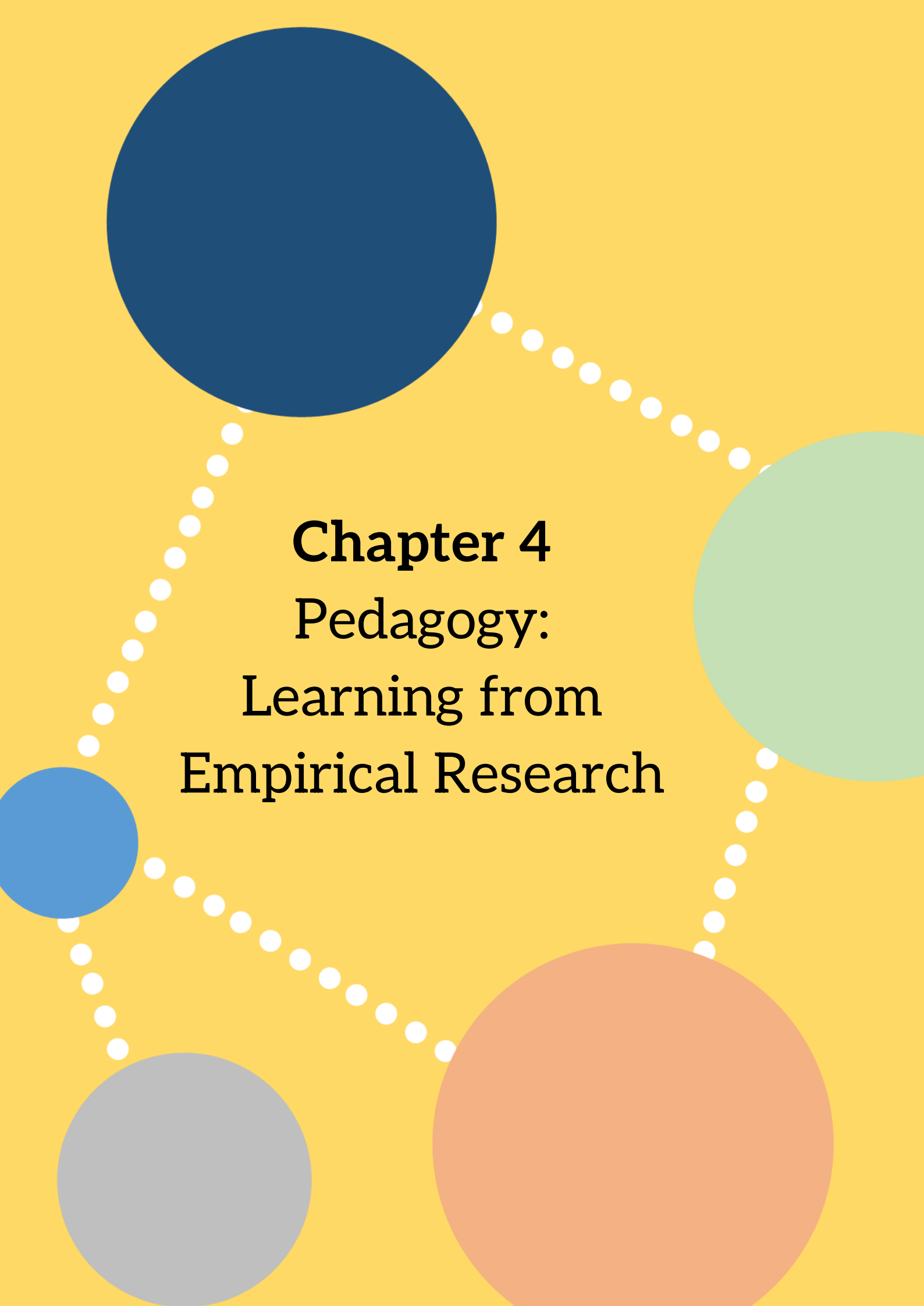


Conclusion

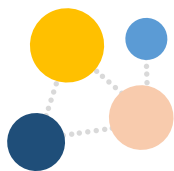
This chapter has considered overarching perspectives for pedagogy, drawing on both theoretical and empirical literature. Key messages from the literature are depicted in the visual chapter summary, overleaf. Insights from these perspectives will be combined with further research evidence from studies of teaching and various pedagogical approaches (e.g. play, explicit instruction) in the next chapter. They will also inform the final chapter's discussion on the associations between integration, pedagogy and assessment in a redeveloped primary curriculum that foregrounds child and teacher agency.





A decorative graphic on a yellow background. It features five large, solid-colored circles: a dark blue circle at the top left, a light green circle at the top right, a medium blue circle on the left, a light grey circle at the bottom left, and a light orange circle at the bottom right. A white dotted line connects these circles in a circular path, starting from the top blue circle, moving clockwise through the other four circles, and ending back at the top blue circle. The text is centered in the middle of this path.

Chapter 4
Pedagogy:
Learning from
Empirical Research



Chapter 4

Pedagogy: Learning from Empirical Research

Introduction

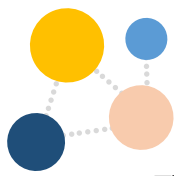
This chapter builds on the broad conceptual considerations that should inform pedagogy outlined in the previous chapter by turning to high-quality empirical research on teaching and learning in classrooms. It begins with a brief overview of the methodology used to source the literature that underpins the chapter. A specific focus on studies of effective teaching follows this. Much of the chapter is devoted to the empirical research base for various high-level pedagogical approaches, including scaffolding, explicit teaching, collaborative learning, play, project-/problem-/inquiry-based learning and technology-enhanced learning. This includes a re-analysis of the literature on curriculum integration provided in Report 1, to illustrate the application of these approaches in an integrated context. Both of the latter sections provide a critical account of the underpinning research base, identifying the need for judicious uses and extrapolations for the curriculum and classroom. The implications of these findings for teacher and child agency are addressed before concluding with a summary of key assertions that draws together insights on pedagogy from Chapter 3 and Chapter 4. Readers should note that this chapter does *not* attempt to catalogue or examine the pedagogical approaches needed for individual subjects or areas of learning. This is not a statement on the value or efficacy of different subjects and their associated pedagogies but a reflection of the need to limit the scope of this report. Readers should refer to the reports commissioned by the NCCA on Wellbeing, Social and Environmental Education, STEM and the Arts.

Research Questions and Research Approach

This chapter is underpinned by the following research questions:

- What pedagogical approaches and considerations should inform a redeveloped primary school curriculum?
- How can these be enacted in an integrated context?

The broad and somewhat all-encompassing nature of these questions demanded a tailored research strategy; conducting a full review of the literature on pedagogy from first principles would be an unwieldy, if not impossible, task. Therefore, four main approaches were used to develop a research-informed account of high-quality pedagogy in the first instance, followed by a mapping of its application in the curriculum integration literature.



These approaches are outlined in Table 2 and more fully described in **Section 2** of the **Annex for Report 2**.

Table 2 Summary of Sources for Chapter 4

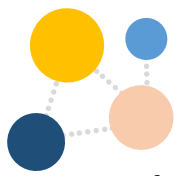
Strand 1 Teaching Effectiveness Studies	Reviews of the research on teaching effectiveness were identified, tabulated and synthesised. See Table 1, Section 2 of the Annex.
Strand 2 Scoping Searches	Boolean searches of relevant databases (e.g. Education Research Complete) to identify recent reviews/meta-analyses of particular pedagogical approaches.
Strand 3 Handsearch of seminal texts on pedagogy/pedagogical approaches	Handsearching of important sources on pedagogical effectiveness (e.g. Education Endowment Foundation), relevant handbooks, and other reviews that were not captured in the scoping searches outlined above.
Strand 4 Content Analysis of Report 1 Annex of Studies on Curriculum Integration	All 211 studies included in the Report 1 Annex were analysed to identify examples of how pedagogical approaches were adopted in studies of curriculum integration.

Findings from strand 1 (Teaching Effectiveness Studies) are presented in their own right, while key themes/approaches from strands 2, 3 and 4 are presented together in a narrative review.

Learning from studies on effective teaching

A large number of reviews on educational effectiveness have been published in the last twenty years. These studies tend to rely on the systematic observation of effective teachers, most commonly identified through the achievement of children in particular classrooms or settings. For example, the *Effective Pre-School, Primary and Secondary Education* study was a UK-based longitudinal study that followed 3000 children from early childhood education through to post-primary school, involving observations of teaching in schools found to have particularly high levels of achievement in standardised measures (see Siraj et al., 2014). Reviews (or reviews of reviews) of studies such as this provide insights into the characteristics associated with good teaching. The



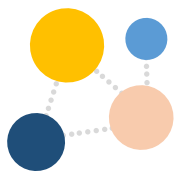


headline considerations from eight such reviews can be found in the Report 2 Annex (Section 2, Table 1).

Several common features of effective teaching are evident from these reviews:

- *Teacher (pedagogical) content knowledge:* Teachers should have a deep understanding of the material they are teaching and how best to frame it for the children in their classroom; this includes an appropriate understanding of the relevant portions of this knowledge conveyed in curriculum material (Coe et al., 2014, 2020a; Ko et al., 2013).
- *Sequencing, structuring and orienting new learning:* New learning is very carefully sequenced and introduced in a manner that supports conceptual understanding; the intended outcomes/goals of learning activities are clear to both learners and teachers; new learning is reviewed and consolidated (Coe et al., 2020; Creemers & Kyriakidēs, 2012; Ko et al., 2013; Kyriakides et al., 2013; Muijs et al., 2014; Siraj et al., 2014).
- *Presenting and explaining concepts and skills:* Teachers clearly model new skills and knowledge in advance of student application; they draw on a range of strategies to explain new concepts (e.g. examples/non-examples) (Coe et al., 2014, 2020; Creemers & Kyriakidēs, 2012; Kyriakides et al., 2013).
- *Monitoring and advancing student understanding:* Teachers actively ensure that students understand new concepts (e.g. through questioning), offering feedback as appropriate (see also the later section on assessment; Coe et al., 2014, 2020; Husbands & Pearce, 2012; Ko et al., 2013).
- *Purposeful and proactive classroom management:* Teachers adopt a pro-active approach to supporting student learning and behaviour, ensuring that time on learning activities is purposeful, engaged and without unnecessary distractions (e.g. there are clear routines, transition structures between lessons; time-on-task is prioritised) (Coe et al., 2014, 2020a; Creemers & Kyriakidēs, 2012; Ko et al., 2013; Kyriakides et al., 2013; Muijs et al., 2014; Seidel & Shavelson, 2007; Siraj et al., 2014).
- *Creating a positive learning environment/classroom climate:* Teacher-learner and learner-learner interactions are positive and form a supportive foundation for learning; relationships reflect a sense of “respect, trust, cooperation and care” (Coe et al., 2014, 2020a, p. 6; Creemers & Kyriakidēs, 2012; Kyriakides et al., 2013; Muijs et al., 2014; Siraj et al., 2014).





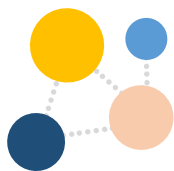
- *Building on children's prior knowledge and experiences:* Teachers are deeply familiar with the learners in their class and pitch the teaching of new concepts in a way that capitalises on this foundation (Coe et al., 2020a; Husbands & Pearce, 2012; Ko et al., 2013).
- *Focusing on engagement, thinking, application and self-regulation:* Teaching approaches ensure that students are cognitively engaged in new learning, including higher and lower-order processing; student metacognition on their own learning is supported; students apply their new learning in meaningful ways, individually or in collaborative settings, while being supported to regulate their new learning (Coe et al., 2020a; Husbands & Pearce, 2012; Ko et al., 2013; Kyriakides et al., 2013; Siraj et al., 2014).
- *High expectations and inclusion of all learners:* Teachers hold high expectations for all students and modify their teaching to ensure that all achieve their potential (Husbands & Pearce, 2012; Muijs et al., 2014).
- *Reflection and collaboration:* Professional activities such as reflection and collaboration with other teachers contribute to good teaching practice (Coe et al., 2014).

It is notable that making links across areas of learning explicit is noted in two reviews (Ko et al., 2013; Siraj et al., 2014). Siraj et al. (2014) noted that excellent teachers were far more likely to make connections between subjects explicit for learners, rather than leaving this to chance. Overall, these features of good teaching are likely to be important in many contexts, for different learning areas and in the service of different pedagogical approaches reviewed in a later section (e.g. inquiry, explicit teaching)¹⁵.

These studies provide insightful, generally applicable insights for teaching and learning in the classroom, yet, they alone do not fully encapsulate what is meant by pedagogy. 'Effectiveness' is a contested term in the literature, with scholars underlining the need to ask: effective *for what* and effective *for whom*? (Biesta, 2015; Bogotch et al., 2007). The idea that effectiveness cannot and should not be divorced from *purpose* (Biesta, 2015) is an important one, which this report will return to in a later section. Broader considerations of pedagogy may invoke other considerations *not* captured in effectiveness studies. In the Irish context, Devine et al. (2013) drew primarily on questionnaire data to identify the factors that *teachers* consider to be 'good':

¹⁵ Teaching skills such as those outlined here are often referred to as 'high-leverage practices'. For example, Teaching Works identifies practices such as leading a group discussion, explaining and modelling content and implementing organisational routines. See <https://www.teachingworks.org/high-leverage-practices/> and the work of Ball (e.g. Ball & Farzano, 2009).





- Good teachers have a passion for teaching and learning.
- Good teachers are socially and morally aware.
- Good teachers are reflective practitioners.
- Good teachers effectively plan for and manage learning.
- Good teachers have a love for children.

These attributes are not in opposition to those identified by the effectiveness studies cited above, but they *do* paint a picture of the craft of teaching in a broader sense. They also reflect priorities that include but extend beyond academic learning outcomes, which tend to be prioritised in effectiveness studies. Similar characteristics are emphasised in the depictions of ‘good teaching’ captured in the Irish CSL study of pedagogy (Devine et al., 2023).

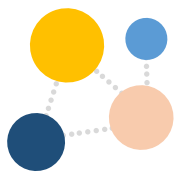
Pedagogical Approaches: Empirical Evidence and Application in Integrated Curriculum

This section synthesises the research provided through the scoping searches and secondary analysis of the literature on curriculum integration. The approaches included here in alphabetical order were prevalent across the conceptual and empirical literature consulted. Furthermore, though we present a range of headline ‘approaches’ such as play or inquiry separately, there is likely to be significant overlap in their application in the classroom. Each section begins with a general overview of the approach and its effectiveness in achieving various learning outcomes. It should be noted that this section relies on review studies, and in particular, meta-analyses, to illustrate effectiveness. This ‘review of reviews’ approach has recently been applied in other research reports conducted to inform educational policy in Ireland (see Kennedy et al., 2023). Relevant conceptual and theoretical papers complement these reviews to provide a clear picture of the approach in question.

The approaches contained in this chapter are **not** exhaustive and should not be construed as a complete ‘catalogue’ of all possible pedagogies.

Reference to studies of integration outlined in the upcoming sections refer to *individual studies* sourced from the systematic review conducted for Report 1. It will become evident that the nature of the research methods used in these studies varies substantially. Their citation here serves to illustrate the application of a pedagogical approach in the service of integrated learning, *not* to provide a statement of whether there is particularly robust evidence to suggest that they were effective for learning in that particular context. We refer readers to Chapter 2 of this report and the Annex





accompanying Report 1 for further information on the methodological quality of studies examining curriculum integration.

The focus on over-arching approaches that span disciplines means, by necessity, that 'signature pedagogies' (Shulman, 2005) associated with many subjects are not mentioned here (e.g. the use of teacher in role in Drama; the use of circle time in SPHE/Wellbeing). We refer readers to the other reviews conducted on behalf of the NCCA for an exploration of more fine-grained pedagogical approaches.

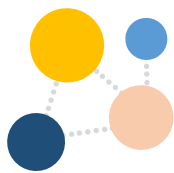
Collaborative/Cooperative Approaches and Peer-Interaction

Collaborative learning can be characterised as “instructional arrangements that involve two or more students working together on a shared learning goal” (van Leeuwen & Janssen, 2019, p. 71). Though the terms collaborative and cooperative learning are often used interchangeably (Kyndt et al., 2013), the former is sometimes considered to involve a *shared* focus in achieving an educational goal, while the latter may involve *sub-division* of work or tasks in achieving an educational goal (van Leeuwen & Janssen, 2019). Others distinguish the terms differently according to the nature of the tasks involved or the age group in question (Kyndt et al., 2013). Regardless of terminology, this form of learning involves shared, goal-directed activity that does not take place under the direct supervision of the teacher; it can be contrasted with, for example, small group instruction in which a teacher stays with, directs and scaffolds a small group of students for a period of time (Cohen, 1994).

Cooperative learning has grown in popularity since the 1970s, to the point that it is now a ubiquitous practice internationally (Johnson & Johnson, 2009). Enthusiasm for this approach may be partially explained by its potential to support dialogue in the classroom. Drawing on interdependence theory and a body of over 1200 research studies on the topic, Johnson and Johnson outline five variables that influence the success of cooperative learning:

- Positive *interdependence* is necessary; i.e. ensuring that all group members feel that they must work together to attain shared goals.
- Students should be *individually* accountable for their own share of work and *personally responsible* to facilitate others' work.
- *Promotive interaction* should be encouraged, in which students encourage each other and offer feedback in order to complete tasks necessary to achieve group goals.
- The necessary social and groupwork skills should be *taught* (e.g. how to resolve conflicts).



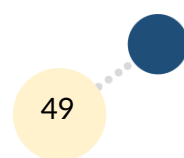


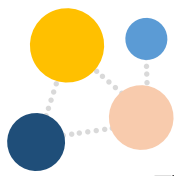
- Group processing should involve *feedback* to members on the group on their progress towards the group's goals.

Cooperative learning groups can vary in formality and composition (Johnson & Johnson, 2009). Peer-interaction stems from constructivist approaches (e.g. Piaget, Vygotsky) that emphasises intersubjectivity and the active engagement of all actors (Tenenbaum et al., 2020). A meta-analysis of 62 studies conducted by Tenenbaum et al. (2020) indicated positive effects on learning for students who completed tasks collaboratively compared to those who worked individually ($g=0.40$). This approach was *less* effective than student-teacher collaboration or interaction. They note, in particular, the value of requiring students to *reach consensus* in their collaboration, which helps to ensure that all students must participate in the work of the pair or group. Another meta-analytic study conducted by Kyndt et al. (2013) affirms the academic and attitudinal benefits of cooperative learning ($ES=0.54$), particularly at the primary level.

A high level of teacher expertise is needed to acquit collaborative learning successfully. A systematic review of 66 qualitative and quantitative studies on collaborative learning led van Leeuwen and Janssen (2019) to conclude that teachers must “walk a fine line” (p. 84) between explaining too little and too much when allowing students to work together in groups. Though a teacher must provide guidance on the learning content and how to work as a group, too little or too much of this guidance can have a detrimental effect on the work of the group (van Leeuwen & Janssen, 2019). In a framework informed by a review of the research (Kaendler et al., 2015) identifies five key teacher competences for collaborative learning:

- The ability to *plan* student interaction (e.g. identify learning goals; assign roles to students).
- *Monitor* student interaction (checking the degree to which actual student collaboration matches that which was expected, e.g. the degree to which they are explaining their thinking to each other).
- *Support* student interaction (e.g. scaffolding and prompting at the appropriate time).
- *Consolidate* student interaction (e.g. having students process the output of the collaboration and different groups through presentations, classroom discussions, quizzes).
- *Reflection* on collaborative learning (e.g. successes, failures, and plans for the next implementation).





This makes clear that ‘just putting children talking’ or ‘just putting children working together’ is not sufficient.

Curriculum Integration - Examples

The research on curriculum integration regularly invokes collaborative learning approaches, though it may be referred to in a variety of ways (e.g. cooperative learning, group work, pair work) or embedded within other approaches (c.f. section on inquiry-based learning). Its use is evident across studies that have focussed on a variety of disciplinary and non-disciplinary configurations, including literacy and social studies (Huck, 2019), STEM integration (Hourigan et al., 2021; Schellinger et al., 2021), music and mathematics (Lovemore et al., 2021) and arts integration (Edsall Giglio, 2012). As these studies tended to draw on an eclectic range of pedagogical approaches, the specific arrangements for *how* collaborative learning was implemented was not always explicitly outlined. An example of an exception to this lack of specificity is provided by a small case study of two primary teachers who planned STEM learning around the ‘plight of honeybees’ (Mildenhall et al., 2021). This study adopted a *jigsaw* approach (Aronson et al., 1978), in which students first worked with their home group to note what they already knew about the endangerment of bees, then broke into four expert groups that each examined one cause of bee population decline (e.g. insecticide use) and then returned to their home group to share and record their new learning.

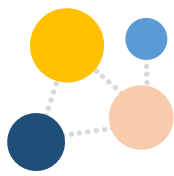
Explicit teaching, direct instruction and the gradual release of responsibility

Direct instruction, explicit teaching and the gradual release of responsibility are broadly related, but distinct, approaches. **Direct Instruction** stems from the work of Engelmann on the teaching of literacy and numeracy (Adams & Engelmann, 1996; 1980) and emphasises highly structured, carefully sequenced programmes of learning grounded in the principle that all children can learn important skills when they are carefully and unambiguously taught (Engelmann et al., 1988). Engelmann’s Direct Instruction¹⁶ is based on particular learning programmes, usually focussed on literacy and numeracy. A broader and more transferable version of **direct instruction**, also referred to as **explicit teaching**, is often traced to the work of Rosenshine (1986, 2012a). Rosenshine (2012a) cites studies on cognitive science, scaffolding, and effective teaching in support of ten core principles of effective teaching:

1. Starting a lesson by reviewing previous learning.

¹⁶ Direct Instruction (with capital letters) refers to Engelmann’s work, while direct instruction (with lower-case letters) to broader work including that of Rosenshine.

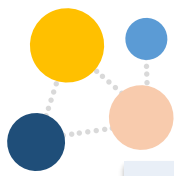




2. Presenting new learning/information in small steps, with time to practice after each step.
3. Asking questions and checking the response of all students.
4. Providing models and worked examples.
5. Guiding student practice of new material.
6. Actively checking for student understanding.
7. Obtaining a high success rate.
8. Providing scaffolds (temporary supports) for difficult tasks.
9. Requiring and monitoring students' independent practice.
10. Engaging in review of learning (weekly/monthly).

Rosenshine (1986) acknowledges that this form of teaching is not necessarily appropriate for every topic or subject. Furthermore, learner age and stage of development likely needs consideration. It is crucial to note that labelling explicit teaching as boring, traditional or excessively teacher-focused is something of a 'strawman' argument (Kirschner et al., 2022). In fact, learner activity and interaction are core features of this form of teaching (e.g. active student responding may involve a think-pair-share; guided practice may involve pair or group work). The **gradual release of responsibility** model (Pearson & Gallagher, 1983) places a similar emphasis on teacher modelling, scaffolding, guided practice, eventually giving way to independent practice. The model has proven highly influential, particularly in the area of literacy education (Pearson et al., 2019), and has been popularised in many different iterations over the years (e.g. *I do, we do, you do it together, you do it alone*; Fisher & Frey, 2013). The 'Goldilocks Principle' is important in its application; *just enough* modelling and guided practice is required to enable eventual independent application (Pearson et al., 2019). There is solid empirical evidence for the efficacy of Direct Instruction, as evidenced in a meta-analysis of 328 studies conducted by Stockard et al. (2018) that found significant, positive effects across a range of outcome measures (an *overall* effect of 0.60 is reported). Explicit teaching was a component of effective teaching in a wide range of studies included in the scoping review. This included systematic reviews or meta-analyses on literacy-related interventions for children with language-related learning needs (Peterson et al., 2020), children with intellectual and developmental disabilities (Rodgers & Loveall, 2022), and children with, or at risk of, attention-deficit/hyperactivity disorder (Stewart & Austin, 2020). Positive effects were also seen in a range of interventions for children encountering difficulties with mathematics (Arizmendi et al., 2021; Monei & Pedro, 2017; Roesslein & Coddling, 2019; Schnepel & Aunio, 2022).





Curriculum Integration - Examples

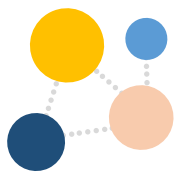
Explicit teaching was adopted in a number of studies that focussed on curriculum integration. This form of teaching often happened *alongside* other approaches. In an experimental study on science-literacy integration that investigated children's learning about light in 94 fourth grade classrooms, Cervetti et al. (2012) incorporated first-hand inquiry in science with the explicit teaching of comprehension strategies and writing using the gradual release of responsibility model. The study reported positive results for science (ES=0.65) and literacy learning outcome measures (e.g. vocabulary ES=0.22). In another study, Bravo and Cervetti (2014) report on the positive effects of explicit teaching of scientific language (within inquiry-based teaching) for English language learners. In an integrated engineering, science and mathematics unit examined in a small scale study of 17 fifth graders, Robinson et al. (2021) balanced direct and teacher-guided instruction with student prototyping of a water filter in response to a water quality problem. The authors report positive effects for students' perceived STEM abilities. Though not labelled as such, Viñas et al.'s (2021) action research study on the integration of maths, music and dance involved sessions in which key concepts relating to symmetry were explained *before* children's active application in the form of composition and choreography. Thus, some form of explicit teaching can play a part in integrated teaching across various disciplines.

Play

Play has been recognised as a fundamental right of the child (United Nations, 1989). The potential of play¹⁷ to support children's learning and development has received increasing attention in curriculum and policy internationally. Recent data from the CSL study (Devine et al., 2023) suggests that play is valued in infant classrooms, but less so in middle and senior classrooms in Irish schools. Proponents of play argue that it is a critically important and developmentally appropriate pedagogy for young children's holistic development (Hirsh-Pasek, 2009). How best to define play has been the focus of much debate in the literature (Burghardt, 2010; Eberle, 2014), especially regarding the role adults should hold when applied in educational contexts (Rogers, 2010). *Free play* is instigated and led by children and, according to Gray (2013), involves engaged and non-stressed activity that is imaginative, focuses on means rather than ends, and relies on structures or rules created and shared by the players (rather than external actors). Free play can be distinguished from *guided play*, which involves at least some level of adult

¹⁷ See French et al. (2022) for a recent review on the early childhood literature commissioned by the NCCA.





guidance toward particular learning objectives, while still adopting playful approaches and allowing some level of child direction (Weisberg et al., 2013; 2016). The application of play in educational contexts has moved from presenting a dichotomous stance to presenting play-based approaches along a continuum. For example, Zosh et al. (2018) outline a spectrum of play that varies according to its initiation and direction (see Figure 1). Drawing on the work of Hirsh-Pasek et al. (2015), all forms of play along this continuum involve learning that is active ('minds-on', not just 'hands-on'), engaged, meaningful, socially interactive, iterative (e.g. generating and testing hypotheses) and joyful. Approaches such as direct instruction are positioned outside the spectrum. Play theorists place a high premium on children's agency. Theoretical accounts suggest a reciprocal relationship between play and agency, with consequent benefits for motivation and self-regulation in the learning process (Baker et al., 2021).

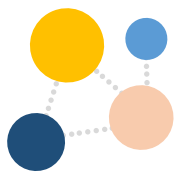


Figure 1 A spectrum of play and play-based approaches (Zosh et al., 2018)

Play-based approaches are seen as valuable from a developmental perspective. In noting challenges to the wider acceptance of play as a pedagogy in schools, Parker et al. (2022) assert that a framework for quality learning through play that emphasises learning outcomes *and* student experience is necessary. Their framework¹⁸ emphasises the need for a holistic view of learning to be considered. Pyle et al. (2017) conducted a scoping review of a wide range of literature, including conceptual pieces and empirical papers that drew on varying methods. They concluded that theoretical and empirical papers that focused on developmental learning (e.g. social-emotional development, self-regulation) were more likely to endorse free play. In contrast, papers focused on academic learning (e.g. literacy, mathematics) were more likely to endorse an active role for the teacher (guided play). The limitations of free play for particular forms of *academic* learning are noted by scholars in the area (Weisberg et al., 2016, p. 177):

¹⁸ The full framework posits four dimensions that can support a common understanding of playful pedagogy: student experience (how students feel and act); learning outcomes (knowledge, skills, attitudes fostered); design (how materials and the environment are used to support play); facilitation (the purposeful use of teacher led/teacher-guided/child-led activities).





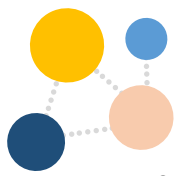
Giving children unstructured time to explore may indeed boost their social and self-regulatory abilities, but pedagogy of some kind is necessary to encourage the growth of knowledge and critical-thinking skills. Put simply, children cannot learn letter-sound pairings or addition by running around on a playground, even if that playground is covered in letters and numbers.

Studies of high-quality early childhood settings affirm the needs for a balance between teacher- and child-directed learning in the early years (Siraj-Blatchford, 2010; Siraj-Blatchford et al., 2002).

Despite its popularity in policy and practice, the empirical research base in support of play is not conclusive. Lillard et al.'s (2013) comprehensive review of the high-quality empirical evidence on pretend play draws on intervention, training and correlational studies. In their view, the argument that play is absolutely crucial for children's development is not well supported by the available research. However, they also caution that this does not mean that play is not valuable in its own right or that this means that adult-centred instruction is the only alternative. A meta-analytic review by Skene et al. (2022) included only randomised controlled trials and quasi-experiments in their review of the impact of play-based approaches. Their results paint a mixed picture; guided play was found to be more effective than direct instruction for some mathematical measures (early maths [$g=0.24$] and shape knowledge [$g=0.63$]) and one aspect of executive functioning (task-switching; $g=0.40$). However, for the majority of areas of learning included, guided play was not found to be more effective. No significant positive difference was found for measures of literacy (e.g. receptive vocabulary; $g=-0.06$), measures of socioemotional learning (prosocial behaviour [$g=1.25$] and social competence [$g=0.06$]), other measures of mathematics (spatial/mathematical language; $g=-0.17$) or other measures of executive function (behavioural regulation [$g=-0.03$] and inhibitory control [$g=-0.06$]). An Education Endowment Foundation review (EEF; 2023) of the evidence for play-based learning concludes that it has a moderate positive impact on learning, but the review notes reservations about the evidence base (which is described as 'very limited'). It should also be noted that these studies do not necessarily measure the long-term impact of play-based pedagogies. Given the assumption that play positively impacts on an individual's overall development, studies that examine the impact or otherwise of play-based experiences on learners as they age are required to unequivocally identify what these benefits are.

Recently, there has been a move to extend the use of play or playful pedagogies into the traditionally more 'formal' years of primary school. It should be noted that the large-scale reviews noted above (Education Endowment Foundation, 2023; Lillard et al.,





2013; Pyle et al., 2017; Skene et al., 2022) focussed overwhelmingly on studies for children under the age of six. There is a dearth of large-scale evidence for play-based learning in the older years. This is not to say that elements of playful approaches (e.g. games, playful instruction) are *ineffective*, but neither does it mean that they are well supported by large scale reviews or robust research designs. In an attempt to address the gap in research for older children (aged 6-12), Parker and Thomsen's scoping study¹⁹ (2019) broadens the conceptualisation of play to include 'older sibling' approaches which bear similarities in form and principle, including collaborative/cooperative learning, inquiry-based learning, project-based learning and so on. Whether this is a welcome extension of the term 'play' is open to question; we review these approaches in separate sections. Game-based learning²⁰ is seen to have natural parallels with play (Homer et al., 2020), and may involve both digital or face-to-face interaction. Digital game-based learning is theorised as having three key elements (challenge, response and feedback) and particular design features (an incentive system, game mechanics, aesthetic design, narrative design and a musical score) (Plass et al., 2015). A recent systematic review of game-based learning in primary education (Guan et al., 2022) suggests that most experimental studies examining this approach have used some form of technology. While a majority of the studies they included in the review reported positive results across various cognitive and affective outcomes (54%), others reported mixed (43%) results or a neutral result (one study).

Curriculum Integration - Examples

The content analysis of research on curriculum integration indicated that play was explicitly named as an approach in a relatively small number of studies, often alongside other approaches. In a multi-site ethnographic case study of four settings, Speldewinde (2022) examined the potential for integrated STEM learning in 'bush kinders', forms of Australian kindergarten settings based on the forest school²¹ approach. The study provides qualitative vignettes of how play-based approaches, involving child-led experiences guided by the teacher, fostered STEM thinking. For example, children who imagined that a fallen log is a spaceship, had their thinking extended by an educator who prompted considerations of weather, gravity and balance. Play has natural affinities with drama, as captured in Tam's (2021) case study of integrated learning in one Hong Kong

¹⁹ It should be noted that this paper is published by the Lego Foundation.

²⁰ See, also, the section on technology-enhanced learning.

²¹ The forest school approach emphasises the value of extended, child-centred experiences in the outdoors for children's holistic learning and development (see Knight, 2016).





early childhood setting. In Wright and Gotwal's (2017) quasi-experiment of disciplinary literacy with 147 kindergarteners, science and literacy integration was supported by their active engagement with scientific phenomena through structured play. Though the term curriculum integration is common at primary level, other terms may be more likely to capture the concept in early childhood settings. The early childhood literature emphasises an *emergent* curriculum that, in starting with and following children's interests, incorporates a variety of learning experiences from across disciplines (Stacey, 2009). However, the challenge of achieving clearly delineated learning outcomes across a broad range of discipline-based subjects in a child-led curriculum must be acknowledged.

*Project-, problem- and inquiry-based learning*²²

This broad umbrella of approaches is commonly associated with child-centred learning involving the pursuit of a meaningful question or goal. These approaches are often linked with theorists such as Dewey and Bruner. Though project-, problem- and inquiry-based learning may have similar philosophical underpinnings they are distinct approaches. The descriptions that follow are generic; discipline-specific variations of these approaches are common. **Project-based learning** facilitates children to “learn by doing, to apply ideas, figure out how phenomena occur, and solve challenging, real-world problems” (Krajcik & Shin, 2022, p. 73). Though its key features vary, Mergendoller (2018) noted that high quality project-based learning has come to be associated with:

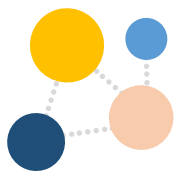
- (i) Intellectual challenge and accomplishment
- (ii) Authentic application of meaningful learning, often including some level of choice
- (iii) Sharing of a public product (e.g. models, displays, videos)
- (iv) Collaboration between students
- (v) Project management (e.g. planning how to achieve the project's goals)
- (vi) Reflection on learning from the process

Problem-based learning has many similarities but tends to place a higher premium on the *driving* problem or question (Brush & Saye, 2017). Drawing on the original work of Barrows in medical education, Walker and Leary (2009) emphasise the following characteristics of this approach:

- (i) Use of ill-structured problems that do not have a single correct answer
- (ii) Learner-centred focus in which children drive learning

²² There are a range of other, related but distinct approaches that it is not possible to review within the context of this report. These include approaches such as challenge-based learning and phenomenon-based learning.





- (iii) Positioning of the teacher as a facilitator
- (iv) Authentic application to real world practice

Inquiry-based learning emphasises the construction of knowledge relating to a research question through investigations carried out by the learner (Friesen & Scott, 2013; Lazonder & Harmsen, 2016). Research on inquiry-based learning is popular in subjects like science, in which the 5E framework (Engage, Explore, Explain, Elaborate, Evaluate) is prevalent (Koyunlu Ünlü & Dökme, 2022). It may also be linked with inquiry in the arts (e.g. the use of Mantle of the Expert to support inquiry in drama; Aitken, 2013). There is significant overlap in the features of these approaches. Consequently, their evidence base is considered together in this section.

Large scale reviews of these approaches provide relatively positive evidence. A review of 30 studies involving project-based learning indicated a medium to large effect ($ES=0.71$) on learning compared to more traditional approaches (Chen & Yang, 2019), but there is a noted need to increase the number of methodologically robust studies in this area (Ferrero et al., 2021). Meta-analytic reviews provide strong evidence that discovery approaches require careful orchestration if they are to be effective in the classroom. This is evidenced in Alfieri et al.'s (2011) analysis of 108 studies comparing unassisted discovery with explicit teaching, which found more positive effects for the latter ($d=-0.38$). However, the same study also analysed 56 papers comparing 'enhanced discovery' (which involved teacher scaffolding/guidance) with other instructional methods (e.g. direct teaching) and found a more positive effect for the former ($d=0.30$). They conclude that unassisted discovery generally did not benefit learning, but that discovery involving guidance such as teacher feedback, examples and scaffolds *did*. A further meta-analysis of 72 studies involving mathematics or science confirms this finding (Lazonder & Harmsen, 2016), while another such study points to benefits for both attitudes (d ranged from 0.22 to 0.40) and academic learning ($d=0.78$; Savelsbergh et al., 2016). This finding is also affirmed by a meta-analysis of 37 studies of science from 22 papers ($ES=0.50$), in which Furtak et al. (2012) provide a helpful illustration of the continuum of guidance (see Figure 2). Review studies included in the scoping search signalled the importance of teacher professional development for successful inquiry learning in science (Slavin et al., 2012). A further meta-analysis focussed on the impact of inquiry-based learning on English language learners (Estrella et al., 2018); it found beneficial impacts on learning (compared to more direct instruction approaches) but indicated the need for additional academic and linguistic support beyond that provided by inquiry alone.



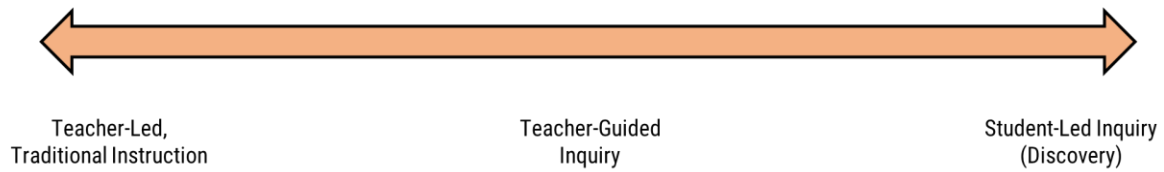
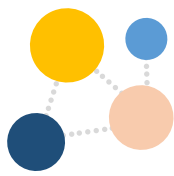


Figure 2 Continuum of guidance in inquiry-based science teaching (reproduced from Furtak et al., 2012)

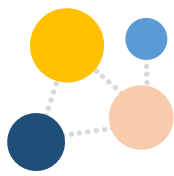
Curriculum Integration - Examples

The studies on curriculum integration reviewed in Report 1 made extensive use of project-, problem- and inquiry-based approaches. One of the most robust studies of project-based learning was conducted by Duke et al. (2021), which involved a randomised controlled trial involving 684 second graders. A project approach was used to integrate literacy and social studies (addressing economics, geography, history and civics/government). Extensive instructional materials and guidance were provided to teachers to support the completion of projects, which supported achievement in both social studies and informational reading when compared to the control condition. Problem-based learning was regularly associated with STEM integration, as reported in Hourigan et al.'s (2021) qualitative study of teachers in the Irish context. Inquiry approaches were common in science-focussed integration (e.g. Cervetti et al., 2012), but not exclusively so. For example, Jordan (2016) reports case study findings on the integration of English language arts and social studies, using an inquiry approach. It is important to note that overlaps in the features of project-, problem- and inquiry-based approaches were common in the studies of curriculum integration. For example, Duke et al.'s (2021) study of project-based learning involved an inquiry stance. This study also demonstrates how explicit instruction was necessary *within* more discovery-led approaches; each session commenced with whole-class instruction that provided explicit teaching on relevant concepts for the project-work of the day.

Scaffolding

Scaffolding is likely present in one form or another in nearly every pedagogical interaction, excepting the most open forms of discovery- or play-based learning. The use of the term 'scaffolding' in an educational context was instigated by Wood, Bruner and Ross (1976), who used it to describe how a student is supported to "solve a problem, carry out a task or achieve a goal which would be beyond his unassisted efforts" (p. 90). Scaffolding requires that the teacher (or 'More Knowledgeable Other') control aspects of the new learning tasks that are beyond a learner's current capacity, enabling them to concentrate on aspects that are achievable within their current range of competence. It





corresponds with Vygotsky's (1978) sociocultural theory and the Zone of Proximal Development²³. Scaffolding consists of three main components, according to Van de Pol et al. (2010):

- *Contingency*: Scaffolding is responsive to a learners' needs at a particular time; this depends on accurate and dynamic assessment.
- *Fading*: Scaffolding is reduced over time as student competence grows.
- *Transfer of responsibility*: The student gradually takes over responsibility for the target learning/task.

Different means of scaffold can exist, such as feedback, provision of hints, instructing, explaining, modelling and questioning (Van De Pol et al., 2010). Van de Pol et al.'s (2010) review found strong support for scaffolding across various studies and reviews. The scoping search conducted as part of this review identified the successful uses of scaffolds in various forms, such as the use of graphic organisers to support children with reading comprehension, language-related difficulties and mathematics difficulties (Filderman et al., 2022; Peterson et al., 2020; Powell et al., 2021). The strong potential of *concrete* and *visual* scaffolds to support conceptual development was also common in these studies (Kim & Jin, 2022; Roesslein & Coddling, 2019).

Curriculum Integration -Examples

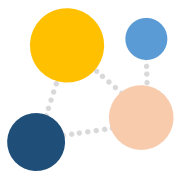
Scaffolding was used in a variety of ways throughout the studies on curriculum integration. In an action research study, Lovemore et al. (2021) explored the synergies between fractions in mathematics and note values in music. A key pedagogical scaffold involved the visual representation of fractions as portions of paper plates, which were then used to represent the note values. Scaffolding was commonly alluded to throughout studies, but may not have been explicitly discussed or explained.

Technology-enhanced learning

Pedagogical approaches associated with technology are broad and diverse. The large amount of review studies uncovered in the scoping search indicates the significant attention this aspect of teaching and learning has received in recent years. In a review of other meta-analyses, Lewin et al. (2019) conclude that educational technology interventions broadly show small to medium positive effects across a range of learning areas (literacy, maths, science) and approaches (e.g. simulation, computer-based

²³ "The distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (p. 86)



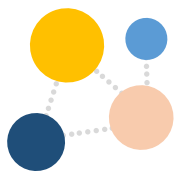


scaffolding). However, they also note that the beneficial effects of technology depend on a range of factors including “the context, the subject area, the content, the pedagogy, access to technology, training/support, the length of the intervention and how it is integrated with other classroom teaching” (p.29). Therefore, technology will not *automatically* or *necessarily* enhance teaching. The use of technology was found to be effective across a range of other more recent systematic and meta-analytic reviews included in this scoping review. Positive effects were noted for example in maths (Akçay et al., 2021; Pellegrini et al., 2021; Verschaffel et al., 2019), including children with mathematical learning difficulties (Benavides-Varela et al., 2020); writing (Wen & Walters, 2022), and science education for students with disabilities (Mikropoulos & Iatraki, 2022). The scoping search also identified reviews of research on specific forms of technology enhanced learning. These include:

- *Digital personalised learning*, which uses technology to adapt instruction for children depending on their strengths and needs, was founded to show generally positive outcomes in a systematic review carried out by Van Schoors et al. (2021) and a review of effective differentiation by (Deunk et al., 2018).
- A systematic review of 92 studies on the use of *artificial intelligence*²⁴ in education at all educational levels (Chiu et al., 2023) identifies its potential to support student learning (e.g. in providing feedback), teaching (e.g. providing suggestions for teaching strategies based on student needs) and administration, but the nascent research base suggests that cautious interpretation is warranted; similar findings are reported in a systematic review by Celik et al. (2022). Teaching children about machine learning/artificial intelligence was the focus of a number of studies in Sanusi et al.’s (2022) systematic review, which also identified the need for further research.
- In a meta-analysis of 85 studies (from 78) articles, Wang et al. (2023) found that teaching involved *mobile devices* (e.g. tablets, laptops, clicker response systems) had medium positive effects for cognitive ($g=0.50$), affective ($g=0.45$) and behavioural ($g=0.34$) learning outcomes compared to teaching without technology or adopting more traditional technologies. This finding held across both primary

²⁴ An explosion of interest in and availability of Artificial Intelligence (AI) occurred during the drafting of the report. Whether AI will lead to the revolution (*Education has a key role to play in unlocking the potential of AI* - Irish Times, 2/5/23) or ruination (*Schools bewildered by AI advances, say head teachers* - BBC News, 20/5/23) of pedagogy and assessment has yet to be seen. A middle path is most likely. Guidance on AI will require ongoing attention as further technology and evidence become available.

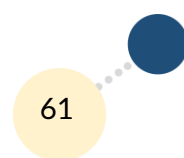


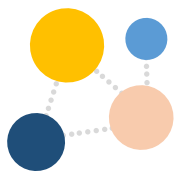


and secondary settings. However, the potential distracting effect of technologies such as tablets has also been noted (Boon et al., 2021).

- Meta-analyses conducted by Zhang and colleagues indicate that *educational robotics* was found to have beneficial effects on creativity and problem-solving ($g=0.82$; Zhang & Zhu, 2022), computational thinking and STEM attitudes (ES= 0.46; Zhang et al., 2021); however, methodological shortcomings in the underlying studies (e.g. very small sample sizes, rigour of design) suggest that significant caution is warranted in over-interpreting these findings. Subject-specific systematic reviews on robotics in maths education (Xia & Zhong, 2018) and language learning (Hein & Nathan-Roberts, 2018) also suggest benefits, but with methodological quality reservations.
- Digital *game-based learning* has been demonstrated to hold moderate effect sizes (ES = 0.67) compared to other approaches in STEM (L.-H. Wang et al., 2022), including science in particular (Hussein et al., 2019; Lei et al., 2022); positive effects of *augmented reality* game-based learning are reported in a systematic review by Fotaris et al. (Fotaris et al., 2017) and Pellas et al. (2019), but more robust research methods are required in future studies (the latter review also identifies challenges with this approach, including the distraction provided by its novelty and its non-generalisability beyond specific educational uses).
- In a systematic review of the role of *makerspaces* in education Rouse and Rouse (2022) suggests their benefits for STEM learning and '21 century' competencies; however, from an educational effectiveness perspective, the 22 studies included in the review have significant methodological limitations.

A range of technological advances have the potential to benefit teaching and learning in the classroom. However, it is also abundantly clear that newer technologies require further testing in high quality research studies before widespread adoption as pedagogical tools as part of a national curriculum. As noted in a recent UNESCO review (2023), several factors need to be borne in mind when weighing the benefits of technology in education, including the influence of commercial interests in advocating for particular software and hardware, the potential distraction caused by device use in the classroom and the decidedly mixed research evidence.





Curriculum Integration - Examples

Technology was used as a pedagogical tool in different ways in the studies of curriculum integration. As might be expected, its use was common in studies focusing on STEM integration. For example, a qualitative study of STEAM integration by Quigley (2019) indicated the successful use of technology for movie making and creating digital brochures, as part of a series of vignettes of STEAM practice. Educational robotics were incorporated into a quasi-experimental study in Cannon-Ruffo's (2020) examination of STEM integrated learning with 80 4th graders.

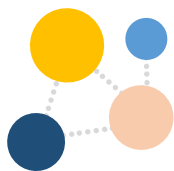
Looking across approaches: Commonalities and tensions

Though the forerunning approaches have been explained discretely, it is readily evident that there are similarities in their application and underlying principles. All approaches rely on the active engagement of the learner, though the outward orchestration and manifestation of this engagement may vary quite substantially. Implicit in all approaches is the need to build on children's learning to achieve new understanding, though the degree to which this is systematically pinpointed may also vary. Proponents of all approaches assert that they hold high expectations for children's learning and development.

The most fundamental variation in these approaches relates to *who* initiates new learning, *who* influences its direction thereafter, and the level of *guidance* offered. This is fundamentally tied to theories of how children learn. One of the most significant critiques of child-led, 'discovery' approaches is that they conflate the *epistemology* of a discipline (e.g. inquiry in science) with the *pedagogy* that is most likely to advance learning in that discipline (Kirschner, 2009). It is evident from the review of evidence presented here that at least some level of teacher direction and guidance is necessary for learning (which is largely related to the cognitive process involved in memory) to occur. Human learning is both facilitated and constrained by cognitive factors such as working-memory and the availability of relevant knowledge in long-term memory (Sweller, 1988; Sweller et al., 2019). Willingham (2008) refers to memory as "the residue of thought", going on to state that "the more you think about something, the more likely it is that you'll remember it later" (p. 18). This tallies with the idea that *cognitive* (rather than physical) activity requires particular attention²⁵. Mayer (2004, p. 17) stated that approaches should be

²⁵ There are obvious exceptions and nuances required, including when the physical activity is the unit of focus (e.g. when teaching fundamental movement skills in physical education; embodied approaches in drama).





“judged not on how much doing or discussing is involved but rather on the degree to which they promote appropriate cognitive processing”. Advances in cognitive science have led some to reject the role played by ‘discovery’ approaches²⁶. Our desired end-point may not be a good indicator of where to start, as noted by Christodoulou (2014, p. 104):

The aim of education should be for our pupils to be able to solve real-world problems on their own. But we will not achieve that aim if we begin by teaching them as though they can already solve real-world problems on their own.

In reality, it is possible that more child-led and teacher-led approaches will have differential effects depending on the prior learning/achievement of the children and the area of learning involved, and may be decided to at least some extent by the time available for teaching particular content (Tobias, 2009). Another key difference between each end of the spectrum is the stimulus that drives learning (Duffy, 2009). Discovery approaches foreground sense-making in the student’s own environment, following their interests. Those approaches aligned with more direct teaching give less attention to this aspect of pedagogy, focussing instead on the acquisition of knowledge. To summarise, a careful, evidence-informed balance should be struck between teacher- and child-led approaches, depending on the subject matter, context and purpose (Ko et al., 2013; Weisberg et al., 2016). This aligns with the philosophical viewpoint that nuance is required in interpreting and enacting ‘child-centred’ pedagogy (Irwin, 2018) and that “teaching is essential rather than accidental to education” (Biesta, 2022, p.73). This nuance is required in both integrated and disciplinary forms of teaching and learning.

Implications for Learner and Teacher Agency

The pedagogical approaches reviewed in this chapter have particular implications for learner and teacher agency. These are reviewed now in turn.

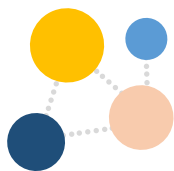
Learner agency

Learner agency²⁷ depends on dispositional, motivational and positional dimensions (Vaughn, 2020). Its development is contingent on developing children’s *sense* of agency and the provision of opportunities to actually *shape* the trajectory of their learning (Manyukhina & Wyse, 2019). Evidence from Irish classrooms suggests that there is scope

²⁶ Sweller (2021) posits that biologically secondary information (e.g. learning to write; learning specific science concepts) must be treated differently to biologically primary information (e.g. learning social interaction, learning to speak) when it comes to education (see Geary, 2008). Based on cognitive load theory (Sweller, 1988; Sweller et al., 2019) he suggests that explicit teaching is the most efficient way of acquiring the biologically secondary information associated with the school curriculum. Scepticism about inquiry-based learning is not uncommon in the literature that emphasises cognitive perspectives on learning, often on the basis that more discovery-based approaches may prove less efficient (e.g. Christodoulou, 2013; Kirschner et al., 2022).

²⁷ For a review of the literature on learner agency, please return to Report 1 (Chapter 2).



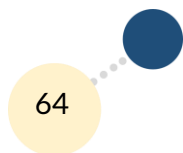


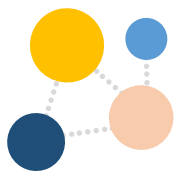
to increase the opportunities for primary school children to exert influence over matters that affect them in school, particularly as they enter the senior classes (Devine et al., 2023). Varying levels of attention are afforded to learner agency in the pedagogical literature reviewed to this point. Different approaches and considerations afford differing attention to learner agency.

Some of the contemporary considerations for pedagogy analysed in Chapter 3 emphasise ways of teaching that enable children's participation in the classroom and society more broadly. The literature on children's participation (Lundy, 2007) makes clear that, from a human rights perspective, children deserve not only the space to express their opinions but the opportunity to have them listened to and acted upon. Creative pedagogy affords particular attention to the active role taken by learners in exploring new ideas and solving problems in a playful, risk-taking manner (Cremin & Chappell, 2021). Critical perspectives on pedagogy are grounded in the belief that children must be active agents who challenge received knowledge and act upon the world (Freire, 1970; Giroux, 2011); this is built upon in the literature on global citizenship education and related topics. Pedagogy that supports and sustains diversity is grounded in valuing and building on children's out-of-school culture and experiences (Gay, 2013; Ladson-Billings, 1995; Paris, 2012), a practice that is seen to support learner agency. Thus, from a conceptual perspective, foregrounding learner agency is in keeping with contemporary pedagogical thinking.

Studies of effective teaching tend to place more emphasis on the actions of the teacher than the actions of the learner. Though one of the reviews included here specifically mentions consideration of learner voice as a core feature of effective pedagogy (Husbands & Pearce, 2012), this is, at most, implicit in other reviews. The development of self-regulated learning and metacognition is highlighted in some reviews (Kyriakides et al., 2013; Muijs et al., 2014), which can be considered broadly supportive of the development of learner agency. It could be concluded that research that places a high premium on learner academic outcomes is less concerned with learner agency. Whether this is a desirable situation is a different question.

Research on various pedagogical approaches makes clear that they span across a continuum of considerations relating to agency. Some approaches place a high premium on learner autonomy; free play and some forms of student-led inquiry/discovery are (almost) completely directed by the learner, with the teacher in the 'back seat'. These approaches may benefit some aspects of learner development but have not been endorsed for the development of curriculum-based learning outcomes in the research reviews





considered in this chapter (e.g. Alfieri et al., 2011). Approaches in which children exercise some level of control over the direction of their learning, but guided by the teacher, find more support. More teacher-focussed practices (e.g. explicit teaching or direct instruction) are supported by robust research, but give less consideration to learner agency. However, this does not mean that explicit teaching cannot be combined with supporting practices, such as the provision of choice and the leveraging of student interests. A teacher must chart a middle path to achieve the learning outcomes that are delineated into specific learning areas while also affording learners control over the material they wish to learn. This charting is contingent on nuanced understanding of the concept of agency, coupled with insights into the evidence base for various pedagogical approaches. This has implications for teacher agency.

Teacher agency

Agency is achieved by a teacher when they meaningfully shape their responses to their professional circumstances, influenced by a range of factors²⁸. Agency can be considered according to three dimensions: the *iterational* (past experiences), *practical-evaluative* (considerations in the present) and the *projective* (future aspirations and expectations) (Emirbayer & Mische, 1998; Priestley et al., 2015). Though few of the studies reviewed for this chapter directly addressed teacher agency, it is possible to highlight their implications based on conceptual models.

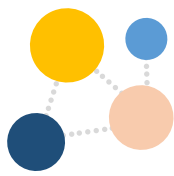
An important consideration for teacher agency is teacher knowledge in various forms. This includes an understanding of good pedagogical practices (e.g. modelling), approaches (e.g. collaborative learning) and insights relating to curriculum structure and learning outcomes. A recent, in-depth qualitative study on teacher agency in the context of Irish language curriculum reform has highlighted the crucial role of teacher *knowledgeability* (Ó Breacháin, 2022)²⁹. This idea of knowledgeability can be tied with the forms of knowledge identified by Shulman (1986, 1987), including content knowledge, pedagogical knowledge and the amalgam of the two, pedagogical content knowledge. A deep knowledge of how and when to deploy particular approaches to different aspects of learning is crucial, as no one pedagogical approach is suitable for all purposes, learners and contexts. It is possible for a teacher to be highly agentic in their adoption of one approach

²⁸ See Report 1 for further information on the concept of teacher agency.

²⁹ Drawing on the work of Giddens (1984) to extend the ecological model of teacher agency (Priestley et al., 2015), Ó Breacháin (2022)

highlights four layers of knowledge that are necessary for teacher agency to emerge: knowledge of the curriculum; knowledge of curriculum-making; knowledge of the structural features of the reform; knowledge of pedagogies commensurate with the structural features of the reform.





or strategy, but less so when it comes to another³⁰. Practical-evaluative considerations such as the culture of a school or school system, and the suitability of resources will also influence the adoption of different pedagogical approaches. Importantly, the *projective* dimension is also likely to heavily influence the adoption of different pedagogies; a teacher who can see the value of inquiry for children's learning is more likely to adopt it than one unconvinced of its efficacy. This underscores the importance of having solid research evidence to support the adoption of various pedagogical approaches for various pedagogical purposes. Agentic teachers are equipped to make professional decisions about which approaches are best suited to the children in their classroom, based on their individual characteristics and local circumstances, but informed by high quality research evidence.

The necessary architecture to support teacher agency requires careful consideration from an ecological perspective (Priestley et al., 2015). The availability of professional learning and collaboration opportunities to develop nuanced understanding of the curriculum and pedagogical evidence base is crucial. Developing shared pedagogical understandings and values at local and systemic levels is also extremely important.

Principles of Good Pedagogy

To summarise the review of literature on pedagogy in this and the preceding chapter, a number of overarching propositions can be formulated, regardless of whether traditional or integrated approaches are in use. We acknowledge Biesta's (2010) argument that "any claims about what is effective and desirable can only be made with reference to what it is one aims to achieve" (p.202), thus context-specific decisions need to be made when enacting the following principles, e.g. the purpose of a particular lesson, learner characteristics.

³⁰ In an integrated curriculum context, teachers also require *interdisciplinary pedagogical content knowledge* (An, 2017); see Report 1 for further information.





Good Pedagogy:

1. Builds on and values deep insights about learners



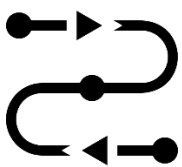
Teaching builds on well-informed, holistic and dynamic understanding of the children in a class; children's prior learning and current understanding forms the starting point for new learning; this understanding of children extends to the appreciation and advancement of their interests, preferences, characteristics and funds of knowledge (e.g. home languages, culture) in a responsive manner.

2. Requires thorough teacher (pedagogical) content knowledge



Teachers are deeply knowledgeable about the content they are teaching, how it is represented in the curriculum and about the range of pedagogical options open to them in supporting children's learning. This includes being knowledgeable about how, if, and when to use *technology* to support learning.

3. Gives serious attention to sequencing, structuring, scaffolding and reviewing new learning



Pedagogy is supported by the thoughtful sequencing and structuring of new learning in an incremental manner, in response to ongoing assessment of student understanding; appropriate scaffolds are introduced and faded to support students in achieving independent application of new knowledge and skills; new learning is periodically reviewed.

4. Relies on excellent fundamental teaching skills



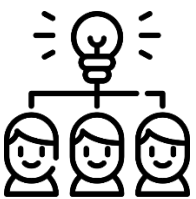
Fluency in a range of skills such as modelling, explaining and questioning are crucial in all classroom settings and learning areas and across all pedagogical approaches.

5. Ensures active engagement and responsibility for learning



Children's active engagement is prioritised regardless of the pedagogical approach used, ensuring that they are thinking deeply about new learning - this is not conflated with the *appearance* of productivity or physical movement; children are scaffolded to become self-regulated learners.

6. Advances learning through meaningful dialogue and peer-interaction



Teachers should ensure that a high level of purposeful *dialogue* and discussion permeates their lessons; children should be scaffolded so that their contributions build on each other and so that expression of varying perspectives and understandings is facilitated. Carefully planned *collaborative learning* is an important component of good pedagogy; this should be monitored and supported by the teacher.



7. Is underpinned by positive relationships and responsiveness to children's voice



Good pedagogy is supported by positive **relationships** characterised by care and compassion; teachers should consciously reflect on interactions with and between children, ensuring that a strong foundation for academic, social and emotional learning is provided. **Children's voice** is meaningfully considered, ensuring that children can materially influence their learning, while respecting the professional responsibility of the teacher.

8. Is enhanced by creative and imaginative approaches



Though teaching should be informed by high quality evidence and research, this does not preclude the development of the creative domain, including a focus on imagination, problem-solving and risk-taking.

9. Establishes and fosters a respectful and purposeful classroom environment



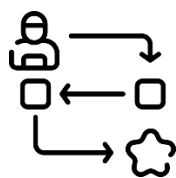
Creating a well-ordered classroom environment is a crucial component of pedagogy, including purposeful and proactive classroom management and the creation of a positive classroom climate.

10. Expects and supports learner variation, but holds high expectations for all



Inclusive pedagogy is premised on high expectations for all learners coupled with an understanding that human variation should not be framed from a deficit perspective; practices that 'box' children into static or deterministic groups (e.g. ability groups that rarely change) should be minimised or avoided. Targeted support and varied means of engagement, representation and expression may support inclusive learning.

11. Draws on evidence to decide the balance between teacher-led, teacher-guided and child-led approaches

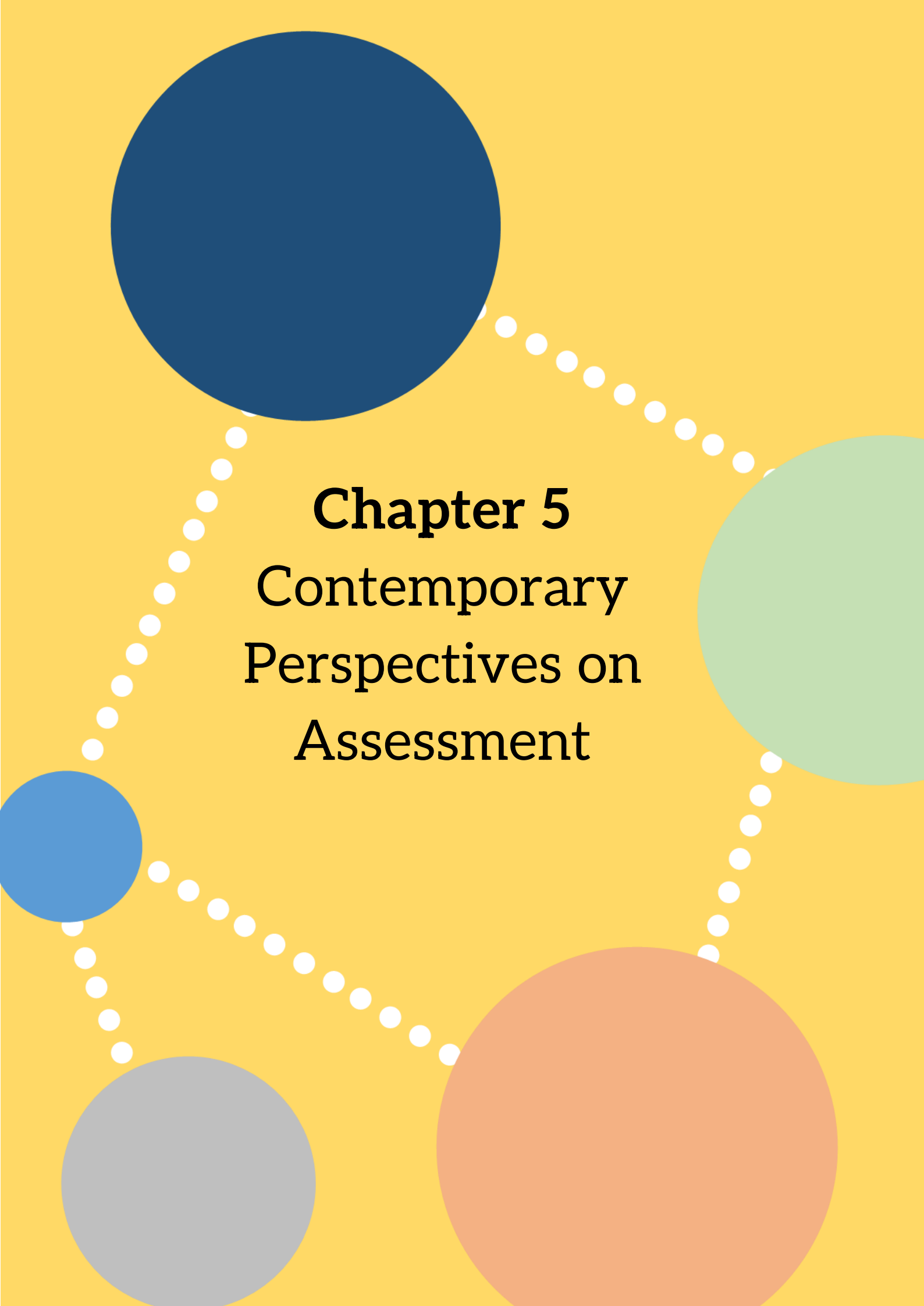


Teachers should exercise professional discretion on the balance and use of different approaches (e.g. teacher-led, teacher-guided, child-led), informed by the evidence base for different learning areas, stages, and their knowledge of the children in their classroom. Dichotomous positions (e.g. 'it's all about play' or 'direct instruction=drill and kill') should be avoided.

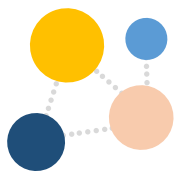
12. Is informed by (and acts on) broad, current and critical understandings of the world within and outside the classroom



Good pedagogy builds on a deep understanding of a wide range of influences on the teaching and learning process; this extends to having a critical understanding of broader societal issues and structures that have a direct or indirect influence on children's lives (e.g. climate action); it further extends to enabling children to respond to and shape the world in which they live.

A decorative graphic on a yellow background. It features a central text block surrounded by five large, solid-colored circles: a dark blue circle at the top, a light green circle on the right, a light blue circle on the left, a light grey circle at the bottom left, and a light orange circle at the bottom right. A white dotted line connects these circles in a circular path, starting from the dark blue circle, moving clockwise through the light blue, light grey, light orange, and light green circles, and returning to the dark blue circle.

Chapter 5
Contemporary
Perspectives on
Assessment



Chapter 5

Contemporary Perspectives on Assessment

Introduction

This chapter outlines some of the core considerations that underlie classroom assessment. These perspectives surface from consultation with an array of theoretical, conceptual, and where applicable, empirical literature. To begin, a brief definition of assessment will be provided. Some contemporary considerations of assessment will then be outlined before discussing the four cornerstones of assessment: purpose, validity, fairness and reliability.

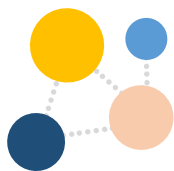
What is assessment?

Assessment is generally considered as a process of “generating, gathering, recording, interpreting, using and reporting evidence of learning in individuals, groups or systems” (NCCA, 2007, p. 7). While this definition is appropriately broad, we wish to highlight how *classroom assessment*, a distinct specialisation within educational assessment, can further enhance teachers’ understanding of the assessment process. The ultimate purpose of classroom assessment is to provide information that can support student *learning* (Heritage, 2018). To do this, the information gathered should allow inferences on learning to be made in order to identify the next instructional step (Black & Wiliam, 2018). This requires the continual collection, evaluation and use of learning evidence “locally controlled by the teacher” (Brookhart & McMillan, 2020, p. 5). This perspective advocates for a “contextualised, interactive and evolving” approach to assessment in which teachers can use assessment data to make inferences that inform future teaching and learning (Bonner & Chen, 2019, p. 3).

It is crucial to note that assessment does not require the generation of *unnecessary* paperwork or written records. The judgment and actions that arise from assessment are most important.

Contemporary Perspectives on Assessment

This section will outline some of the significant concepts influencing classroom assessment, providing context for the specific assessment approaches that follow later. These concepts have been selected based on their relevance to the Irish context. Other publications (e.g. Lysaght et al., 2019) should be consulted for more in-depth examination of the range of factors that should also be considered (e.g. learning progressions). Those that have been selected for inclusion here aim to offer a broad rather than a



comprehensive overview of some of the contemporary perspectives for assessment. Furthermore, many of the contemporary considerations for pedagogy (as outlined in Chapter 3) are also applicable to assessment.

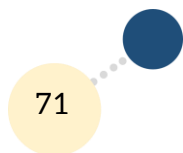
Authentic Assessment

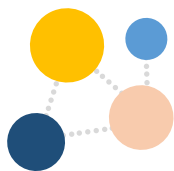
Modern discussions of classroom assessment have advocated for the greater use of a range of assessment methods that go beyond the traditional paper-and-pencil tests such as performance and portfolio assessments (e.g. McMillan, 2021). This has coincided with the growing emphasis on 21st Century Knowledge, Skills and Dispositions, e.g. creativity, problem-solving, collaborative working (see Partnership for 21st Century Skills, 2006). While there is ongoing discussions on what role knowledge and skills should play in curriculum (e.g. Wyse & Manyukhina, 2018) and whether 21st Century Skills are actually 'new' (Rotherham & Willingham, 2010), efforts to assess these constructs are still in their infancy. Further challenges also exist in operationally defining these constructs in a way that allows them to be meaningfully assessed in classroom contexts (Lysaght et al., 2019). Gulikers et al.'s (2004) framework for authentic assessment asserts that assessment tasks should resemble an authentic, realistic learning task but in a new situation that requires learners to integrate their knowledge, skills and abilities with minimal support. Tasks can be collaborative or individual depending on the knowledge, skills or abilities being examined. Authentic assessments are closely aligned with the creation of a product or solution that is evaluated using transparent and previously agreed criteria.

Technology

The prevalence of technology in classrooms has had a knock on effect for assessment. Indeed, there has been a significant growth in computerised testing and digitally-enhanced assessment for the past two decades. Looney (2019) outlines a number of advantages to the use of digital technology for assessment including the real-time feedback, personalised learning, game-based features, immersive learning and increased collaboration. For example, advancements in technology have allowed for the incorporation of UDL principles³¹ into the development and delivery of educational assessments that prioritise accessibility for all learners (Russell, 2020). In line with these principles, technology allows teachers to flexibly tailor learners' experiences with assessment tasks by facilitating "adaptations to the presentation of item content, the interaction with the content, the response mode, or the representational form in which

³¹ As mentioned previously, the three key principles of UDL focus on the provision of multiple means for engagement, representation and action and expression (Rose & Meyer, 2002).



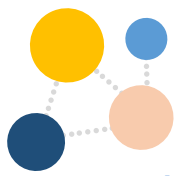


content is communicated” (Russell, 2020, p. 236). This ensures that the interaction between the learner, the assessment content, and the delivery interface is optimised to gather the information that best reflects the learner’s knowledge, skills, or abilities. This supports fairness and equity in assessment, which ultimately enhances the validity of judgments being formed. Progress in relation to computer-adaptive testing (CAT) can also support this endeavour. In adaptive testing, learners start on a common set of items. The difficulty level of each question administered to learners gets harder or easier following a correct or incorrect response (Murchan & Shiel, 2017). While technology represents a range of exciting possibilities for assessment, more work is needed to better understand the balance between technology and what teachers feel is best for teaching, learning, and assessment.

Culturally and Linguistically Responsive Assessment

Given the increasing diversity of classrooms in Irish schools, culturally and linguistically responsive classroom assessment must also be considered. It refers to approaches that are “sensitive to and take cognisance of cultural affiliations” so that values, experiences and ways of thinking that are culturally influenced are recognised and celebrated within the assessment process (Brown et al., 2022, p. 18). It comes from an understanding that the uncritical use of assessment methods with culturally and linguistically diverse learners can undermine the validity of the inferences arising from such assessments (McMillan, 2021). Failure to recognise the inappropriateness of an assessment approach’s content, form, administration or scoring for learners will likely lead to results that will conceal a learner’s real abilities, thus resulting in “erroneous inferences, conclusions and actions” (Murchan & Shiel, 2017, p. 170). For example, the majority of standardised assessment procedures have been developed and shaped by Western-centric cultures which largely ignore other cultural influences (see Hays, 2016) and often have questionable norms, outdated content and strong cultural biases (Herrera et al., 2013). Therefore, they need to be adapted for use with culturally and linguistic learners or supplemented (and in some cases replaced) by other assessment information. For example, in the case of assessment practices for linguistically diverse learners, an understanding of learners’ proficiency in all of the languages they know is important to help plan instruction in a way that minimises barriers and leverages any learner assets (Herrera et al., 2013). When using oral assessments that are not conducted using an individual’s first language, the fluency of a learner’s second language acquisition must be considered or else their learning may be underestimated or misrepresented (Murchan & Shiel, 2017).





Assessment for Inclusion

Given the range of learner needs in a classroom, assessments must be adaptable to ensure that information to support learning can be gathered from *all* learners. This requires an assessment approach consistent with the fundamentals of inclusive education and that prioritises strengths-based approaches. Consequently, **dynamic assessment** has become particularly prevalent in discussions on inclusive assessment (and also culturally responsive assessments). Dynamic assessment is an interactive approach that blends instruction and assessment (e.g. Grigorenko, 2009) and focuses on learning potential rather than just learning attainment. Assessment approaches are modified ‘on the go’ based on learner responses so that what the learner can do with and without assistance is established. For example, Gellert and Elbro (2018) used dynamic assessments of early reading skills with young learners (K-2) to demonstrate how ‘better’ data can be gathered from all learners. In this study, the dynamic decoding test involved learners working with known *and* unknown letters, words and texts to see what they had mastered independently and what they could (or could not) do with support. The authors noted that this dynamic assessment of early reading skills was a more valuable way of identifying ‘at risk’ learners than traditional screeners. It should be noted that dynamic assessment is an ‘umbrella’ term used to describe a range of assessment approaches and models. However, Grigorenko (2009) asserts that three assumptions appear to be shared by those authors who initially advocated for its use and those who are currently researching it:

- Given the diversity of learners in classrooms, ‘conventional’ assessments may not capture a learner’s knowledge or level of cognitive development.
- While it is important to establish what a child knows due to their past experiences, educators should prioritise understanding where a learner can be ‘tomorrow’ if given adequate educational intervention.
- Assessing for the sake of assessment is pointless and potentially damaging - it should be carried out to inform ‘next steps’, e.g. selecting or modifying intervention.

Conducting assessments with these assumptions in mind reframes assessment as a ‘service’ for all children that adopts an appreciative perspective of what they can already know and do (Rottman et al., 2020). In their examination of inclusive assessment approaches in early mathematics for visually impaired learners Rottman et al. (2020), noted that this can allow assessments to not only “find difficulties and show deficits but also [intends to] emphasise the (mathematical) understanding and mastery of strategies already developed” (p. 150). This strengths-based approach also prioritises a solution-





orientated approach teaching, learning and assessment. This aligns well with the underpinning principles and approaches contained within the **Response to Intervention (RTI)** system which adopts a multi-tiered approach to supporting learners in schools (see Chapter 3; Grigorenko, 2009).

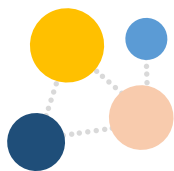
Foundations of Classroom Assessment

While assessment is often defined as a process (see NCCA, 2007), Black and Wiliam (2018) focus most on the desired *outcome* of assessment and consider the process as “a procedure for making inferences about student learning” (p. 553). While many aspects of assessment quality have been identified to support the development of such inferences, those relating to *purpose*, *validity*, *fairness* and *reliability* are fundamental to designing valuable, fair and effective assessments (American Educational Research Association [AERA] et al., 2014; McMillan, 2021; Murchan & Shiel, 2017). However, applying these in an environment as dynamic as a primary classroom is not straightforward.

Purpose

While a range of purposes for collecting assessment data exist (e.g. monitoring, diagnostic), there is a tendency in education to label the purpose of a classroom assessment into one of two broad categories - formative and summative. Assessments that claim to serve a summative purpose generally focus on the grading or ranking of students. In contrast, formative assessments involve the interpretation of evidence to make decisions about the ‘next steps’ of instruction (Murchan & Shiel, 2017). While it has become common for teachers to categorise the purpose of a classroom assessment in line with the summative/formative classification system, this may be somewhat counterproductive (Lysaght et al., 2019). Instead, it is more important to remember that the purpose of an assessment varies according to the “kinds of inferences being drawn” (Black & Wiliam, 2018, p. 553). As a result, it may be more accurate to say that ‘formative’ and ‘summative’ are descriptions of different types of inferences. This suggests that a range of inferences can be drawn from a single assessment source. For example, an end-of-unit assessment designed to measure operational knowledge in mathematics may have been originally conceived as a summative measure of learning. However, it can also be used to identify areas for future learning and instruction. Consequently, when thinking about the *purpose* of a classroom assessment, it is more important that teachers determine from the outset *what* information they need to gather to support particular inferences about a student’s learning.





Validity and Fairness

Validity is also a core concern of all assessments and considers the “plausibility and appropriateness of the interpretations and use of assessment results” (Kane & Wools, 2020, p. 11)³². From a functional perspective, the validity of an assessment is primarily dependent on how well it supports the intended use of the information arising from it (Cronbach, 1988). Given that the broad purpose of classroom assessment is to support future learning, the validity of a classroom assessment is closely linked to the success of future instruction. Therefore, assessments that can guide teachers’ actions and support *future* learning are most useful in a classroom context. It is important to note though that these practices should also be *fair*. While it is challenging to offer a single definition of fairness, in the context of classroom assessment it implies that teachers should conduct assessments that are accessible to *all* students (Hermann & Cook, 2020)³³. Hermann and Cook (2020) suggest that fair classroom assessments use assessment tools and strategies that address target learning through “multiple modes of representation and use a variety of formats and action to gauge student learning” (p. 251). In this way, there is sensitivity to individual learning needs, yielding a “better and fairer estimate of student capability” (Hermann & Cook, 2020, p. 261). Based on this, it is clear that when designing a classroom assessment, teachers should consider how well the approaches or tools used can support the generation of valid and fair inferences about their learning.

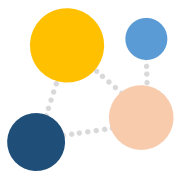
Reliability

Reliability is the final element that underpins most discussions on educational and classroom assessment. Reliability is concerned with accuracy and consistency, e.g. the consistency of scores from a test. It is a crucial prerequisite for validity. Within a classroom context, reliable assessments should provide sufficient evidence about a student’s learning, usually in relation to a particular objective (Brookhart, 2003). It should be noted that a teacher’s understanding of a student’s learning or competence will never be wholly complete or accurate but it can be *refined* over time with daily interactions and multiple samplings of student work (Kane & Wools, 2020). A “steady stream of

³² Validity is not a ‘property’ of an assessment. However, different forms of validity evidence can be gathered for an assessment in order to justify the appropriateness of a particular inference. These include content validity, construct validity, predictive validity and consequential validity (AERA et al., 2014).

³³ There is an inherent tension between issues of equality and equity when considering fairness in assessment (see Hermann & Cook, 2020). Equality in assessment implies that everyone can be assessed in the same way leading to fair and valid inferences (also known as ‘standardisation’ in testing). Equitable assessment practices suggest that some differentiation is required to ensure equality of meaning is maintained. More and more approaches to assessment are favouring equitable practices. From this perspective, it is considered fairest for learners to be ‘matched’ with “principled variations of an assessment” to ensure equality of meaning from the information gathered (Mislevy et al., 2013).





information” (Heritage, 2018, p. 39) would be required for any inference about student learning to be reliable. This evidence should be derived from many sources to increase accuracy (Heritage, 2018; Kane & Wools, 2018). This further reinforces the idea that classroom assessment is fundamental to successful teaching and learning rather than something that is ‘additional’ or occurs only after learning has occurred. It also suggests that assessment should be considered a sampling process that facilitates an improved understanding of a student’s learning over time.

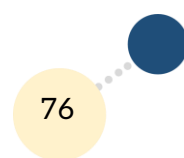
While these four cornerstones of classroom assessment have been presented separately, they are closely intertwined. Taking the above into consideration however, they can be distilled into three key questions to guide a teacher’s approach to classroom assessment:

1. What do I want to know from the information I will gather?
2. Have I gathered enough information to have an accurate overview of the specific knowledge, skill or understanding of interest?
3. How well does the information that has been gathered justify my future actions?

Answering these questions should help design assessments to ‘bridge the gap’ between teaching and learning (Wiliam, 2013).

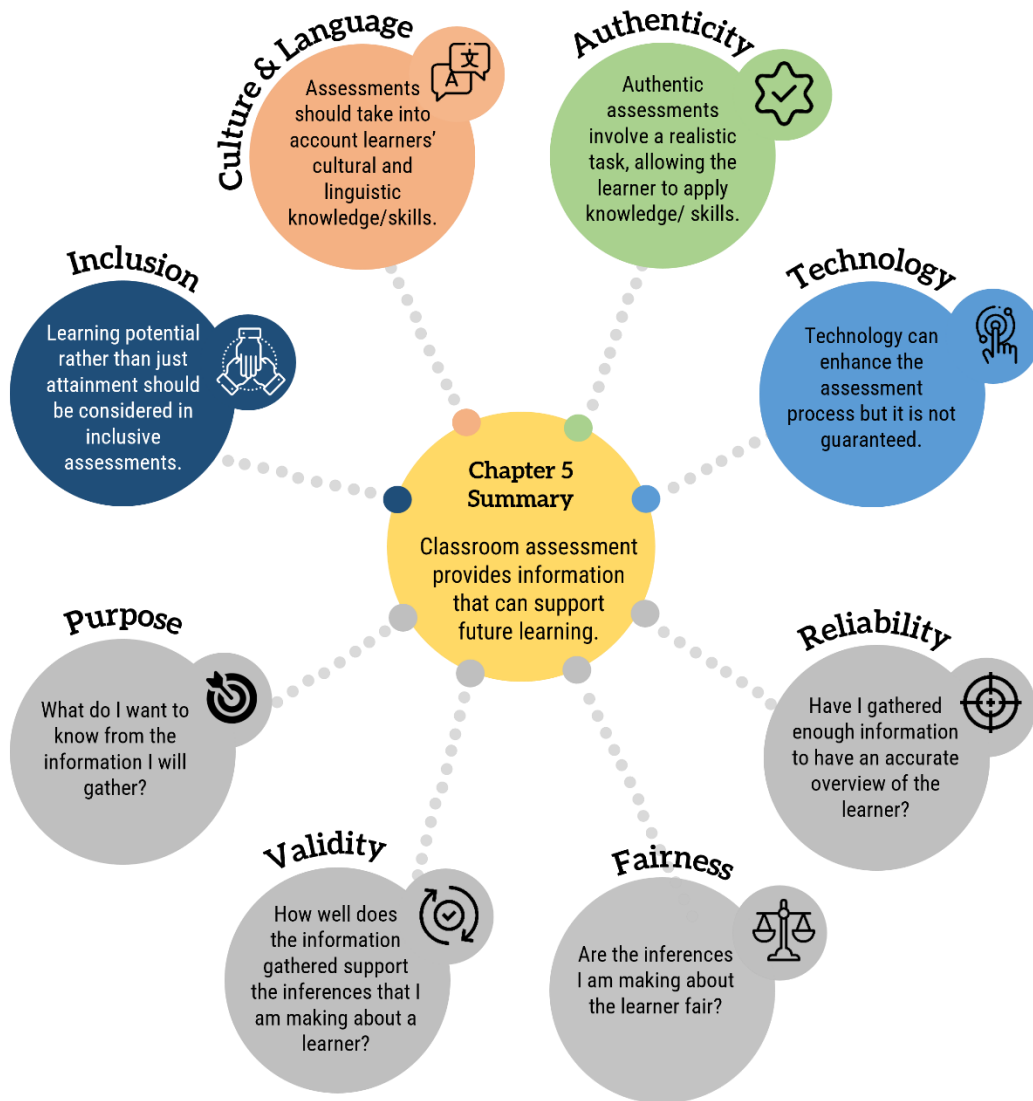
Conclusion

This chapter has considered overarching considerations for assessment. These are summarised visually on the next page. Some of these related to assessment more broadly (e.g. technology) while others related to aspects of assessment that are fundamental to its efficacy (e.g. validity). The ideas outlined here will be considered alongside a more thorough examination of the empirical literature examining assessment approaches (e.g. performance-based assessments) in the next chapter.

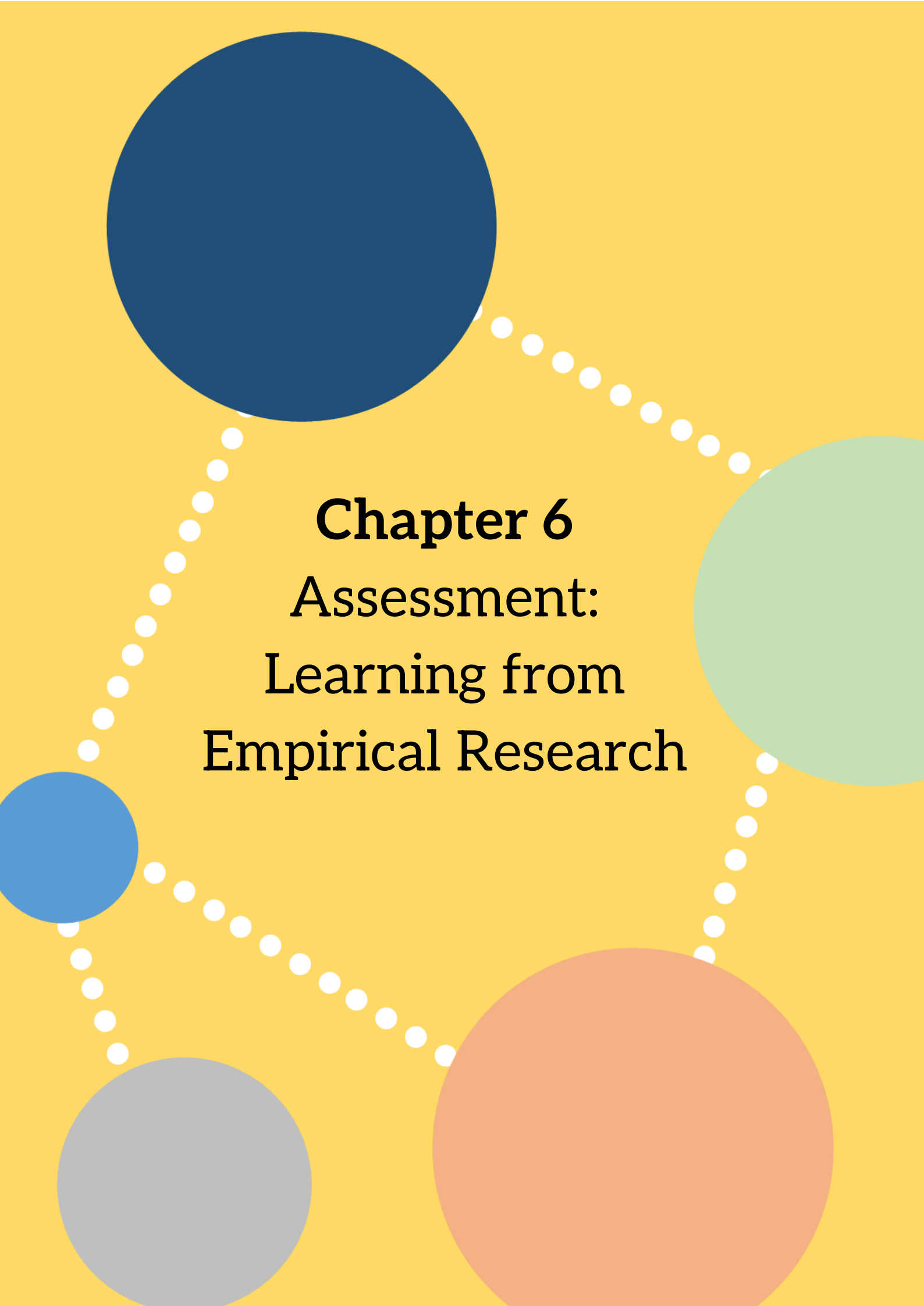




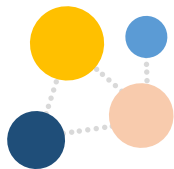
Perspectives



Foundations

A decorative graphic on a yellow background. It features a central text block surrounded by five large, solid-colored circles: a dark blue circle at the top, a light green circle on the right, a light blue circle on the left, a light grey circle at the bottom left, and a light orange circle at the bottom right. A white dotted line connects these circles in a circular path, starting from the top circle, moving clockwise through the right, bottom right, bottom left, and left circles, and returning to the top circle.

Chapter 6
Assessment:
Learning from
Empirical Research



Chapter 6

Assessment: Learning from Empirical Research

Introduction

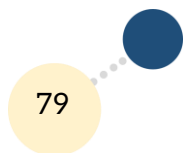
Accurate and appropriate assessment provides teachers with the information they need to make better decisions about how to support their learners. Achieving this can involve a wide array of instruments and approaches that are continually evolving. If teachers are to use evidence-informed assessment practices, the current evidence on common assessment practices and approaches employed in primary classrooms requires examination. This chapter will begin by briefly chronicling the research questions and chosen research approach. A summary of the pertinent evidence available on the role, value, and use of different classroom assessment practices will then be provided. The suitability and applicability of these practices in classrooms that use an integrated curriculum will also be considered (denoted in blue boxes throughout). Implications for teacher and child agency will then be explored. The chapter will conclude with a series of principles on classroom assessment that may help guide policy and practice.

Research Questions and Research Approach

The following research questions underpin the current chapter:

- What assessment approaches and considerations should inform a redeveloped primary school curriculum?
- How can these be enacted in an integrated context?

Three strands of evidence were woven together to develop a research-informed description of high-quality assessment and its existence in the curriculum integration literature. Table 3 summarises this process. A more complete explanation can be found in Annex 2 (Section 3).



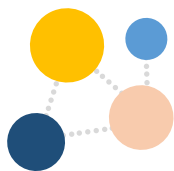


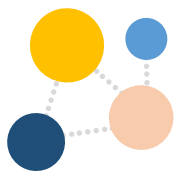
Table 3 Summary of Sources for Chapter 6

Strand 1 Seminal Texts/Handbooks	This involved consultation with seminal texts and handbooks that outline the core considerations for classroom and educational assessment.
Strand 2 Scoping and Hand Searches	Literature within this strand was derived from Boolean searches of academic databases for research reviews (e.g. meta-analytic studies, systematic reviews) and supplementary hand searches.
Strand 3 Content Analysis of Report 1 Annex	A re-analysis of the assessment approaches used in the studies returned for the systematic review conducted for Report 1 was undertaken. Please refer to Report 1 and its accompanying Annex for a full account as to how these studies were identified.

Assessment Approaches: Empirical Evidence and Application in Integrated Curriculum

Nine assessment approaches were identified within the review of the literature as being highly applicable for use in primary contexts. While this list does not claim to be exhaustive of all possible assessment methods, these approaches were extensively examined or discussed in the literature that was consulted for this chapter. Except for some differences in nomenclature, these approaches align well with the continuum of methods outlined in the 2007 NCCA Guidelines on Assessment. The terminology used in this report reflects changes within the field more broadly (see Brookhart & McMillan, 2020) and the literature that was returned from the scoping review. Furthermore, in line with the recommendations of Lysaght et al. (2019) and Black and Wiliam (2018), the categorisation of assessment practices as ‘formative’ and ‘summative’ was not applied in this review of assessment methods, as information arising from any assessment can potentially be used for summative or formative purposes. Each of the assessment approaches will now be considered in alphabetical order. Relevant literature for each will be examined in terms of its general efficacy and utility. Where possible, illustrative examples of how they were applied in the context of an integrated curriculum will also be provided.





Classroom Tests

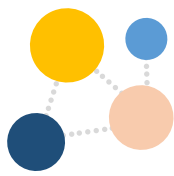
As noted in the 2007 NCCA Assessment guidelines, tests “provide opportunities for children to demonstrate their levels of understanding (or misunderstanding)” (p. 54). However, ‘test’ is still a relatively vague term in educational literature which often has negative connotations (Murchan & Shiel, 2017). Yet, the information obtained from testing can be used to guide what the teacher does next to support learners. We use the term ‘test’ to represent any written or oral assignment that consists of a series of questions/problems that must be answered by individual learners within a limited time frame in a classroom context (Brookhart, 2015). In designing classroom tests, teachers are encouraged to consider a number of factors including representative content sampling³⁴, administration and minimising learner anxiety³⁵ (McMillan, 2021). A range of item (question) types are available to teachers - constructed response (e.g. short answers, essays, completing maths problems), selected response (e.g. multiple choice, binary choice) and cloze procedures. These can be represented in oral or written form. It can be difficult to select and design the most appropriate item type for any classroom test that is to be administered to a diverse group of learners. For example, many of these items (in particular multiple-choice questions) have received a great deal of criticism within the literature (see Scully, 2017 for an overview). The most significant of these criticisms lie in the assertion that these items are inauthentic ways of determining higher-order thinking skills and the *application* of knowledge. Furthermore, Collins et al. (2018) conducted a meta-analysis investigating the impact of item type³⁶ on the performance of learners with and without reading difficulties on standardised and researcher-designed assessments of reading comprehension (82 studies; learners were within the K-12 age range). Results indicated that the achievement gap between learners with and without reading difficulties was larger for some response formats (e.g. picture selection $g=-1.80$) than others (e.g. retell $g=-0.60$). Therefore, it can be argued that the design of classroom tests can mediate their overall efficacy and they may not always be the most appropriate method in assessing certain constructs.

³⁴ Tests generally measure a *sample* of what students have learned over the larger domain of knowledge (McMillan, 2021).

³⁵ McMillan (2021) asserts that there are a range of approaches that teachers can use to minimise testing anxiety such as the explicit teaching of test-taking skills, provision of feedback and the elimination of any punitive or rewarding consequences. Instead, learners should see tests as a way to show the teacher what they do and do not know so that their learning experiences can be improved upon.

³⁶ Reading comprehension tests were administered to students in all studies, and each measure used one of six response formats: multiple choice, cloze, sentence verification, open-ended questions, retell, or picture selection.

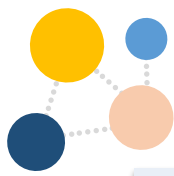




Given that the construction of tests is often the responsibility of the classroom teacher, teacher knowledge of *when* to use classroom tests as well as how to best *design* and *score* them is fundamental if they are to be considered reliable and fair sources of information from which valid inferences about student learning can be drawn. For example, if teachers only include test items that focus on factual recall or procedural fluency, teachers may have insufficient evidence to draw appropriate conclusions about their learners' abilities in applying the content to more novel contexts (Wellberg, 2023). Despite design challenges, classroom tests remain a useful assessment method. When considered *alongside* a larger sample of work, classroom tests are a useful, quick and efficient tool for teachers to use in assessing learner progress (McMillan, 2021; Murchan & Shiel, 2017). This can be further enhanced when technology is involved. Murchan and Oldham (2017) developed an Irish, curriculum-based computerised mathematics assessment for 3rd class learners. Automated scoring of responses allowed teachers to quickly determine learner performance. The extra time that was available to teachers allowed them to engage in error-analysis techniques. The authors assert that digitally mediated error-analysis approaches for classroom tests can help teachers to more efficiently and effectively understand, and plan for, their learners.

Curriculum Integration – Examples

Classroom tests were a common assessment practice in those studies examining curriculum integration. In their large-scale research study, Duke et al. (2021) designed a social studies test and a reading comprehension test to assess what their participants had learned in an integrated literacy-social studies unit of work. This research tool was aligned with the relevant educational standards for the American state in question. Cervetti et al. (2012) followed a similar procedure when designing the necessary science and literacy tests for their study. It must be acknowledged that for these two examples, the classroom tests were designed by researchers and administered by teachers for the purposes of a research project. These tests were not necessarily used by the teachers to inform their classroom practice. Therefore, some generalisability issues exist with applying this approach to the assessment of integrated learning to Irish classrooms by teachers. Yet, the use of subject matter experts (SMEs) by these researchers highlights the value of 'pooling' knowledge to design more effective tests. Other studies that examined teachers' approaches to the use of classroom tests found that end-of-chapter tests, teacher designed quizzes and essay type questions were commonly used (Akbar, 2012; Bazemore, 2015). While the items used in these tests involved multiple-choice questions, short answer questions or essays (Bazemore, 2015; Birsa, 2018; Hardiman et al., 2017), other question



types that do not rely on the production of text were also used. For example, a doctoral study by Levy (2018) used a drawing assessment to determine what their 6th grade learners could recall about the water cycle after experiencing an integrated STEM unit.

Feedback

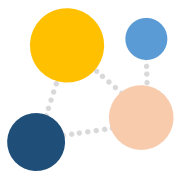
Hattie and Timperley (2007) define feedback as “information provided by an agent (e.g. teacher, peer, book, parent, experience) regarding aspects of one’s performance or understanding” (p. 102). This feedback should then be used by the learner in order to move their learning forward³⁷ and should be specific, tangible, goal-referenced, actionable and understandable (Collins & Quigley, 2021; Hattie & Timperley, 2007; Hodgen et al., 2018, 2020; Wiliam & Leahy, 2015). It is important to acknowledge that the boundary between feedback as pedagogical practice and its role as an assessment method is somewhat blurred. In an ideal world, it should be “impossible to tell where one ends and the other begins” (Wiliam & Leahy, 2015, p. 129). Nevertheless, given that “the starting point for feedback is eliciting the right evidence” (Collin & Quigley, 2019, p. 5), it is being treated in this report as an assessment approach. While there is evidence to indicate the positive impact feedback can have on learning (Graham et al., 2015; Newman et al., 2021; Wisniewski et al., 2020), there is disagreement on what should be considered core features of high-quality feedback. For example, Alqassab et al. (2023) identified ten ‘design elements’ of peer feedback. Many of these can also be applied to other feedback agents and include, amongst others, output (e.g. oral comment, written comment, scores), privacy (public, confidential etc.), and group ‘constellations’ (e.g. pairs, groups). Schildkamp et al. (2020) also emphasise the value of process feedback rather than just achievement related feedback. Process feedback focuses on what strategies or changes are needed to support the learners in moving from where they currently are to where they wish to be. In this way, we can see how feedback can be complex and variable, making it difficult to understand from research the ‘optimum’ approach for classroom use.

It is because of this that Wisniewski et al. (2020) note that “feedback, on average, is powerful but some feedback is more powerful” (p. 13). Double et al. (2020) found an overall small to medium effect of peer feedback on academic performance ($g = 0.31$)³⁸. This

³⁷ In the Hattie and Timperley Feedback Model (2007), feedback must answer three key questions to support learning: “Where am I going?”, “How am I going?”, and “Where to next?”. Feedback can work across the levels of self, task, process and self-regulation.

³⁸ The results of Double et al.’s (2020) also suggest that peer assessment improves academic performance compared with teacher assessment ($g = 0.28$). The authors themselves note that such a finding is “counterintuitive” and hypothesise that the “pedagogical disadvantages of peer assessment are compensated for by affective or motivational aspects of peer assessment” (p. 501). However, further research with more rigorous and domain specific outcome measures would be required to understand how such a result emerged.





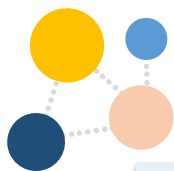
was consistent across all educational settings and indicates that teachers should structure classroom activities in a way that utilises peer assessment. A meta-analysis by Graham et al. (2015) found that timely feedback on learners' writing led to improved writing quality but that effect sizes varied according to the agent involved. Feedback from adults had the largest positive impact on writing improvement³⁹. However, feedback from peers was also considered to be quite powerful. The average weighted effect size for adult feedback (0.87) was statistically larger than the average weighted effect size for peer (0.58) or self-feedback (0.62). Regardless of the challenges involved in the design and delivery of 'powerful' feedback in primary classrooms, there is an agreement amongst practitioners and researchers that feedback is a necessary assessment method to ensure that learning is kept 'on track' (Collins & Quigley, 2021; Murchan & Shiel, 2017; Wiliam & Leahy, 2015). However, the methods and timing of feedback in complex environments like classrooms are likely best left to a teacher's professional judgement⁴⁰. Indeed, Hodgen et al. (2018) note that the provision of feedback to learners aged 9-14 years in maths classes should be restricted to more complex tasks. In particular, training before peer assessment appears to be necessary for its success (see Li et al., 2020). A study reviewed in Zheng et al.'s (2020) meta-analysis found that training on assessment criteria decreased the discrepancy between teacher and student ratings and improved the quality of peer feedback and students' work.

Curriculum Integration - Examples

The use of peer and teacher feedback in studies of curriculum integration tended to be closely related to the process of teaching and learning. For example, in Moss et al.'s (2019) Australian study, oral feedback from peers and teachers was highly valuable to primary-aged learners and was part of an important routine that was "an integral part to their learning" (p. 32). Peer feedback in this study was guided by a rubric. This combination of assessment methods was also noted in other studies reviewed for this report (Bartholomew et al., 2019). However, some studies identified the very specific challenges associated with the delivery of feedback when an integrated curriculum is involved.

³⁹ It is interesting to note that only one study in Graham et al.'s (2015) meta-analysis examined the effects of teachers providing feedback on a learner's written work.

⁴⁰ The Education Endowment Foundation (EEF) (2021) identified six key principles to guide the use of teacher feedback in primary classrooms within the English education system: (i) Lay the foundations for effective feedback; (ii) Deliver appropriately timed feedback that focuses on moving learning forward; (iii) Plan for how pupils will receive and use feedback; (iv) Carefully consider how to use purposeful, and time-efficient, written feedback; (v) Carefully consider how to use purposeful verbal feedback; (vi) Design a school feedback policy that prioritises and exemplifies the principles of effective feedback.



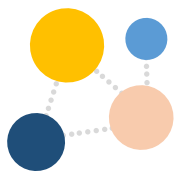
Teachers in García-Carrillo et al.'s (2021) study acknowledged that their feedback in a STEM-integrated unit of work involving robotics did not “leave sufficient time for the pupils to reassume a leading role” (p.12). This underscores the importance of teachers being able to know *when* feedback should be delivered to ensure it actually promotes learning and is “of more work for the recipient than the donor” (William & Leahy, 2015, p. 122). Difficulties in relation to the *content* of the feedback provided by teachers in integrated STEM units were also observed. Aguirre-Munoz et al. (2021) found that teachers need more assistance in knowing how to provide “feedback to students that supports the development of analogous concepts” in integrated science and maths classes (p. 79). The authors noted that teacher feedback to learners failed to “support understanding of the relationship between targeted concepts” (p. 73) and tended to focus more on giving feedback on learners’ computational abilities in mathematics rather than their ability to reason scientifically.

Observation

Observation is a core assessment practice that supports the use of intuitive assessments and planned interactions (Lysaght et al., 2019). It is particularly valuable for formative assessment as it allows for the timely collection of data to support future teaching and learning. Observations can occur at the teacher's discretion and most tend to be unstructured and happen naturally. Nevertheless, this does not necessarily mean that teacher observations are ‘random’. Specific learners can be targeted for observation depending on the teacher’s need for specific information. These observations can provide “important contextual information in which to situate more formal and recorded assessments,” which ultimately supports their validity (Pyle & Danniels, 2017, p. 2282). Observational checklists can also be used to guide teacher observation and increase precision. Checklists like these can focus on a procedure, behaviour, or a product and can be psychometrically validated (Murchan & Shiel, 2017).

Observations can be undertaken to assess many different constructs, including the nature of student participation in class discussions, the degree of understanding demonstrated in student answers, and the affective responses of learners (McMillan, 2021). Pyle and Danniels (2017) noted that observational assessment is often used by teachers in the assessment of developmental milestones in free play activities by young learners. However, the most significant difficulty concerning the use of observation as an assessment practice surrounds the accuracy of teacher observations. Teachers, like all individuals are prone to a range of biases that can distort the meaning of what has been





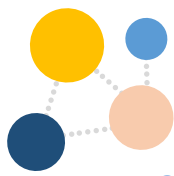
observed⁴¹. Furthermore, learners may act differently in certain situations because they are being observed (Fraenkel et al., 2018). Teachers should be aware of these drawbacks to ensure they know how to overcome them when using observational data to make judgements about learning (McMillan, 2021). In their examination of assessment practices in kindergarten classrooms, Pyle and Danniels (2017) noted that observation was the leading assessment practice employed by teachers when their learners were playing. The teachers in this study noted that the lack of recorded evidence during observations occurring in free play meant that they relied on their own, potentially unreliable, recall to support any analysis of learning. That is why observational data in this study was often combined with other approaches. One teacher noted that they “always have a checklist or blank piece of paper” next to them where they are “making notes about things” that they considered relevant (Pyle & Danniels, 2017, p. 2270). Using a variety of documentation strategies to support and supplement observational data appears commonplace in research (Chang et al., 2020; Harris et al., 2022), illustrating how this naturalistic assessment approach can be implemented in a reliable, purposeful manner to promote more valid judgements about learning.

Curriculum Integration - Examples

Despite their ubiquity in classrooms, observations were rarely explicitly discussed as a source of assessment data in studies on curriculum integration. Those that did discuss their use of observation as an assessment tool emphasised their utility in assessing more complex skills such as communication or collaboration. In Feldwisch et al.’s (2014) work on arts-integrated instruction, teachers and researchers both noted that they noticed significant growth in their learner’s abilities “to express their needs and opinions within a group” as well as their skills in “dividing tasks, making decisions, working through disagreements, and forming compromises” (p. 105). Other teachers used observational data to change the direction of their teaching by modifying their lesson content or its delivery. The teacher in Lau and Grieshaber’s (2018) study changed how she interacted with her learners after observing their responses to her use of musical instruments. These examples demonstrate how assessment data from observations can be a powerful tool in providing the evidence necessary to structure and tailor instruction in any curricular context.

⁴¹ A 2001 discussion paper by Graham Maxwell offered an interesting typology of those teacher-related factors that affect the validity of teacher observations: prejudgments and prejudices, selective perception, providing inadvertent clues, inappropriate inference and inconsistency (see Maxwell, 2001, p. 9-12).



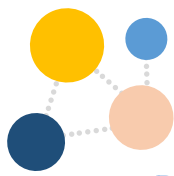


Oral Questioning/Discussion

Questioning to generate classroom discussions is a core element of day-to-day life in a classroom. It is primarily used for two distinct purposes - to promote students' thinking and to assess it (Coe et al., 2020). Its use as both a pedagogical approach and an assessment practice is difficult to disentangle as questioning "lies at the intersection of past and future, development and renewal, achievement and support" (Heritage & Heritage, 2013, p. 188). Nevertheless, when used for assessment purposes, questions and discussions should be constructed to increase the quality of information about a learner's thinking, knowledge, and understanding. Coe et al. (2020) assert that gaining high-quality information about learners through questioning cannot be achieved by simply asking a large quantity of questions. Instead, high-quality questioning relates to "the types of questions, the time allowed for, and depth of, students thinking they provoke or elicit, and how teachers interact with the responses" (Coe et al., 2020, p. 24). Heritage and Heritage (2013) emphasise the importance of teachers knowing how to respond to and use the assessment information provided by learners in discussions to advance and progress their thinking. Other authors stress the importance of using whole-class response systems (e.g. mini-whiteboards) to ensure that all students respond to oral questions (e.g. Coe et al., 2020; Rosenshine, 2012; Wiliam & Leahy, 2015)

Curriculum Integration - Examples

Brough (2012) noted that 'skilful questioning' was a key element of democratic, student-centred curriculum integration. Yet, teacher questioning to support pedagogical and assessment practices becomes more complex in an integrated curriculum. Schellinger et al. (2021) noted that teachers in their study examining integrated science and engineering lessons could not leverage learner discussions and question responses to support connections with other scientific phenomena. The authors attribute these "missed opportunities" to insufficient teacher knowledge on how to make "connections between the science concepts and the investigation and application of those concepts within an engineering context" (p. 51). Aguirre-Munoz et al. (2021) noted something similar in their investigation of teachers' ability to engage students in discussions that facilitated understanding of the relationship between the targeted science and mathematics concepts. Teachers in this study's initial stages could not interpret learner responses 'on the spot' to support progress toward the integrated learning goals. Cunnington et al. (2014) and García-Carrillo et al. (2021) also found that teachers implementing an integrated curriculum found it challenging to allocate sufficient time for teacher questioning and discussion.



Performance-Based Assessments

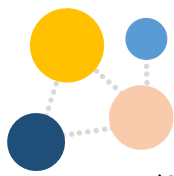
Performance-based assessments require the demonstration of a skill or competency (Brookhart, 2015). They generally involve students applying their newly acquired knowledge and skills to a set task leading to a 'performance' that represents their learning. These performances can be simple or complex. For example, they may involve a skills exhibition (e.g. musical scales, gymnastic moves), the creation of a product or model (e.g. making an electrical circuit, writing an essay⁴²), or illustrating understanding using an oral presentation or conversation (e.g. explaining the 'water cycle', oral examinations in a non-native language). For certain subjects, such as Visual Arts or Physical Education, multiple examples of performance can be gathered in a portfolio in order to demonstrate the learner's growth and development over time (Murchan & Shiel, 2017). They can also involve individuals or groups. Given their emphasis on knowledge and skills application, such assessments are considered highly authentic and valuable as they also mirror tasks carried out in the 'real world' or in line with many '21st Century Skills' frameworks (McMillan, 2021; Murchan & Shiel, 2017). In the United States, they are often used as Kindergarten Entry Assessments as they are considered to be more developmentally appropriate (e.g. Miller-Bains et al., 2017). However, for performance-based assessments to be effective and useful, they require careful planning and design. They should be paired with clear and explicit performance criteria, usually manifested as checklists, rating scales, or rubrics (McMillan, 2021).

Nevertheless, performance-based assessments (e.g. design projects, model making) can be a challenging assessment practice to implement in classrooms that use any type of curriculum. Firstly, they require careful design to ensure that the assessment is 'matched' to the learning outcomes (see Brookhart, 2015)⁴³. Projects, a common form of performance-based assessments, often necessitate a high level of prior knowledge and scaffolding. Teacher bias, significant time investments, and the wide range of correct permutations associated with performance assessments are further disadvantages to such a practice, as Bartholomew et al. (2019) outlined. Rater effects are potentially the greatest risk to the use of performance-based assessments. In their research, Miller-Bains et al.

⁴² Brookhart (2015) acknowledges that it can be difficult to justify the inclusion of essays and other written products as performance-based assessments. For the purposes of this report, they have been classified as a performance-based assessment when they are "administered in a context that is not a test" (Brookhart, 2015, p. 3/4).

⁴³ Brookhart (2015) has a seven step task design process outlined. It involves the following steps: (i) Identify the content to be assessed, (ii) Identify the skills to be assessed, (iii) Draft a task with criteria, (iv) Check for a match with intended content and thinking skills, (v) Check that the requirements of the task do not add additional skills, (vi) Revise the task and make a rubric from the criteria, (vii) Try out the task and the rubric (p. 20-26).





(2017) found that the ratings produced by a common performance-based assessment used in kindergarten were “more influenced by factors that are separate from a child’s actual skills” when compared to other assessments⁴⁴ (p. 11). This has significant implications for validity. However, comparative judgement⁴⁵ may mediate some of these disadvantages. This was recently demonstrated in Wheadon et al.’s (2020) large scale study involving the assessment of 55,599 primary students’ writing in England. Their results showed that a comparative judgement approach to writing showed promise in providing a fair and reliable method to assess writing that could be applied at a school-level with teams of teachers working together. Work conducted at a classroom level by Bartholomew et al. (2019) also offers further validity evidence in favour of this approach.

Curriculum Integration - Examples

Performance-based assessments could be a helpful tool in determining the learning that has occurred in an integrated unit of work, given that they often have learning outcomes associated with “deep understanding, reasoning, skills and products” - areas which performance-based assessments are ideally suited for (McMillan, 2021, p. 279). The use of performance-based assessments within the studies that examined curriculum integration in primary contexts appeared to be relatively common, particularly in relation to STEM (e.g. Liston & Hennessy, 2018) and the arts (e.g. Birsa, 2018). This is to be expected given the emphasis that curriculum integration places on the role of real-world scenarios in teaching and learning. For example, teachers involved in Quigley et al.’s (2019) research planned an ‘end of unit’ assessment task requiring groups of 5th grade learners to create a persuasive infomercial that would convince a government agency to provide funding to address a problem associated with rapid population growth.

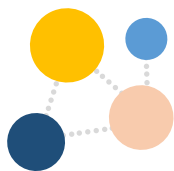
Rubrics/Shared Success Criteria

Rubrics involve the specification of a coherent set of criteria from which a learner’s work or performance can be evaluated. These criteria can be informed by the curriculum, teachers’ own knowledge/experience or learning progressions (Brookhart, 2015; Harris et al., 2022; McMillan, 2021). They can also be used to communicate to

⁴⁴ In this study, the authors examined the extent to which teachers’ ratings on a performance-based assessment (Teaching Strategies GOLD) discriminated among children’s skills in comparison to direct assessments. On average, 37% of a learner’s Teaching Strategies GOLD score within a learning domain could be explained by what classroom a learner was in (and what teacher rated them). Variability in learner performance on direct assessments (Woodcock-Johnson III Tests of Achievement, Pencil Tap) appeared to be almost entirely attributable to differences between learners with only 1% to 4% of the variation being explained by learner’s presence in a particular classroom.

⁴⁵ In comparative judgement, an assessor (or assessor team) ranks pairs of student work based on their expertise and/or a set of criteria (Pollitt, 2012). This ultimately results in a rank order of student work with accompanying comments to explain how the works were ranked.





learners about the quality of their work and what they can do next to improve it. In contrast to checklists, they include *descriptions* indicating standards of attainment for different levels of performance, success, or competency (Brookhart, 2015). This can be done quantitatively (e.g. 1 through 4) or qualitatively (e.g. emerging, developing, proficient, exemplary; Brookhart, 2015). Two broad categories of rubrics exist - holistic and analytic. A holistic rubric is one in which each category contains several criteria to give a single score for an overall rating (McMillan, 2021). Each level of performance contains a description of performance across all criteria. An analytic rubric is one in which each criterion is scored individually and provides more explicit feedback for the learner (Brookhart, 2015). The purpose of the assessment should help determine which form of rubric could be used. Nevertheless, it is important to note that rubrics are most commonly used alongside a wide array of other assessment practices and approaches (e.g. performance-based assessments). This makes it difficult to articulate to what degree rubrics can effectively assess and enhance learning. Regardless, in their qualitative review of the topic, Panadero and Jonsson (2013) acknowledge that there is sufficient evidence to suggest that the use of rubrics as an assessment practice can support learning by “increasing transparency, reducing anxiety, aiding the feedback process, improving student self-efficacy, or supporting student self-regulation” (p. 138).

In the studies they reviewed, Harris et al. (2022) stated that teachers often report finding tools like rubrics useful for guiding their judgments. While it can be difficult for teachers to account for variations in individual learners' performance across related criteria⁴⁶, they remain a valuable tool for guiding teachers' claims about learner performance (Harris et al., 2022). They can also be an effective way to enhance reliability in scoring, as demonstrated by Kennedy and Shiel (2022). The authors designed a writing rubric designed for use by teachers to formatively assess the writing of Irish children in Junior Infants to 2nd class across the criteria of conventions, organisation, ideas, word choice, and voice. The detailed descriptors of performance allowed for good agreement among teachers with overall weighted Kappa values at each grade level ranging from .62 to .80. Furthermore, Kennedy and Shiel (2022) found that the rubric was a catalyst for developing teacher knowledge and expectations about writing quality. It is interesting to note that on the basis of their newfound knowledge, the 33 teachers involved in this study created child-friendly versions of the rubric components. These were very well

⁴⁶ This is perhaps the greatest disadvantage of rubrics as it poses a potential threat to the validity of the claims that can arise from their use. Humphry and Heldsinger (2014) found that the matrix design of rubrics forced judgments on individual criteria to be dependent (rather than independent), resulting in a halo effect.





received by even the youngest of children in the study. Such rubrics could also be used to support peer and self-assessment approaches as they offer an external support to the generation of feedback necessary for self-regulated learning. However, Heitink et al. (2016) caution that the efficacy of rubrics and success criteria in supporting peer and self-assessment is highly reliant on ensuring that learners have appropriate training in using such criteria.

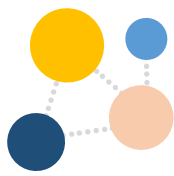
Curriculum Integration - Examples

Rubrics were common in studies on curriculum integration. They were particularly prevalent in studies that involved integrated STEM or Arts disciplines (e.g. Jia et al., 2021; Kok & van Schoor, 2014; Sáez-López et al., 2016; Vallera & Bodzin, 2016). One cluster randomised control trial that examined the impact of an integrated programme on elementary learners' achievement in maths, literacy and visual arts gathered three years of rubric data to assess progress in visual arts. Standardised tests were used to determine the impact of the programme on literacy and maths learning (Cunnington et al., 2014). Some difficulties can arise when attempting to create the success criteria contained in rubrics. In their small-scale doctoral study, Fragakis (2019) noted that teacher-designed rubrics often included elements that were incongruent with the target construct, e.g. creative artworks had to be 'neat'. Another doctoral study noted that teachers had difficulty creating a rubric before they had an "adequate understanding of our [their] expectations" (Jordan, 2016, p. 85).

Self-Assessment

Self-assessment involves learners thinking about the quality of their own work and making an informed judgement about it in order to improve their future learning, performance or achievement (Andrade, 2019; McMillan, 2021). More specifically, it allows the learners themselves to be responsible for monitoring and evaluating their learning and performance. As with any form of classroom assessment, this can involve qualitative (e.g. reflective comments) or quantitative approaches (e.g. grading). Engaging in this process is assumed to improve motivation, learning and metacognition (Chen & Bonner, 2020; McMillan, 2021; Sanchez et al., 2017). In relation to learning, Graham et al. (2015) found that self-assessment in the form of self-grading had a significant, positive impact on learning. In their meta-analysis investigating the impact of self-grading for 3rd-12th grade classrooms across 38 studies, Sanchez et al. (2017) also found that students who engaged in self-grading performed better ($g=0.34$) on subsequent tests than did students who did not. Regarding meta-cognition, self-assessment encourages the development of self-





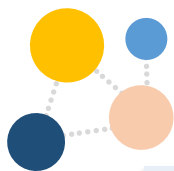
monitoring and self-evaluation. These essential metacognitive skills allow learners to “form internal questions about their learning and performance, to make decisions about what other learning is needed” (McMillan, 2021, p. 356). This promotes self-regulated learning. There is good evidence to suggest that the relationship between self-regulated learning, metacognition and academic attainment is quite strong (Muijs & Bokhove, 2020).

It must be recorded though that research by Andrade (2019) cautions against the unthinking and unstructured use of self-assessment approaches with younger learners. They rightly argue that the strongest evidence for this assessment practice comes from older-learners in upper primary or in post-primary. For example, in their meta-analysis, Sanchez et al. (2017), found that, on average, learners did not grade themselves significantly different from teachers ($g=0.04$) and instead showed a moderate correlation ($r=0.67$). However, all of the studies involved in this meta-analysis involved learners older than 8 years. This correlates with the results of Keane and Griffin’s (2018) work on self-assessment with Irish primary and post-primary learners. Eighty-five children from 2nd Class, 5th Class and Transition Year wrote an English essay and later self-assessed their work using rubrics. The findings illustrated an overall weak relationship between their self-assessed performance on a rubric and the actual scores that the researchers calculated ($r=0.24$). However, learners’ self-assessment of their work became more accurate as they aged (2nd Class: $r=0.19$, 5th Class: $r=0.29$, Transition Year: $r=0.36$). Strong correlations also emerged between higher prior literacy attainment and children’s accuracy in self-assessments (2nd Class: $r=-0.45$; 5th Class: $r=-0.73$). The findings suggest that primary school children with low literacy attainment display difficulty making accurate self-assessments of their academic work in literacy. The authors did propose that there may be a cumulative value to the process of self-assessment, i.e. practice effects may enhance the accuracy of students’ self-assessments over time and that the generalisability of these findings to other subject domains requires investigation.

Curriculum Integration - Examples

Despite the purported benefits of this assessment practice for older learners, its use in studies of curriculum integration appeared to be relatively limited. Lovemore et al. (2021) asked learners to regularly complete a self-assessment feedback form which asked them to indicate on a continuum how they felt about the lessons in general, their level of understanding of the lesson content (which related to fractions as represented by musical and mathematical concepts) and their level of participation. In their research on the impact of an arts integrated curriculum on learners with disabilities, Fragakis (2019) asked





teachers to record their assigned grades for an art work on the same rubric that a learner used for their own self-assessment. Both scores were used to calculate a final grade.

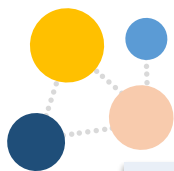
Standardised Tests

Standardised tests assess the “abilities, knowledge and skills of individuals (or groups) under carefully controlled conditions relating to administration and scoring” (Murchan & Shiel, 2017, p. 134). Those scores are usually interpreted in using a norm- and/or criterion-referenced framework⁴⁷. In Ireland, the use of standardised tests in primary contexts to assess learning has been traditionally limited to English reading and mathematics⁴⁸ but other standardised tests can be used for diagnostic purposes (see Circular 0001/2023, Circular 0018/2022, Circular 0013/2017). While standardised tests are traditionally associated with summative assessment, like all other assessment information gathered in a classroom context, they can potentially be used for formative purposes particularly if they contain granular descriptions of performance within a domain. For example, Hoover and Abrams’ (2013) research illustrated how teachers used standardised tests to identify the strengths and needs of their learners. While an in-depth examination of the current use of standardised assessments in Irish classrooms is beyond the scope of this report, findings from a large-scale survey by O’Leary et al. (2019) on this topic can be consulted for further information. One key commentary from this report is the acknowledgement that the administration of standardised tests of English reading and mathematics in primary classrooms are highly ‘visible’ assessment events. Consequently, ‘teaching to the test’ can occur, which can result in a reduction in the valid inferences that can be drawn and broader effects such as curriculum narrowing. To avoid this, Lysaght et al. (2019) recommend that teachers do not conflate the visibility of this assessment approach with its importance - it is one assessment tool that should “co-exist and integrate seamlessly with other types of assessment” (p. 18). This is particularly important to remember given that standardised tests can often fail to provide appropriate inferences for certain groups of learners, e.g. learners with SEN.

⁴⁷ A norm-referenced test is one in which an individual’s score is compared to the performance of the ‘norming’ group on the same test. This group is composed of individuals with similar characteristics (e.g. age, schooling experiences). A criterion-referenced interpretation of attainment involves the comparison of an individual’s performance against a specific set of criteria. These criteria can be summarised in narrative form as statements of proficiency (e.g. ‘The learner can...’). They are often derived from a curriculum standard/outcome (see Murchan & Shiel, 2017; Chapter 8). Other measures can also be included in standardised tests pending their construction e.g. student growth percentiles (see Briggs & Furtak, 2019).

⁴⁸ In Ireland, standardised tests must be administered to learners in 2nd, 4th and 6th classes in primary schools. Compared to other districts (e.g. Australia, US), they are relatively low stakes at a national level (despite their use now informing the allocation of special education resources to schools; see O’Leary et al., 2019) but are considered high stakes at a learner, class and school level.





Curriculum Integration - Examples

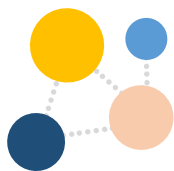
The performance of learners in standardised tests was commonly used to evaluate the impact of curriculum integration on student learning (Cunnington et al., 2014; Doyle et al., 2014). To ascertain if learners in kindergarten classrooms that used an integrated science and literacy curriculum outperformed students in 'business-as-usual' control classrooms, Gray et al. (2022) used a range of norm-referenced standardised literacy tests⁴⁹. A researcher-developed test was used as a measure of science achievement. In their large-scale randomised control study, an integrated curriculum had significant impacts on comprehension, letter-naming fluency, and motivation to read. No impacts were noted within the domain of science. However, it is interesting to note that while the subjects of literacy and science were taught in an integrated manner, they were assessed *separately*. Casady's (2015) doctoral research took the same approach in relation to the assessment of science and English Language Arts (ELA) after an integrated unit of work. Indeed, this was a relatively common approach within the reviewed studies regardless of the subjects or disciplines involved (e.g. Cunnington et al., 2014; Graham and Brouillette, 2017). This may be expected, given that the learning that may occur in integrated settings may not map 'neatly' onto traditional subjects or domains of knowledge that are commonly assessed using standardised tests (Lysaght et al., 2019).

Technology-Facilitated Assessment

Over the past decade, several digital tools have been developed to support and streamline the collection of assessment information. These tools offer new opportunities to gather evidence on learner understanding that were not previously available to teachers. While the potential power of digital technology to enhance and improve assessment is significant, its use and utility must be carefully examined. See et al. (2022) took up this challenge in a recent critical review on the impact of technology in supporting formative assessment and learning in schools (55 studies). While the authors identified some "promising" evidence on the value of digitally delivered formative assessment (mainly in the areas of maths and reading for young children), based on the poor quality of the studies they reviewed, they recommended that there should be "no rush" to use digital technology for assessment as there is only limited evidence to suggest that it can enhance learning.

⁴⁹ Performance in decoding and comprehension was measured by Woodcock Reading Mastery Test, 3rd Edition (WRMT). The ability to read and name letters fluently was assessed using the Developmental Reading Assessment (DRA) and motivation to read was measured by Kindergarten Reading Motivation Scale (KRMS).





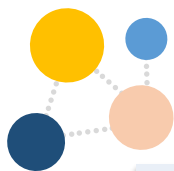
Within the primary classroom, digital technology has had a potent impact on how teachers gather responses from learners to support assessment practices. For example, the use of concept maps as an assessment practice is a common one. In Chang et al.'s (2020) work, technology was used to streamline this process and support formative and summative assessment practices. Other online tools and platforms have also positively supported traditional assessment practices. As mentioned previously, questioning and teacher-designed tasks and activities are core elements of classroom assessment. Gamification⁵⁰ software such as *Kahoot*, *Plickers*, *Quizizz*, and *Socrative*, are widely used to create formative quizzes to make these assessment practices more enjoyable and motivating (Bolat & Taş, 2022). There is also an assumption that these tools can also improve student learning. In a meta-analysis involving 17 studies across all levels of the education system, Bolat and Taş (2022) found that gamified assessment tools indeed had an overall medium effect on learner achievement ($g=0.62$) but that these tools had a significantly larger effect size on academic achievement in higher education ($g=0.82$) rather than with younger learners (K-12; $g=0.24$). This indicates that gamified assessment can support learning outcomes at all educational levels but certain features of gamified assessments (e.g. competition etc.) appears to have a larger impact on older learners. See et al. (2022) did not come to a similar conclusion on these types of response systems or for gamified systems of assessment and failed to find any evidence on their effectiveness. This further underscores the complexity of adding digital features to certain classroom assessment practices.

Curriculum Integration - Examples

In Ensign's (2017) doctoral study examining the integration of STEM disciplines in a project on robotics, teachers were supported in the use of e-portfolios. These portfolios were able "to capture images of the software code programmed by the student, a photo or video of the constructed robot, and student reflections in a journal format" (Ensign, 2017, p. 35). Teachers responded very positively to this technology-facilitated assessment practice. However, it is interesting to note that some studies that used technology-based pedagogies to support integrated teaching and learning did not use technology-facilitated assessment practices. Luo et al. (2022) and Miller (2019) used an online programming language, *Scratch*, to support an integrated STEM unit. However, pen and paper quizzes were used to assess learning. Cassidy and Puttick (2022) used essays as assessment tools in their interdisciplinary robotics curriculum. This 'misalignment' reflects a common issue

⁵⁰ Gamification is defined as "the use of game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems" (Kapp, 2012, p. 10).





in education whereby the assessment practices did not always match how learning occurred.

Curriculum Integration and Assessment: A Core Challenge

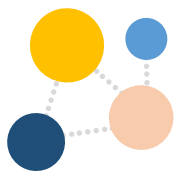
In re-examining the assessment methods and practices used in the studies of curriculum integration in Annex 1, it appeared that many of the challenges associated with this process could be traced back to the nature of knowledge and how knowledge⁵¹ should be considered in an integrated context. For example, many of the studies taught two school subjects in an integrated manner (e.g. science, literacy) but assessed the subjects separately. While this is not necessarily problematic – as integrated instruction should support learning within each discipline – it does pose an interesting challenge for scholars who advocate for truly transdisciplinary approaches (e.g. Beane, 1997). One of the few agreements within educational and classroom assessment is that it is a process of evidentiary reasoning (Black & Wiliam, 2018; Pellegrino, 2014). This reasoning process has been summarised previously with reference to the “assessment triangle” (Pellegrino, 2014)⁵². Of particular relevance to this research is the role of the *cognition* element in the assessment process within curriculum integration. Pellegrino (2014) refers to this as the “theory, data, and a set of assumptions about how students represent knowledge and develop competence in a subject matter domain (e.g. fractions)” (p. 236). However, an integrated curriculum involves *multiple* disciplines or subjects, each with their own unique features and conceptual progressions. Another layer of complexity is added when the interrelated elements of disciplines/subjects require consideration. Consequently, it can be challenging to outline *what* core learning should be assessed to ascertain if learners have developed the requisite knowledge and competences within a single discipline and/or across multiple disciplines⁵³. Without any precise specifications on the meaningful cross-disciplinary/cross-curricular links that may exist in a particular integrated unit, it will remain difficult for teachers to design and use assessments that assess integrated learning. Even if clear learning objectives and criteria for integrated contexts can be achieved, the other vertices of the assessment triangle would then come into play, i.e. how

⁵¹ As a reminder, this report broadly aligns itself with Wyse and Manyukhina’s (2018) definition of knowledge which is an “understanding of something acquired through learning, guidance and practice” and captures more than just facts and skills (p. 2).

⁵² This assessment triangle identified three key elements underlying any assessment: cognition (how learners represent knowledge and develop competence), observation (those observations that provide evidence of learner competencies) and interpretation (how one can make sense of the evidence); Pellegrino, 2014.

⁵³ Gao et al. (2020) make similar points in their review of assessment of student learning in interdisciplinary STEM education within the post-primary and higher education sectors.





well users of the evidence (i.e. teachers) can gather and interpret the data necessary to judge how well disciplinary and cross-disciplinary learning was demonstrated.

Implications for Teacher and Learner Agency

As noted in Report 1, teacher and learner agency was rarely considered within the majority of studies on curriculum integration. This was also true to a lesser extent for the other sources reviewed for this chapter. However, some inferences can be drawn about how assessment should be broadly considered in relation to teacher and learner agency.

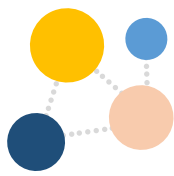
Learner Agency

Once again, learner agency as conceptualised by scholars such as Vaughn (2020), did not feature prominently in the reviewed research. Therefore, some inferential leaps are required to understand how assessment relates to learner agency by examining some complementary ideas that were discussed or alluded to in the reviewed literature. Firstly, returning to Lee et al.'s (2020) meta-analysis, interventions incorporating learners' self-assessment as part of formative assessment had the greatest impact on achievement ($d=0.61$). This finding offers good support to the idea that the *active role* of the learner in the assessment process is essential to its efficacy and success for learning (Andrade, 2019; Chen & Bonner, 2020; Wiliam, 2018; Wiliam & Leahy, 2015). By involving learners in the assessment process (e.g. through self-assessment, peer-assessment), it can be argued that learners are better able to understand themselves and can support their ability to make choices about their work and learning. Teachers can facilitate this through the development of a positive environment and by teaching learners how to engage in the self- and peer-assessment process. While these are ideas central to the field for formative feedback and self-regulated learning, they can also be 'mapped' to the dispositional, motivational and positional dimensions of Vaughn's (2020) model of learner agency.

In particular, work from the field of assessment and self-regulated learning⁵⁴ may be particularly useful in creating approaches that foreground learner agency within the assessment process. Chen and Bonner (2020) created a conceptual framework that attempts to combine the processes of classroom assessment and self-regulated learning. This framework blends the aspects of self-regulated learning with activities that are part of classroom assessment, e.g. identifying key learning to be assessed, provisions of feedback, development of success criteria. This CA:SRL (Classroom Assessment: Self-Regulated Learning) framework is presented in Figure 3. Yet, it can be difficult to support

⁵⁴ As a reminder, this most simply refers to any instance in which "learners set goals and then monitor and manage their thoughts, feelings, and actions to reach those goals" (Andrade, 2019, p. 8). It is closely related to cognition, metacognition and motivation (Muijs & Bokhove, 2020).





self-regulated learning in primary classrooms. While there is now sufficient evidence to suggest that metacognition, a prerequisite for self-regulated learning, emerges in children from a young age, the younger the child, the more explicit instruction is typically needed according to Muijs and Bokhove's (2020) review of the literature. This is partially due to the fact that different aspects associated with self-regulated learning and meta-cognition develop at different times i.e. "planning appears to emerge sooner than monitoring and evaluation, and monitoring earlier than control" (Muijs & Bokhove, 2020, p. 15). Furthermore, how learners engage with self-regulated learning is dependent on a number of factors including self-efficacy, goal orientation and beliefs about effort and learning (Chen & Bonner, 2020; Muijs & Bokhove, 2020). Perhaps that is why, across the studies they examined, Klute et al. (2017) found inconsistent effects for the use of learner-directed formative assessment, an important method in Chen and Bonner's (2020) framework⁵⁵. Overall, self-directed formative assessment had less impact than other-directed formative assessment. However, within the field of mathematics, both learner-directed and other-directed formative assessment was effective. Nevertheless, the use of assessment approaches that support self-regulated learning seem potentially beneficial for both learning and learner agency.

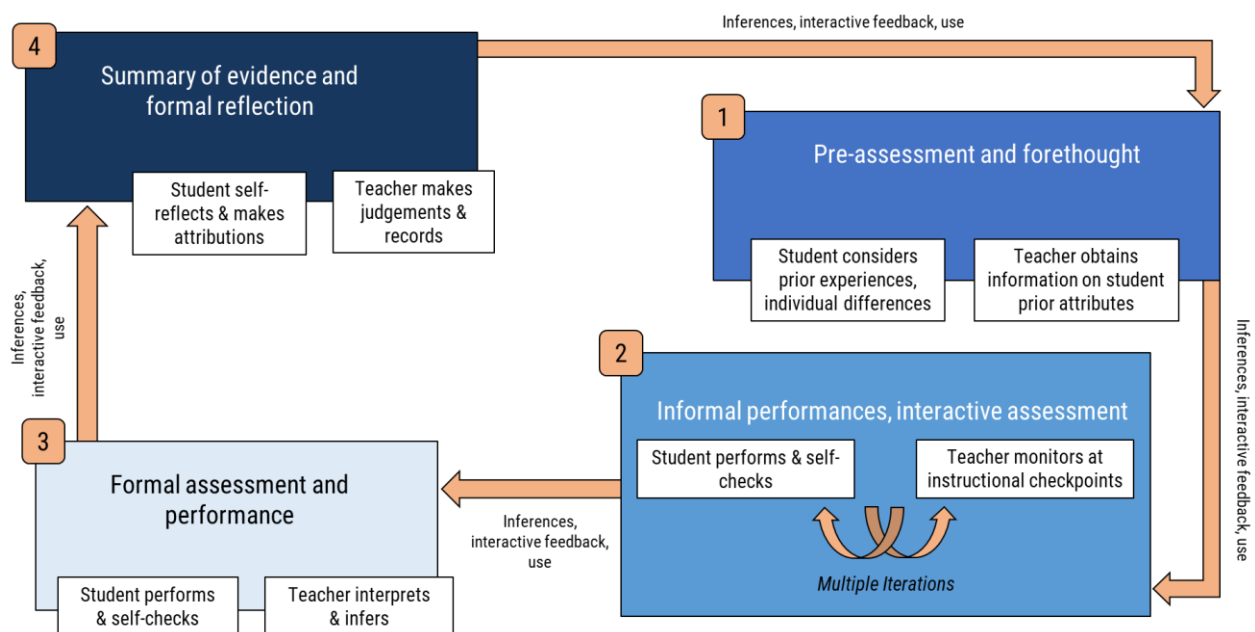
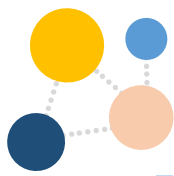


Figure 3 CA:SRL Framework (reproduced from Chen & Bonner, 2020)

⁵⁵ The authors defined this as any instance where "students appraise or monitor their own or their peers' work, performance, strategies, or progress and have the opportunity to reflect on the assessment information they gathered to determine next steps" (p. 3). Other-directed formative assessment involves educators or computers.



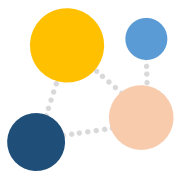


Teacher Agency

The majority of the studies returned in the scoping search aligned themselves with the principles of formative assessment. Some of these studies were broad reviews that examined the impact of formative assessment more generally. For example, Klute et al. (2017) investigated the effect of formative assessment on academic achievement in elementary learners across 23 studies. Formative assessment (in interventions of four weeks or less) was found to have a positive impact on academic achievement - effect size greater for mathematics (0.36 SD) than for reading (0.22 SD) or writing (0.21 SD)⁵⁶. Their analysis also uncovered that the role of the teacher (and the learner) in the formative assessment process moderated its effect on learning. In their meta-analysis of 33 US studies, Lee et al. (2020) found that the different features of the classroom implementation of the formative assessment cycle (e.g. duration, use of feedback, formality, learner role) all informed the small but significant effect formative assessment can have on learning. One key conclusion relevant to teacher agency can be drawn from these studies: teachers' decisions about how assessment is 'done' in their classrooms can have a significant impact on learning. For teachers to be agentic professionals that have the capacity to make the best decisions about teaching, learning and assessment, a number of factors must be optimised in their favour (Priestley et al., 2015). In particular, the cultural, structural and material dimensions of agency (see Figure 4, Report 1, p. 34) as they relate to assessment would all need to be considered. Heitink et al.'s (2016) review noted that school leaders (i.e. a structural dimension that supports teacher agency) play an important role in supporting the classroom implementation of formative assessment practices by communicating "vision, norms, goals and expectations" on this approach to assessment (p. 57). Four of the studies involved in this review asserted that a climate with trust, mutual respect and cooperation can support higher quality assessment practices. Schildkamp et al. (2020) also identified social factors like collaboration among teachers as important to effective assessment practice (i.e. a structural dimension that supports teacher agency). Collaboration allows teachers to leverage the interpersonal resources in their networks to make decisions about assessment approaches and evidence about learning that has been gathered across the school. For example, collaborating with others in making judgements about learners' work would help mitigate the potential biases that can emerge with some assessment approaches. Fostering these within a school environment aligns with the core

⁵⁶ Only 19 of the 23 studies reviewed were used to calculate these effect sizes. The authors evaluated the magnitude of these effect sizes according to the U.S. Department of Education's What Works Clearinghouse (WWC) standards which state that substantively important effect sizes are greater than 0.25 or less than -0.25.



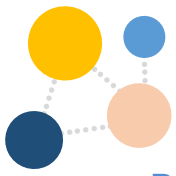


influences within the cultural dimension of the ecological model of teacher agency (see Priestley et al., 2015). This should then support the emergence of more agentic professionals in relation to the process of assessment. However, common structural (e.g. accountability measures or inappropriate use of standardised test scores) and material (e.g. access to high-quality, adaptable resources) pressures would need to be minimised. See Report 1 for further information on the impact of standardised tests on agency and curriculum integration.

Teachers need to have access to a suite of assessment practices and methods. In line with the foundational ideas of validity, reliability and fairness, teachers should be deliberate about matching their selected assessment methods to their specific instructional goals. They should also then be able to interpret the evidence gathered to draw valid conclusions about their learners' achievement and progress. Doing this successfully requires a high level of teacher assessment literacy (Heitink et al., 2016; Schildkamp et al., 2020). Therefore, an individual teacher's capacity to act in an agentic manner within the assessment process would likely be influenced by their own assessment literacy. There is some evidence to support this assertion from the current corpus of research. Assessment literacy encompasses the "knowledge and skills with regard to the entire assessment process, from collecting information on student learning to making instructional changes based on that information" (Schildkamp et al. 2020, p. 5). It is an integral component of data literacy which is associated with the "collection, analysis, and use of other types of data, such as student satisfaction surveys, and background information about students" (Schildkamp et al., 2020, p. 5). On the basis of their meta-analysis involving 54 studies, Schildkamp et al. (2020) argue that this knowledge is a prerequisite for the effective use of assessment by teachers. It is only by having a deep level of assessment and data literacy that teachers are able to gather and interpret data correctly in order to help them to determine the 'next steps' in their instruction⁵⁷. However, for teachers to be able to design effective assessments and draw appropriate inferences about learning from those assessments, they must also understand general principles about how children learn and progress with the content or skills of interest. Consequently, they must also have a good understanding of the content area(s) associated with any assessment (see Brookhart, 2011).

⁵⁷ Schildkamp et al. (2020) also highlight the importance of pedagogical content knowledge (PCK) in this process. Teachers need good assessment information to support appropriate judgements about learning. This paired with a teacher's PCK allows them to determine what feedback should be given or what alterations to instruction should occur.





Principles for Good Assessment

Based on the review of literature examined, some of the central propositions on classroom assessment for primary aged learners are detailed over. These are applicable regardless of curriculum form. Nuance is needed to apply any of these principles in a given situation, bearing in mind, for example, variation in the purpose of an assessment.





Good Assessment:

1. Allows learners to make what they know or can do visible to teachers



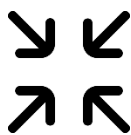
This is best achieved through the interactions that occur in classrooms. These interactions can involve the teacher or their peers and can be mediated by a range of assessment methods.

2. Requires a clear definition of what learning should be assessed



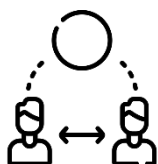
The key learning to be assessed should be clearly defined and specified from the outset of an instructional period. Determining what learning should be assessed in an integrated context is particularly challenging.

3. Calls for a sampling process



No one assessment approach can satisfy the needs of all partners within an education system. A suite of assessment approaches and methods should therefore be used. Teachers should choose appropriate assessment format(s) that are aligned with their assessment and learning purpose and are practical and feasible to implement.

4. Ensures that there is a shared understanding of what 'quality' work looks like



What constitutes 'quality' within an assessment and a particular discipline or subject should be clear for teachers and learners. This shared understanding can support instructional decisions and learners' understanding of their own progress.

5. Necessitates a high level of assessment literacy from teachers



Teachers require a high level of assessment literacy to ensure that they are able to design effective assessments, appropriately infer learners' needs and identify necessary adaptations. Teachers require a strong understanding of the content they are teaching to do this well.

6. Involves the learners

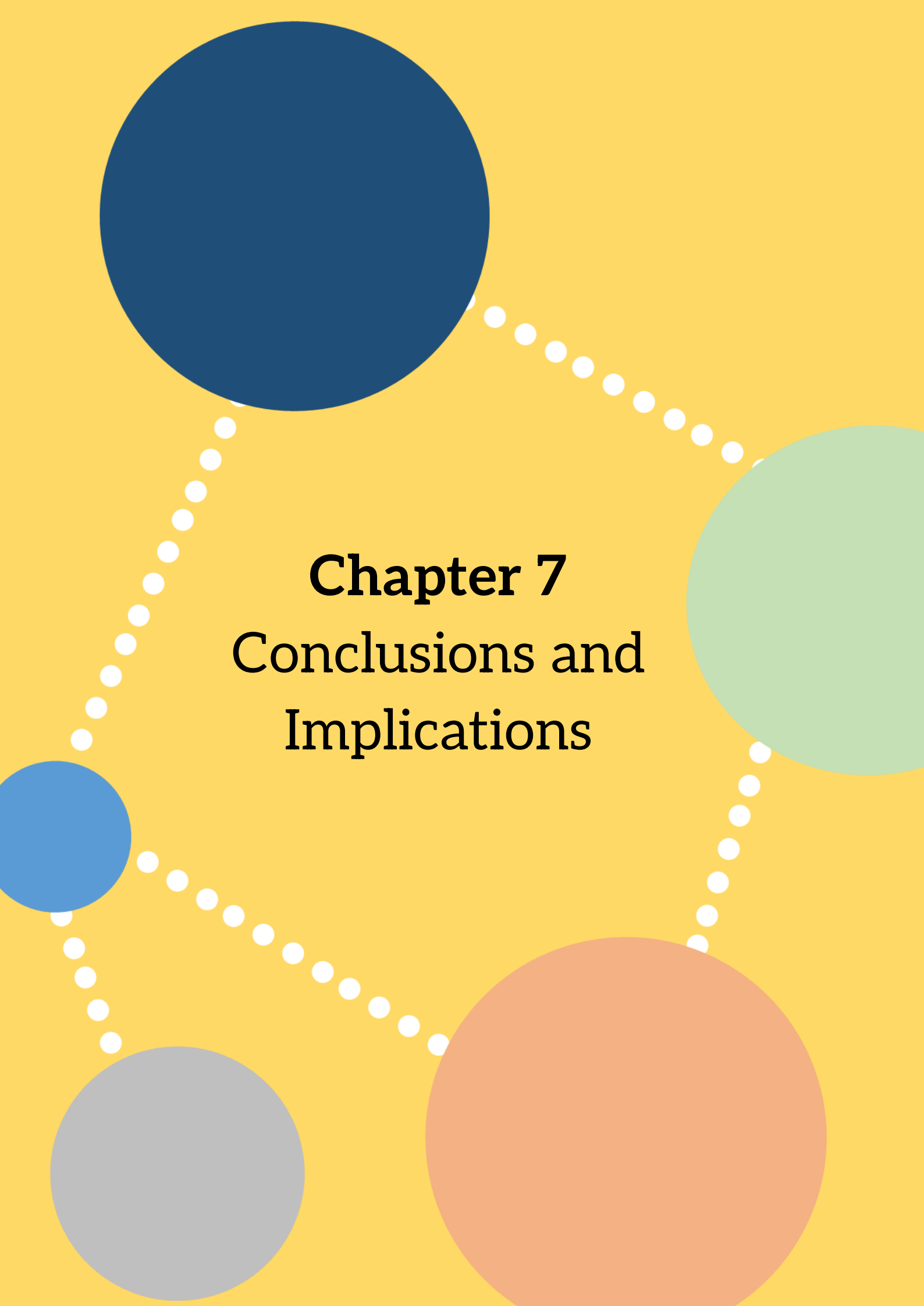


Learners should be actively involved in the assessment process. Young learners need to be supported to do this however through appropriate instructional practices. Feedback, when focused on the task and provides learners with a 'path' (or 'paths') for future learning, is a powerful tool to achieve this.

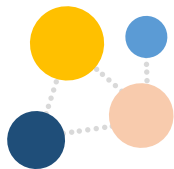
7. Is most successful in a classroom environment that prioritises learning



The classroom environment should be constructed in a way that encourages teachers and learners to see assessment as a pillar that upholds effective teaching and learning.

A decorative graphic on a yellow background. It features five colored circles: a large dark blue circle at the top left, a medium light green circle at the top right, a small medium blue circle on the left, a medium light grey circle at the bottom left, and a large light orange circle at the bottom right. A white dotted line connects these circles in a circular path around the central text.

Chapter 7
Conclusions and
Implications



Chapter 7

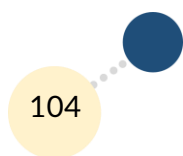
Conclusions and Implications

Introduction

This chapter ties together findings from across Report 1 and Report 2 to provide an overall synthesis and conceptualisations of the connections between integration, pedagogy, assessment, teacher agency and child agency. It begins by outlining principles of curriculum integration. These are then combined with the principles for pedagogy and assessment outlined in earlier chapters to craft a conceptual framework that explains their inter-relationships, synergies and tensions. Based on these associations, suggestions for planning, teaching and assessing integrated units of work follow. The chapter concludes with implications for the ongoing redevelopment of the primary curriculum.

Curriculum Integration: Principles

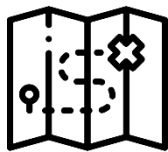
Drawing on considerations for curriculum integration discussed in Report 1 and the review of evidence from intervention studies outlined in Chapter 2 of the current report, a number of principles for curriculum integration are outlined overleaf.





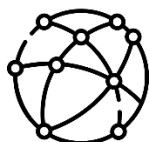
Good Curriculum Integration:

1. Is not an end in itself; its purpose is meaningfully framed



Successful curriculum integration prioritises *children's learning* rather than the notion of curriculum integration itself. The *purpose* for curriculum integration may vary (e.g. pursuit of an idea from multiple angles) but, given the prominence of *disciplines* of knowledge in contemporary schooling and society, integration is not necessarily a foundation for *all* aspects of learning.

2. Identifies and builds on connections across knowledge domains



Curriculum integration is most successful when clear conceptual links exist (or are forged) between two or more subjects. The soundness of this conceptual link is prioritised over the number of subjects involved. Curriculum integration also allows for the connection of knowledge not necessarily housed within a traditional subject/discipline (non-disciplinary knowledge).

3. Responds to context, including children's interests and funds of knowledge



Authentic curriculum integration leverages children's current understandings and cultural repertoires as a springboard for new learning; children's ongoing learning shapes the progression of an integrated unit.

4. Can be supported by curriculum structure and planning processes but is enacted in idiosyncratic ways



The curriculum should demonstrate *how* conceptual links can be forged, including curriculum-making processes. However, the exact means of enacting integration varies depending on the forms of knowledge being connected and learner needs. There is no one way of integrating, but this does not diminish the need for a curriculum to specify connections.

5. Balances the benefits of cross-disciplinary learning with the benefits (and requirements) of disciplinary learning



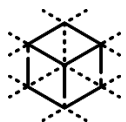
Premised on the idea that children's learning and development is the primary consideration, the advantages of curriculum integration (e.g. supporting children to see connections) are balanced with the requirements of disciplinary learning (e.g. sequence of conceptual development in a subject).

6. Can be achieved using a range of pedagogical and assessment approaches

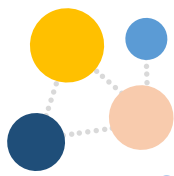


The integration of curriculum-based learning takes place using a blend of pedagogical approaches, including teacher- and child-led activities; project-/problem-/inquiry-based learning is particularly prevalent in the literature on curriculum integration.

7. Privileges engagement and depth of learning on a topic or concept



Curriculum integration is often carried out to make the curriculum more relevant and to look at topics or concepts in more detail, from a new perspective or from multiple perspectives.



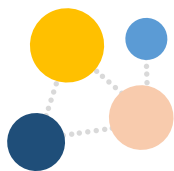
Considering Principles for Pedagogy, Assessment and Curriculum Integration

Many of the findings from the theoretical and empirical literature reviewed for Report 1 and Report 2 are summarised in the principles summarised in Table 4. This is followed by an examination of associations and tensions amongst the concepts.

Table 4 Principles of curriculum integration, pedagogy and assessment

Curriculum Integration	Pedagogy	Assessment
<ul style="list-style-type: none"> ● Is not an end in itself; its purpose is meaningfully framed ● Identifies and builds on connections and synergies across knowledge domains ● Responds to context, including children's interests and funds of knowledge ● Can be supported by curriculum structure and planning, but is enacted in idiosyncratic ways ● Balances the benefits of cross-disciplinary learning with the benefits (and requirements) of disciplinary learning ● Can be achieved using a range of pedagogical approaches ● Privileges engagement and depth of learning on a topic or concept 	<ul style="list-style-type: none"> ● Builds on and values deep insights about learners ● Requires thorough teacher (pedagogical) content knowledge ● Gives serious attention to sequencing, structuring, scaffolding and reviewing new learning ● Relies on excellent fundamental teaching skills ● Ensures active engagement and responsibility for learning ● Advances learning through meaningful dialogue and peer-interaction ● Is underpinned by positive relationships and responsiveness to children's voice ● Is enhanced by creative and imaginative approaches ● Establishes and fosters a respectful and purposeful classroom environment ● Expects and supports learner variation, but holds high expectations for all ● Draws on evidence to decide the balance between teacher-led, teacher-guided and child-led approaches ● Is informed by (and acts on) broad, current and critical understandings of the world within and outside the classroom 	<ul style="list-style-type: none"> ● Allows learners to make what they know or can do visible to teachers. ● Requires a clear definition of what learning should be assessed. ● Calls for a sampling process. ● Ensures that there is a shared understanding of what 'quality' work looks like. ● Necessitates a high level of assessment literacy from teachers. ● Involves the learners. ● Is most successful in a classroom environment that prioritises learning.





Associations

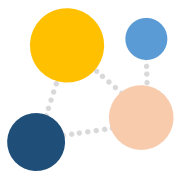
Many aspects of integration, pedagogy and assessment are in alignment, with the potential for curriculum integration to *bolster* the other two:

- Curriculum integration that is premised on children's interests and funds of knowledge aligns with the principle that pedagogy should build on insights about learners and welcome their out-of-school experiences into classroom life. Approaches to curriculum integration that foreground child interests are in harmony with child-centred pedagogical approaches and principles.
- Fundamental principles of good pedagogy (such as the need to establish and nurture warm and supportive relationships) apply equally in integrated curriculum contexts. This extends to teacher skill in modelling, explaining, questioning and scaffolding; these are just as important for integrated as non-integrated teaching. Similarly, the importance of establishing a purposeful, productive and warm classroom environment applies universally.
- Certain pedagogical and assessment approaches are used particularly frequently in studies of integration. The focus on inquiry-based approaches and collaborative learning in curriculum integration supports pedagogy that enables children's active role in their learning. In a similar way, performance-based assessments are particularly well aligned with the assessment of learning in an integrated unit of work.
- Integration, pedagogy and assessment all require particular knowledge and expertise on the part of the teacher. Knowledgeable, skilled and engaged teachers often intuitively make the connections between different sources of knowledge as learning unfolds. This natural, organic approach to curriculum integration is to be celebrated and endorsed. Nevertheless, if curriculum integration is to be a means through which particular learning outcomes and experiences are to be achieved and created, a systematic approach is also required.

Tensions

Some aspects of curriculum integration are likely to render pedagogy and assessment more challenging:

- Good pedagogy is contingent on a teacher's deep understanding of the content they are teaching and how to use pedagogical approaches to support learner understanding and engagement. Curriculum integration relies on knowledge of not only *multiple* subjects but also *how they are connected* and how these connections may be best explored with children.



- Structuring and sequencing children’s learning to support conceptual development is particularly important in some disciplines (see Report 1, Chapter 2).
Appropriately sequencing learning in *one* subject can be a challenging task which becomes all the more challenging when conceptual progressions in multiple domains must be mapped.
- Classroom assessment relies on having a clear sense of *what* is being learned. Learning that draws on knowledge sources from multiple disciplines may be less clearly defined and less amenable to direct measurement, rendering its assessment a challenging task.
- As much of the high-quality pedagogical research is *discipline-specific* and because of the importance of domain-specific knowledge (and the existence of subjects in the first place), it is important that curriculum integration is only deployed when meaningful connections exist.

Building on these associations and tensions, a conceptual framework for the above concepts is proposed.

Towards a Conceptual Framework: Integration, Pedagogy, Assessment & Agency

Synthesising the literature reviewed throughout Report 1 and Report 2 requires an overall ‘bird’s eye view’ of how various factors and concepts are related. Figure 4 provides a conceptual mapping of how integration, pedagogy, assessment and agency are related. Though this may prove helpful in high-level, theoretical discussions and analysis, we caution that this framework is unlikely to provide the nuance necessary for understanding any of its components. We caution that this framework does not attempt to provide a practical encapsulation of enacting any of its constituent parts; we refer readers to the upcoming section for guidance.



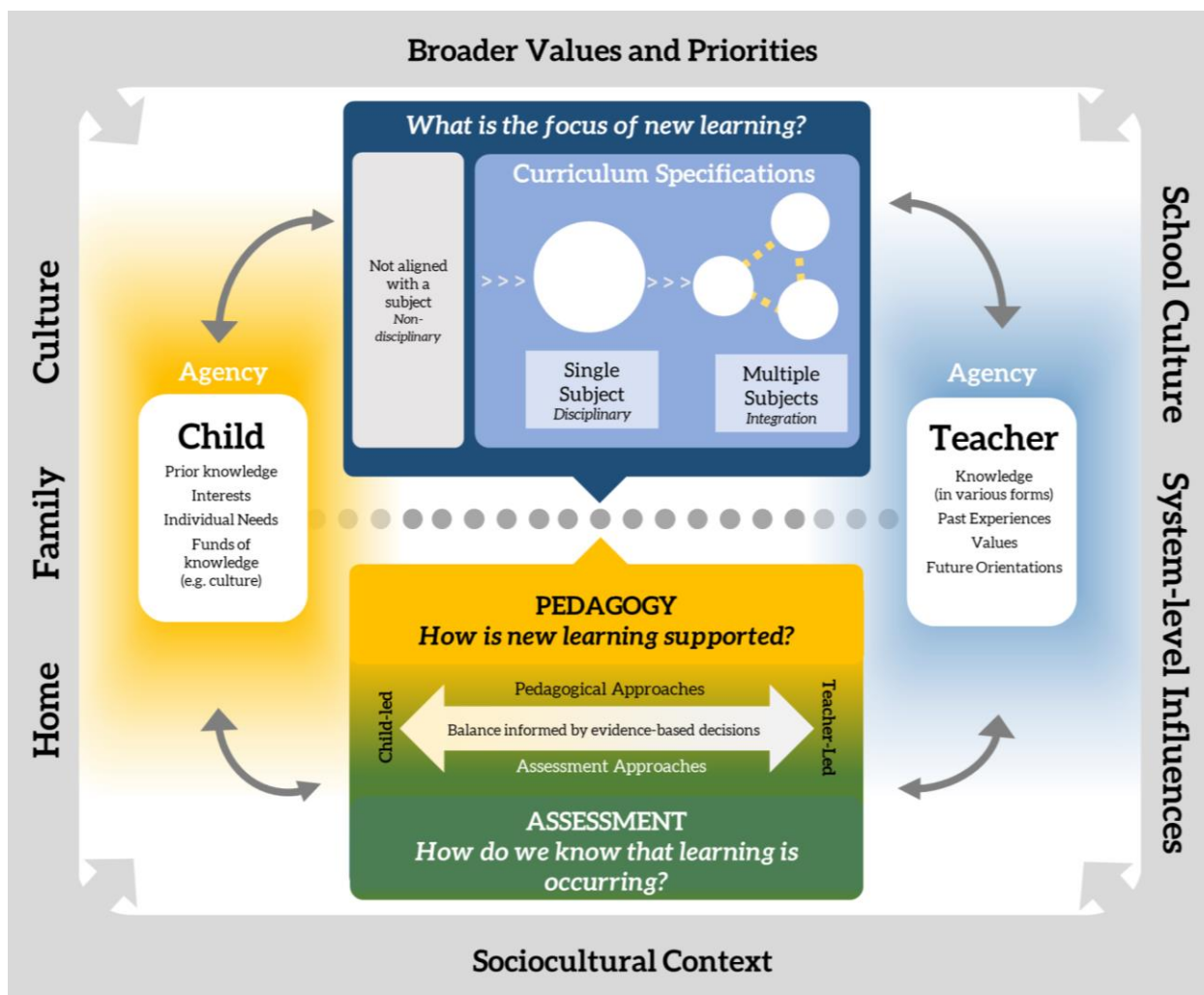
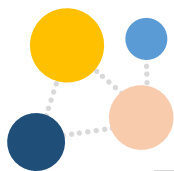
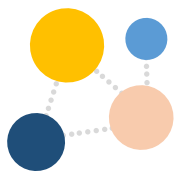


Figure 4 A conceptual framework of the relationships between integration, pedagogy, assessment, teacher and child agency

The grey box around the framework acknowledges that broad influences must be considered when thinking about the curriculum and classroom. Some of these **sociocultural influences** can be mapped at a national (e.g. economic, cultural priorities) or international level (e.g. topics of global debate such as sustainability). Some are particularly salient from the child's perspective, such as home and family influences on culture and language use. Some are particularly salient from the teacher's perspective, such as school culture and the priorities of the education system at large. Broader values and priorities are captured in the national curriculum including its broad focus and the content of its subjects/learning areas.

The **child** is positioned as a key actor, recognising their central, reciprocal role in pedagogy. They bring with them their own interests, funds of knowledge and individual needs. It is recognised that agency is an emergent phenomenon (yellow gradient). Agency



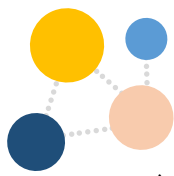


is supported by dispositional, motivational and positional factors (Vaughn, 2020) and the provision of opportunities to influence the classroom environment (Manyukhina & Wyse, 2019); it is supported by pedagogy that affords weight to their decision-making capacity regarding their own learning. The **teacher** is the other key actor. Their agency (represented in the blue gradient) is also an emergent capacity that is exercised in relation to ecological factors. As it relates to a particular aspect of pedagogy or curriculum enactment, their agency is influenced by past, present and future orientations, and in particular, the relevant knowledge that they have developed over time (Ó Breacháin, 2022; Priestley et al., 2015). Crucially, though child and teacher agency are considered separately, they are *not* competing constructs. High 'levels' on the former do not mean 'low' levels on the latter, and vice versa. The importance of the *relationship* between child and teacher in enacting a curriculum effectively should not be underestimated (and is demonstrated using the grey dotted line between child and teacher).

The question of curriculum integration is addressed as a subsidiary consideration of *what children will learn*. It is crucial to note that the focus of new learning may or may not involve integrating multiple subjects; it may happen in the context of single subjects. In recognition of the literature that foregrounds child agency in curriculum integration, the focus of new learning may also fall *outside* of the traditional school subjects and involve exploring topics of concern to children. The connecting lines between non-subject-based, subject-based and multiple-subject based learning recognises the idea that what might start out as a topic with no clear subject-basis may be *linked* by a knowledgeable teacher with subject-based learning. Equally, what starts as a learning focus housed within one subject may be extended to include complementary learning that draws on multiple subjects. Whether or not this integration happens will depend to a very large degree on the teacher's sense of agency for curriculum integration (see Report 1). This agency may be supported, in particular, by a curriculum framework that explicitly outlines the conceptual connections between subjects (represented by yellow dotted lines).

Regardless of the combination (or otherwise) of subjects from which new learning is drawn, its achievement is reliant on appropriate **pedagogy**. Given that children's learning and development are the primary consideration, pedagogical approaches must be chosen to support new learning. They are not chosen for their own sake. A balance and variety of child and teacher-led approaches are needed to achieve the different forms and types of learning outcomes associated with different aspects of development. It should be noted that children's agency may be particularly well supported by certain approaches





(e.g. inquiry or play) but that this must be balanced with the need to ensure that a pedagogical approach is suited to particular forms of conceptual (or other) development (including explicit forms of teaching). **Assessment** is not separate from pedagogy and must also be given a high level of attention. It is through assessment that the starting point for children's learning is established and that ongoing learning is assured.

Planning, Teaching and Assessing Integrated Units of Learning

As noted by Ball (1996), “the enacted curriculum is actually jointly constructed by teachers, students, and materials in particular contexts” (p. 7). Consequently, no ‘one size fits all’ approach can be applied in planning any unit of learning, integrated or not, for primary classrooms. Instead, teachers must be able to draw on their knowledge of curriculum, pedagogy and assessment and synthesise it with knowledge of their learners and school contexts to create a learning ‘blueprint’. Figure 5 captures some of a teacher's key considerations in planning an integrated unit of work. This framework builds on commonly cited planning models in integrated curriculum that adopt a backward design approach (Drake, 2012; Wiggins & McTighe, 2005; Moss et al., 2019). It is crucial to note that this framework envisages the **focus of new learning** as the starting point. **How children will demonstrate** this new learning is then considered, *before* turning to the **approaches and activities** that will support achieving this. This first ‘layer’ of thinking is then enhanced through recursive consideration of each key component. The framework places a high premium on children's contribution to this process, which is recognised in their central location. At this point, we re-iterate that integrated approaches to learning will not always be appropriate.



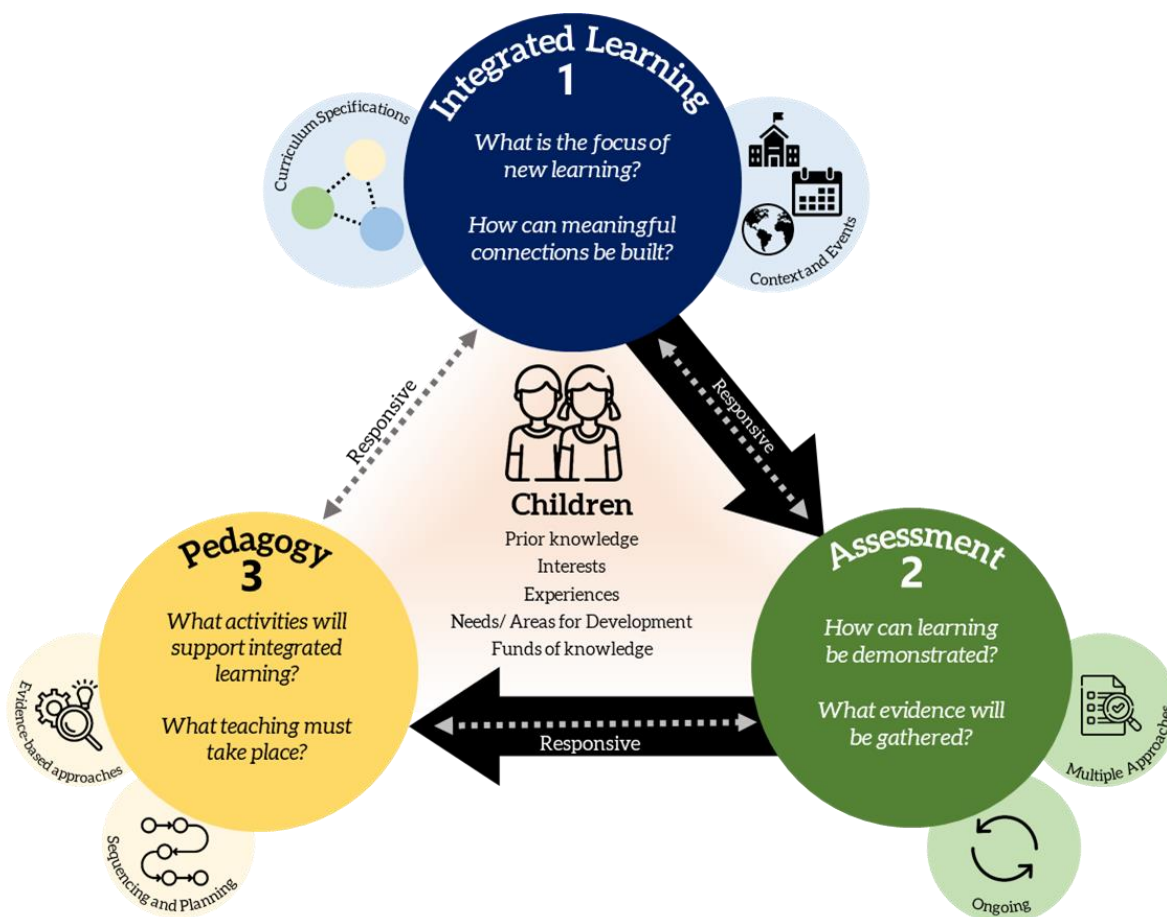
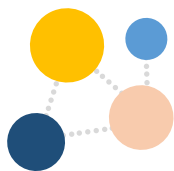


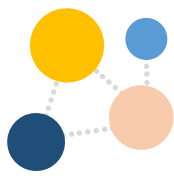
Figure 5 A framework for thinking about planning and enacting an integrated curriculum unit

Integrated Learning - Step 1

What is the focus of new learning? How can meaningful connections be built?

In line with Drake's (2012) approach to curriculum integration, teachers must first consider what learners need to "know, do and be across all subjects" (p. 31). As teachers usually have more content than they can address, they must choose what outcomes are prioritised at any given time. These *choices* can be informed by a range of factors including curriculum area/subject-specific documents, school context (e.g. interests of learners), and contemporary events be they local or global. Unifying ideas or concepts are particularly important as the glue that instigates and propels integration. In the case of curriculum integration, once the overall focus for learning has been identified, teachers can begin to consider where the connections between the **knowledge** sources lie. Drake (2012, p.22) frames this as the 'essential question' that fosters "inquiry, understanding,





and transfer of learning” (p. 22)⁵⁸. She also outlines some of the ‘big ideas’ that have been identified in other districts’ work on curriculum integration e.g. ‘Change and Continuity’, ‘Patterns’ (p. 78-80). These parallel the central idea and concepts associated with the International Baccalaureate Primary Years Programme (See Report 1, Chapter 4). Not every subject, discipline or fund of knowledge will always receive equal treatment or attention. Instead, only the connected knowledge, skills or abilities that support a deeper or new understanding of the ‘essential question’ are considered in the unit. In this way, curriculum integration is **purposeful** and happens in service of the expected learning outcomes. A non-exhaustive list of examples of purposeful connections are outlined in Table 5. It is important to acknowledge that no one connection type should be automatically privileged over another. All potential connections should be explicated in the curriculum framework. This provides teachers with options for how curriculum integration may be carried out in their classrooms.

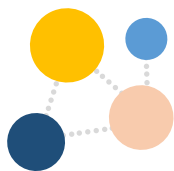
Table 5 Examples of connections on which integration can be built

These connections are not mutually exclusive; they can be addressed simultaneously

Connection	Concepts	Skills	Topics	Experiences
Explanation	A big idea that captures the characteristics of a phenomenon; a way of looking at related pieces knowledge.	An ability or capacity; actions or processes carried out with a particular purpose in mind	Accumulation of related information and facts	Development of understanding in one discipline through the medium of another
Example	<i>Change</i> e.g. change in the physical landscape over time (geography) and related changes in settlements (history); change in states of matter/lifecycles (science); change as I grow (SPHE)	<i>Research Skills</i> e.g. locating sources (history); identifying author’s purpose (English); gathering and analysing data (mathematics)	<i>Learning about my locality</i> e.g. exploring Google Maps to learn about physical geography of the area (geography); learning about local folklore/ logainmneacha (history); local wildlife/habitats (science)	<i>Arts Integration</i> e.g. developing understanding of historical events by exploring them through meaningful arts experiences

⁵⁸ Drake (2012, p. 101) offers a ‘formula’ for designing such essential questions when planning for curriculum integration: How/Why + Big Idea + Verb + Big Idea e.g. How can science provoke change?





Assessment - Step 2

How can learning be demonstrated? What evidence will be gathered?

When integration occurs teachers should have a clear idea of what new learning looks like. Teachers must consider a variety of assessment approaches (e.g. questioning, observations, performance based assessments etc.) for gathering evidence of progress towards this learning. Some of these assessments may be documented (planned events), others may not (intuitive) (Lysaght et al., 2019; Moss et al., 2019). Drake (2012) recommends that an integrated unit finish with a “rich culminating assessment task” (p. 113) that learners work towards completing from the very first day of the unit. However, this may not always be necessary depending on the approaches. Regardless, assessment should be used *throughout* the instructional process to ensure that teachers and learners have a clear idea of how progress towards the required learning outcomes is occurring, i.e. feedback. When making inferences about learning, teachers should ensure that all of the previously identified outcomes are being assessed against a shared set of criteria or a rubric (Wiggins & McTighe, 2011). In an integrated context, this will ensure that no subject or discipline is ‘forgotten’. In monitoring learner progress, the teacher may decide to change the upcoming learning plan or what outcomes should be prioritised. In this way, the process of unit design and enactment is iterative and **responsive** to learners (see Wiggins & McTighe, 2005; 2011).

A ‘sampling’ approach would likely need to be undertaken to support whatever inferences a teacher could make about what has been learned in an integrated context. In this way, the teacher could use multiple assessment approaches to inform their understanding of what knowledge, skills or dispositions emerged as a result of integrated teaching and learning. For example, learners may choose the focus of a classroom project, and, following this, be asked to provide a presentation to their peers about an industry in the local area (e.g. fishing). This could involve examining historical sources to identify changes in the industry over time or significant events. Children may examine different types of fish and their life cycles/habitats in science. They could use research skills and develop genre-related knowledge on oral reports in English. A set of success criteria (including understanding of scientific/historical content) could be provided or co-created with the learners depending on the priorities of the teacher/learners. During the creation of the presentation, the teacher could use observational or questioning techniques to identify their areas of strengths and needs in terms of research and then offer feedback to them as they progress. While the teacher would ultimately use the previously agreed rubric to evaluate the final performance, other assessment data intentionally gathered





throughout the task would also be used. Approaching assessment in this purposeful, learning-focused way should maximise any positive and minimise any negative ‘washback effects’⁵⁹.

Pedagogy - Step 3

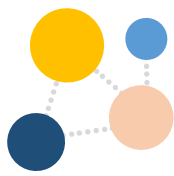
What activities will promote integrated learning? What teaching must take place?

At this point, teachers can begin to plan the activities, experiences and lessons that will lead to the achievement of the desired outcomes. A research-based reservoir of pedagogical approaches should be available to teachers in their design process. For example, assessing the learners’ prior knowledge can allow teachers to decide *what, when* and *how* different pedagogical approaches should be applied, e.g. scaffolding in relation to learning new topics and concepts. Monitoring learning progress also assists in a teachers’ use of different pedagogical practices. While the best learning plans have a clear sequence (often aligned with a particular discipline’s knowledge hierarchy) and make explicit the connections between topics, they are also flexible in responding to learner needs and can be revised as necessary (Wiggins & McTighe, 2011). For example, having an authentic context for learning is a common feature of curriculum integration (Drake, 2012). Depending on learners’ funds of knowledge and prior learning, how they engage with this problem may require teachers to modify the content or order of the planned learning activities. In planning their learning activities, teachers may have to determine when best to draw on different sources of **knowledge** to ensure that the ‘core’ learning outcomes are achieved.

Throughout the actual ‘teaching’ of an integrated unit, a teacher should be informed by the general principles for pedagogy outlined previously (see Table 4). For example, children’s funds of knowledge and prior learning should form a meaningful starting point for the introduction of new topics or concepts. Factors such as classroom climate, relationships and dialogue, as well as teacher fluency in various skills such as modelling and questioning are considered a given. Inclusive approaches are adopted to ensure that all learners are included. The choice of specific pedagogical approaches follows from the types of learning that should be achieved. To continue the example outlined in Step 2 (a learner-initiated project), a teacher may need to draw on forms of explicit teaching and the gradual release of responsibility to ensure that all children

⁵⁹ In this instance, the ‘washback effect’ refers to the effect of assessment on learning. Some of the intended effects of assessment (e.g. focussing learner attention) are positive. However, some of the unintended effects of assessment can lead to negative outcomes (e.g. curriculum narrowing, limiting creativity).





understand the key linguistic and genre features of a report. Dialogue and collaboration would be embedded in children's group work to prepare the report/oral presentation. Guided inquiry may be used to have children examine changes in fishing practices over time, using sources such as photos and newspaper clippings. They may further draw on an inquiry approach to interview a local fisher. The teacher would scaffold this (e.g. types of questions one might ask; how to record notes). It is clear from this example that a mix of pedagogical approaches are needed to ensure learning takes place - all with a clear role for the teacher - while following the path of learning instigated by the children in choosing the project's focus.

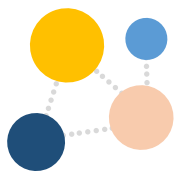
Planning on a Whole-School Basis: Vertical and Horizontal Mapping

Enacting high-quality pedagogy and assessment in a flexible curriculum framework likely requires increased levels of local decision-making and preparation than hitherto practised in Irish primary schools. The processes and supports needed to make this vision a reality need substantial attention.

School-based curriculum development envisages an active role for teachers, in collaboration with multiple stakeholders in education, in the planning, designing, enacting and evaluating of programmes of learning at a local (school) level (Skilbeck, 1984). This form of local curriculum-making positions teachers as key agents in bringing national guidance to life in a manner that builds on, supports and advances the distinctive attributes of the school community. It also envisages a role for children in determining the focus and manner of their learning. It is premised on the idea that a school, acting alone and without external support, may not succeed in effecting curricular change, but that change mandated from external sources without local involvement is also likely to fail (Skilbeck, 1984). Skilbeck's original work on school-based curriculum development envisaged five actions:

1. Analyse the situation (this includes consideration of school-level experiences, e.g. staffing, and values as well as external developments, e.g. a new national framework).
2. Define objectives (e.g. desired learning at school level).
3. Design the teaching-learning programme (e.g. considering subject areas, content, resources, teaching approaches, timetabling etc.).
4. Interpret and implement the programme (e.g. adopting a progressive model so that increasing breadth and depth of topics occurs as learners progress).
5. Assess and evaluate (e.g. how well did a particular approach to curriculum achieve the stated objectives?).





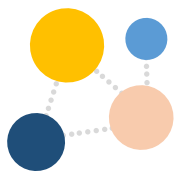
This occurs as a collaborative process involving children and the wider community, in which teacher expertise and knowledge is considered a crucial determinant of success. By necessity, it requires 'buy-in' (i.e., teachers should value their role in making local curriculum decisions) and ample support (e.g., time for preparation, collaboration, appropriate professional learning opportunities). Crucially, school-based curriculum development does not devolve the generation of instructional and curriculum materials to schools alone (Skilbeck, 1984) and recent research both internationally and nationally attest to the necessity for this level of support (Tan, 2016; Wang, 2019; Ó Breacháin, 2022).

Curriculum integration in a more flexible curriculum framework requires new ways of thinking about whole-school planning. The concept of *horizontal* and *vertical* mapping is prevalent in the literature on curriculum integration (Drake, 2012). Horizontal mapping involves looking at the envisaged learning in various curriculum areas at a particular stage or class level and identifying how new learning can be drawn together in a meaningful way that supports conceptual progression. It looks *across* a stage/class level. Vertical mapping involves looking at progress from year to year, identifying how the learning in one stage/class level is advanced by the next. It looks *up and down* the school. In the process of curriculum mapping at school level, teachers can work collaboratively to identify meaningful curriculum connections while also attending to the interests and needs of their learners.

A curriculum framework may offer differing levels of support for local curriculum integration. Drake's (2012) guidance on curriculum integration envisages that much of the collation and integration of curriculum learning outcomes is carried out by teachers. However, curriculum frameworks such as the International Baccalaureate Primary Years Programme (IB PYP) provide further support in terms of overall themes (e.g. who we are; how we express ourselves) and concepts (e.g. change, connection, perspective) that help in providing a conceptual framework to tie disciplinary learning outcomes together⁶⁰. These go beyond the general capacities seen in the Scottish Curriculum for Excellence and the general capabilities seen in the Australian Curriculum. Even with these scaffolds, teachers adopting the IB PYP report challenges relating to planning (Drake et al., 2015). A redeveloped curriculum may need to go beyond key competencies to provide specific conceptual links, so that teachers at local level are provided with a way of thinking about cross-disciplinary connections. While the key competencies may provide high-level

⁶⁰ Please see Report 1, Chapter 4, for more information on the details of these case studies of integrated curriculum.





guidance on the aims of the curriculum, akin to overarching principles that inform planning in process models of curriculum (Stenhouse, 1975), they may not be specific enough to support the complex work of meaningful curriculum integration. The importance of piloting ways of thinking about and enacting integrated learning in school-based curriculum development deserves significant attention prior to the wide-scale enactment of the redeveloped curriculum. The investment needed in teacher development is universally acknowledged as crucial for local curriculum-making to be successful (Stenhouse, 1975; Skilbeck, 1984; Kelly, 2009).

Implications for Learner and Teacher Agency

The term agency comes from the Latin *agere*, meaning “to set in motion” or “incite to action”. However, it is insufficient to ‘tell’ someone to take action. Taking into account the implications highlighted in Chapters 4 and 6, as well as the previously discussed models, the following issues require particular attention when attempting to use curriculum integration in a primary school context that reflects learner and teacher agency.

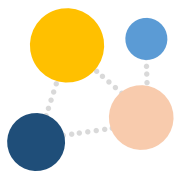
Learner Agency

Learner agency emerges when opportunities to actually shape the trajectory of their learning are provided to learners (Manyukhina & Wyse, 2019). Taking into consideration the literature reviewed, the following issues require attention if this is to be achieved in Irish classrooms.

Teachers’ Understanding of Learner Agency

The emergence of learner agency in the classroom is highly influenced by the teacher. Some pedagogical and assessment approaches place a high value on creating conditions aligned with models of learner agency (e.g. free play, self-assessment). For other approaches, the teacher must be the ‘driving force’ (e.g. direct instruction). All of these approaches can be used when engaging in curriculum integration. Yet, uninformed use of these approaches in service of learner agency could ultimately be counterproductive. Consequently, teachers must understand *what* classroom practices can support learner agency (e.g. affording decision-making power to learners) as well as *how* and *when* they can be best employed for their learners (e.g. age appropriate use of self-assessment).





Learners' Understanding of Agency

While teachers play a valuable role in supporting learner agency, ultimately, it is a capacity that needs to be developed by the learner themselves. As a result, learners must know what is involved in being an 'agent of change' (Leadbeater, 2017). Given that agency generally requires "the ability to frame a guiding purpose and identify actions to achieve a goal" (OECD, 2018, p. 4), learners must develop the knowledge they need to engage in such a process. This may require explicit teaching to help learners understand, for example, how situational variables inform agency (positional dimension; see Report 1) or how they can persist with difficult tasks, e.g. discussing how effort can lead to observable progress which in turn supports motivation (motivational disposition; see Report 1).

Learner Voice

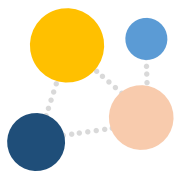
Embedding and elevating the place of learner voice in classrooms can support learner agency. Lundy's (2007) model emphasises the importance of affording decision-making power to learners. Allowing children to take an active role in their learning demonstrates that their perspectives are valued and reflects a democratic culture in the classroom, i.e. an individual voice has 'weight' in society. However, listening to learner voice (and allowing it to inform decisions) requires active effort. The voice of *all* learners must be considered, including those that need support in making their views known (e.g. learners with language and communication needs, younger learners). Supporting learner voice necessitates that children's preferences be considered in the teacher's professional judgment and decision-making. Understanding the opportunities and challenges in using learner voice requires that national and school-level policies provide explicit support materials for teachers about this aspect of learner agency.

Teacher Agency

Using Priestley et al.'s (2015) ecological model as an interpretative framework, three interconnected points should be addressed if Irish teachers are to emerge as agentic professionals in relation to curriculum integration, pedagogy and assessment. Addressing these points would require some reform at each level of the education system.

Knowledgeability (Giddens, 1984; Ó Breacháin, 2022)

Teacher knowledge of good pedagogy and assessment as applied to different curriculum arrangements (e.g. curriculum areas, integrated) and to their learners is a core influence that informs a teacher's capacity to act as an agentic professional. If teachers are



to make decisions regarding the use, implementation and evaluation of curriculum integration in their classrooms, then they need to develop a wide form of pedagogical, assessment, disciplinary and cross-disciplinary knowledge. Of particular relevance to curriculum integration is disciplinary knowledge. Given the breadth of disciplines involved in a curriculum for primary-aged learners, it is unrealistic for each teacher to become a subject-matter expert in every area. Nevertheless, an understanding of the *fundamentals* involved in a particular discipline and how pedagogy and assessment can be best deployed within it is a prerequisite condition for teacher agency. For example, while it is not necessary for every teacher to be an expert in the intricacies of every musical genre, they do need to know how to develop learners' capacity to critically engage and respond (in an age-appropriate way) to a musical piece. Interdisciplinary pedagogical content knowledge is layered on top of disciplinary pedagogical content knowledge (An, 2017). Furthermore, a teacher's agency for curriculum integration is likely to be influenced by their own values, specifically whether or not it will be beneficial for their learners. The arrival of this value judgement can be informed by continually reflecting on their ongoing professional and personal experiences as well as engagement with classroom-based research on its efficacy.

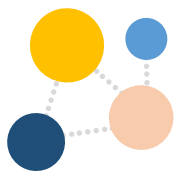
Flexibility

For teachers, a flexible disposition is an asset as the classroom is a dynamic environment that requires ongoing adjustments in practice to support learning. However, curriculum flexibility appears to be one of the conditions conducive to supporting teacher agency. If teachers are to be agentic, they should be afforded sufficient autonomy and flexibility within the curriculum to decide what approach would best suit their learners' needs at any time. This flexibility must be coupled with a deep knowledge of evidence-informed approaches to supporting learning in different contexts and for different learners. Furthermore, a range of material supports to help capitalise on this autonomy, and an appropriate structural and cultural environment, would also be necessary if teachers are to leverage the relational resources in their particular contexts-for-action.

Values and Systems

A teacher's characteristics and capacities interact with wider cultural (e.g. society) and structural (e.g. schools) phenomena that all impact their daily classroom practice. The cultural values in the school and the wider education system must also support curriculum integration in theory *and* practice if teachers are to feel agentic in its provision (e.g. through the use of exemplars, explicit curriculum guidance). Given the in-depth





knowledge necessary for curriculum integration, professional learning and collaboration opportunities within and between schools would likely be extremely beneficial and should also be supported.

Agentic teachers draw on their knowledge, values and aspirations to decide which approaches are best suited to children's learning. Other individual characteristics and local circumstances highly influence a teacher's ability to engage with this decision-making process. This is applicable across most classroom practices, including curriculum integration.

Implications for the Redeveloped Primary Curriculum

Considering the forerunning models and considerations, several implications for the ongoing redevelopment of the primary curriculum are worth particular attention.

Supporting Nuanced Curriculum Integration

Curriculum integration is worthwhile, but only when it serves a clear purpose for children's learning. The curriculum framework should identify where meaningful connections exist.

Curriculum integration is a worthy endeavour supported by research evidence. However, it should be deployed only when it will have a meaningful impact on children's learning. The evidence base is insufficient to propose that integrated learning will *always* be better than discipline-based learning. Ensuring that appropriate curriculum integration takes place in schools will require that extensive, meaningful, well-explicated conceptual connections are clearly outlined in the curriculum. Highly agentic teachers will forge their own connected pathways through even the most disconnected curriculum documents. However, if curriculum integration is to achieve widespread use *and* ensure *meaningful* learning connections, the curriculum itself must be structured in such a way that as much of the 'heavy-lifting' as possible is done to establish these connections. This does not preclude local interpretations of 'other' connections that the curriculum does not explicate.

To-date, the national curriculum has been presented on a subject-by-subject basis. This delineation will continue with the redeveloped curriculum, and in light of the evidence reviewed for the report, this is likely prudent. However, consideration should also be given to the *dynamic* presentation of learning outcomes in the online version of curriculum area specifications. This dynamic presentation could allow individual learning outcomes to be presented according to other categorisations (e.g. a concept, skill) that cross





disciplinary or curriculum area boundaries. To ensure that this is possible, substantial and ongoing attention would need to be afforded to the conceptual links emerging from the developmental work occurring in each of the curriculum areas in the coming period. Attending to these connections 'after the fact' may prove less fruitful. This 'alternative' presentation of the learning outcomes should be seen as an additional functionality rather than the primary presentation of the framework (which has already been initiated on a curriculum area basis). Furthermore, the 'curriculum in practice' section should provide specific guidance on how integration may occur (see examples of integration within curriculum areas in Report 1).

Teacher Knowledge and Professional Learning

A vision for curriculum integration requires adequate support.

Various forms of discrete and overlapping knowledge are needed to weave together the manifold concepts, ideas and tensions inherent in any one pedagogical approach or disciplinary area. Supporting teacher agency for enacting evidence-based pedagogical and assessment practices in an integrated curriculum will require significant investment in professional learning and its associated architecture (e.g. time). Though pedagogical content knowledge and curriculum knowledge will require support, attention should also be paid to teachers' *subject/content* knowledge, particularly in upper primary school (see recommendations from Report 1).

School-based curriculum making

Integrated learning necessitates a well-piloted and well-resourced process for school-level planning.

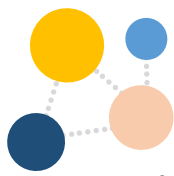
A redeveloped curriculum, which foregrounds integration, requires a process for school-based curriculum making commensurate with this particular curricular structure. A rigorous review of the literature of school-based curriculum making was beyond the scope of this paper. However, a model of backwards design has been proposed in this report, which could provide a springboard for the development of such a process. Before adopting or adapting such an approach, it should be put through a rigorous, iterative piloting process with teachers to ensure its appropriateness.

Enacting Appropriate Pedagogies and Assessments

Research evidence should inform the balance of approaches used to support learners.

All pedagogical approaches have strengths and weaknesses, depending on the intended learning and purpose they expect to achieve (see Chapter 4). The same applies





for assessment (see Chapter 6). The nuance around the evidence base for different approaches must be clearly communicated in professional learning relating to the curriculum. Oversimplified messages about the value or utility of one approach or another will not serve teachers or - more importantly, children - well. *Children's learning* should be foregrounded rather than any one pedagogical approach. Regardless of the approach, a solid foundation for teaching is required, including excellent classroom management skills, fluency in the craft of modelling, questioning, and explaining, and insights about how best to sequence and review new learning. Equally, assessment matters to learning and should be an embedded process in classrooms. This assessment should be purposeful. It does not require excessive documentation. A varied landscape of pedagogical and assessment approaches exists. A teacher should draw on all of these to support children's learning.

Developing Insights on Child Agency

Agency is a complex construct. A shared understanding is necessary.

Although child agency is afforded relatively little attention in much of the empirical literature on curriculum integration, pedagogy and assessment, there is rich potential to build practices that support children's decision-making and influence on classroom activities. Nuanced insights about agency are required, however. The crucial role of the teacher in *supporting* child agency must be acknowledged. Overly simplistic statements (e.g. explicit teaching restricts children's input) must be avoided. The need for further professional learning opportunities regarding agency and voice has been highlighted by the CSL study (Devine et al., 2023).

Ongoing Research

Previous studies on curriculum integration were conducted in particular circumstances and often with extensive instructional supports; further research in the Irish context is needed.

Though a large volume of literature has been reviewed in preparing this and the previous report, it is crucial to continue classroom-based research on how best to conceptualise and enact the redeveloped curriculum. In many instances where high-quality pedagogy and high quality integration overlap to support demonstrable gains in children's learning, *significant* support is provided to teachers in the form of instructional programmes and materials. It would be unrealistic to expect similar results in the absence of similar supports. Consequently, extensive piloting and rigorous research should be carried out to ensure that propositions about integration, pedagogy, assessment and



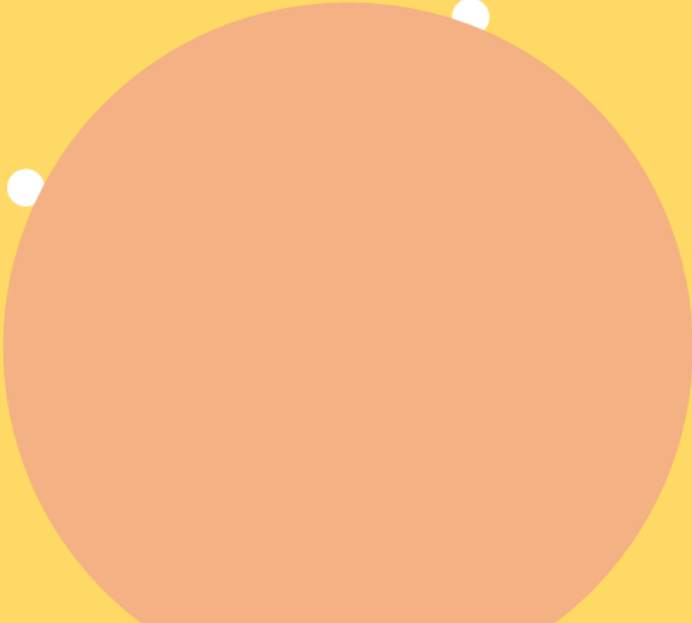


agency are well-grounded in *actual* classroom experience, bearing in mind the available resources.

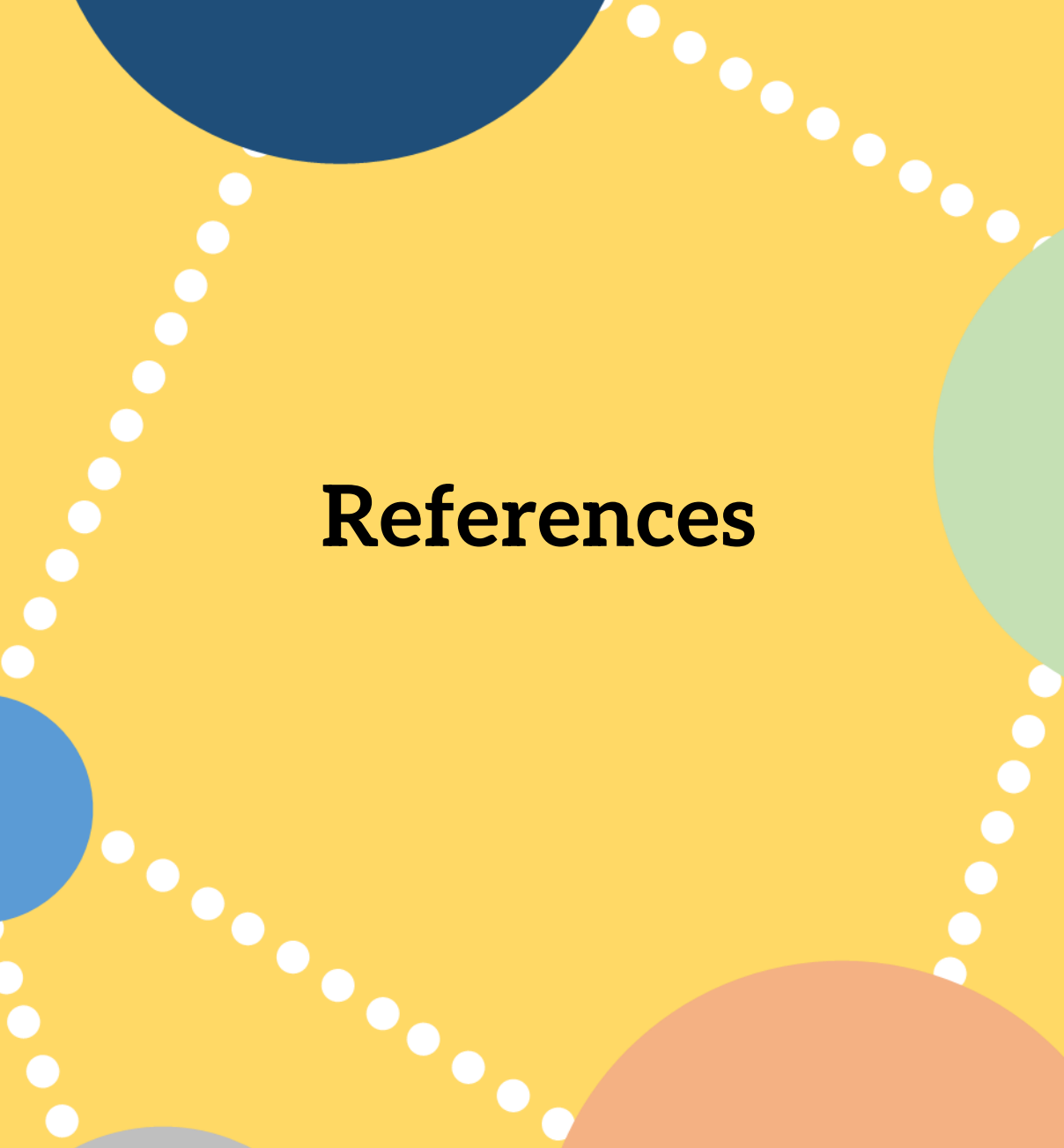
Conclusion

Weaving together the research on integration, pedagogy, assessment and agency is an important step in forming holistic, evidence-informed insights for the development of a new curriculum. Those contained in this report may prove helpful to teachers and policy makers in this endeavour. However, despite the breadth and depth of literature reviewed, it only goes *some* of the way in capturing the complexities and intricacies of classroom life. It is crucial to continue research and piloting in the coming period, as we move from the predicted pattern in a curriculum framework to the textured reality of the classroom. Distinctive tapestries combining different knowledge sources, teaching approaches and forms of assessment will be influenced by the unique experiences and contributions of the teachers and children involved.





References

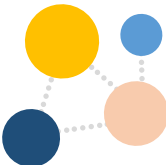


References

- Adams, G. L., & Engelmann, S. (1996). *Research on direct instruction: 25 years beyond DISTAR*. Educational Achievement Systems.
- 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>
- Aitken, V. (2013). Dorothy Heathcote's mantle of the expert approach to teaching and Learning: A Brief introduction. In D. Fraser, V. Aitken, & B. Whyte (Eds.), *Connecting Curriculum, Linking Learning* (pp. 34–56). NZCER Press.
- Akbar, S. (2012). *Language arts concepts infusion for improved math learning*. Capella University.
- Akçay, A. O., Karahan, E., & Bozan, M. (2021). The effect of using technology in primary school mathematics teaching on students' academic achievement: A meta-analysis study. *FIRE: Forum for International Research in Education*, 7(2), 1–21.
- Alexander, R. (2018). Developing dialogic teaching: Genesis, process, trial. *Research Papers in Education*, 33(5), 561–598. <https://doi.org/10.1080/02671522.2018.1481140>
- Alexander, R. (Ed.). (2010). *Children, their world, their education: Final report and recommendations of the Cambridge Primary Review*. Routledge.
- Alexander, R. J. (2000). *Culture and pedagogy: International comparisons in primary education*. Blackwell Pub.
- Alfieri, L., Brooks, P. J., Aldrich, N. J., & Tenenbaum, H. R. (2011). Does discovery-based instruction enhance learning? *Journal of Educational Psychology*, 103(1), 1–18. <https://doi.org/10.1037/a0021017>
- 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.
- Alqassab, M., Strijbos, J.-W., Panadero, E., Ruiz, J. F., Warrens, M., & To, J. (2023). A Systematic Review of Peer Assessment Design Elements. *Educational Psychology Review*, 35(1), 18. <https://doi.org/10.1007/s10648-023-09723-7>
- AlRawi, J. M., & AlKahtani, M. A. (2022). Universal design for learning for educating students with intellectual disabilities: A systematic review. *International Journal of Developmental Disabilities*, 68(6), 800–808. <https://doi.org/10.1080/20473869.2021.1900505>
- American Educational Research Association (AERA), American Psychological Association (APA), National Council on Measurement in Education (NCME), & Joint Committee on Standards for Educational and Psychological Testing (JCSEPT). (2014). *Standards for Educational and Psychological Testing*. AERA.
- 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>
- Andrade, H. L. (2019). A Critical Review of Research on Student Self-Assessment. *Frontiers in Education*, 4, 87. <https://doi.org/10.3389/feduc.2019.00087>
- Andreotti, V. de O. (2006). Soft versus critical global citizenship education. *Policy &*

- Practice - A Development Education Review*, 3, 40–51.
- Arizmendi, G. D., Li, J., Van Horn, M. L., Petcu, S. D., & Swanson, H. L. (2021). Language-Focused Interventions on Math Performance for English Learners: A Selective Meta-Analysis of the Literature. *Learning Disabilities Research & Practice*, 36(1), 56–75. <https://doi.org/10.1111/ldrp.12239>
- Aronson, E., Blaney, N., Stephan, C., Sikes, J., & Snapp, M. (1978). *The jigsaw classroom* (p. 197). Sage.
- Ashman, G. (2021). *The power of explicit teaching and direct instruction* (1st ed). SAGE Publications.
- 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.
- Ávila, J., Rud, A. G., Waks, L. J., & Ring, E. (Eds.). (2022). *The contemporary relevance of John Dewey's theories on teaching and learning: Deweyan perspectives on standardization, accountability, and assessment in education*. Routledge, Taylor & Francis Group.
- Ayers, W., Quinn, T. M., & Stovall, D. (Eds.). (2009). *Handbook of Social Justice in Education* (0 ed.). Routledge. <https://doi.org/10.4324/9780203887745>
- Bailey, A. L., & Durán, R. (2019). Language in Practice: A Mediator of Valid Interpretations of Information Generated by Classroom Assessments among Linguistically and Culturally Diverse Students. In S. M. Brookhart & J. H. McMillan (Eds.), *Classroom Assessment and Educational Measurement*. Routledge.
- Baker, S. T., Le Courtois, S., & Eberhart, J. (2021). Making space for children's agency with playful learning. *International Journal of Early Years Education*, 1–13. <https://doi.org/10.1080/09669760.2021.1997726>
- Baker, S., Lesaux, N., Dimino, J., Proctor, C. P., Morris, J., Gersten, R., Haymond, K., Kieffer, M. J., Linan-Thompson, S., & Newman-Gonchar, R. (2014). *Teaching Academic Content and Literacy to English Learners in Elementary and Middle School*. National Center for Education Evaluation and Regional Assistance (NCEE), Institute of Education Sciences, U.S. Department of Education.
- Ball, D., & Forzani, F. M. (2009). The Work of Teaching and the Challenge for Teacher Education. *Journal of Teacher Education*, 60(5), 497–511. <https://doi.org/10.1177/0022487109348479>
- Bartholomew, S. R., Strimel, G. J., & Yoshikawa, E. (2019). Using adaptive comparative judgment for student formative feedback and learning during a middle school design project. *International Journal of Technology and Design Education*, 29(2), 363–385. <https://doi.org/10.1007/s10798-018-9442-7>
- Barz, N., Benick, M., Dörrenbächer-Ulrich, L., & Perels, F. (2023). The Effect of Digital Game-Based Learning Interventions on Cognitive, Metacognitive, and Affective-Motivational Learning Outcomes in School: A Meta-Analysis. *Review of Educational Research*, 003465432311677. <https://doi.org/10.3102/00346543231167795>
- 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. A. (1997). *Curriculum integration: Designing the core of democratic education*. Teachers College Press.
- Benavides-Varela, S., Zandonella Callegher, C., Fagiolini, B., Leo, I., Altoè, G., & Lucangeli, D. (2020). Effectiveness of digital-based interventions for children with mathematical learning difficulties: A meta-analysis. *Computers & Education*, 157, 103953. <https://doi.org/10.1016/j.compedu.2020.103953>
- Benick, M., Dörrenbächer-Ulrich, L., Weißenfels, M., & Perels, F. (2021). Fostering Self-Regulated Learning in Primary School Students: Can Additional Teacher Training Enhance the Effectiveness of an Intervention? *Psychology Learning & Teaching*, 20(3), 324–347. <https://doi.org/10.1177/14757257211013638>
- 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>
- Biesta, G. (2015). Improving education through research? From effectiveness, causality and technology to purpose, complexity and culture. *Policy Futures in Education*, 14(2), 194–210. <https://doi.org/10.1177/1478210315613900>
- Biesta, G. (2022). *World-centred education: A view for the present*. Routledge.
- Biesta, G. J. J. (2010). Why 'What Works' Still Won't Work: From Evidence-Based Education to Value-Based Education. *Studies in Philosophy and Education*, 29(5), 491–503. <https://doi.org/10.1007/s11217-010-9191-x>
- 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.
- Black, P., & Wiliam, D. (2018). Classroom assessment and pedagogy. *Assessment in Education: Principles, Policy & Practice*, 25(6), 551–575. <https://doi.org/10.1080/0969594X.2018.1441807>
- Bogotch, I., Mirón, L., & Biesta, G. (2007). "Effective for What; Effective for Whom?" Two Questions SESI Should Not Ignore. In T. Townsend (Ed.), *International Handbook of School Effectiveness and Improvement* (Vol. 17, pp. 93–110). Springer Netherlands. https://doi.org/10.1007/978-1-4020-5747-2_6
- Bolat, Y. I., & Taş, N. (2022). A meta-analysis on the effect of gamified-assessment tools' on academic achievement in formal educational settings. *Education and Information Technologies*, 28, 5011–5039. <https://doi.org/10.1007/s10639-022-11411-y>
- Boon, H. J., Boon, L., & Bartle, T. (2021). Does iPad use support learning in students aged 9–14 years? A systematic review. *The Australian Educational Researcher*, 48(3), 525–541. <https://doi.org/10.1007/s13384-020-00400-0>
- Booth, T., & Ainscow, M. (2002). *Index for inclusion: Developing learning and participation in schools*. Centre for Studies on Inclusive Education. <https://www.tandfonline.com/doi/full/10.1080/02667363.2012.728810>
- 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.
- Briggs, D., C., & Furtak, E., M. (2019). Learning progressions and embedded assessment. In S. M. Brookhart & J. H. McMillan (Eds.), *Classroom Assessment and Educational Measurement* (pp. 146–169). Routledge.

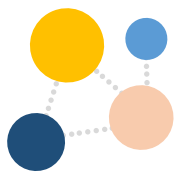
- 
- Brookhart, S. M. (2003). Developing measurement theory for classroom assessment purposes and uses. *Educational Measurement: Issues and Practice*, 22(4), 5–12.
- Brookhart, S. M. (2015). *Performance assessment: Showing what students know and can do*. Learning Sciences International.
- Brown, M., Burns, D., McNamara, G., & O'Hara, J. (2022). Culturally responsive classroom-based assessment: A case study of secondary schools in Ireland. *Revista de Investigación Educativa*, 40(1), 15–32. <https://doi.org/10.6018/rie.496681>
- 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.
- Brush, T., & Saye, J. (2017). Problem-Based Learning in K-12 and Teacher Education: Introduction and Current Trends. In T. Brush & J. Saye (Eds.), *Successfully implementing problem-based learning in classrooms: Research in K-12*.
- Bryant, K. G. (2012). *Effect of Music-Integrated Instruction on First Graders' Reading Fluency*. Liberty University.
- Burghardt, G. M. (2010). Defining and recognising play. In A. Pellegrini (Ed.), *The Oxford Handbook of the Development of Play* (pp. 9–18). Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780195393002.013.0002>
- Burnard, P., Craft, A., Cremin, T., Duffy, B., Hanson, R., Keene, J., Haynes, L., & Burns, D. (2006). Documenting 'possibility thinking': A journey of collaborative enquiry. *International Journal of Early Years Education*, 14(3), 243–262. <https://doi.org/10.1080/09669760600880001>
- Cannon-Ruffo, C. M. (2020). *The Efficacy of Educational Robotics in an Integrated Stem Elementary Curriculum*. Northern Illinois University.
- Carter, P. L., & Darling-Hammond, L. (2016). Teaching Diverse Learners. In C. Bell & D. H. Gitomer (Eds.), *Handbook of Research on Teaching* (5th ed.). American Educational Research Association.
- 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>
- Centre for Applied Special Technology (CAST). (2018). *Universal Design for Learning Guidelines version 2.2*. <http://udlguidelines.cast.org>
- Celik, I., Dindar, M., Muukkonen, H., & Järvelä, S. (2022). The Promises and Challenges of Artificial Intelligence for Teachers: A Systematic Review of Research. *TechTrends*, 66(4), 616–630. <https://doi.org/10.1007/s11528-022-00715-y>
- 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>
- 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.

- 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.
- Chang, H.-Y., Lin, T.-J., Lee, M.-H., Lee, S. W.-Y., Lin, T.-C., Tan, A.-L., & Tsai, C.-C. (2020). A systematic review of trends and findings in research employing drawing assessment in science education. *Studies in Science Education*, 56(1), 77–110. <https://doi.org/10.1080/03057267.2020.1735822>
- Chen, C.-H., & Yang, Y.-C. (2019). Revisiting the effects of project-based learning on students' academic achievement: A meta-analysis investigating moderators. *Educational Research Review*, 26, 71–81. <https://doi.org/10.1016/j.edurev.2018.11.001>
- Chen, P. P., & Bonner, S. M. (2020). A framework for classroom assessment, learning, and self-regulation. *Assessment in Education: Principles, Policy & Practice*, 27(4), 373–393. <https://doi.org/10.1080/0969594X.2019.1619515>
- Devine, D., Martinez-Sainz, G., Symonds, J., Sloan, S., Moore, B., Crean, M., Barrow, N., Grieves, M., Donegan, A., Samonova, E., Davies, A., Farrell, E., O'Giobúin, R. & Farrell, J. (2023). *Primary Pedagogies: Children and teachers' experiences of pedagogical practices in primary schools in Ireland 2019 - 2022*. NCCA.
- Chiu, T. K. F., Xia, Q., Zhou, X., Chai, C. S., & Cheng, M. (2023). Systematic literature review on opportunities, challenges, and future research recommendations of artificial intelligence in education. *Computers and Education: Artificial Intelligence*, 4, 100118. <https://doi.org/10.1016/j.caeai.2022.100118>
- Christodoulou, D. (2014). *Seven myths about education*. Routledge.
- Coe, R., Aloisi, C., Higgins, S., & Major, L. E. (2014). *What makes great teaching? Review of the underpinning research*. Sutton Trust. <https://www.suttontrust.com/wp-content/uploads/2014/10/What-Makes-Great-Teaching-REPORT.pdf>
- Coe, R., Rauch, C. J., Kime, S., & Singleton, D. (2020a). *Great Teaching Toolkit: Evidence Review*. Evidence Based Education. <https://evidencebased.education/great-teaching-toolkit-evidence-review/>
- Coe, R., Rauch, C. J., Kime, S., & Singleton, D. (2020b). *Great Teaching Toolkit: Evidence Review*. Cambridge Assessment: International Education. <https://2366135.fs1.hubspotusercontent-na1.net/hubfs/2366135/Great%20Teaching%20Toolkit%20Evidence%20Review.pdf>
- Cohen, E. G. (1994). Restructuring the Classroom: Conditions for Productive Small Groups. *Review of Educational Research*, 64(1), 1–35.
- Collins, A. A., Lindström, E. R., & Compton, D. L. (2018). Comparing Students With and Without Reading Difficulties on Reading Comprehension Assessments: A Meta-Analysis. *Journal of Learning Disabilities*, 51(2), 108–123. <https://doi.org/10.1177/0022219417704636>
- Collin, J., & Quigley, A. (2021). *Teacher Feedback to Improve Pupil Learning: Guidance Report*. Education Endowment Foundation.
- Council of Europe (Ed.). (2001). *Common European framework of reference for languages: Learning, teaching, assessment*. Cambridge University Press.

- Craft, A. (2003). The Limits To Creativity In Education: Dilemmas For The Educator. *British Journal of Educational Studies*, 51(2), 113-127. <https://doi.org/10.1111/1467-8527.t01-1-00229>
- Craft, A., (2002). Little c Creativity. In A. Craft, B. Jeffrey & M. Leibling, *Creativity in Education* (pp. 45-61), Continuum.
- Creemers, B. P. M., & Kyriakidēs, L. (2012). *Improving quality in education: Dynamic approaches to school improvement*. Routledge.
- Cremin, T., & Chappell, K. (2021). Creative pedagogies: A systematic review. *Research Papers in Education*, 36(3), 299-331. <https://doi.org/10.1080/02671522.2019.1677757>
- Cremin, T., Burnard, P., & Craft, A. (2006). Pedagogy and possibility thinking in the early years. *Thinking Skills and Creativity*, 1(2), 108-119. <https://doi.org/10.1016/j.tsc.2006.07.001>
- Cronbach, L. (1988). Five perspectives on validity argument. In H. Wainer & H. Braun (Eds.), *Test Validity*. (pp. 3-17). Erlbaum.
- 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.
- Davidson, J., & Feldman, J. (2010). Formative assessment applications of culminating demonstrations of mastery. In H. L. Andrade & G. Cizek J. (Eds.), *Handbook of Formative Assessment* (pp. 75-89). Routledge.
- Davies, D., Jindal-Snape, D., Collier, C., Digby, R., Hay, P., & Howe, A. (2013). Creative learning environments in education—A systematic literature review. *Thinking Skills and Creativity*, 8, 80-91. <https://doi.org/10.1016/j.tsc.2012.07.004>
- Deunk, M. I., Smale-Jacobse, A. E., de Boer, H., Doolaard, S., & Bosker, R. J. (2018). Effective differentiation Practices: A systematic review and meta-analysis of studies on the cognitive effects of differentiation practices in primary education. *Educational Research Review*, 24, 31-54. <https://doi.org/10.1016/j.edurev.2018.02.002>
- Devine, D., & McGillicuddy, D. (2016). Positioning pedagogy - A matter of children's rights. *Oxford Review of Education*, 42(4), 424-443. <https://doi.org/10.1080/03054985.2016.1197111>
- Devine, D., Fahie, D., & McGillicuddy, D. (2013). What is 'good' teaching? Teacher beliefs and practices about their teaching. *Irish Educational Studies*, 32(1), 83-108. <https://doi.org/10.1080/03323315.2013.773228>
- Dewey, J. (1900). *The school and society*. University of Chicago Press.
- Dignath, C., & Büttner, G. (2008). Components of fostering self-regulated learning among students. A meta-analysis on intervention studies at primary and secondary school level. *Metacognition and Learning*, 3(3), 231-264. <https://doi.org/10.1007/s11409-008-9029-x>
- Dignath, C., Buettner, G., & Langfeldt, H.-P. (2008). How can primary school students learn self-regulated learning strategies most effectively? *Educational Research Review*, 3(2), 101-129. <https://doi.org/10.1016/j.edurev.2008.02.003>
- Double, K. S., McGrane, J. A., & Hopfenbeck, T. N. (2020). The Impact of Peer Assessment on Academic Performance: A Meta-analysis of Control Group Studies. *Educational Psychology Review*, 32(2), 481-509. <https://doi.org/10.1007/s10648-019-09510-3>

- 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. (2012). *Creating Standards-Based Integrated Curriculum*. Corwin.
- Drake, S. M. (2012). *Creating Standards-Based Integrated Curriculum*. Corwin.
- 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.
- Duffy, T. M. (2009). Building lines of communication and a research agenda. In *Constructivist Instruction: Success or Failure?* (pp. 351-367). Routledge.
- 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>
- Eberle, S. G. (2014). Toward a Philosophy and a Definition of Play. *Journal of Play*, 6(2), 214-233.
- Edsall Giglio, L. (2012). *Imagication = imagination + education: What fifth graders think of arts integration in public elementary schools*. The University of San Francisco.
- Education Endowment Foundation. (2023). *Play-based learning*. <https://educationendowmentfoundation.org.uk/education-evidence/early-years-toolkit/play-based-learning>
- Egan, K. & Nadaner, D. (1988). Introduction. In K. Egan & D. Nadaner (Eds.) *Imagination & Education* (pp. ix-xv). Open University Press.
- Egan, K. (1992). *Imagination in Teaching and Learning*. Routledge.
- Emirbayer, M., & Mische, A. (1998). What Is Agency? *American Journal of Sociology*, 103(4), 962-1023. <https://doi.org/10.1086/231294>
- Endedijk, H. M., Breeman, L. D., van Lissa, C. J., Hendrickx, M. M. H. G., den Boer, L., & Mainhard, T. (2022). The Teacher's Invisible Hand: A Meta-Analysis of the Relevance of Teacher-Student Relationship Quality for Peer Relationships and the Contribution of Student Behavior. *Review of Educational Research*, 92(3), 370-412. <https://doi.org/10.3102/00346543211051428>
- Engelmann, S. (1980). *Direct Instruction*. Educational Technology Publications.
- Engelmann, S., Becker, W. C., & Car, D. (1988). The Direct Instruction follow through model: Design and outcomes. *Education and Treatment of Children*, 11(4), 303-317.
- 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.
- Estrella, G., Au, J., Jaeggi, S. M., & Collins, P. (2018). Is Inquiry Science Instruction Effective for English Language Learners? A Meta-Analytic Review. *AERA Open*, 4(2), 233285841876740. <https://doi.org/10.1177/2332858418767402>
- 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,

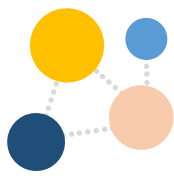
- 95–111. <https://doi.org/10.14434/ijlcle.v3i0.26910>
- Ferrero, M., Vadillo, M. A., & León, S. P. (2021). Is project-based learning effective among kindergarten and elementary students? A systematic review. *PLOS ONE*, *16*(4), e0249627. <https://doi.org/10.1371/journal.pone.0249627>
- Field, A. (2017). *Discovering Statistics Using IBM SPSS Statistics* (5th ed.). SAGE Publications.
- Filderman, M. J., Austin, C. R., Boucher, A. N., O'Donnell, K., & Swanson, E. A. (2022). A Meta-Analysis of the Effects of Reading Comprehension Interventions on the Reading Comprehension Outcomes of Struggling Readers in Third Through 12th Grades. *Exceptional Children*, *88*(2), 163–184. <https://doi.org/10.1177/00144029211050860>
- Fisher, D., & Frey, N. (2013). *Better learning through structured teaching: A framework for the gradual release of responsibility*. ASCD.
- Flavell, J. H., Green, F. L., Wahl, K. E., & Flavell, E. R. (1987). The effects of question clarification and memory aids on young children's performance on appearance-reality tasks. *Cognitive Development*, *2*(2), 127–144. [https://doi.org/10.1016/S0885-2014\(87\)90104-3](https://doi.org/10.1016/S0885-2014(87)90104-3)
- Fletcher, J. M., & Vaughn, S. (2009). Response to Intervention: Preventing and Remediating Academic Difficulties. *Child Development Perspectives*, *3*(1), 30–37. <https://doi.org/10.1111/j.1750-8606.2008.00072.x>
- Florian, L. (2019). On the necessary co-existence of special and inclusive education. *International Journal of Inclusive Education*, *23*(7–8), 691–704. <https://doi.org/10.1080/13603116.2019.1622801>
- Florian, L., & Black-Hawkins, K. (2011). Exploring inclusive pedagogy. *British Educational Research Journal*, *37*(5), 813–828. <https://doi.org/10.1080/01411926.2010.501096>
- Florian, L., & Spratt, J. (2013). Enacting inclusion: A framework for interrogating inclusive practice. *European Journal of Special Needs Education*, *28*(2), 119–135. <https://doi.org/10.1080/08856257.2013.778111>
- Fotaris, P., Pellas, N., Kazanidis, I., & Smith, P. (2017). A Systematic Review of Augmented Reality Game-Based Applications in Primary Education. *Proceedings of the 11th European Conference on Games Based Learning (ECGBL17)*, 181–190.
- Fraenkel, J. R., Wallen, N. E., & Hyun, H. (2018). *How to design and evaluate research in education* (10th Ed.). McGraw Hill.
- 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.
- Freire, P. (1970). *Pedagogy of the Oppressed*. Continuum.
- French, G., McKenna, G., Giblin, F., Concannon-Gibney, T., Farrell, T., Gillic, C., Halligan, C., Lake, G., Ní Dhiorbháin, A., Ní Láimhín, M., & O'Neill, S. (2022). *Literature review to support the updating of Aistear, the Early Childhood Curriculum Framework*. National Council for Curriculum and Assessment.
- Friesen, S., & Scott, D. (2013). *Inquiry-Based Learning: A Review of the Research Literature*. Alberta Ministry of Education.
- Furtak, E. M., Seidel, T., Iverson, H., & Briggs, D. C. (2012). Experimental and Quasi-Experimental Studies of Inquiry-Based Science Teaching: A Meta-Analysis. *Review*



- of *Educational Research*, 82(3), 300–329.
<https://doi.org/10.3102/0034654312457206>
- Gao, X., Li, P., Shen, J., & Sun, H. (2020). Reviewing assessment of student learning in interdisciplinary STEM education. *International Journal of STEM Education*, 7(1), 24. <https://doi.org/10.1186/s40594-020-00225-4>
- García, O., & Flores, N. (2012). Multilingual pedagogies. In M. Martin-Jones, A. Blackledge, & A. Creese (Eds.), *The Routledge Handbook of Multilingualism* (pp. 232–246). Routledge.
- 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>
- Gay, G. (2013). Teaching To and Through Cultural Diversity. *Curriculum Inquiry*, 43(1), 48–70. <https://doi.org/10.1111/curi.12002>
- Geary, D. (2008). An evolutionarily informed education science. *Educational Psychologist*, 43, 179–195.
- Gellert, A. S., & Elbro, C. (2018). Predicting reading disabilities using dynamic assessment of decoding before and after the onset of reading instruction: A longitudinal study from kindergarten through grade 2. *Annals of Dyslexia*, 68(2), 126–144. <https://doi.org/10.1007/s11881-018-0159-9>
- Gersten, R., Beckmann, S., Clarke, B., Foegen, A., Marsh, L., Star, J. R., & Witzel, B. (2009). *Assisting Students Struggling with Mathematics: Response to Intervention (RtI) for Elementary and Middle Schools*. National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education.
- Gersten, R., Compton, D., Connor, C. M., Dimino, J., Santoro, L., Linan-Thompson, S., & Tilly, W. D. (2009). *Assisting Students Struggling with Reading: Response to Intervention (RtI) and Multi-Tier Intervention in the Primary Grades*. National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education.
- Gersten, R., Haymond, K., Newman-Gonchar, R., Dimino, J., & Jayanthi, M. (2020). Meta-Analysis of the Impact of Reading Interventions for Students in the Primary Grades. *Journal of Research on Educational Effectiveness*, 13(2), 401–427. <https://doi.org/10.1080/19345747.2019.1689591>
- Giddens, A. (1984). *The constitution of society*. Polity Press.
- Giroux, H. A. (2011). *On critical pedagogy*. Continuum International Publishing Group.
- Goren, H., & Yemini, M. (2017). Global citizenship education redefined – A systematic review of empirical studies on global citizenship education. *International Journal of Educational Research*, 82, 170–183. <https://doi.org/10.1016/j.ijer.2017.02.004>
- Graham, L. J., de Bruin, K., Lassig, C., & Spandagou, I. (2021). A scoping review of 20 years of research on differentiation: Investigating conceptualisation, characteristics, and methods used. *Review of Education*, 9(1), 161–198. <https://doi.org/10.1002/rev3.3238>
- 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>
- Graham, S., Hebert, M., & Harris, K. R. (2015). *Formative Assessment and Writing: A Meta-*

- Analysis. *The Elementary School Journal*, 115(4), 523–547.
<https://doi.org/10.1086/681947>
- 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>
- Gray, P. (2013). *Free to learn: Why unleashing the instinct to play will make our children happier, more self-reliant, and better students for life*. Basic Books.
- Griful-Freixenet, J., Struyven, K., Vantieghem, W., & Gheysens, E. (2020). Exploring the interrelationship between Universal Design for Learning (UDL) and Differentiated Instruction (DI): A systematic review. *Educational Research Review*, 29, 100306.
<https://doi.org/10.1016/j.edurev.2019.100306>
- Grigorenko, E. L. (2009). Dynamic Assessment and Response to Intervention: Two Sides of One Coin. *Journal of Learning Disabilities*, 42(2), 111–132.
<https://doi.org/10.1177/0022219408326207>
- Guan, X., Sun, C., Hwang, G., Xue, K., & Wang, Z. (2022). Applying game-based learning in primary education: A systematic review of journal publications from 2010 to 2020. *Interactive Learning Environments*, 1–23.
<https://doi.org/10.1080/10494820.2022.2091611>
- Gulikers, J. T. M., Bastiaens, T. J., & Kirschner, P. A. (2004). A five-dimensional framework for authentic assessment. *Educational Technology Research and Development*, 52(3), 67–86. <https://doi.org/10.1007/BF02504676>
- 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. (2019). *The Influence of an Interdisciplinary Elementary Curriculum on Student Outcomes: Providing Cognitive Student Learning through an Integrated Approach*. Seton Hall University.
- Harris, A. 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. R., Adie, L., & Wyatt-Smith, C. (2022). Learning Progression-Based Assessments: A Systematic Review of Student and Teacher Uses. *Review of Educational Research*, 92(6), 996–1040. <https://doi.org/10.3102/00346543221081552>
- Hartzler, D. M. (2000). *A meta-analysis of studies conducted on integrated curriculum programs and their effects on student achievement*. Indiana University.
- Hattie, J., & Timperley, H. (2007). The Power of Feedback. *Review of Educational Research*, 77(1), 81–112. <https://doi.org/10.3102/003465430298487>
- Hays, P. A. (2016). Conducting a culturally responsive assessment. In P. A. Hays, *Addressing cultural complexities in practice: Assessment, diagnosis, and therapy* (3rd ed.). (pp. 127–160). American Psychological Association.
<https://doi.org/10.1037/14801-007>
- Hein, M., & Nathan-Roberts, D. (2018). Socially Interactive Robots Can Teach Young Students Language Skills; a Systematic Review. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, 62(1), 1083–1087.

- <https://doi.org/10.1177/1541931218621249>
- Heitink, M. C., Van der Kleij, F. M., Veldkamp, B. P., Schildkamp, K., & Kippers, W. B. (2016). A systematic review of prerequisites for implementing assessment for learning in classroom practice. *Educational Research Review*, *17*, 50–62. <https://doi.org/10.1016/j.edurev.2015.12.002>
- Hélot, C. (2012). Linguistic diversity and education. In M. Martin-Jones, A. Blackledge, & A. Creese (Eds.), *The Routledge Handbook of Multilingualism* (pp. 214–231). Routledge.
- Hendrickx, M. M. H. G., Mainhard, T., Oudman, S., Boor-Klip, H. J., & Brekelmans, M. (2017). Teacher behavior and peer liking and disliking: The teacher as a social referent for peer status. *Journal of Educational Psychology*, *109*(4), 546–558. <https://doi.org/10.1037/edu0000157>
- Heritage, M. (2018). Making Assessment Work for Teachers. *Educational Measurement: Issues and Practice*, *37*(1), 39–41. <https://doi.org/10.1111/emip.12191>
- Heritage, M., & Heritage, J. (2013). Teacher Questioning: The Epicenter of Instruction and Assessment. *Applied Measurement in Education*, *26*(3), 176–190. <https://doi.org/10.1080/08957347.2013.793190>
- Hermann, J., & Cook, L. (2020). Fairness in classroom assessment. In S. M. Brookhart & J. H. McMillan (Eds.), *Classroom Assessment and Educational Measurement*. (pp. 265–275). Routledge.
- Herrera, S. G., Cabral, R. M., & Murry, K. G. (2013). *Assessment accommodations for classroom teachers of culturally and linguistically diverse students* (2nd ed). Pearson.
- Hetland, L., Winner, E., Veenema, S., & Sheridan, K. (2007). *Studio thinking: The real benefits of visual arts education*. Teachers College Press.
- Higgins, S., & Katsipataki, M. (2016). Communicating comparative findings from meta-analysis in educational research: Some examples and suggestions. *International Journal of Research & Method in Education*, *39*(3), 237–254. <https://doi.org/10.1080/1743727X.2016.1166486>
- Hirsh-Pasek, K. (Ed.). (2009). *A mandate for playful learning in preschool: Presenting the evidence*. Oxford University Press.
- Hirsh-Pasek, K., Zosh, J. M., Golinkoff, R. M., Gray, J. H., Robb, M. B., & Kaufman, J. (2015). Putting Education in “Educational” Apps: Lessons From the Science of Learning. *Psychological Science in the Public Interest*, *16*(1), 3–34. <https://doi.org/10.1177/1529100615569721>
- Hodgen, J., Barclay, N., Foster, C., Gilmore, C., Marks, R., & Simms, V. (2020). *Early Years and Key Stage 1 Mathematics Teaching: Evidence Review*. Education Endowment Foundation.
- Hodgen, J., Foster, C., Marks, R., & Brown, M. (2018). *Improving Mathematics in Key Stages Two and Three: Evidence Review*. Education Endowment Foundation.
- Homer, B. D., Raffaele, C., & Henderson, H. (2020). Games as Playful Learning: Implications of Developmental Theory for Game-Based Learning. In J. L. Plass, R. E. Mayer, & Homer (Eds.), *Handbook of Game-Based Learning* (pp. 25–52). MIT Press.
- Hoover, N. R., & Abrams, L. M. (2013). Teachers’ Instructional Use of Summative Student Assessment Data. *Applied Measurement in Education*, *26*(3), 219–231.

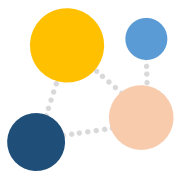


- <https://doi.org/10.1080/08957347.2013.793187>
- Hornby, G. (2015). Inclusive special education: Development of a new theory for the education of children with special educational needs and disabilities: Inclusive Special Education. *British Journal of Special Education*, 42(3), 234–256. <https://doi.org/10.1111/1467-8578.12101>
- Hornby, G., & Greaves, D. (2022). *Essential evidence-based teaching strategies: Ensuring optimal academic achievement for students*. Springer.
- 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>
- 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>
- Humphry, S. M., & Heldsinger, S. A. (2014). Common Structural Design Features of Rubrics May Represent a Threat to Validity. *Educational Researcher*, 43(5), 253–263. <https://doi.org/10.3102/0013189X14542154>
- Hurley, M. M. (2001). Reviewing Integrated Science and Mathematics: The Search for Evidence and Definitions From New Perspectives. *School Science and Mathematics*, 101(5), 259–268. <https://doi.org/10.1111/j.1949-8594.2001.tb18028.x>
- Husbands, C., & Pearce, J. (2012). *What makes great pedagogy? Nine claims from research*. National College for School Leadership.
- Hussein, M. H., Ow, S. H., Cheong, L. S., Thong, M.-K., & Ale Ebrahim, N. (2019). Effects of Digital Game-Based Learning on Elementary Science Learning: A Systematic Review. *IEEE Access*, 7, 62465–62478. <https://doi.org/10.1109/ACCESS.2019.2916324>
- Hwang, H., Cabell, S. Q., & Joyner, R. E. (2021). Effects of integrated literacy and content-area instruction on vocabulary and comprehension in the elementary years: A meta-analysis. *Scientific Studies of Reading*, 26(3), 1–27. <https://doi.org/10.1080/10888438.2021.1954005>
- 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>
- Irwin, J. (2018). *Towards a Values-Led Redevelopment of the Primary Curriculum*. National Council for Curriculum and Assessment.
- Jeffrey, B., & Craft, A. (2004). Teaching creatively and teaching for creativity: Distinctions and relationships. *Educational Studies*, 30(1), 77–87. <https://doi.org/10.1080/0305569032000159750>
- Jia, Y., Zhou, B., & Zheng, X. (2021). A Curriculum Integrating STEAM and Maker Education Promotes Pupils' Learning Motivation, Self-Efficacy, and Interdisciplinary Knowledge Acquisition. *Front Psychol*, 12, 725525. <https://doi.org/10.3389/fpsyg.2021.725525>
- Johnson, D. W., & Johnson, R. T. (2009). An Educational Psychology Success Story: Social Interdependence Theory and Cooperative Learning. *Educational Researcher*, 38(5), 365–379. <https://doi.org/10.3102/0013189X09339057>

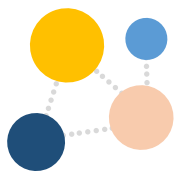


- Jordan, D. (2016). *Investigating Teacher Learning and Change in a Professional Learning Community: Integrating ELA and Social Studies Curriculum*. University of Nevada - Las Vegas.
- Kaendler, C., Wiedmann, M., Rummel, N., & Spada, H. (2015). Teacher Competencies for the Implementation of Collaborative Learning in the Classroom: A Framework and Research Review. *Educational Psychology Review*, 27(3), 505–536. <https://doi.org/10.1007/s10648-014-9288-9>
- Kane, M. T., & Wools, S. (2020). *Perspectives on the validity of classroom assessments* (S. M. Brookhart & J. H. McMillan, Eds.; pp. 11–26). Routledge.
- Kapp, K. M. (2012). *The gamification of learning and instruction: Game-based methods and strategies for training and education*. John Wiley & Sons.
- Kavanagh, A. M., & Dupont, M. (2021). Making the invisible visible: Managing tensions around including Traveller culture and history in the curriculum at primary and post-primary levels. *Irish Educational Studies*, 40(3), 553–569. <https://doi.org/10.1080/03323315.2021.1932548>
- Keane, L., & Griffin, C. P. (2018). Assessing self-assessment: Can age and prior literacy attainment predict the accuracy of children’s self-assessments in literacy? *Irish Educational Studies*, 37(1), 127–147. <https://doi.org/10.1080/03323315.2018.1449001>
- Kelly, A. V. (2009). *The curriculum: Theory and practice* (6th ed). Sage Publications.
- Kennedy, E., & Shiel, G. (2022). Writing assessment for communities of writers: Rubric validation to support formative assessment of writing in Pre-K to grade 2. *Assessment in Education: Principles, Policy & Practice*, 29(2), 127–149. <https://doi.org/10.1080/0969594X.2022.2047608>
- Kennedy, E., Shiel, G., French, G., Harbison, L., Leahy, M., Ó Duibhir, P., & Travers, J. (2023). *Towards a new literacy, numeracy and digital literacy strategy: A review of literature*. Department of Education.
- Kim, M., & Jin, Q. (2022). Studies on visualisation in science classrooms: A systematic literature review. *International Journal of Science Education*, 44(17), 2613–2631. <https://doi.org/10.1080/09500693.2022.2140020>
- Kincheloe, J. L. (2008). *Knowledge and critical pedagogy*. Springer.
- King-Sears, M. E., Stefanidis, A., Evmenova, A. S., Rao, K., Mergen, R. L., Owen, L. S., & Strimel, M. M. (2023). Achievement of learners receiving UDL instruction: A meta-analysis. *Teaching and Teacher Education*, 122, 103956. <https://doi.org/10.1016/j.tate.2022.103956>
- Kirschner, P. A. (2009). Epistemology or pedagogy, that is the question. In S. Tobias & T. M. Duffy (Eds.), *Constructivist instruction: Success or failure?* (pp. 144–157). Routledge/Taylor & Francis Group.
- Kirschner, P. A., Hendrick, C., & Heal, J. (2022). *How teaching happens: Seminal works in teaching and teacher effectiveness and what they mean in practice*. Routledge.
- Klute, M., Apthorp, H., Harlacher, J., & Reale, M. (2017). *Formative assessment and elementary school student academic achievement: A review of the evidence*. : U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Central.
- Knight, S. (2016). *Forest School in Practice*. SAGE.

- Ko, J., Sammons, P., & Bakkum, L. (2013). *Effective teaching: A review of research and evidence*. CfBT Education Trust.
- 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.
- Koyunlu Ünlü, Z., & Dökme, İ. (2022). A systematic review of 5E model in science education: Proposing a skill-based STEM instructional model within the 21-st century skills. *International Journal of Science Education*, 44(13), 2110–2130. <https://doi.org/10.1080/09500693.2022.2114031>
- Kraft, M. A. (2020). Interpreting Effect Sizes of Education Interventions. *Educational Researcher*, 49(4), 241–253. <https://doi.org/10.3102/0013189X20912798>
- Krajcik, J. S., & Shin, N. (2022). Project-Based Learning. In R. K. Sawyer (Ed.), *The Cambridge Handbook of the Learning Sciences* (3rd ed., pp. 72–92). Cambridge University Press. <https://doi.org/10.1017/9781108888295.006>
- Kruger, J., & Dunning, D. (1999). Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments. *Journal of Personality and Social Psychology*, 77(6), 1121–1134.
- Kyndt, E., Raes, E., Lismont, B., Timmers, F., Cascallar, E., & Dochy, F. (2013). A meta-analysis of the effects of face-to-face cooperative learning. Do recent studies falsify or verify earlier findings? *Educational Research Review*, 10, 133–149. <https://doi.org/10.1016/j.edurev.2013.02.002>
- Kyriakides, L., Christoforou, C., & Charalambous, C. Y. (2013). What matters for student learning outcomes: A meta-analysis of studies exploring factors of effective teaching. *Teaching and Teacher Education*, 36, 143–152. <https://doi.org/10.1016/j.tate.2013.07.010>
- Ladson-Billings, G. (1995). But That's Just Good Teaching! The Case for Culturally Relevant Pedagogy. *Theory Into Practice*, 34(3), 159–165.
- 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>
- 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>
- Lazonder, A. W., & Harmsen, R. (2016). Meta-Analysis of Inquiry-Based Learning: Effects of Guidance. *Review of Educational Research*, 86(3), 681–718. <https://doi.org/10.3102/0034654315627366>
- Lei, H., Chiu, M. M., Wang, D., Wang, C., & Xie, T. (2022). Effects of Game-Based Learning on Students' Achievement in Science: A Meta-Analysis. *Journal of Educational Computing Research*, 60(6), 1373–1398. <https://doi.org/10.1177/073563312111064543>
- Lesperance, K., Hofer, S., Retelsdorf, J., & Holzberger, D. (2022). Reducing gender differences in student motivational-affective factors: A meta-analysis of school-based interventions. *British Journal of Educational Psychology*, 92(4), 1502–1536. <https://doi.org/10.1111/bjep.12512>
- 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>
- Lewin, C., Smith, A., Morris, S., & Craig, E. (2019). *Using Digital Technology to Improve Learning: Evidence Review*. Education Endowment Foundation.
- Li, H., Xiong, Y., Hunter, C. V., Guo, X., & Tywoniw, R. (2020). Does peer assessment promote student learning? A meta-analysis. *Assessment & Evaluation in Higher Education*, 45(2), 193–211. <https://doi.org/10.1080/02602938.2019.1620679>
- Lillard, A. S., Lerner, M. D., Hopkins, E. J., Dore, R. A., Smith, E. D., & Palmquist, C. M. (2013). The impact of pretend play on children's development: A review of the evidence. *Psychological Bulletin*, 139(1), 1–34. <https://doi.org/10.1037/a0029321>
- Lin, Y.S. (2011). Fostering Creativity through Education – A Conceptual Framework of Creative Pedagogy. *Creative Education*, 2(3), 149–155. <https://doi.org/10.4236/ce.2011.23021>
- 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.
- Little, D., & Kirwan, D. (2019). *Engaging with linguistic diversity: A study of educational inclusion in an Irish primary school*. Bloomsbury.
- Looney, J. (2019). *Digital Formative Assessment: A review of the literature*. <http://www.eun.org/documents/411753/817341/Assess%40Learning+Literature+Review/be02d527-8c2f-45e3-9f75-2c5cd596261d>
- Lortie, D. C. (1975). *Schoolteacher: A sociological study*. University of Chicago Press.
- 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.
- Lundy, L. (2007). 'Voice' is not enough: Conceptualising Article 12 of the United Nations Convention on the Rights of the Child. *British Educational Research Journal*, 33(6), 927–942. <https://doi.org/10.1080/01411920701657033>
- 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*. NCCA.
- 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>
- Mallon, B. (2021). Teaching for social justice and sustainable development across the primary curriculum. In A. M. Kavanagh, F. Waldron, & B. Mallon (Eds.), *Global citizenship education: Interconnection, social justice and sustainability* (pp. 141–154). Routledge.
- 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>
- Maxwell, G. S. (2001). *Teacher observation in student assessment*. The Council.
- Mayer, R. E. (2004). Should There Be a Three-Strikes Rule Against Pure Discovery Learning? *American Psychologist*, 59(1), 14–19. <https://doi.org/10.1037/0003-066X.59.1.14>
- McGillicuddy, D. (2021). “They would make you feel stupid”—Ability grouping, Children’s friendships and psychosocial Wellbeing in Irish primary school. *Learning and Instruction*, 75, 101492. <https://doi.org/10.1016/j.learninstruc.2021.101492>
- McLinden, M., Douglas, G., Cobb, R., Hewett, R., & Ravenscroft, J. (2016). ‘Access to learning’ and ‘learning to access’: Analysing the distinctive role of specialist teachers of children and young people with vision impairments in facilitating curriculum access through an ecological systems theory. *British Journal of Visual Impairment*, 34(2), 177–195. <https://doi.org/10.1177/0264619616643180>
- McMillan, J. H. (2021). *Classroom Assessment: Principles and Practice that Enhance Student Learning and Motivation* (7th ed.). Pearson.
- Mercer, N. (2000). *Words and Minds: How We Use Language to Think Together*. Taylor & Francis Group. <http://ebookcentral.proquest.com/lib/dcu/detail.action?docID=170176>
- Mergendoller, J. R. (2018). *Defining high quality project based learning: A look at the research*. High Quality Project Based Learning. <https://hqpbl.org/wp-content/uploads/2018/04/Defining-High-Quality-PBL-A-Look-at-the-Research.pdf>
- Mikropoulos, T. A., & Iatraki, G. (2022). Digital technology supports science education for students with disabilities: A systematic review. *Education and Information Technologies*. <https://doi.org/10.1007/s10639-022-11317-9>
- 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-Bains, K. L., Russo, J. M., Williford, A. P., DeCoster, J., & Cottone, E. A. (2017). Examining the Validity of a Multidimensional Performance-Based Assessment at Kindergarten Entry. *AERA Open*, 3(2), 233285841770696. <https://doi.org/10.1177/2332858417706969>
- Mislevy, R. J., Haertel, G., Cheng, B. H., Ructtinger, L., DeBarger, A., Murray, E., Rose, D., Gravel, J., Colker, A. M., Rutstein, D., & Vendlinski, T. (2013). A “conditional” sense of fairness in assessment. *Educational Research and Evaluation*, 19(2–3), 121–140. <https://doi.org/10.1080/13803611.2013.767614>
- Moll, L. C., Amanti, C., Neff, D., & Gonzalez, N. (1992). Funds of knowledge for teaching: Using a qualitative approach to connect homes and classrooms. *Theory Into Practice*, 31(2), 132–141. <https://doi.org/10.1080/00405849209543534>
- Monei, T., & Pedro, A. (2017). A systematic review of interventions for children presenting with dyscalculia in primary schools. *Educational Psychology in Practice*, 33(3), 277–293. <https://doi.org/10.1080/02667363.2017.1289076>

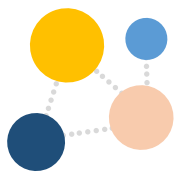


- Morrissey, D. (2023). *Creative Clusters: A Collaborative approach to Cultivating Creativity in Schools*. Department of Education.
- Moss, J., Godinho, S., & Chao, E. (2019). Enacting the Australian Curriculum: Primary and Secondary Teachers' Approaches to Integrating the Curriculum. *Australian Journal of Teacher Education*, 44(3), 24-41. <https://doi.org/10.14221/ajte.2018v44n3.2>
- Muijs, D., & Bokhove, C. (2020). *Metacognition and Self Regulation: Evidence Review*. Education Endowment Foundation.
- Muijs, D., Kyriakides, L., van der Werf, G., Creemers, B., Timperley, H., & Earl, L. (2014). State of the art - teacher effectiveness and professional learning. *School Effectiveness and School Improvement*, 25(2), 231-256. <https://doi.org/10.1080/09243453.2014.885451>
- Murchan, D., & Oldham, E. (2017). Exploring the role of computer-based assessment in diagnosing children's mathematical errors in primary education in Ireland. *Irish Educational Studies*, 36(4), 489-510. <https://doi.org/10.1080/03323315.2017.1393765>
- Murchan, D., & Shiel, G. (2017). *Understanding and Applying Assessment in Education*. SAGE Publications.
- Murphy, M.P. (2020). Belief without evidence? A policy research note on universal design for learning. *Policy Futures in Education*, 19(1), 7-12. DOI:10.1177/1478210320940206
- Murphy, P. (2008). Defining pedagogy. In K. Hall, P. Murphy, & J. Soler (Eds.), *Pedagogy and practice: Culture and identities* (pp. 28-39). SAGE.
- National Educational Psychological Service. (2007). *Special Educational Needs: A Continuum of Support, Guidelines for Teachers*. Department of Education and Science.
- Newman, M., Kwan, I., Schucan Bird, K., & Hui-Teng, H. (2021). *The impact of feedback on student attainment: A systematic review*. Education Endowment Foundation.
- Nind, M., Hall, K., & Curtin, A. (2016). *Research methods for pedagogy*. Bloomsbury Academic, an imprint of Bloomsbury Publishing, Plc.
- Noddings, N. (2012). The caring relation in teaching. *Oxford Review of Education*, 38(6), 771-781. <https://doi.org/10.1080/03054985.2012.745047>
- Ó Breacháin, C. (2022). *Peeling the Curriculum-reform Onion: How to Avoid Teachers Ending Up in Tears? A multi-phase, multi-method study exploring teachers' agency in the context of engagement with Ireland's new 'Primary Language Curriculum' [Unpublished Dissertation]*. University College Dublin.
- O'Neal, M. 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].
- O'Neal, M. 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 (1916518852)* [California State University, Fresno]. <https://www.proquest.com/dissertations-theses/defining-relationship-student-achievement-between/docview/1916518852/se-2?accountid=15753>



- Osher, D., Cantor, P., Berg, J., Steyer, L., & Rose, T. (2020). Drivers of human development: How relationships and context shape learning and development. *Applied Developmental Science, 24*(1), 6–36. <https://doi.org/10.1080/10888691.2017.1398650>
- Panadero, E. (2017). A Review of Self-regulated Learning: Six Models and Four Directions for Research. *Frontiers in Psychology, 8*, 422. <https://doi.org/10.3389/fpsyg.2017.00422>
- Panadero, E., & Jonsson, A. (2013). The use of scoring rubrics for formative assessment purposes revisited: A review. *Educational Research Review, 9*, 129–144. <https://doi.org/10.1016/j.edurev.2013.01.002>
- Panagopoulos, K. (2015). *Closing the Achievement Gap Through Arts Integration*. Notre Dame of Maryland University.
- Paris, D. (2012). Culturally Sustaining Pedagogy: A Needed Change in Stance, Terminology, and Practice. *Educational Researcher, 41*(3), 93–97. <https://doi.org/10.3102/0013189X12441244>
- Parker, R., & Thomsen, B. S. (2019). *Learning through play at school: A study of playful integrated pedagogies that foster children's holistic skills development in the primary school classroom*. LEGO Foundation.
- Parker, R., Thomsen, B. S., & Berry, A. (2022). Learning Through Play at School – A Framework for Policy and Practice. *Frontiers in Education, 7*, 751801. <https://doi.org/10.3389/educ.2022.751801>
- Pashler, H., McDaniel, M., Rohrer, D., & Bjork, R. (2008). Learning Styles: Concepts and Evidence. *Psychological Science in the Public Interest, 9*(3), 105–119. <https://doi.org/10.1111/j.1539-6053.2009.01038.x>
- Pearson, P. D., & Gallagher, M. C. (1983). The instruction of reading comprehension. *Contemporary Educational Psychology, 8*, 317–344. [https://doi.org/10.1016/0361-476X\(83\)90019-X](https://doi.org/10.1016/0361-476X(83)90019-X)
- Pearson, P. D., McVee, M. B., & Shanahan, L. E. (2019). In the Beginning: The Historical and Conceptual Genesis of the Gradual Release of Responsibility. In M. B. McVee, E. Ortlieb, J. S. Reichenberg, & P. D. Pearson (Eds.), *Literacy Research, Practice and Evaluation* (pp. 1–21). Emerald Publishing Limited. <https://doi.org/10.1108/S2048-045820190000010001>
- Pellas, N., Fotaris, P., Kazanidis, I., & Wells, D. (2019). Augmenting the learning experience in primary and secondary school education: A systematic review of recent trends in augmented reality game-based learning. *Virtual Reality, 23*(4), 329–346. <https://doi.org/10.1007/s10055-018-0347-2>
- Pellegrini, M., Lake, C., Neitzel, A., & Slavin, R. E. (2021). Effective Programs in Elementary Mathematics: A Meta-Analysis. *AERA Open, 7*, 233285842098621. <https://doi.org/10.1177/2332858420986211>
- Pellegrino, J. W. (2014). A Learning Sciences Perspective on the Design and Use of Assessment in Education. In R. K. Sawyer (Ed.), *The Cambridge Handbook of the Learning Sciences* (2nd ed., pp. 233–252). Cambridge University Press. <https://doi.org/10.1017/CBO9781139519526.015>
- 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>
- Peterson, A. K., Fox, C. B., & Israelsen, M. (2020). A Systematic Review of Academic Discourse Interventions for School-Aged Children With Language-Related Learning Disabilities. *Language, Speech, and Hearing Services in Schools*, 51(3), 866–881. https://doi.org/10.1044/2020_LSHSS-19-00039
- Pianta, R. C., & Stuhlman, M. W. (2004). Teacher-Child Relationships and Children's Success in the First Years of School. *School Psychology Review*, 33(3), 444–458. <https://doi.org/10.1080/02796015.2004.12086261>
- Plass, J. L., Homer, B. D., & Kinzer, C. K. (2015). Foundations of Game-Based Learning. *Educational Psychologist*, 50(4), 258–283. <https://doi.org/10.1080/00461520.2015.1122533>
- Pollitt, A. (2012). The method of Adaptive Comparative Judgement. *Assessment in Education: Principles, Policy & Practice*, 19(3), 281–300. <https://doi.org/10.1080/0969594X.2012.665354>
- Powell, S. R., Mason, E. N., Bos, S. E., Hirt, S., Ketterlin-Geller, L. R., & Lembke, E. S. (2021). A Systematic Review of Mathematics Interventions for Middle-School Students Experiencing Mathematics Difficulty. *Learning Disabilities Research & Practice*, 36(4), 295–329. <https://doi.org/10.1111/ldrp.12263>
- Priestley, M., Biesta, G., & Robinson, S. (2015). *Teacher agency: An ecological approach*. Bloomsbury Academic.
- Puzio, K., Colby, G. T., & Algeo-Nichols, D. (2020). Differentiated Literacy Instruction: Boondoggle or Best Practice? *Review of Educational Research*, 90(4), 459–498. <https://doi.org/10.3102/0034654320933536>
- Pyle, A., & Danniels, E. (2017). A Continuum of Play-Based Learning: The Role of the Teacher in Play-Based Pedagogy and the Fear of Hijacking Play. *Early Education and Development*, 28(3), 274–289. <https://doi.org/10.1080/10409289.2016.1220771>
- Pyle, A., DeLuca, C., & Danniels, E. (2017). A scoping review of research on play-based pedagogies in kindergarten education. *Review of Education*, 5(3), 311–351. <https://doi.org/10.1002/rev3.3097>
- Quigley, A., Muij, D., & Stringer, E. (2018). *Metacognition and self-regulated learning: Guidance report*. Education Endowment Foundation. https://educationendowmentfoundation.org.uk/public/files/Publications/Metacognition/EEF_Metacognition_and_self-regulated_learning.pdf
- 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
- Rapport, M. D., Orban, S. A., Kofler, M. J., & Friedman, L. M. (2013). Do programs designed to train working memory, other executive functions, and attention benefit children with ADHD? A meta-analytic review of cognitive, academic, and behavioral outcomes. *Clinical Psychology Review*, 33(8), 1237–1252. <https://doi.org/10.1016/j.cpr.2013.08.005>
- Reeves, J. (2017). Supporting Teachers in Relational Pedagogy and Social Emotional Education: A Qualitative Exploration. *International Journal of Emotional Education*, 9(1), 85–98.
- Resnick, L. B., Asterhan, C. S. C., & Clarke, S. N. (2018). *Accountable Talk: Instructional*

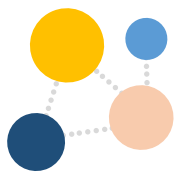


- dialogue that builds the mind*. The International Academy of Education and the International Bureau of Education.
- Revelle, K. Z. (2019). Teacher perceptions of a project-based approach to social studies and literacy instruction. *Teaching and Teacher Education*, 84, 95–105. <https://doi.org/10.1016/j.tate.2019.04.016>
- Ring, E., O'Sullivan, L., Ryan, M., & Burke, P. (2018). *A Melange or a Mosaic of Theories?: How theoretical perspectives on children's learning and development can inform a responsive pedagogy in a redeveloped primary school curriculum*. National Council for Curriculum and Assessment.
- Rix, J., & Sheehy, K. (2014). Nothing special – the everyday pedagogy of teaching. In L. Florian (Ed.), *Sage Handbook of Special Education* (Vol. 2, pp. 459–474). Sage.
- Robinson, L., Kirn, A., Guy-Gaytán, C., & Ellis, J. A. (2021). *Fostering Student Beliefs About Engineering and Mathematics Through Integrated Instruction (RTP)*. 2021 ASEE Virtual Annual Conference Content Access. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85124565872&partnerID=40&md5=5f2201bf5b0e2b05160fded0eee55a7f>
- Rodgers, D. B., & Loveall, S. J. (2022). Writing Interventions for Students With Intellectual and Developmental Disabilities: A Meta-Analysis. *Remedial and Special Education*, 074193252211088. <https://doi.org/10.1177/07419325221108896>
- Roesslein, R. I., & Coddling, R. S. (2019). Fraction interventions for struggling elementary math learners: A review of the literature. *Psychology in the Schools*, 56(3), 413–432. <https://doi.org/10.1002/pits.22196>
- Rogers, S. (2010). Play and pedagogy A conflict of interests? In S. Rogers (Ed.), *Rethinking play and pedagogy in early childhood education: Concepts, contexts and cultures* (pp. 5–18). Taylor and Francis.
- Roorda, D. L., Koomen, H. M. Y., Spilt, J. L., & Oort, F. J. (2011). The Influence of Affective Teacher–Student Relationships on Students' School Engagement and Achievement: A Meta-Analytic Approach. *Review of Educational Research*, 81(4), 493–529. <https://doi.org/10.3102/0034654311421793>
- Rose, D. H., & Meyer, A. (2002). *Teaching every student in the digital age: Universal design for learning*. Association for Supervision and Curriculum Development.
- Rosenshine, B. (1986). Synthesis of Research on Explicit Teaching. *Educational Leadership*, 43, 60–69.
- Rosenshine, B. (2012a). Principles of Instruction: Research-based strategies that all teachers should know. *American Educator*, 12–20. <https://doi.org/10.1111/j.1467-8535.2005.00507.x>
- Rosenshine, B. (2012b). Principles of Instruction: Research-based strategies that all teachers should know. *American Educator*, 36(1), 12–39.
- Rottmann, T., Haberzettl, N., & Krämer, M. (2020). Inclusive assessment of whole number knowledge—Development and evaluation of an assessment interview for children with visual impairments in the primary grades. *Mathematics Education Research Journal*, 32(1), 147–170. <https://doi.org/10.1007/s13394-019-00296-9>
- Rouse, R., & Rouse, A. G. (2022). Taking the maker movement to school: A systematic review of preK-12 school-based makerspace research. *Educational Research Review*, 35, 100413. <https://doi.org/10.1016/j.edurev.2021.100413>
- Russell, M. (2020). Digital technologies: Supporting and advancing assessment practices in

- the classroom. In S. M. Brookhart & J. H. McMillan (Eds.), *Classroom Assessment and Educational Measurement*. (pp. 224–242). Routledge.
- 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.
- Sanchez, C. E., Atkinson, K. M., Koenka, A. C., Moshontz, H., & Cooper, H. (2017). Self-grading and peer-grading for formative and summative assessments in 3rd through 12th grade classrooms: A meta-analysis. *Journal of Educational Psychology*, 109(8), 1049–1066. <https://doi.org/10.1037/edu0000190>
- Sanusi, I. T., Oyelere, S. S., Vartiainen, H., Suhonen, J., & Tukiainen, M. (2022). A systematic review of teaching and learning machine learning in K-12 education. *Education and Information Technologies*. <https://doi.org/10.1007/s10639-022-11416-7>
- 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.
- Savelsbergh, E. R., Prins, G. T., Rietbergen, C., Fechner, S., Vaessen, B. E., Draijer, J. M., & Bakker, A. (2016). Effects of innovative science and mathematics teaching on student attitudes and achievement: A meta-analytic study. *Educational Research Review*, 19, 158–172. <https://doi.org/10.1016/j.edurev.2016.07.003>
- 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>
- Schildkamp, K., van der Kleij, F. M., Heitink, M. C., Kippers, W. B., & Veldkamp, B. P. (2020). Formative assessment: A systematic review of critical teacher prerequisites for classroom practice. *International Journal of Educational Research*, 103, 101602. <https://doi.org/10.1016/j.ijer.2020.101602>
- Schnepel, S., & Aunio, P. (2022). A systematic review of mathematics interventions for primary school students with intellectual disabilities. *European Journal of Special Needs Education*, 37(4), 663–678. <https://doi.org/10.1080/08856257.2021.1943268>
- 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.
- Scully, D. (2017). Constructing Multiple-Choice Items to Measure Higher-Order Thinking. *Practical Assessment, Research, and Evaluation*, 22. <https://doi.org/10.7275/SWGT-RJ52>
- See, B. H., Gorard, S., Lu, B., Dong, L., & Siddiqui, N. (2022). Is technology always helpful?: A critical review of the impact on learning outcomes of education technology in supporting formative assessment in schools. *Research Papers in Education*, 37(6), 1064–1096. <https://doi.org/10.1080/02671522.2021.1907778>
- Seidel, T., & Shavelson, R. J. (2007). Teaching Effectiveness Research in the Past Decade: The Role of Theory and Research Design in Disentangling Meta-Analysis Results.

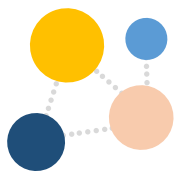
- Review of Educational Research*, 77(4), 454–499.
<https://doi.org/10.3102/0034654307310317>
- Shepard, L. A., Penuel, W. R., & Pellegrino, J. W. (2018). Classroom Assessment Principles to Support Learning and Avoid the Harms of Testing. *Educational Measurement: Issues and Practice*, 37(1), 52–57. <https://doi.org/10.1111/emip.12195>
- Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, 15(2), 4–14.
- Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review*, 57(1), 1–22.
- Shulman, L. S. (2005). Signature pedagogies in the professions. *Daedalus*, 134(3), 52–59.
<https://doi.org/10.1162/0011526054622015>
- Siraj, I., Taggart, B., Melhuish, W. E., Sammons, P., & Sylva, K. (2014). *Exploring Effective Pedagogy in Primary Schools: Evidence from Research*. Pearson.
- Siraj-Blatchford, I. (2010). Case studies of effective practice. In K. Sylva, E. Melhuish, P. Sammons, I. Siraj-Blatchford, & B. Taggart (Eds.), *Early childhood matters: Evidence from the effective pre-school and primary education project*. Taylor and Francis.
- Siraj-Blatchford, I., Sylva, K., Muttock, S., Gilden, R., & Bell, D. (2002). *Researching effective pedagogy in the early years*. Department for Education and Skills.
- Skene, K., O'Farrelly, C. M., Byrne, E. M., Kirby, N., Stevens, E. C., & Ramchandani, P. G. (2022). Can guidance during play enhance children's learning and development in educational contexts? A systematic review and meta-analysis. *Child Development*, 93(4), 1162–1180. <https://doi.org/10.1111/cdev.13730>
- Skilbeck, M. (1984). *School-based Curriculum Development*. Harper and Row.
- Slavin, R. E., Lake, C., Hanley, P., & Thurston, A. (2012). Effective Programs for Elementary Science: A Best-Evidence Synthesis. *Best Evidence Encyclopedia*.
- Smith-Gayle, P., & Dippold, L. (2014). *The Impact of an Integrated Curriculum on the Achievement of Middle-School Boys* (1648175300) [Northcentral University].
<https://www.proquest.com/dissertations-theses/impact-integrated-curriculum-on-achievement/docview/1648175300/se-2?accountid=15753>
- Smith-Gayle, P., & Dippold, L. (2014). *The Impact of an Integrated Curriculum on the Achievement of Middle-School Boys*. Northcentral University.
- Snook, I., O'Neill, J., Clark, J., O'Neill, A.-M., & Openshaw, R. (2009). Visible Learning: A Synthesis of Over 800 Meta-analyses Relating to Achievement. *New Zealand Journal of Educational Studies*, 44(1), 93–106.
- 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>
- Stacey, S. (2009). *Emergent curriculum in early childhood settings: From theory to practice*. Redleaf Press.
- Stenhouse, L. (1975). *An introduction to curriculum research and development*. Heinemann.
- Sternberg, R. J. (2007). Culture, instruction, and assessment. *Comparative Education*, 43(1), 5–22. <https://doi.org/10.1080/03050060601162370>
- Stewart, A. A., & Austin, C. R. (2020). Reading Interventions for Students With or At Risk

- of Attention-Deficit/Hyperactivity Disorder: A Systematic Review. *Remedial and Special Education*, 41(6), 352–367. <https://doi.org/10.1177/0741932519849660>
- Stockard, J., Wood, T. W., Coughlin, C., & Rasplica Khoury, C. (2018). The Effectiveness of Direct Instruction Curricula: A Meta-Analysis of a Half Century of Research. *Review of Educational Research*, 88(4), 479–507. <https://doi.org/10.3102/0034654317751919>
- Sweller, J. (1988). Cognitive Load During Problem Solving: Effects on Learning. *Cognitive Science*, 12(2), 257–285. https://doi.org/10.1207/s15516709cog1202_4
- Sweller, J. (2021). *Why Inquiry-based Approaches Harm Students' Learning*. The Centre for Independent Studies.
- Sweller, J., van Merriënboer, J. J. G., & Paas, F. (2019). Cognitive Architecture and Instructional Design: 20 Years Later. *Educational Psychology Review*, 31(2), 261–292. <https://doi.org/10.1007/s10648-019-09465-5>
- Swiecki, Z., Khosravi, H., Chen, G., Martinez-Maldonado, R., Lodge, J. M., Milligan, S., Selwyn, N., & Gašević, D. (2022). Assessment in the age of artificial intelligence. *Computers and Education: Artificial Intelligence*, 3, 100075. <https://doi.org/10.1016/j.caeai.2022.100075>
- 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, C. (2016). Teacher agency and school-based curriculum in China's non-elite schools. *Journal of Educational Change*, 17(3), 287–302. <https://doi.org/10.1007/s10833-016-9274-8>
- Tank, K. M. (2014). *Examining the Effects of Integrated Science, Engineering, and Nonfiction Literature on Student Learning in Elementary Classrooms*. University of Minnesota.
- Tenenbaum, H. R., Winstone, N. E., Leman, P. J., & Avery, R. E. (2020). How effective is peer interaction in facilitating learning? A meta-analysis. *Journal of Educational Psychology*, 112(7), 1303–1319. <https://doi.org/10.1037/edu0000436>
- Tobias, S. (2009). An eclectic appraisal of the success or failure of constructivist instruction. In S. Tobias & T. M. Duffy (Eds.), *Constructivist Instruction: Success or Failure?* (pp. 335–350). Routledge.
- Tomlinson, C. A., Brighton, C., Hertberg, H., Callahan, C. M., Moon, T. R., Brimijoin, K., Conover, L. A., & Reynolds, T. (2003). Differentiating Instruction in Response to Student Readiness, Interest, and Learning Profile in Academically Diverse Classrooms: A Review of Literature. *Journal for the Education of the Gifted*, 27(2–3), 119–145. <https://doi.org/10.1177/016235320302700203>
- 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>
- Tucker, S. D. (2017). *The Effects of Arts Integration on Literacy Comprehension Achievement*. University of South Carolina.
- 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>
- UNESCO (2023). *Global Education Monitoring Report 2023: Technology in education – A tool on whose terms?* UNESCO.
- United Nations. (1989). *United Nations Convention on the Rights of the Child*. United Nations.
- 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 De Pol, J., Volman, M., & Beishuizen, J. (2010). Scaffolding in Teacher–Student Interaction: A Decade of Research. *Educational Psychology Review*, 22(3), 271–296. <https://doi.org/10.1007/s10648-010-9127-6>
- van Leeuwen, A., & Janssen, J. (2019). A systematic review of teacher guidance during collaborative learning in primary and secondary education. *Educational Research Review*, 27, 71–89. <https://doi.org/10.1016/j.edurev.2019.02.001>
- Van Schoors, R., Elen, J., Raes, A., & Depaepe, F. (2021). An overview of 25 years of research on digital personalised learning in primary and secondary education: A systematic review of conceptual and methodological trends. *British Journal of Educational Technology*, 52(5), 1798–1822. <https://doi.org/10.1111/bjet.13148>
- 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>
- Verschaffel, L., Depaepe, F., & Mevarech, Z. (2019). Learning Mathematics in Metacognitively Oriented ICT-Based Learning Environments: A Systematic Review of the Literature. *Education Research International*, 2019, 1–19. <https://doi.org/10.1155/2019/3402035>
- 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/10.1177/025576142111050996>
- Volante, L. (2018). *Effective Pedagogies for a Redeveloped Primary School Curriculum*. https://ncca.ie/media/3501/seminar_two_volante_paper.pdf
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.
- Waldron, F., Mallon, B., & Kavanagh, A. M. (2021). Transforming pedagogy for a socially just and sustainable world. In A. M. Kavanagh, F. Waldron, & B. Mallon (Eds.), *Teaching for social justice and sustainable development across the primary curriculum* (pp. 231–235). Routledge.
- Walker, A., & Leary, H. (2009). A Problem Based Learning Meta Analysis: Differences Across Problem Types, Implementation Types, Disciplines, and Assessment Levels. *Interdisciplinary Journal of Problem-Based Learning*, 3(1). <https://doi.org/10.7771/1541-5015.1061>
- Walsh, D. T. (2018). *Towards an Overview for the Redeveloped Primary School Curriculum*. NCCA.
- Wang, J., Tigelaar, D. E. H., Zhou, T., & Admiraal, W. (2023). The effects of mobile technology usage on cognitive, affective, and behavioural learning outcomes in primary and secondary education: A systematic review with meta-analysis. *Journal of Computer Assisted Learning*, 39(2), 301–328.





- <https://doi.org/10.1111/jcal.12759>
- Wang, L.-H., Chen, B., Hwang, G.-J., Guan, J.-Q., & Wang, Y.-Q. (2022). Effects of digital game-based STEM education on students' learning achievement: A meta-analysis. *International Journal of STEM Education*, 9(1), 26. <https://doi.org/10.1186/s40594-022-00344-0>
- Wang, L.-Y., Chen Victor, D.-T., & Neo, W.-L. (2019). Studying the enactment of School-Based Curriculum Development (SBCD) in Singapore. *Educational Research*, 61(3), 337–355. <https://doi.org/10.1080/00131881.2019.1642120>
- Wang, M.-T., L. Degol, J., Amemiya, J., Parr, A., & Guo, J. (2020). Classroom climate and children's academic and psychological wellbeing: A systematic review and meta-analysis. *Developmental Review*, 57, 100912. <https://doi.org/10.1016/j.dr.2020.100912>
- Wanzek, J., Vaughn, S., Scammacca, N. K., Metz, K., Murray, C. S., Roberts, G., & Danielson, L. (2013). Extensive Reading Interventions for Students With Reading Difficulties After Grade 3. *Review of Educational Research*, 83(2), 163–195. <https://doi.org/10.3102/0034654313477212>
- Wanzek, J., Vaughn, S., Scammacca, N., Gatlin, B., Walker, M. A., & Capin, P. (2016). Meta-Analyses of the Effects of Tier 2 Type Reading Interventions in Grades K-3. *Educational Psychology Review*, 28(3), 551–576. <https://doi.org/10.1007/s10648-015-9321-7>
- Webb, N. M. (2009). The teacher's role in promoting collaborative dialogue in the classroom. *British Journal of Educational Psychology*, 79(1), 1–28. <https://doi.org/10.1348/000709908X380772>
- Weisberg, D. S., Hirsh-Pasek, K., & Golinkoff, R. M. (2013). Embracing complexity: Rethinking the relation between play and learning: Comment on Lillard et al. (2013). *Psychological Bulletin*, 139(1), 35–39. <https://doi.org/10.1037/a0030077>
- Weisberg, D. S., Hirsh-Pasek, K., Golinkoff, R. M., Kittredge, A. K., & Klahr, D. (2016). Guided Play: Principles and Practices. *Current Directions in Psychological Science*, 25(3), 177–182. <https://doi.org/10.1177/0963721416645512>
- Wellberg, S. (2023). Teacher-made tests: Why they matter and a framework for analysing mathematics exams. *Assessment in Education: Principles, Policy & Practice*, 30(1), 53–75. <https://doi.org/10.1080/0969594X.2023.2189565>
- Wen, X., & Walters, S. M. (2022). The Impact of Technology on Students' Writing Performances in Elementary Classrooms: A Meta-Analysis. *Computers and Education Open*, 3, 100082. <https://doi.org/10.1016/j.caeo.2022.100082>
- Wheadon, C., Barmby, P., Christodoulou, D., & Henderson, B. (2020). A comparative judgement approach to the large-scale assessment of primary writing in England. *Assessment in Education: Principles, Policy & Practice*, 27(1), 46–64. <https://doi.org/10.1080/0969594X.2019.1700212>
- Wiggins, G. P., & McTighe, J. (2005). *Understanding by design* (2nd ed). Association for Supervision and Curriculum Development.
- Wiggins, G. P., & McTighe, J. (2011). *The understanding by design guide to creating high-quality units*. ASCD.
- Wiliam, D. (2013). Assessment: The Bridge between Teaching and Learning. *Voices from the Middle*, 21(2), 15–20.
- Wiliam, D. (2016). *Leadership for teacher learning: Creating a culture where all teachers*



- improve so that all students succeed. Learning Sciences International.
- Wiliam, D. (2018). How Can Assessment Support Learning? A Response to Wilson and Shepard, Penuel, and Pellegrino. *Educational Measurement: Issues and Practice*, 37(1), 42-44. <https://doi.org/10.1111/emip.12192>
- Wiliam, D., & Leahy, S. (2015). *Embedding Formative Assessment: Practical Techniques for K-12 Classrooms*. Learning Sciences International.
- Willingham, D. T. (2008). What will improve a student's memory? *American Educator*, Winter 2008-2009, 17-25.
- Willingham, D. T. (2009). *Why don't students like school? A cognitive scientist answers questions about how the mind works and what it means for the classroom*. Jossey-Bass.
- Wisniewski, B., Zierer, K., & Hattie, J. (2020). The Power of Feedback Revisited: A Meta-Analysis of Educational Feedback Research. *Frontiers in Psychology*, 10, 3087. <https://doi.org/10.3389/fpsyg.2019.03087>
- Wood, D., Bruner, J. S., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Psychiatry*, 17(2), 89-100. <https://doi.org/10.1111/j.1469-7610.1976.tb00381.x>
- 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.
- Wyse, D., Hayward, L., & Pandya, J. Z. (Eds.). (2016). *The SAGE handbook of curriculum, pedagogy and assessment*. SAGE reference.
- Xia, L., & Zhong, B. (2018). A systematic review on teaching and learning robotics content knowledge in K-12. *Computers & Education*, 127, 267-282. <https://doi.org/10.1016/j.compedu.2018.09.007>
- 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>
- Zhang, L., Carter, R. A., & Hoekstra, N. J. (2023). A critical analysis of universal design for learning in the U.S. federal education law. *Policy Futures in Education*, 0(0), 1-6. <https://doi.org/10.1177/14782103231179530>
- Zhang, Y., & Zhu, Y. (2022). Effects of educational robotics on the creativity and problem-solving skills of K-12 students: A meta-analysis. *Educational Studies*, 1-19. <https://doi.org/10.1080/03055698.2022.2107873>
- Zhang, Y., Luo, R., Zhu, Y., & Yin, Y. (2021). Educational Robots Improve K-12 Students' Computational Thinking and STEM Attitudes: Systematic Review. *Journal of Educational Computing Research*, 59(7), 1450-1481. <https://doi.org/10.1177/0735633121994070>
- Zheng, L., Zhang, X., & Cui, P. (2020). The role of technology-facilitated peer assessment and supporting strategies: A meta-analysis. *Assessment & Evaluation in Higher Education*, 45(3), 372-386. <https://doi.org/10.1080/02602938.2019.1644603>
- Zosh, J. M., Hirsh-Pasek, K., Hopkins, E. J., Jensen, H., Liu, C., Neale, D., Solis, S. L., & Whitebread, D. (2018). Accessing the Inaccessible: Redefining Play as a Spectrum.



Frontiers in Psychology, 9, 1124. <https://doi.org/10.3389/fpsyg.2018.01124>

Zyngier, D. (2016). Culture and pedagogy(ies): (What) Have We Learned from and Since Alexander 2001. In D. Wyse, L. Hayward, & J. Pandya, *The SAGE Handbook of Curriculum, Pedagogy and Assessment* (pp. 171–185). SAGE Publications Ltd. <https://doi.org/10.4135/9781473921405.n11>

