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Mapping Consensus in Evidence-Informed Initial Teacher Education Core Curricula

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Abstract

A robust, evidence-informed knowledge base for initial teacher education (ITE) is essential for preparing prospective teachers. Although a growing body of research addresses the content of ITE curricula, there is little consensus on what constitutes the minimal agreed knowledge for 'learning how to teach'. This study reports a comparative analysis of two published, evidence-informed core ITE curricula. Items appearing in both were compiled into the Minimal Agreed Knowledge Set (MAKS) and corroborated against two research literature: teacher-effectiveness research and cognitive/educational psychology. The MAKS comprises 52 knowledge elements, organised under eight instructional principles and one category of general statements on teaching and learning, and represents areas of convergence between two frameworks from a shared, evidence-informed policy tradition. It is intended as a tool for ITE providers to review and refine their own curricula, rather than as a prescriptive programme. Implications for curriculum development and directions for future research on MAKS are discussed.

Keywords: initial teacher education; teacher education curriculum; evidence-informed practice; instruction; core curriculum; teacher effectiveness; cognitive psychology; document analysis

1. Introduction

Decades of research on teacher effectiveness show the powerful influence of teaching on student achievement (e.g., Muijs & Reynolds, 2017; Muijs et al., 2014; Nye et al., 2004), especially for children from disadvantaged backgrounds (Kyriakides et al., 2020). Students who have experienced highly effective teachers tend to display stronger social, behavioural, and motivational skills, enjoy better health outcomes, and later in life are more likely to attend college, secure higher earnings, and accumulate greater savings for retirement (see e.g., Chetty et al., 2014; Hanushek & Rivkin, 2012; Jennings & DiPrete, 2010; Ruzek et al., 2015). However, no one is born a great teacher, and even those who appear 'born to teach' need good instruction to prepare them for the complex demands of teaching (Darling-Hammond, 2006). While initial teacher education (ITE) is expected to provide prospective teachers with the foundational skills and knowledge for entry-level teaching competence, the lack of agreement at all levels (from local, to state, to national; see the United States of America as an example; Darling-Hammond, 2000; Levine, 2006) on what such curricula should contain makes it difficult to establish what we collectively agree

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should belong in an ITE curriculum (Perry et al., 2019). Anchoring ITE curricula in robust evidence from cognitive and educational psychology and teacher-effectiveness research may help to address the current gaps and variability in content. In this article, we explore the extent to which existing evidence-informed ITE core curricula show convergence on a set of instructional principles. We analyse content from two national ITE curricular frameworks and evaluate the empirical grounding of any shared items with the aim to identify candidate areas of commonality that can inform the development of a Minimal Agreed Knowledge Set (MAKS).

2. Current Findings from Teacher Education Curriculum Research

Curriculum is defined here as a framework that sets out the content of a programme, including the declarative knowledge ('know that') and procedural knowledge ('know how', sometimes also referred to as 'skills') to be gained in the programme (Van den Akker, 2003). Within this narrow definition, two problems hamper determining the quality of an ITE curriculum: a lack of information on the effectiveness of ITE curricula, and a lack of agreement on what instructional content should be included.

2.1. Lack of Information on the Effectiveness of ITE Curricula

The lack of information on the effectiveness of ITE curricula centres on three interrelated areas, namely (1) the specific components of ITE-curricula that contribute to a programme's effectiveness, (2) the characteristics of the ITE curricula themselves, and (3) their scientific underpinnings.

While much research has been conducted on particular aspects of ITE curricula, there is little unequivocal evidence on what makes them effective as a whole. Extensive research has been conducted on various aspects of these curricula including methodology (e.g., competency-based vs. holistic; see Creemers et al., 2013), underlying philosophical–ethical aspects of teaching including socially sensitive and moral issues (Malinen et al., 2012), and acquisition of twenty-first-century competences and soft skills (Kereluik et al., 2013). Also, there is a substantial body of research on the inclusion of instruction on pedagogical content knowledge (PCK), teacher identity, lesson delivery and planning, teacher educator pedagogy, etc. (for an overview, see Flores, 2016). Despite the recent surge in research linking specific full teacher education programmes (such as traditional vs. alternative) to the outcomes of in-service teachers and their students (Goldhaber, 2019), our understanding of how best to prepare pre-service teachers at the curriculum level remains limited. Also, the causal effects of how ITE curricula affect future teachers' knowledge and skills is not well understood (Comb et al., 2023; Goldhaber, 2019). What, for example, is the direct impact on teacher (e.g., PCK, instructional quality, retention rates) and student outcomes (e.g., academic performance, self-efficacy) of embedding specific curricular content in a primary education ITE curriculum? This knowledge gap is unsurprising, considering the vast number of confounding variables inherent in programme studies and the intricate causality chains of those variables (Scheerens & Blömeke, 2016; Zhang et al., 2022).

This effectiveness problem might also be partly grounded in the second area, namely the characteristics of ITE curricula themselves, as it is often unclear what (i.e., the content) is taught, making it difficult to relate content to outcomes. For instance, propelled by social constructivism, some curricula emphasise reflective practice, soft skills, and generic competencies (Bolhuis, 2006; Menter, 2016) to the detriment of subject knowledge and knowledge of how we learn, leading to generically formulated competencies that are sometimes pitched at such an abstract level that they could be applied to different constructs (for a sociological perspective, see Barrett et al., 2017). This is often reinforced by local standards and/or competences for teachers, which are then used to inform ITE curricula

and which vary significantly in interpretation and application internationally, ranging from tightly defined and more instrumental conceptions of standards and competences to broader and more adaptable interpretations (Conway et al., 2009; Townsend, 2011). This diversity results in substantial differences in teacher standards worldwide and over time (Shulman, 1986). For instance, in the Flanders region of Belgium, one can read this standard: "The teacher can select, structure, and translate learning content or learning experiences into coherent educational provision" (Aelterman et al., 2008, p. 12). This standard does not specify the nature of such 'learning experiences' and what constitutes a 'coherent educational provision'. As a reaction to this generic competence-oriented characteristic, a countermovement can now be observed, with a growing interest in and research on the importance of reintegrating well-defined bodies of knowledge into the curriculum (Graesser, 2009; Rata, 2024; Surma et al., 2025; Willingham, 2021).

Another area contributing to the lack of knowledge on the effectiveness of ITE curricula centres on their scientific underpinnings. If constituent courses fail to align with the best available evidence, it is unclear if such courses add to ITE's effectiveness. Several lines of evidence suggest that pre-service teachers may not be exposed to the current state of scientific knowledge within the teaching domain. Recent reviews of ITE textbooks found that many devoted little to no attention to the substantial body of research and evidence about teaching and learning, and in some cases even presented concepts with minimal or no empirical foundation as hard science (Flower et al., 2017; Freeman et al., 2014; Pomerance et al., 2016; Surma et al., 2018; Sylvester Dacy et al., 2011). In 29 US states, government-issued test-preparation materials for ITE exams still promote the discredited theory of 'learning styles' (Robinson et al., 2022). Freeman et al. (2014) examined the classroom management courses provided within American ITE programmes. Even though 95% of the ITE programmes analysed claimed to provide instruction on classroom management strategies (e.g., setting rules and establishing positive environments), yet just 65% demonstrated that they addressed classroom management practices supported by empirical evidence. Similar results were found in studies by Pomerance et al. (2016) and Surma et al. (2018), which noted a scarcity of information on foundational instructional strategies such as spaced practice and retrieval practice in textbooks used in the USA and the Netherlands/Flanders (Belgium), respectively. Furthermore, it is frequently reported that introductory psychology and educational textbooks often are outdated, failing to incorporate or reflect recent advancements and contemporary understandings in the field (Bartels, 2023; Wininger et al., 2019; Zrudlo, 2023).

Despite a lack of information on what constitutes an effective ITE curriculum, a minimal consensus can be observed to be forming. Perry et al. (2019) presented a valuable working model for ITE curricular content consisting of three interconnected domains: learning to teach (including generic instructional strategies and behavioural management strategies), learning to teach a subject (including subject and curriculum knowledge, and subject-specific approaches), and learning to be a teacher (including knowledge of the educational system and wider professional responsibilities).

This tripartite structure resonates across numerous other curricular frameworks in teacher education, manifesting itself under varying terminologies and conceptualisations (e.g., Baumert et al., 2010; Darling-Hammond, 2006; Shulman, 1986). There is also a growing consensus in the academic community that the content of ITE-curricula should be grounded in a solid evidence base and that there should be ample room for clinical practice (BERA-RSA, 2014; Perry et al., 2019; Toom et al., 2010). This implies that curricula should deliver both declarative ('know that') and procedural ('know how to') knowledge on teaching supported by a strong theoretical foundation and rigorous empirical research and provide opportunities for pre-service teachers to apply this knowledge base in clinical (i.e., teaching)

settings. This approach inherently presupposes the need for ITE to establish and adhere to a common ground for a curriculum on 'learning to teach': a common core of best evidence on the science of instruction.

2.2. Lack of Agreement on Instructional Content of ITE Curricula

A second fundamental challenge in evaluating the quality of ITE curricula concerns the absence of a shared understanding of what instructional content should be included. Blömeke and Kaiser (2014) recognised that there was no common comprehensive core curriculum on 'learning how to teach' among fifteen participating countries in the Teacher Education and Development Study in Mathematics (TEDS-M). To move toward an evidence-informed reform of ITE, pre-service teachers must be provided with clearly defined and agreed-upon opportunities to learn what empirical research has taught us about high-quality instruction (Conway et al., 2009). But defining a core base of declarative and procedural knowledge (from here onwards referred to as 'knowledge') for ITE curricula on instruction is no simple matter. This may be due to a lack of consensus amongst researchers, teachers, teacher educators, government agencies and policy makers, accreditation boards, etc., on what constitutes that knowledge base. Seeing as how 'learning to teach' is one of the three core areas of ITE curricula, the lack of research on the content thereof is surprising (Perry et al., 2019). For instance, of the 67 chapters in the SAGE Handbook of Research on Teacher Education (Clandinin & Husu, 2017)—a reference work of the state-of-the-art of research on ITE—only one (Van Driel & Berry, 2017 on pedagogical content knowledge) attempted to provide insight into a curricular focus on learning how to teach. This may be because there are many different perspectives on what 'teaching' is. Defining teaching is at times hotly contested, as seen in debates on what constitutes expert, quality, good, successful, effective teaching (Ko et al., 2013), as well as the discussions on constructivist education, explicit instruction, and problem-based learning. Central to this ambiguity is the 'assistance dilemma', a term coined by Koedinger and Aleven (2007) to describe the discussions in educational science about the balance between providing explicit guidance and promoting discovery in learning environments. This debate, historically explored by P. A. Kirschner et al. (2006), Kuhn (2007), Tobias and Duffy (2009), Lee and Anderson (2013), and recently continued by Zhang et al. (2022), de Jong et al. (2023, 2025), and Sweller et al. (2024), highlights the complexities of teaching, where no single approach can be isolated as universally effective. For instance, despite the strong empirical backing for explicit instruction, more experienced learners with high levels of domain-specific prior knowledge can benefit from instructional methods with less guidance (i.e., the expertise reversal effect; Kalyuga, 2007; Tetzlaff et al., 2025). Therefore, a key question is whether a knowledge base for ITE can be developed that distinguishes 'what is known' from 'what is contested'. If this is possible, then it can become an evidence-informed approach to developing ITE curricula, without engaging in often fruitless discussion of, for example, 'traditional' versus 'progressive' approaches.

Despite efforts to establish a clear understanding of the nature of requisite knowledge, these attempts have not yielded unequivocal outcomes. Koedinger et al. (2013, p. 935) stated that "many debates about instructional methods suffer from a tendency to apply compelling labels to vaguely described procedures, rather than operational definitions of instructional practices". Theoretical accounts of teaching are both numerous and highly varied (e.g., Maulana et al., 2023; Praetorius & Charalambous, 2023), and theories often fail to translate straightforwardly into instructional practice and have been criticised for generating uncertainty and opacity for teachers, to the point of irrelevancy for practice (e.g., Barrett & Hordern, 2021; Grossman & Richert, 1988). Teacher-effectiveness research, in contrast, has provided frameworks outlining the characteristics of effective teachers

(e.g., P. A. Kirschner et al., 2022), and educational and cognitive psychology research has provided central principles for how learning happens (e.g., P. A. Kirschner & Hendrick, 2020). However, clarity regarding what should be integrated into an ITE curriculum is lacking. Therefore, many ITE programmes rely on the experiences and traditions of their faculty members, existing textbooks and course materials, national or local standards, and sometimes even the latest "educational buzzwords" (Yan et al., 2024) to design a coursework for teaching. Consequently, ITE curricula risk becoming an ever-evolving hodgepodge of diverse interpretations, practices, and hypes as evidenced by the varied and sometimes unscientific approaches adopted by different ITE programmes (Perry et al., 2019).

3. Towards 'Best Knowledge' in Teacher Education

3.1. The 'What Works' Movement

To tackle these challenges, there has been a discernible push towards better specifying ITE curricula based on best evidence (Cochran-Smith, 2021; D'haese et al., 2024). This 'what works' movement was initially incentivised by policies such as the No Child Left Behind Act (2001) and best-evidence centres such as the What Works Clearinghouse in the US and the Education Endowment Foundation (EEF) in England (Slavin, 2020). The EEF, for instance, has been instrumental in publishing toolkits and guidance reports summarising the "best available evidence" (Edovald & Nevill, 2021, p. 55). In the US, the What Works Clearinghouse claims to provide scientific evidence on which to ground education practice and policy (Institute of Education Sciences, n.d.). Deans for Impact emerged in the United States as a bottom-up collaborative effort among 20 teacher education institutions, offering curriculum blueprints such as the science of learning based on insights from cognitive psychology (Deans for Impact, 2015, 2026). This movement, while not without criticism (e.g., Hordern & Brooks, 2023; Surma, 2026; Yan et al., 2024), was accompanied by a movement towards developing materials summarising the most valuable evidence from the learning sciences. Pioneered by educators such as John Hattie and Robert Marzano, these materials address the challenges faced by teachers, such as limited time, lack of specialised knowledge, and restricted access to scholarly articles (Rowe & Hattie, 2023). Comparable actions were taken in the fields of medicine, architecture and social work (see e.g., Institute of Medicine, 2004), where incorporating best evidence encountered some initial resistance, but despite its recognised and ongoing limitations, it has since become a cornerstone of the pre-service education of many professional domains. While the movement's primary objective was not the direct enhancement of ITE, it significantly influenced curriculum initiatives aimed at bringing best evidence to ITE. The English Department for Education, for example, published the Core Content Framework. An Initial Teacher Training Framework (Department for Education, 2019)—endorsed by the EEF—comprises a core curriculum that all teacher education programmes must meet to be accredited. In Australia, Strong Beginnings (Teacher Education Expert Panel, 2023), a core curriculum for ITE, was developed in collaboration with the Australian Education Research Organisation.

3.2. The New Science of Learning

The 'what works' movement and its core curricula on ITE have brought certain fields of scientific research to the forefront, such as cognitive and educational psychology and teacher-effectiveness research, sometimes critically referred to as the 'new science of education' (Furlong & Whitty, 2017). We describe these fields, highlighting why they are considered valuable for providing best evidence for ITE curricula on instruction.

3.2.1. Cognitive and Educational Psychology

General description. Cognitive and educational psychology deal with 'the development and application of psychological principles to education, as well as the adoption of psychological perspectives on education' (O'Donnell & Levin, 2001, p. 73). Researchers in cognitive psychology design experimental studies—preferably but not exclusively the manipulation of one or more variables under controlled conditions—to obtain evidence of the operation of internal psychological processes instrumental to human thought and behaviour (Mandler, 2011). Educational psychologists take the insights gained from cognitive psychology and then apply them to understand how learners learn and to determine how teaching can most effectively support that process. This field has progressively brought to the forefront influential theories such as cognitive load theory, dual coding theory, elaboration theory, cognitive theory of multimedia learning, and information processing theory, to name but a few (for an overview, see, e.g., Graesser et al., 2008; P. A. Kirschner & Hendrick, 2020; Pashler et al., 2007; Winne & Nesbit, 2010). Since the effects in these studies were first found in controlled laboratory settings, questions about their practical applicability in real classroom environments have been raised. In response, a growing contingent of researchers actively sought to apply and validate these findings within classroom environments (e.g., Agarwal et al., 2021; Dunlosky & Rawson, 2015). These studies confirm the effectiveness of various practices for more effective learning, some of which are even counterintuitive, including retrieval practice (e.g., retrieving information from long-term memory, even if faulty or incomplete, works better than rereading for learning), spaced practice (e.g., shorter but spaced periods of study work better than massed study for learning), and generative learning (e.g., transforming presented information such as a text into another form such as a mind map or figure). These practices have been empirically studied for many years, and the results have been replicated to the point where psychologists no longer question their value or lack thereof. A notable example is research on cognitive load theory (Sweller, 2023), which has significant instructional implications, especially in terms of addressing the limitations of working memory capacity. Findings from cognitive load theory research suggest that explicit instruction is generally more effective for novice learners in a domain than unguided, discovery-based methods (P. A. Kirschner et al., 2006). This assertion is supported by research examining the relationship between classroom practices and student achievement (see the subsequent section on teacher effectiveness).

Relevance for ITE. At the end of the last century, an influential paper by Anderson et al. (1995) called for the integration of psychological topics throughout the ITE curriculum. Historically, there has been a strong interconnection between learning, teaching, and psychology, with educational psychological theories often considered the scientific basis for teaching practices (Berliner, 2006; Mayer, 2018). As preparing pre-service teachers to become effective teachers is the central purpose of ITE, and learning is the central goal of education, it follows that teaching practices that have a greater chance to lead to better learning outcomes, why this is so, and how they should be employed should be at the core of ITE. If teachers have a profound understanding of the central principles of human cognitive architecture (Sweller, 2012) and human learning (Willingham, 2017, 2018), they will be better equipped to both teach and evaluate their classroom actions based on the cognitive processes they stimulate in their students and will also be given a language with which they can critically communicate with each other, reflect on their own teaching practices and see through the daily teaching hypes they are confronted with (Schön, 1987; Yan et al., 2024). This is analogous to the field of medicine, where research in anatomy, physiology, pathology, oncology, and so forth underpin daily medical practice.

Many educational and psychological research findings are also often broadly applicable across diverse age groups, demographics, and subject matter, highlighting the versatility

of learning principles within ITE for both general teaching practice and subject-specific teaching (P. A. Kirschner et al., 2017). Systematic reviews and accessible articles, practice guides, and books containing research findings on learning are available to teachers and teacher educators in ITE curricula (P. A. Kirschner & Hendrick, 2020; Weinstein et al., 2018; Willingham, 2021). For instance, seven cognitive principles of learning were described as a consensus among researchers in the cognitive community in a practice guide for teachers on Organising Instruction and Study to Improve Student Learning (Pashler et al., 2007). The seven principles are (1) space learning over time, (2) interleave worked example solutions with problem-solving exercises, (3) combine graphics with verbal descriptions, (4) connect and integrate abstract and concrete representations of concepts, (5) use quizzing to promote learning, (6) help students allocate study time effectively, and (7) ask deep explanatory questions.

Concurrently, the field continues to address and rectify common misconceptions concerning topics as learning styles, multiple intelligences, and discovery-based approaches, which have also invaded the teacher landscape through ITE (P. A. Kirschner & De Bruyckere, 2017; Mayer, 2004; Robinson et al., 2022).

3.2.2. Teacher-Effectiveness Research

While cognitive and educational psychology provide one scientific foundation for understanding how students learn, a complementary strand of evidence emerges from research that examines what effective teaching looks like in real classrooms.

General description. Teacher-effectiveness research can be viewed as a subset of the broader domain of educational effectiveness research, which focuses on identifying what works in education and understanding the underlying reasons for their effectiveness (Muijs & Reynolds, 2017). Where educational and cognitive psychological research addresses psychological constructs in both laboratory and ecologically valid experimental settings, teacher-effectiveness research investigates 'natural' variation in classroom settings (Lindorff et al., 2020). Effective teaching has been characterised in multiple ways, for example, in terms of observable teacher behaviour (such as warmth and clarity), teacher knowledge (such as subject matter), or teacher beliefs, among others. But here, we follow the definition as proposed by Good et al. (2009, p. 803): "the ability to improve student achievement as shown by research". The basic model is the process-product approach to instruction, which revolutionised educational research by bringing researchers into classrooms to examine how teaching practice contributes to student achievement, classroom climate, and student attitudes (e.g., Brophy & Good, 1986). This literature includes both correlational and quasi-experimental studies that relate teacher and teaching factors (e.g., daily review, guided practice, feedback) to student and classroom outcomes, illuminating factors that are positively and negatively—and correlational and/or causally—related to these outcomes (e.g., Creemers, 1994; Muijs & Reynolds, 2003; Rosenshine & Stevens, 1986). These factors were included in frameworks and models of effective teaching such as the dynamic model of educational effectiveness (Creemers & Kyriakides, 2011), the three-dimensional model of instructional quality (Praetorius et al., 2018), and the general model of effective instruction of Rosenshine and Stevens (1986). This research has, for example, consistently shown positive relations between components of explicit and structured teaching and student achievement, particularly for but not limited to disadvantaged students or students with less prior knowledge (Muijs et al., 2014; Opdenakker, 2020).

Relevance for ITE. Findings from teacher-effectiveness research can be viewed as generalised and codified examples of what the most effective teachers do to construct classrooms that value achievement, maximise time on task, and respect individual differences in students. These findings yield valuable guidelines for ITE curricula, and give prospective

teachers the opportunity to include these factors in their teaching (Kyriakides et al., 2013). The greater our understanding of teacher characteristics and processes associated with favourable student outcomes, the better the teacher can enhance learning (Mortimore, 1998). Furthermore, teaching factors such as feedback, questioning, and modelling have been found to be teachable to teachers, i.e., teachers trained on these factors outperformed teachers who were not trained, based on student learning outcomes (Good & Grouws, 1979; Anderson et al., 1979; Antoniou & Kyriakides, 2011). Factors derived from teacher-effectiveness research were also found to be transferable across disciplines and age groups, although it is important to note the varying amount of evidence across subject areas, with more data available for some, such as mathematics and English as a native language, than for others such as Geography and Religious Education. The field is rich with reviews that have not only documented effective instructional practices but have also translated them into actionable insights for the teachers and their ITE (Coe et al., 2020; Rosenshine, 2012).

It should, of course, be clear that these knowledge bases cannot in themselves encompass the full range of knowledge that beginning teachers require. An understanding of Special Educational Needs, pastoral care, and the role of the teacher as part of the school community are all important for ITE curricula. However, the two knowledge bases discussed are core to the practice of classroom teaching for student learning. While we have presented these two approaches separately, it should be clear that there is a significant overlap in the findings from them. A number of researchers have summarised the key findings of both and have developed frameworks for doing so (e.g., Rosenshine, 2012; Surma et al., 2019). A prominent example is Rosenshine's (2012) Principles of Instruction, which summarises key findings from both in an integrated and accessible way.

4. Towards a Knowledge Base on Instruction

Teacher competence goes beyond 'knowing' or 'implementing effective teaching strategies'. It also includes applying a solid knowledge base with theoretical underpinnings to everyday problems and tasks in teaching (Berliner, 2001; Korthagen et al., 2006). Van Driel et al. (1998) speak of teachers' craft knowledge, which represents teachers' accumulated wisdom with respect to their teaching practice. A codified knowledge base on effective learning and instruction does not replace this craft knowledge but can be regarded as a complement. As no piece of best evidence carries with it the situations in which it applies, a teacher who holds this evidence must still determine when, why, and how it is warranted in the lesson before them. Expert teachers make such judgements from rich experiential schemas accumulated over years of practice, which allow them to read a situation and act on it almost intuitively (Berliner, 2001; Shulman, 1986). Student teachers do not yet hold those schemas. This is why initial teacher education should give access to a well-organised and research-informed knowledge base: it provides the material from which such schemas can begin to form, and the explanatory principles with which a novice can reason about a situation that experience has not yet made legible. As stated by Blömeke et al. (2022), teachers' knowledge of instruction is relatively stable across different situations, representing the potential a teacher brings to the classroom to be a reflective practitioner who can perceive, interpret, and make teaching decisions in specific classroom situations (Hartmann et al., 2021; Schön, 1987). Such knowledge acts as a filter in the mind for each situation encountered and facilitates teachers learning from these situations (Borko et al., 1997). As reflective processes often occur subconsciously, possessing this knowledge potentially reshapes professional experience into an intuitive or even 'obvious' appearance while teaching (Abbott, 1988; Yates, 2005). Even though it is nearly impossible to empirically link teacher knowledge to student gains (Blömeke et al., 2022), some longitudinal evidence suggests that applying theory to classroom problems is itself a resource for teaching quality

(Rochnia et al., 2023), and it seems unlikely that not possessing foundational knowledge would lead to better teaching practice and student learning.

5. The Current Study

5.1. The Rationale Adopted in This Analysis

Every curriculum begins with a rationale. Even on that grand day when all the evidence is in, were it ever to occur, decisions would still rest in part on values, moral principles, priorities, available resources, trade-offs, and commitments. The analysis reported here adopts an effectiveness lens, as instruction is examined in terms of its contribution to student learning outcomes, thereby explicitly drawing on findings from research in cognitive and educational psychology and teacher effectiveness. Other traditions or paradigms, for instance, those grounded in European Pädagogik and Didaktik, would organise such a core around instruction for its formative potential rather than around instructional effectiveness, and would do so on principled grounds (Deng, 2025; Wiliam, 2013). Democratic and commons-oriented conceptions of schooling go further still, treating knowledge and curriculum time as goods to be collectively governed rather than be specified in advance (Pantazidis, 2026b).

The scope of our analysis is narrower than the term 'core curriculum' might suggest in at least three respects. First, the inclusion criteria documented below select curriculum documents from a single and identifiable policy tradition: two Anglophone systems with strong accountability procedures, both commissioned or endorsed by local best evidence bodies. Some convergence between these curriculum documents is therefore anticipated in part by the sampling frame, and what the analysis maps is convergence within the effectiveness lens rather than agreement across the broad field of initial teacher education or the stakeholders who would have to implement such a curriculum. Second, only content relating to instruction was examined, on the grounds set out in Section 6, which leaves substantial parts of both frameworks (, e.g., behaviour management) outside the scope of the analysis. Finally, the analysis is confined to research linking instruction to learning outcomes, and it does not consider work relating teaching practices to behavioural or socio-emotional outcomes. That is not to say that these outcomes are not important, but these restrictions are stated here rather than among the limitations because they shape what the resulting item set can be taken to establish.

Whether teacher educators, teachers, scholars, and policy makers would endorse items from our analysis is an open question, and one for which Delphi procedures are better suited than document analysis (D'haese et al., 2026). The resulting set should therefore be seen as a candidate object for such procedures to examine.

5.2. Selection of Curricula

To develop a body of core knowledge, we conducted a comparative document analysis of published core curricula in teacher education. We selected curricula that claim to be grounded in strong empirical evidence from cognitive and educational psychology and teacher-effectiveness research and were endorsed by best-evidence centres such as the EEF. The curricula needed to be published in English and needed to be accessible—a prerequisite for thorough and transparent analysis. They needed to articulate a core of evidence-based declarative ('know that') and procedural knowledge ('know how'), as opposed to a complete, prescriptive curriculum with detailed teaching materials and sequenced learning and evaluation activities. The curricula needed to be 'general' and not limited to an individual ITE programme; rather, it should include the minimum amount of specific knowledge required for ITE programmes in general (e.g., at the national or regional level). Two curricula met all of the criteria: The Core Content Framework. An

Initial Teacher Training Framework (Department for Education, 2019, 2024) and 'Strong Beginnings' (Teacher Education Expert Panel, 2023), the Australian core curriculum for ITE.

To our knowledge, this is the first time that the content features of national best-evidence core knowledge curricula have been systematically studied. The central research question guiding this analysis was: To what extent do core curricula claiming to be evidence-informed reflect converging content, and to which extent are shared items empirically grounded in two established evidence bases of cognitive/educational psychology and teacher-effectiveness research? By identifying both commonalities and differences, this study helps to establish a knowledge base on effective instruction to inform the design and revision of ITE programmes. The analysis aims to support curriculum developers, teacher educators, and textbook authors in aligning instructional content more explicitly with established research on how learning and teaching works.

6. Method

Comparative document analysis is appropriate for cross-curricular studies, as it facilitates a comprehensive and systematic examination of curricular content (Bowen, 2009). The analysis process is split into two distinct phases: within-case analysis and cross-case analysis. In the within-case analysis, each curriculum is analysed separately with respect to three relevant curriculum components: (1) context and genesis, (2) core vision, and (3) curriculum structure and items (Madaus & Kellaghan, 1992). This analysis constructs a descriptive understanding of each curriculum and sets the stage for the second phase: the cross-case analysis. Cross-case analysis involves constant comparative analysis, a method well suited for identifying recurrent themes across multiple cases, encompassing cyclic iteration of reading, interpreting, and controlling the items of the curricula. Codebook thematic analysis was used, which combines a structured pre-existing coding framework with additional themes formulated early in the research procedure. This facilitated further advancement of themes throughout the analysis process. Each item across the curricula was interpreted and coded.

6.1. Delimiting Instructional Content

Both core curricula extend well beyond instruction, so a boundary had to be drawn before coding could begin. Items were retained when they referred to teaching behaviours observable during a typical lesson and directed at the learning of factual, conceptual, procedural, and metacognitive knowledge (Ko et al., 2013), together with items that theoretically underpin the effectiveness of those behaviours. This boundary was drawn by the content of an item rather than by the sections within the source documents. Models of teacher effectiveness comprise both an instructional strand and a classroom management strand (Creemers & Kyriakides, 2011; Rosenshine & Stevens, 1986); the present analysis deliberately confines itself to the former, and management-specific content, together with, e.g., pastoral care and lesson planning, was therefore excluded for this analysis. Because the curricula section architecture does not coincide with that boundary, a small number of items were retained from sections nominally devoted to behaviour management. For instance, 'Use feedback that acknowledges student effort' appears in Strong Beginnings under classroom management as a proactive practice, yet it was retained as instructional content on feedback. Conversely, 'Creating and explicitly teaching routines in line with the school ethos that maximise time for learning', filed in the English framework under Managing Behaviour, was excluded as behaviour management content even though time for learning is a central factor in effectiveness models. The full set of decisions is visible in Appendix A.

6.2. Coding Procedure

For logical categorisation of the items, knowledge items were coded using a pre-existing framework derived from Rosenshine's (2012) Ten Principles of Instruction. The initial categories were to: (1) Begin a lesson with a short review of previous learning; (2) present new material in small steps with student practice after each step; (3) ask a large number of questions and check the responses of all students; (4) provide models; (5) guide student practice; (6) check for student understanding; (7) obtain a high success rate; (8) provide scaffolds for difficult tasks; (9) require and monitor independent practice; (10) engage students in weekly and monthly reviews. Items from the two curricula were coded deductively to the Rosenshine categories where possible. Categories were renamed during the coding process when the underlying items could be conceptually better captured using a different term (see Table 1).

Table 1. Comparison of final coding categories with Rosenshine's Principles of Instruction.

Final Coding Category	Rosenshine's Original Principle(s)	Modification and Rationale
General statements on teaching and learning	Not explicit in Rosenshine	Added as an overarching category for general statements on teaching and learning that could not be mapped to a single principle.
Activating and using prior knowledge	Begin a lesson with a short review of previous learning	Renamed and broadened to include activation of prior knowledge beyond lesson openings.
Clear, structured and challenging learning environment	Present new material in small steps with student practice after each step; obtain a high success rate	Merged and broadened to encompass structuring content, stepwise introduction, and the setting of challenging yet achievable goals.
Modelling, worked and concrete examples	Provide models	Terminology broadened to include concrete representations of abstract ideas.
Activating and generative learning	Guide student practice; ask a large number of questions and check the responses of all students	Combined and broadened to include activating strategies such as collaborative work and questioning.
Checking for students' understanding	Ask a large number of questions and check the responses of all students	Combined to reflect questioning as a means to systematically check understanding.
Scaffolding	Provide scaffolds for difficult tasks	Retained
Spaced practice opportunities	Engage students in weekly and monthly reviews	Renamed and broadened
Feedback	Not a separate category in Rosenshine (implicit in checking for student understanding; obtaining high success rates and providing scaffolds for difficult tasks)	Identified as a standalone theme due to its prominent presence in both curricula.
Multimodal instruction	Not explicit in Rosenshine	Newly added based on inductive coding of items concerning the combination of modalities (e.g., text, image, audio).
Metacognition	Not explicit in Rosenshine	Newly added from inductive analysis of items promoting metacognitive knowledge and strategy use.

Final categories were derived through iterative deductive and inductive coding. Deductive coding began with Rosenshine's (2012) principles as a framework; inductive coding identified new categories not present in the original list.

For instance, the category 'Begin a lesson with a short review of previous learning' was replaced by 'Activate prior knowledge', as items in the curricula suggested that activation of prior knowledge need not only occur at the beginning of a lesson. Additional categories were incorporated when a curriculum item did not align with one of Rosenshine's principles.

Two coding rounds were conducted. In the first round, the second author, acting as principal coder, and the first author coded all items independently of one another. In the second round, the two coders reviewed every discrepancy and settled each by discussion, referring unresolved cases to the remaining authors for adjudication. Agreement was

reached by negotiation, which is consistent with a codebook thematic analysis in which the category set is itself an output of the procedure rather than an instrument applied to it. Coding was managed in NVivo (Lumivero, 2023).

6.3. Corroboration Against the Two Evidence Bases

Items appearing in both frameworks were subsequently examined against the two research literature. Each shared item was mapped onto four models of effective teaching, selected because they are widely used syntheses that specify teacher factors at a level of granularity comparable to that of the curriculum items: the dynamic model of educational effectiveness (Creemers & Kyriakides, 2011), the three-dimensional model of instructional quality (Praetorius et al., 2018), the synthesis of Seidel and Shavelson (2007), and the general model of effective instruction of Rosenshine and Stevens (1986). The cognitive mechanism underlying each category was identified using Graesser et al.'s (2008) principles of learning. Their synthesis was adopted as the labelling instrument because it condenses twenty-five well-replicated learning principles into testable, mechanism-level claims at a satisfying level of granularity (see also Winne & Nesbit, 2010). No item was removed at this stage as the mapping records where an item's empirical backing lies rather than testing whether it has one, and the step should accordingly not be regarded as an exclusionary filter.

7. Results

7.1. Within-Case Analysis

7.1.1. Initial Teacher Training and Early Career Framework (ITTECF, England)

Following the Carter (2015) review's audit of the English Teacher Education System, a core content framework for ITE (Department for Education, 2019) was established, which underwent substantial updates in 2019 and 2024. The Carter review noted that the English ITE system was generally functioning well, yet also pointed to considerable variability in ITE content across the higher education system. They identified significant gaps in areas such as subject knowledge, subject-specific pedagogy, assessment, behaviour management, and Special Educational Needs and Disabilities (SEND). The version analysed in the present study is the 2024 framework (Department for Education, 2024).

Both the initial and the revised content framework, "Initial Teacher Training and Early Career Framework" (ITTECF), were designed to offer a systematic introduction to fundamental knowledge and skills that exemplify excellent teaching in five areas: behaviour management, pedagogy, curriculum, assessment, and professional behaviours. Endorsed by the EEF, the framework is now compulsory for all ITE programmes in England. According to the Department for Education (2019), all ITE providers integrated the comprehensive content outlined in the framework to maintain or achieve accreditation. To align with the eight British Teachers' Standards, the framework is organised into eight sections. Behaviour management is addressed in High Expectations and Managing Behaviour (S1 and S7); instruction in How Pupils Learn, Classroom Practice and Adaptive Teaching (S2, S4, S5); and curriculum, assessment and professional behaviours in S3, S6 and S8, respectively. Each section presents 'Learn that' statements, which provide knowledge over best-evidence in teaching, and 'Learn how to' statements detailing practical skills and opportunities for collaborative learning with colleagues (see Figure 1). The framework asserts that the 'Learn that' statements are "informed by the best available educational research" (p. 5), with references and further reading provided for in-depth exploration. It also includes a comprehensive reference list, citing 186 sources.

How Pupils Learn (Standard 2 – Promote good progress)

Learn that…	Learn how to…
1. Learning involves a lasting change in pupils' capabilities or understanding. 2. Prior knowledge plays an important role in how pupils learn; committing some key facts to their long-term memory is likely to help pupils learn more complex ideas. 3. An important factor in learning is memory, which can be thought of as comprising two elements: working memory and long-term memory. 4. Working memory is where information that is being actively processed is held, but its capacity is limited and can be overloaded.	**Avoid overloading working memory, by:** a) Taking into account pupils' prior knowledge when planning how much new information to introduce. b) Breaking complex material into smaller steps (e.g. using partially completed examples to focus pupils on the specific steps). c) Reducing distractions that take attention away from what is being taught (e.g. keeping the complexity of a task to a minimum, so that attention is focused on the content). **Build on pupils' prior knowledge, by:** d) Identifying possible misconceptions and planning how to prevent these forming. e) Linking what pupils already know to what is being taught (e.g.

Figure 1. An example of a standard with 'Learn that…' and 'Learn how to…' statements.

The framework covers the content pre-service teachers are required to learn and know regardless of subject area or educational stage. It is therefore the responsibility of ITE providers to ensure that they carefully create well-structured and coherent curricula appropriate for the phase, setting, and subject to be taught. It is stipulated that the ITTECF should not be used as an assessment framework against the teachers (Department for Education, 2019, p. 7). The introduction of the framework was not without controversy. Critics such as Hordern and Brooks (2023) and Murtagh et al. (2023) have argued that the curriculum is overly technical, too generic, takes a limited view of evidence, and is overly prescriptive. Some of these criticisms were said to be addressed in the most recent revision of the framework, which is now integrated within a curriculum for early career support (Department for Education, 2024).

7.1.2. Strong Beginnings (Australia)

The Quality Initial Teacher Education Review (Department of Education, Skills and Employment, 2022) reported that many novice teachers in Australia enter the profession insufficiently prepared for crucial areas such as reading, cultural responsiveness, supporting diverse learners, classroom management, and engagement with families and carers. The review further concluded that their readiness would be enhanced by a stronger emphasis on evidence-based teaching strategies. The Australian Education Research Organisation was tasked with identifying evidence-based practices with the strongest impact on student learning, which pre-service teachers should acquire and be able to demonstrate. The panel published a discussion paper that consisted of a core content framework, 'Strong Beginnings' (2023), which draws on evidence from a broad range of disciplinary perspectives that teachers are expected to integrate into varied subject-specific teaching contexts. It identified four content domains to be mandated in ITE:

(1) The brain and learning—understanding why specific instructional practices work (see Figure 2); (2) effective pedagogical practices—understanding how teaching strategies respond to how the brain processes, stores and retrieves information; (3) classroom management—including rules and routines, proactive practices, managing behaviour and whole-school frameworks; (4) responsive teaching—content that ensures teachers are teaching culturally and contextually appropriate material (p. 9).

The framework is not designed to encompass all knowledge that beginning teachers should master; responsibility lies with ITE providers to embed the core content coherently within their curricula and adapt it to local contexts. To guarantee its integration, pre-service teachers are required to demonstrate mastery of the core content and achieve its learning outcomes before graduation. The framework includes a comprehensive reference list, citing 73 sources.

Knowledge of and skill in explicit teaching, modelling and scaffolding practices that support how a student's brain learns.	**Explicit modelling and scaffolding**
	The research base that shows **explicit teaching, modelling and scaffolding practices** are highly effective and attend best to **how a student's brain learns**.
	How to effectively begin instruction of a task through using a clear explanation of what students are expected to learn, chunked into small, manageable tasks with well-defined goals.
	The importance of presenting all information required to complete these chunked tasks **in one place and at one time**, excluding information not directly related to the task, to reduce cognitive overload.
	How to **explicitly model new skills and content** through '**worked examples**' that clearly demonstrate how to complete the task, followed by a **progressive removal of scaffolding** as students become more proficient.
	How to **develop and deliver appropriately challenging recall practice to promote retention** and plan to include ample opportunities to practise in a lesson or sequence of lessons.
	Why **independent problem-solving is only effective once a student approaches proficiency** (i.e. after ample opportunities to practise progressively challenging tasks) and why independent problem-solving should not represent a large proportion of teaching and learning time.

Figure 2. An example of a learning outcome with 'Core content ITE programmes should teach'. Bold type appears in the original document.

Both frameworks locate this knowledge in initial teacher preparation, although their reach differs. In Australia, pre-service teachers must have demonstrated knowledge of the core content prior to graduation (Teacher Education Expert Panel, 2023), whereas in England, the ITTECF extends beyond initial training into the statutory two-year induction period, during which early career teachers revisit and deepen the content acquired during training (Department for Education, 2024). Neither framework prescribes where within a programme the content is to be taught or practised; the division between theoretical coursework and clinical practice is left to the providers.

7.2. Cross-Case Analysis

Based on a cross-case analysis, the most relevant findings underlying this study are presented in Table 2 and, in full, in Appendix A. Note first that both curricula are generic in nature and thus refer to teacher knowledge as being assumed to affect student learning irrespective of student age, content domain, gender, ethnicity, grade, and other contextual elements. The category structure used in this comparison was developed through an iterative codebook thematic analysis, starting from Rosenshine's (2012) Principles of Instruction as a deductive framework and refined through merging, renaming, and the inductive addition of new categories where curriculum items did not align with the original list. The knowledge items are arranged around eight instructional principles and one category comprising general statements on learning and instruction. Within each category, there are declarative items ("pre-service teachers should know that") and procedural items ("pre-service teachers should know how to…"). The principles that a pre-service teacher should acquire are minimally a multifaceted understanding of general statements on teaching and learning: (1) activating and using prior knowledge; (2) providing clear, structured and challenging learning environments; (3) modelling and using worked and concrete examples; (4) activating and generative learning; (5) check for students' understanding; (6) scaffolding; (7) spaced practice opportunities; (8) providing feedback opportunities.

Table 2. Minimal Agreed Knowledge Set structure with example items.

Instructional Principles	Example Curriculum Item (Italic = Procedural Knowledge)
General statements on teaching and learning	Effective teaching has a long-term positive effect on students' life chances, particularly for students from disadvantaged backgrounds.
Activating prior knowledge	The brain applies prior knowledge from long-term memory to learn new information and to acquire complex skills by accessing memory or combining and re-combining memory to generate possible solutions. *Link what students already know to what is being taught (e.g., explaining how new content builds on what is already known).*
Clear, structured and challenging learning environment	Students with less prior knowledge need more structure early in a domain than students with more prior knowledge do. *Balance input of new content in a way that students master foundational concepts and knowledge before moving on.*
Modelling, worked and concrete examples	Modelling helps students understand new processes and ideas. *Remove worked and concrete examples progressively/slowly as students become more proficient.*
Activating and generative learning	Complex skills (e.g., independent problem-solving) are only effective once a student approaches proficiency (i.e., after ample opportunities to practise progressively challenging tasks). *Stimulate students' thinking through a range of types of questions in class discussions to extend and challenge students (e.g., by modelling new vocabulary or asking students to justify answers).*
Checking for students' understanding	Effective assessment is critical to teaching because it provides teachers with information about students' understanding and needs. *Use formative assessment practices (such as exit tickets, quick quizzes, or other forms of questioning) to prompt students to identify common misconceptions and systematic errors as learning is taking place.*
Scaffolding	Adapting teaching in a responsive way, including by providing targeted support to students who are struggling, is likely to increase student success. *Design practice and tasks that provide just enough support so that students experience a high success rate when attempting challenging work.*
Spaced Practice opportunities	Regular purposeful spaced practice of what has previously been taught helps to consolidate material and help students remember what they have learned. *Use effective practice opportunities (e.g., spaced practice and retrieval practice) to build automatic recall and application of key knowledge and concepts.*
Feedback	High-quality feedback can be written or oral; it is likely to be accurate and clear, encourage further effort, and provide specific guidance on how to improve. *Provide feedback as learning is taking place that is specific, honest, accurate, constructive, and clear.*

Appendix A presents a comprehensive examination of all the curriculum items from Strong Beginnings and ITTECF arranged around the same eight instructional principles and category comprising general statements on learning and instruction. It shows 52 knowledge items shared by both core curricula (which constitute the Minimal Agreed Knowledge Set) and 65 curriculum items found in only one of the two (which reflect specific educational foci or priorities unique to one of the two). For each principle, the corresponding theoretical underpinnings from educational or cognitive psychology are shown. Concurrently, the principles outlined in our analysis show maximal overlap with current models of teacher effectiveness (i.e., Creemers & Kyriakides, 2011; Praetorius et al., 2018; Rosenshine & Stevens, 1986; Seidel & Shavelson, 2007), though some teacher factors from these models were missing in the core curriculum. For instance, knowledge items associated with findings stating that effective teachers are expected to assist students to apply metacognitive strategies and to develop their own strategies to solve different kinds of problems (Muijs et al., 2014) appear in the Creemers and Kyriakides (2011) and Praetorius et al. (2018) frameworks but not in both Strong Beginnings and ITTECF. Dealing with student responses is also a common feature of many of the research-based frameworks (e.g., Praetorius et al., 2018; Rosenshine & Stevens, 1986) but did not find overlap in both core curricula.

The same holds for the evidence base in cognitive and educational psychological evidence base, although the mapping here operates at the level of the categories rather than

of individual items. Of the twenty-five learning principles (Graesser et al., 2008), twenty are named as theoretical underpinnings in Appendix A, and seventeen of these sit in categories that contain at least one shared item. Dual coding and multimedia effects, imperfect metacognition, and self-regulated learning appear only under multimodal instruction and metacognition, the two categories that yielded no shared items. Perceptual-motor grounding, organisation effects, exam expectations, cognitive disequilibrium, and cognitive flexibility have no mirror in both core curricula.

The corroboration mapping is reported in full in Appendix A. Of the 52 shared items, 30 correspond to a teacher factor in at least one of the four models of effective teaching, and 22 do not. Fourteen of these are concentrated in two categories: eight of the ten items under general statements on teaching and learning, and six of the eight items under scaffolding. The remaining eight are distributed across the other categories. These items are not thereby unsupported. They concern the limited capacity of working memory, the reduction in cognitive load, and the structure of long-term memory, and their warrant comes from cognitive and educational psychology rather than from classroom process-product research. The two evidence bases therefore seem to operate complementarily across the set, and an item's presence in the Minimal Agreed Knowledge Set reflects corroboration by at least one of them.

Table 3 offers a detailed breakdown of the number of items per curriculum coded under each instructional principle. While not all instructional principles were represented equally in both curricula, providing clear, structured, and challenging learning environments (Principle 2); scaffolding (Principle 6); modelling and using worked and concrete examples (Principle 3); and checking for students' understanding (Principle 5) were the most consistently featured principles across all curricula. Multimodal instruction and metacognition emerged inductively during coding but yielded no items shared by both curricula; they are retained as categories in Table 3 and Appendix A but contribute no items to the MAKS.

Table 3. Overview of the number of items per curriculum coded under each instructional Principle.

Instructional Principles	ITTECF (2024)	Strong Beginnings (2023)	Items in Both Core Curricula (MAKS)
General statements on teaching and learning	13	11	10
Activating and using prior knowledge	8	5	4
Clear, structured and challenging learning environment	17	14	10
Modelling, worked and concrete examples	11	5	5
Activating and generative learning	10	3	3
Checking for students' understanding	12	6	5
Scaffolding	14	10	8
Spaced practice opportunities	5	6	4
Feedback	10	3	3
Multimodal instruction	2	1	0
Metacognition	3	0	0

8. Discussion and Conclusions

This study set out to examine whether existing evidence-informed ITE core curricula converge on specific items of knowledge relating to 'learning how to teach'. The results add to the current literature on ITE curricula in general and curricula on 'learning how to teach' in particular. Based on the analyses of existing core curricula, 52 curriculum items were identified as shared, 42 categorised under eight instructional principles and 10 under a category of general statements on teaching and learning. These shared items together form what is referred to as the Minimal Agreed Knowledge Set (MAKS). Although

these instructional principles (see Table 2) are interrelated, each has its own distinctive characteristics that translate into particular teacher behaviours when applied. Therefore, each principle acts as an overarching factor comprising specific items associated with student achievement gains. Our analysis counters critiques of the quality of ITE curricula regarding its underlying scientific underpinnings and its specificity. It offers an initial point of convergence for ITE institutions to shape their curriculum on instruction.

8.1. A Curriculum Underpinned with Best Evidence

The set of shared items identified in this study is backed by best evidence about 'learning how to teach'. Not only was there overlap in principles from both the English ITT-framework and the Australian Strong Beginnings curriculum, but evidence for the shared principles and their underlying knowledge items was also found in both teacher-effectiveness research (Creemers & Kyriakides, 2011; Praetorius et al., 2018) and cognitive and educational psychology, as the principles were also conceptually linked to well-established findings that explain why each principle supports students' thinking and learning (Graesser et al., 2008; Pashler et al., 2007). A notable example is spaced practice opportunities which contains the knowledge items stating that regular purposeful spaced practice of what has previously been taught helps to consolidate material and help students remember what they have learned and that requiring students to retrieve information from memory is likely to strengthen recall. Cognitive psychologists have provided a robust foundation for both the effectiveness of the underlying spacing and testing effect (Carpenter et al., 2022; Mawson & Kang, 2025). Similarly, various frameworks from teacher-effectiveness research indicate the importance of daily, weekly or monthly reviews, frequent revision and questioning, and structured opportunities to practice as characteristic behaviours of effective teachers (Creemers & Kyriakides, 2011; Rosenshine & Stevens, 1986). Pre-service teachers should therefore recognise that spacing practice sessions with retrieval opportunities, both within and between lessons, contributes more to sustainable learning than concentrated practice at a single time and they could consider this in their lesson planning. A second example pertains to activating prior knowledge which consists of knowledge items clarifying that the brain applies prior knowledge from long-term memory to learn new information and to achieve complex skills (e.g., critical thinking, problem solving, and reading comprehension) by accessing memory or combining and re-combining memory to generate possible solutions. Psychologists have revealed that activated and relevant prior knowledge is one of the most important determinants of the quality of future learning (Ausubel, 1968; Brod, 2021; Simonsmeier et al., 2022; Surma et al., 2025). Concurrently, the role of teacher factors, such as 'exploring and activating prior knowledge', is considered critical in the findings of systematic observations of expert teachers (Creemers & Kyriakides, 2011; Praetorius et al., 2018). Therefore, pre-service teachers whose programmes incorporate MAKS should be aware of the advantages of engaging with prior knowledge from earlier curriculum units when, for instance, introducing a new chapter. Because of its scientific backbone, it is reasonable to assume that the principles in the MAKS establish a knowledge base that, within the evolving nature of science, is stable and can be considered to be, as it currently stands, an agreed-upon absolute minimum of codified practical and scientific wisdom of beginner teaching practice

8.2. A Curriculum More Specific in Nature

The MAKS counters the critique that overly broad knowledge items or widely accepted truisms leave too much room for interpretation (Graesser, 2009; Surma et al., 2025). In particular, ITE institutions with limited research literacy should find it easier to interpret and implement the MAKS when the items are clearly and specifically stated. For instance,

a curriculum item on the use of examples (i.e., explicitly model new skills and content through (partially) worked examples to focus on the specific steps and to demonstrate clearly how to complete a task or to execute a skill) is more specific than curriculum items derived from teacher standards such as '. . . select learning experiences' (Aelterman et al., 2008, p. 12). It is argued that specified and testable principles are more inviting of enquiry, debate, and inspiration regarding the construction of the ITE curriculum. These are "claims with teeth" (Graesser, 2009, p. 195) that motivate researchers and instructional designers to uncover situations where these principles fail in teaching pre-service teachers how to teach, to engage in discussions with those who contest or confirm the curriculum items, and to measure relevant curriculum effects on teacher and student outcomes.

8.3. A Curriculum on Instruction Beyond the Debates

The knowledge items focus on well-established concepts rather than those contested in scientific debates about instruction (e.g., practice is crucial to long-term retention, prior knowledge impacts future learning) and offer an initial point of convergence on knowledge concerning 'learning how to teach'. From a content perspective, it is notable that the MAKS incorporates principles and items that stem from specific approaches to instruction, such as direct and explicit instruction (i.e., structuring lessons, questioning, feedback, and independent practice; Rosenshine & Stevens, 1986), as well as a wider spectrum of knowledge that integrates items from different frameworks, models, or theories, including teacher expectations of student performance (Good, 2024), generative learning (Fiorella & Mayer, 2016), and scaffolding (Van de Pol et al., 2010). From a theoretical perspective, it may not be beneficial for ITE curricula to impose unnecessary divisions between different teaching frameworks, models, or theories, nor to perpetuate the ongoing debate over which single approach or model is "best." Instead, it may be more fruitful to focus on specific instructional actions, interactions between the teacher and learners, and the underlying mechanisms that facilitate student learning, regardless of whether they align more closely with one framework or another (Kyriakides et al., 2013). It is noteworthy that the items in our analysis resonate with other fields of literature not typically included in Strong Beginnings or ITTECF. For example, in school improvement literature (Agirdag & Muijs, 2023), elements of this core curriculum are part of evidence-informed approaches to improving the quality of schools (i.e., high-performing schools placed a strong emphasis on explicit teaching methods as a central element of their pedagogical approach). This aligns with one of the initial objectives of teacher-effectiveness research, namely to enhance overall education (Kyriakides et al., 2018; Lindorff et al., 2020). The knowledge described in our analysis also connects with findings from Special Educational Needs and Disability (SEND) literature (Hughes et al., 2017; Mitchell & Sutherland, 2020) and non-WEIRD (Western, Educated, Industrialised, Rich, Democratic) populations (Ekuni & Jaeger, 2022), which suggests that these practices appear to travel across populations. While some items vary in granularity, comprehensiveness, and other characteristics, most also align with features identified by the literature on high leverage practices (Ball & Forzani, 2009), which are frequently used practices in teaching that teachers can implement in classrooms across different instructional approaches and/or curricula (e.g., explaining and modelling content, practices, and strategies; providing appropriate scaffolding; and providing feedback to students) (Matsumoto-Royo & Ramírez-Montoya, 2021). Most items, however, are linked to teacher behaviour associated with forms of explicit, teacher-guided instruction. Hughes et al. (2017) describe explicit instruction as "group of research-supported instructional behaviours used to design and deliver instruction that provides needed support for successful learning through clarity of language and purpose, and reduction in cognitive load. It promotes active student engagement by requiring frequent and varied responses followed

by appropriate affirmative and corrective feedback and assists long-term retention through the use of purposeful practice strategies" (p. 143).

The prominence of items stemming from explicit instruction can be explained as follows. First, it has been demonstrated that components of explicit instruction can be taught to teachers (i.e., 'learn to teach'), as evidenced by experimental studies that found that students taught by teachers who mastered explicit instruction outperformed students taught by teachers not taught these principles (Anderson et al., 1979; Antoniou & Kyriakides, 2011; Good & Grouws, 1979; Grenell et al., 2024). Second, these teachable elements form the foundational instructional approach crucial for pre-service teachers to become skilled at, as they underpin more complex instructional approaches (Lavigne & Good, 2019). In these approaches, such as project-based learning, collaborative learning, and blended learning, teachers should understand how students learn, make use of students' prior knowledge, and provide them with feedback and opportunities to practice. Achieving success with these approaches is therefore, to some extent, reliant on teachers' competence in the execution of the principles specified in the MAKS. Finally, the emphasis on explicit forms of teaching also corresponds with findings from teacher expertise development, indicating that progress in instructional quality is made through several phases, from novice to expert (Kyriakides et al., 2013; Maulana et al., 2015). Kyriakides et al. (2013, 2025) describe that the teacher initially masters the basic elements of explicit forms of instruction and practices to demonstrate expertise in these components. As the teacher progresses from novice to expert, more complex approaches such as adaptive instruction emerge. Consequently, it is logical that the knowledge items associated with the first phase of expertise development hold a prominent place in curricula designed to train pre-service teachers into becoming competent beginners.

8.4. Next Steps for Core ITE Curriculum

The mere delivery of this MAKS should not be viewed as a panacea. This work should be seen as a precursor to a "Volume 1" in a more comprehensive overview of ITE core curricula. To scrutinise current core curriculum, the professional and academic community should thoroughly assess the MAKS and undertake similar activities for other key components of the ITE curriculum such as 'learning to teach a subject' (i.e., domain-specific issues) and 'learning to be a teacher' (Perry et al., 2019).

Future research should address some limitations of the present study. First, it is important to acknowledge that not all essential aspects of teaching practices are explicitly listed in the MAKS. It should not be considered an irrevocable compilation of the core characteristics of expert teachers, but as a minimal set of agreed-upon items to be entry-ready for the profession. Core curriculum building is perceived here as an evolving process that requires ongoing debate, refinement, validation, and research, rather than as a fixed product that fosters reductionism or is used as a performative tool for assessing teaching behaviour. For instance, certain principles prominent in cognitive psychology and teacher effectiveness frameworks, such as those related to collaborative group work, adaptive teaching, multimedia instruction, and self-regulated learning, are conspicuously absent from our synthesis. Collaborative group work, for instance, has been found to be effective, provided the right circumstances are present (e.g., P. A. Kirschner et al., 2018; Slavin, 2017), and should be considered part of the toolkit of an expert teacher (Seidel & Shavelson, 2007). However, effective group work is notoriously difficult to achieve (F. Kirschner et al., 2009; Muijs et al., 2014) and might therefore be less likely to be a primary skill for pre-service teachers. Similarly, advanced forms of classroom adaptive teaching, such as being able to differentiate teaching practices according to students' needs and offering appropriate application and structuring tasks for a subgroup of students, are situated at the most

demanding stages of the developmental scale of teaching skills (Kyriakides et al., 2025). This hierarchy of professional skills originates from practice, not from principle. Although considering individual student needs is essential for good teaching and should be a basic skill, research indicates that novice teachers must initially master other skills before they can begin addressing individual differences among students effectively (Maulana et al., 2015; Van de Grift et al., 2011). Furthermore, as advancements in technology have made it remarkably easy for educators to purposefully combine illustrations and visuals with verbal content, it is unclear why dual coding or multimedia learning mechanisms have not emerged as a prominent aspect of the contemporary core ITE curriculum (Camp et al., 2021; Mayer, 2008). Finally, given the current enthusiasm for incorporating self-regulated learning in educational settings, it should be discussed whether knowledge elements related to this belong in the core curriculum. Clearly, ITE institutions could—and arguably should—incorporate some of the aforementioned elements, along with other elements, into their core curriculum as well.

Debates on how the core curriculum can be expanded and refined can and should thus proceed in various ways. A fruitful avenue for future research could entail carrying out different iterations of Delphi-like studies to engage teacher educators, scholars, teachers, and other practitioners in identifying essential knowledge areas for inclusion in the core ITE curriculum (for initial work in this area, see D'haese et al., 2026), as has been done with specific curricula for teaching history and mathematics (Fogo, 2014; Muñiz-Rodríguez et al., 2017) and project-based learning (Dean et al., 2023).

It should not be considered that teaching skills develop naturally by incorporating this MAKS in ITE. Pre-service teachers do not move through these principles in a lock-step fashion, nor should they be educated solely in these principles. Nor do they arrive without prior conceptions and beliefs about teaching practice: pre-service teachers enter ITE with sedimented images of schooling that shape how curricular content is received (Pantazidis, 2026a). The principles and underlying knowledge items must be carefully embedded in the curriculum. For instance, the principles and items should be systematically integrated into both theoretical and practical courses, ensuring a gradual and cumulative build-up of opportunities to revisit key concepts using a spiral curriculum approach (walk-the-walk principle). Additionally, practical curriculum development necessitates prioritisation and determination of which principles should be introduced earlier to provide a coherent basis for subsequent learning (Surma et al., 2025). For instance, it may be useful to introduce fundamental insights into cognitive processes, such as the constraints of working memory, before discussing why certain instructional approaches, such as explicit guided instruction, can be effective for students with limited prior knowledge. Attention should also be paid to follow-up curricula in induction programmes and further continuous professional development, as teachers and teaching continue to evolve during the initial years of practice—a period where teaching skills are honed as much in the field as in formal teacher education (Van Driel et al., 1998). These aspects warrant further research, linking theories of curriculum design to theories of teacher development and professional learning continuum from ITE to the early years of teaching (e.g., Berliner, 2001; Feiman-Nemser, 2001; Kyriakides et al., 2013). Future research should also investigate the effectiveness of the MAKS itself, in particular whether teachers prepared with its content integrated in the ITE curriculum have a measurable positive impact on their students' learning. Such research would enable ITE curriculum developers to make informed decisions regarding prioritisation, sequencing, and a spiral approach in integrating theory and practice overarching the teacher education continuum.

Finally, one could argue that the question of what constitutes effective teacher education must be answered first. Obviously, this question goes without a straightforward

answer due to the varying perspectives and frameworks regarding the goals of education (Wiliam, 2013) and variations in ideological orientations towards teaching and teacher education, such as a focus on social efficiency, deregulation, and social justice, which are often different across countries but also within different ITE providers within the same national context (Conway et al., 2009). As set out in Section 5.1, the analysis is confined to research linking instruction to learning outcomes. This is not because other outcomes are not important. It has been observed, in part as a result of the COVID pandemic, that the emotional welfare of students has increasingly come to the forefront in education (Mazrekaj & De Witte, 2023), and as we develop ITE curricula, existing and emerging evidence in these areas should be considered in future work.

9. Concluding Remarks

There is an absence of a "common technical vocabulary" for teaching, as sociologist Lortie (1975, p. 73) observed in his influential book on the field half a century ago. The same goes for ITE, which lacks a core agreed-upon curriculum that encompasses both specified declarative and procedural knowledge on 'learning to teach'. A first step toward working more collaboratively within the field of ITE curricula content research, as well as its effects on teacher and student outcomes, lies in granting teacher educators and curriculum designers the opportunity to discuss their specific findings and rationales to others. Consider this as an initial attempt in an under-researched area. The aim was to propose components on instruction in which an initial consensus appears to be emerging from published core ITE curricula, and which were backed with best-evidence findings in cognitive and educational psychology and teacher-effectiveness research. This work is just one part of a complex puzzle, limited to one aspect (instruction) from one perspective (effectiveness of learning and teaching processes) for one goal (describing a Minimal Agreed Knowledge Set for educating pre-service teachers). Successful teaching will require many categories of teacher knowledge, and only a subset of them are targeted by cognitive psychologists and teacher-effectiveness researchers. This, in turn, does not imply relativism. Their part is nevertheless fundamental in gaining a basic understanding of teaching and, in general, includes the core contents that teachers have to possess to engage in the effective teaching of new ideas and concepts.

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Abbreviations

The following abbreviations are used in this manuscript:

EEF	Education Endowment Foundation
ITE	Initial Teacher Education
ITT	Initial Teacher Training
ITTECF	Initial Teacher Training and Early Career Framework
MAKS	Minimal Agreed Knowledge Set
PCK	Pedagogical Content Knowledge
SEND	Special Educational Needs and Disabilities
TEDS-M	Teacher Education and Development Study in Mathematics

Appendix A

Table A1. A Comprehensive examination of the curriculum items.

	Instructional Principle (Learn that . . .)	ITTECF (2024)	Strong Beginnings (2023)	Creemers and Kyriakides (2011)	Praetorius et al. (2018)	Seidel and Shavelson (2007)	Rosenshine and Stevens (1986)
General statements on learning and instruction							
1.	High-quality teaching is underpinned by positive interactions between pupils, their teachers and their peers.	X	X				
2.	Effective teaching has a long-term positive effect on pupils' life chances, particularly for pupils from disadvantaged backgrounds.	X	X				
3.	Explicitly teaching pupils the knowledge and skills they need to succeed within particular subject areas is beneficial.	X					
4.	There is a difference in the process of knowledge acquisition in the brain of a pupil with lesser prior knowledge vs. the brain of a pupil with more prior knowledge.	X	X				
5.	It is beneficial to use explicit teaching strategies when introducing content to pupils with lesser prior knowledge. Self-directed approaches are ineffective for pupils with lesser prior knowledge.	X	X				X
6.	The cognitive process of learning (including how the brain moves information through working memory into long-term memory) is central to learning.	X	X				
7.	Working memory is where information that is being actively processed is held and its capacity is limited and can be overloaded.	X	X				
8.	There are several effective teaching practices to reduce cognitive overload (e.g., explicit instruction, scaffolding, clearly structured content, chunked into manageable steps, that connects new information to prior learning and reducing distractions that take attention away from what is being taught).	X	X				
9.	Long-term memory can be considered as a storeroom of knowledge that changes as pupils learn by integrating new ideas with existing knowledge.	X	X				
10.	Committing some key facts to their long-term memory is likely to help pupils learn more complex ideas.	X	X				X
11.	Pupils with greater prior knowledge have developed more mental models and schemas than pupils with lesser prior knowledge.	X	X				
12.	A pupils' brain develops from early childhood through to young adult, including the development of executive functions and the implications for teaching.		X				
13.	Learning involves a lasting change in pupils' capabilities or understanding.	X					
14.	Effective teaching can transform pupils' knowledge, capacities and beliefs about learning.	X					
Theoretical underpinning from educational or cognitive psychology (Graesser et al., 2008): Manageable cognitive load; Coherence effect; Segmentation principle; Discovery learning.							
Principle 1: Activating and using prior knowledge							
15.	The brain applies prior knowledge from long-term memory to learn new information and to achieve complex skills (such as critical thinking, problem solving, reading comprehension) by accessing memory or combining and re-combining memory to generate possible solutions.	X	X				

Table A1. *Cont.*

	Instructional Principle (Learn that . . .)	ITTECF (2024)	Strong Beginnings (2023)	Creemers and Kyriakides (2011)	Praetorius et al. (2018)	Seidel and Shavelson (2007)	Rosenshine and Stevens (1986)
16.	When prior knowledge is weak, pupils are more likely to develop misconceptions, particularly if new ideas are introduced too quickly.	X					
17.	*Structure tasks and ask questions to identify past learning, prior knowledge gaps and misconceptions.*	X					X
18.	*Identify pupils' prior knowledge when introducing new material and planning how much new information needs to be introduced.*	X	X			X	X
19.	*Link what pupils already know to what is being taught (e.g., explaining how new content builds on what is already known).*	X	X			X	
20.	*Identify possible misconceptions.*	X	X				
21.	*Plan to prevent forming misconceptions.*	X					
22.	*Provide additional pre-teaching if pupils lack critical prior knowledge.*	X					
23.	*Pitch an introductory lesson before starting a unit of work at an appropriate level after identifying what they know or think they know.*		X				
	Theoretical underpinning from educational or cognitive psychology (Graesser et al., 2008): Coherence effects; Segmentation principle; Goldilocks principle; Discovery learning.						
	Principle 2: Clear, structured and challenging learning environment						
24.	*Begin instruction of content and task through using a clear explanation of what pupils are expected to learn or to do.*		X	X		X	X
25.	*Checking pupils' understanding of instructions before a task begins.*	X					
26.	*Reduce distractions that take attention away from what is being taught (e.g., keeping the complexity of a task to a minimum, so that attention is focused on the content).*	X		X			
27.	Well-structured teacher talk can support pupils to articulate key ideas, consolidate understanding and extend their vocabulary.	X					X
28.	The use of structured lessons with small, manageable steps reduces cognitive load.	X	X			X	X
29.	Pupils with less prior knowledge need more structure early in a domain than pupils with greater prior knowledge do.	X	X				
30.	A well-sequenced and structured curriculum is important to ensure that pupils have the prior knowledge they need to master new ideas.	X	X				X
31.	Ensuring pupils master foundational concepts and knowledge before moving on is likely to help them succeed.	X	X		X		X
32.	*Balance input of new content in a way that pupils can master foundational concepts and knowledge before moving on.*	X	X		X		X
33.	*Plan and sequence content and tasks in a sequence of lessons.*	X	X	X		X	
34.	*Start expositions at the point of current pupil understanding.*	X	X		X		
35.	*Deliver lessons in a clear and structured way.*	X	X		X		X
36.	*Introduce new material, chunked into manageable steps, to focus pupils' attention on those specific steps.*		X	X		X	X
37.	*Deliver instructions with well-defined goals.*						

Table A1. *Cont.*

	Instructional Principle (Learn that . . .)	ITTECF (2024)	Strong Beginnings (2023)	Creemers and Kyriakides (2011)	Praetorius et al. (2018)	Seidel and Shavelson (2007)	Rosenshine and Stevens (1986)
38.	*How to produce and use developmental rubrics with criteria tailored to the specific task and/or work samples so that pupils understand what is expected.*		X				
39.	Clear and high teacher expectations have a positive impact on pupils' achievements.	X	X			X	
40.	Setting goals and tasks that stretch pupils within a challenging, but still achievable, curriculum has a positive impact on pupil outcomes.	X					
41.	*Plan and sequence content and tasks that build upon each other within a lesson so that they become increasingly challenging.*	X	X				
42.	*Use intentional and consistent language that promotes high expectations.*	X					
43.	*Creating a positive environment where making mistakes and learning from them and the need for effort and perseverance are part of the daily routine.*	X			X	X	
44.	*Adapt lessons, whilst maintaining high expectations for all, so that all pupils have the opportunity to meet expectations.*	X			X		
	Theoretical underpinning from educational or cognitive psychology (Graesser et al., 2008): Contiguity effects; Manageable cognitive load; Segmentation principle; Goldilocks principle;						
	Principle 3: Modelling, worked and concrete examples						
45.	Modelling helps pupils understand new processes and ideas. It attends best to how pupils' brains learn.	X	X	X	X	X	X
46.	Worked examples that take pupils through each step of a new process are likely to support pupils in learning.	X	X				
47.	Worked examples should be gradually removed as pupil expertise increases.	X	X				X
48.	Good models and concrete representations of abstract ideas make new content accessible.	X					X
49.	*Teach key concepts through a range of worked examples, modelling examples, and concrete examples.*	X					
50.	*Make steps in a process more memorable by teacher modelling (e.g., by explicitly naming them, developing mnemonics, linking them to stories).*	X					X
51.	*Use powerful analogies, illustrations, examples, explanations and demonstrations.*	X					X
52.	*Explicitly model new skills and content through (partially) worked examples to focus on the specific steps and to demonstrate clearly how to complete a task or to execute a skill.*	X	X				
53.	*Remove worked and concrete examples progressively/slowly as pupils become more proficient.*	X	X				
54.	*Meet individual needs by removing unnecessary expositions of content.*	X					
55.	*Interleave concrete and abstract examples, slowly withdrawing concrete examples and drawing attention to the underlying structure of problems and deconstructing this approach.*	X			X		
	Theoretical underpinning from educational or cognitive psychology (Graesser et al., 2008): Stories and example cases; Multiple examples; Anchored learning						
	Principle 4: Activating and generative learning						
56.	Complex skills (e.g., independent problem-solving) are only effective once a student approaches proficiency (i.e., after ample opportunities to practise progressively challenging tasks).	X	X				X

Table A1. *Cont.*

	Instructional Principle (Learn that . . .)	ITTECF (2024)	Strong Beginnings (2023)	Creemers and Kyriakides (2011)	Praetorius et al. (2018)	Seidel and Shavelson (2007)	Rosenshine and Stevens (1986)
57.	Paired and group activities can increase pupil success, but to work together effectively, pupils need guidance, support and practice.	X					
58.	How pupils are grouped is also important; care should be taken to monitor the impact of groupings on pupil attainment, behaviour and motivation.	X					
59.	*Stimulate student thinking by designing generative activities (such as summarising, mind mapping) with just enough support so students experience a high success rate.*	X					
60.	*Stimulate student thinking through effective collaborative or paired work.*	X		X		X	
61.	*Stimulate student thinking through a range of types of questions in class discussions to extend and challenge pupils (e.g., by modelling new vocabulary or asking pupils to justify answers).*	X	X	X	X	X	X
62.	*Provide scaffolds for pupil talk to increase focus and rigour of practice.*	X					
63.	*Stimulate student thinking by planning activities around what you want pupils to think hard about.*	X	X	X	X	X	X
64.	*Stimulate student thinking by using effective questioning that encourages participation.*	X		X	X		
65.	*Providing appropriate waiting time between questions and responses where more developed responses are required.*	X					
	Theoretical underpinning from educational or cognitive psychology (Graesser et al., 2008): Generation effect; Explanation effects; Deep questions.						
	Principle 5: Checking for students' understanding						
66.	Questioning can be used to assess pupils current understanding.	X					X
67.	Effective assessment is critical to teaching because it provides teachers with information about pupils' understanding and needs.	X	X	X	X		X
68.	Effective assessment is critical to teaching because it provides teachers the opportunity to inform the decisions they make.	X	X				X
69.	Effective assessment helps teachers avoid being over-influenced by potentially misleading factors, such as how busy pupils appear to be.	X					
70.	Before using any assessment, teachers should be clear about the decision it will be used to support and be able to justify its use.	X					
71.	*Use formative assessment practices (such as exit tickets, quick quizzes, or other forms of questioning, hinge questions) to assess what students know as learning is taking place.*	X	X				X
72.	*Use formative assessment practices (such as exit tickets, quick quizzes, or other forms of questioning) to prompt pupils to identify common misconceptions and systematic errors while learning is taking place.*	X	X				X
73.	*Plan formative assessment activities linked to lesson objectives.*	X					
74.	*Plan ahead which answers on formative assessment activities would indicate understanding.*		X				
75.	*Help pupils understand the progression of skills needed to attain mastery.*						
76.	*Design and use summative assessment to assess students against a standard or benchmark to gain an understanding of the level of mastery attained.*	X	X				
77.	*Use externally validated materials when making summative assessments.*	X					

Table A1. *Cont.*

	Instructional Principle (Learn that . . .)	ITTECF (2024)	Strong Beginnings (2023)	Creemers and Kyriakides (2011)	Praetorius et al. (2018)	Seidel and Shavelson (2007)	Rosenshine and Stevens (1986)
78.	*Draw conclusions about what pupils have learned by looking at patterns of performance over a number of assessments.*	X					
Theoretical underpinning from educational or cognitive psychology (Graesser et al., 2008): Negative suggestion effects; Testing effects.							
Principle 6: Scaffolding							
79.	Pupils are likely to learn at different rates and to require different levels and types of support from teachers to succeed.	X			X		
80.	Scaffolding practices (e.g., guides or worked examples) support pupils' learning as they attend to how pupils' brains learn.	X	X				
81.	Adapting teaching in a responsive way, including by providing targeted support to pupils who are struggling, is likely to increase pupil success.	X	X		X		X
82.	It is a common misconception that pupils have distinct and identifiable learning styles. Thus, attempting to tailor lessons to learning styles is unlikely to be beneficial.	X	X				
83.	Seeking to understand pupils' differences, including their different levels of prior knowledge and potential barriers to learning, is an essential part of teaching.	X	X				
84.	*Design practices and tasks that provide just enough support so that pupils experience a high success rate when attempting challenging work.*	X	X		X		
85.	*Meet individual needs by including additional practices.*	X					
86.	Scaffolds (e.g., guides or worked examples) should be gradually removed as pupils become more proficient.	X	X				
87.	*Increase challenge by removing scaffolds only when pupils are achieving a high degree of success in applying previously taught material.*	X	X				
88.	Adaptive teaching is less likely to be valuable if it causes the teacher to artificially create distinct tasks for different groups of pupils or to set lower expectations for particular pupils.	X					
89.	Flexibly grouping pupils within a class to provide more tailored support can be effective, but care should be taken to monitor its impact on engagement and motivation, particularly for low attaining pupils.	X					
90.	Students' perception that groups are fixed should be avoided.	X					
91.	*Group pupils into groups effectively based on specific attainment subject.*	X					
92.	The fundamental elements and underpinning theory of a multi-tiered system of support and why it is effective.		X				
93.	How a multi-tiered framework works in a classroom setting, with the opportunity to observe additional or adapted support in the implementation of this multi-tiered framework.	X	X				
94.	Positive impact of high-quality instruction (tier 1) delivered by the classroom teacher as a protective measure reduces the need for further intervention.		X				
Theoretical underpinning from educational or cognitive psychology (Graesser et al., 2008): Goldilocks' principle							
Principle 7: Spaced practice opportunities							

Table A1. *Cont.*

	Instructional Principle (Learn that . . .)	ITTECF (2024)	Strong Beginnings (2023)	Creemers and Kyriakides (2011)	Praetorius et al. (2018)	Seidel and Shavelson (2007)	Rosenshine and Stevens (1986)
95.	Regular purposeful spaced practice of what has previously been taught helps to consolidate material and help pupils remember what they have learned.	X	X				X
96.	Requiring pupils to retrieve information from memory is likely to strengthen recollection.	X	X				X
97.	*Use effective practice opportunities (e.g., spaced practice and retrieval practice) to build automatic recollection and application of key knowledge and concepts.*	X	X	X			X
98.	*Plan a sequence of lessons that incorporate spaced practice, with several opportunities to practice.*		X				X
99.	*Incorporate ample opportunities to review and practice content, spaced in time.*	X	X				X
100.	*Increase challenge with practice by increasing spacing intervals.*	X	X				X
101.	*Plan a sequence of lessons that incorporates retrieval practice.*						
	Theoretical underpinning from educational or cognitive psychology (Graesser et al., 2008): Testing effect; Spacing effect; Desirable difficulties						
	Principle 8: Feedback						
102.	High-quality feedback can be written or verbal; it is likely to be accurate and clear, encourage further effort, and provide specific guidance on how to improve.	X	X		X		
103.	High-quality feedback should support pupils in monitoring and regulating their own learning over time.	X					
104.	Pupils must be able to act on feedback for it to have an effect.	X			X		
105.	Appreciation of pupils' responses to feedback can vary depending on a range of social factors (e.g., the message the feedback contains or the age of the child).	X					
106.	*Use feedback that acknowledges student effort.*	X	X		X		
107.	*Provide feedback as learning is taking place that is specific, honest, accurate, constructive, and clear.*	X	X		X		X
108.	*Prioritise the highlighting of errors related to misunderstandings, rather than careless mistakes, when marking.*	X					
109.	*Use abbreviations and codes in written feedback to reduce the cost of marking and giving feedback.*	X					
110.	*Scaffolding self-assessment by sharing model work with pupils, highlighting key details.*	X					
111.	*Using verbal feedback during lessons in place of written feedback after lessons where possible.*						
	Theoretical underpinning from educational or cognitive psychology (Graesser et al., 2008): Feedback effects; Negative suggestions effects.						
	Multimodal instruction						
112.	*Combine a verbal explanation with a relevant graphical representation of the same concept or process, where appropriate.*	X			X		X
113.	*Making use of well-designed resources.*	X	X				
114.	*Offer information in one place and at one time.*						

Table A1. *Cont.*

Instructional Principle (Learn that . . .)	ITTECF (2024)	Strong Beginnings (2023)	Creemers and Kyriakides (2011)	Praetorius et al. (2018)	Seidel and Shavelson (2007)	Rosenshine and Stevens (1986)
Theoretical underpinning from educational or cognitive psychology (Graesser et al., 2008): Contiguity effects; Dual code and multimedia effects; Coherence effect.						
Metacognition						
115. Explicitly teaching pupils metacognitive strategies linked to subject knowledge, including how to plan, monitor and evaluate; supports independence and academic success.	X			X		
116. *Model thought processes to make explicit how experts think (e.g., asking questions aloud that pupils should consider when working independently and drawing pupils' attention to links with prior knowledge).*	X		X	X		
117. *Exposing potential pitfalls and explaining how to avoid them.*	X					
Theoretical underpinning from educational or cognitive psychology (Graesser et al., 2008): Imperfect metacognition; Self-regulated learning						

Note. *italic = procedural knowledge*.

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