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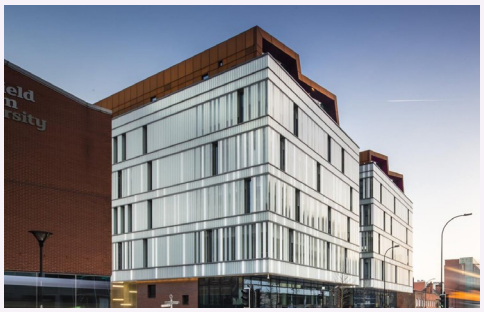
Leadership for professional development: supporting schools and empowering teachers to be professional development ready

Making change happen in teacher professional development

Strand Report 1



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Summary

In this research study, our intention was to develop greater understanding of how to make change relating to teacher Professional Development (PD) happen, through:

- the implementation of professional development innovations and programmes in relation to policy, teacher entitlements and the school environment;
- the leadership of processes, practices and conditions which underpin and support change.

We wanted to understand the actions, behaviours, policies and practices which support the effective implementation of professional development at multiple system levels. In identifying these 'mechanisms for change', we hope to support stakeholders including school leaders, teachers and policy makers in making decisions which lead to sustained, embedded improvement in teachers' professional development in England.

We used a mixed methods approach combining three complementary strands of research: a systematic review of the national and international literature, which is the focus of this report, interviews with leaders of 'Hub' models of professional development in science and mathematics (Department for Education, 2023), and primary data collection with schools in England looking at the implementation of teacher PD in the current school context.

In this strand of the study, we aimed to gain understanding of factors within the school environment which influence the implementation of professional development in schools and what school leaders can do to help create environments where teachers are able to engage in and implement their learning from professional development. We carried out a systematic literature review, looking at national and international literature from education and other professional contexts, using theoretical framings relating to professional development and change readiness. Through a rigorous search and analysis process, we mapped the field of professional development implementation in the school environment, looking at a range of studies across different national and school contexts and forms and content of professional development.

We understood leadership in terms of role and process, rather than formal function, thereby including senior leaders, middle leaders and teachers as leaders driving and implementing professional development with and for their staff. Therefore, the review recommendations deliberately do not focus on different leader roles and hierarchies, but rather capture and codify what the role of professional development leader at any level in the school may look like.

Our findings offer insights into the body of evidence which currently exists for the leadership of professional development within the school environment, highlighting the prevalence of particular forms of research, reported outcomes and types of professional development. We identify three leadership dimensions: trusting leadership, engaged leadership and learning leadership. Through these dimensions, our findings demonstrate the complex role of school leaders in the implementation of professional development, navigating balances of formal and informal roles, direction and autonomy, and individualisation and collaboration. Using evidence from the literature we analysed, we explore how school leaders can adopt policies and practices which build a shared vision for professional development and set its direction, promote and maintain participation in professional development activities, and improve teachers' engagement in professional development.

Introduction

Background to the study

Teacher professional development is important. There is a strong, and growing, international consensus that teacher professional development leads to improvements in teaching and thereby improved educational outcomes for children and young people (OECD, 2019). Effective engagement with good professional development can lead to changes in teachers' practice, increased pupil attainment and is associated with positive career experiences and retention (Coldwell, 2017; Day & Gu, 2010; Fischer et al., 2018; Meissel et al., 2016).

In spite of this body of evidence around teacher professional development, there continues to be limited sustained movement, in England at least, towards a goal of all teachers being able to participate in high quality professional development throughout their careers (Fletcher-Wood & Zuccollo, 2020; Van Den Brande & Zuccollo, 2021). To address this, greater understanding is needed of how to make change happen.

Our approach

Through this study, our intention was to develop greater understanding of how to make change relating to teacher professional development happen, through:

- the implementation of professional development innovations and programmes in relation to policy, teacher entitlements and the school environment;
- the leadership of processes, practices and conditions which underpin and support change.

We wanted to understand the actions, behaviours, policies and practices which support the effective implementation of PD at multiple system levels. In identifying these 'mechanisms for change', we hope to support stakeholders including school leaders, teachers and policy makers in making decisions which lead to sustained, embedded improvement in teachers' professional development in England.

This study, carried out over two years, was funded by Wellcome (grant reference 224016/Z/21/Z). A mixed-methods approach (Table 1) combined three complementary strands of research. These were: a systematic review of the national and international literature, interviews with leaders of 'Hub' models of professional development in science and mathematics (Department for Education, 2023), and case studies of schools in England looking at the implementation of teacher professional development in the current school context.

The study followed Sheffield Hallam University ethical protocols, receiving approval from the university research ethics committee[1] (references ER43465841 and ER43438613). All participants in data collection gave informed consent before completing surveys, interviews or focus groups. Further details of ethical protocols relevant to this strand of the study are given below.

1 Sheffield Hallam University Research Ethics and Integrity webpages: www.shu.ac.uk/research/excellence/ethics-and-integrity

Table 1. Our approach to the study

Strand 1	Leadership for professional development: supporting schools and empowering teachers to be PD ready	Systematic evidence review of national and international research	Identifying what is known about leadership in the school environment that has led to sustained, effective teacher professional development
Strand 2	System leadership: policy implementation in mathematics and science professional development	Analysis of policy implementation in mathematics and science professional development	Exploring 'Hub' models of professional development in science and mathematics, and mapping the implementation of large-scale, sustained policy initiatives relating to professional development for teachers of STEM subjects
Strand 3	Embedding change: leadership of professional development in English schools	Primary mixed methods data collection: survey and case studies	Understanding the leadership of teacher professional development in the current school context in England

Theoretical framing

We drew on previous research, such as that mentioned above, relating to professional development and its leadership. In addition, we applied insights from theory-based evaluation, implementation science and systems and complexity theory (Belcher et al., 2020; Maxwell et al., 2022; Nilsen & Birken, 2020) to explore how change relating to professional development can be embedded in practice. We also used information about how research evidence can be used to support decision-making in policy and practice (Langer et al., 2016). These approaches acknowledge and work with the complexity inherent in the education system, enabling professional development to be examined in relation to other parts of the system.

The importance of leadership

As the study progressed, leadership of professional development emerged as an essential repeating theme operating across multiple system levels. Therefore, we chose to investigate, in depth, this aspect of professional development as being of major importance, especially since it has often been overlooked and under-represented in research.

The professional development leadership roles we identified and explored included:

- practitioners who have specific professional development leadership roles, both internal and external to schools, such as in-school PD leads and those who design and facilitate professional development activities, workshops and courses (Perry & Boylan, 2018)
- school senior leaders and headteachers whose roles include responsibility for or oversight of professional development

The ways in which leadership is conceptualised within each strand of the study vary depending on its particular focus, but the common themes for investigation included:

- the formal and informal roles of professional development leaders
- the processes and resources which support professional development leaders to carry out their roles
- the processes and practices by which professional development leaders support others in their professional development
- the interactions between professional development leadership at different system levels

This focus on leadership is not to downplay the importance of other aspects of PD implementation. Instead, our intention was to identify how leaders of professional development at multiple system levels can support its successful implementation, and thereby contribute significant learning about this vital, but often under-valued, aspect of professional development.

Reporting

A summary report brings together findings from the three strands of the study. This includes a detailed background to the study including the research and policy landscape of teacher professional development, further details of our overarching approach and theoretical framing, a summary of each strand's major findings, a synthesis of those findings, their implications for policy and practice and recommendations for policy makers, school leaders and other stakeholders, and for further research. Meanwhile, the project website[2] contains summaries of emerging findings and outputs from dissemination events.

Each strand of the study has its own report, which describes in detail its aims, methods, findings and implications. This report focusses on Strand 1, in which we carried out a systematic literature review, looking at national and international literature from education and other professional contexts, using theoretical framings relating to professional development, and change readiness (Kwakman, 2003; T. Wang et al., 2023; Weiner, 2009).

In the next section, we describe the methodology and theoretical framing of the review. We then look at each of the three phases of the review in turn, summarising the methods used to identify, code and analyse the literature and describing the findings of each phase. This includes, in the final phase, the identification of three leadership dimensions (trusting leadership, engaged leadership and learning leadership) and eleven associated themes which exemplify the findings of our analysis. Following this, we consider the limitations of our approach. We end by drawing together the findings from each phase of the study into a series of recommendations for further research and for school leaders' implementation of professional development.

2 https://research.shu.ac.uk/psemc/

Leadership for professional development implementation in the school environment

In this strand of the study, we set out to deepen our understanding of the implementation of teacher professional development in relation to the school environment through an extensive systematic review of the national and international literature. The review purpose was to identify how successful continuing professional development implementation in different educational contexts relates to affordance and constraints within the school environment, particularly those influenced by school staff, including school leadership.

In the studies included in our review, leadership qualities and procedures were regularly mentioned as factors affecting the implementation of continuous professional development. The significance of leadership in the successful implementation of professional development was also evident in the other project strands. Therefore, in this strand of the study, we examined the role of leadership closely, with the aim of identifying what school leaders can do to create school environments where teachers are able to engage in and implement their learning from professional development. We acknowledge the influence of the wider socio-political and policy context on professional development implementation, but these broader contextual factors were beyond the scope of this review.

Methodology

The systematic review was guided by the following research questions (RQ):

> **RQ1:** What research literature exists that investigates how the school environment influences teachers' ability to engage in professional development or their professional development outcomes?
>
> **RQ2:** What attributes, actions and mechanisms underpin effective leadership for professional development implementation in relation to the school environment?

The Preferred Reporting Items for Systematic review and Meta-Analysis Protocols (PRISMA) 2020 checklist (Page et al., 2021) was used to develop the protocol for the review, modifying this where needed in accordance with the specific focus and mixed-method nature of the review.

Defining professional development

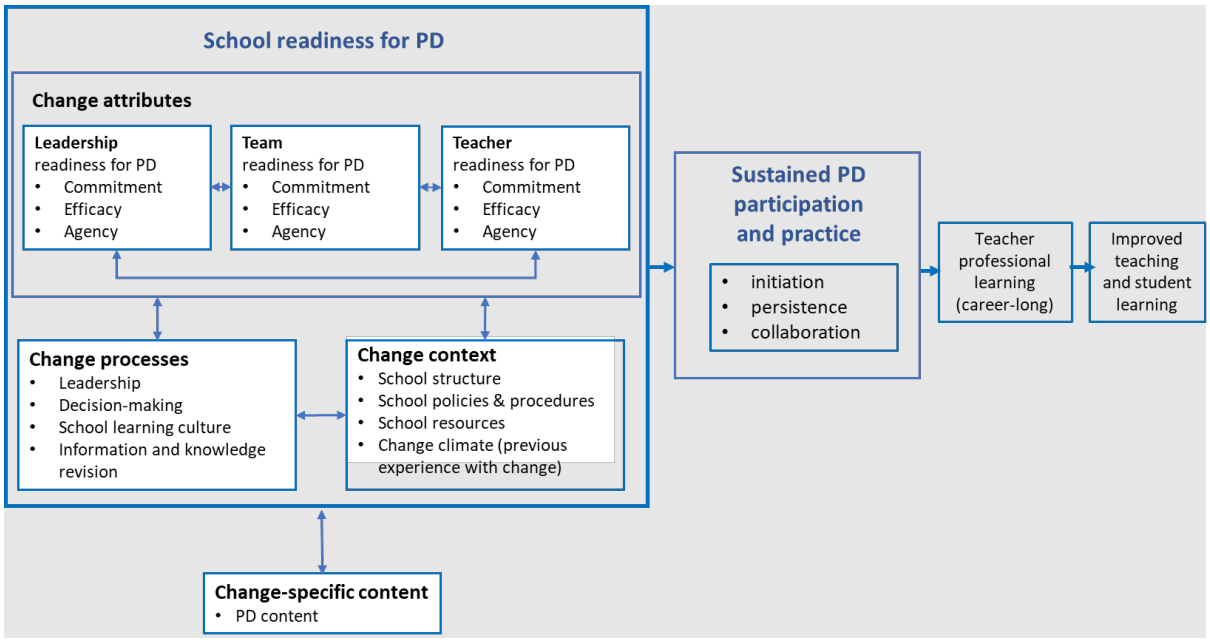
In this strand of the study, we adopted a working definition of teacher professional development (PD) that builds on work by Stoll et al. (2006) and defines this broadly as a teacher learning event that "*enhance[s] teachers' effectiveness as professionals, for pupils' ultimate benefit*" (p229). We use 'event' deliberately to encapsulate both the idea of PD as a specific event or events (e.g. training, meeting) that intend to lead to teacher learning, and the idea of teacher learning itself as an event. These 'events' can be formal, informal, or incidental in nature, and the change brought about through professional development can be transformational or incremental.

Our use of 'teacher professional development' and 'teacher learning' implies a focus on *qualified* teachers and thus on *continuing* professional development events rather than initial teacher education or training. Moreover, this definition highlights that the ultimate outcome of teacher PD should be experienced by pupils, even though there are intermediate outcomes pertaining to the capacities of teachers (i.e., teacher change) as well as the wider school environment (i.e., school change). This definition also highlights that, while we acknowledge that continuing professional development can include single training events, our interest lies in understanding how more active and consistent professional development based in the teaching environment can be implemented, either to embed learning from specific training events within practice or to strengthen and sustain any formal, informal, and incidental teacher learning occurring within the school.

Theoretical framing: change readiness

The conceptual framework guiding the systematic review (Figure 1) draws on change readiness theory (Kwakman, 2003; T. Wang et al., 2023; Weiner, 2009), implementation science (Century et al., 2012) and complexity theories (Maxwell et al., 2022). We viewed teachers' ability to engage in professional development and to successfully implement change in their practice as an emergent property of a complex system, in that "organizational structures and resource endowments shape [teachers'] readiness perceptions" (Weiner, 2009, p3).

Figure 1. Theoretical framework of school readiness for continuing professional development guiding the systematic review



We adopted Holt et al.'s (2007, p.326) conceptualisation of change readiness as:

> a comprehensive attitude that is influenced simultaneously by the content (i.e., what is being changed), the process (i.e., how the change is being implemented), the context (i.e., circumstances under which the change is occurring), and the individuals (i.e., characteristics of those being asked to change) involved and collectively reflects the extent to which an individual or a collection of individuals is cognitively and emotionally inclined to accept, embrace, and adopt a particular plan to purposefully alter the status quo.

In this way, teacher professional development is understood as occurring within and influenced by schools as learning communities (Clarke & Hollingsworth, 2002) that can be more or less ready for change, rather than as a primarily individual and cognitive activity. In other words, teacher readiness for PD is nested within overall school readiness for PD.

The literature on change readiness (Kwakman, 2003; T. Wang et al., 2023; Weiner, 2009) suggests that teachers' readiness to participate in professional development comprises at least three key socio-psychological change attributes (Table 2). Moreover, the concept of change readiness lies at the heart of understanding sustained engagement and participation in PD, as the precursor to change-related behaviours such as initiation, persistence, and cooperation (Weiner, 2009), both in the short and longer term (Holt et al., 2007).

Table 2. Key socio-psychological change attributes underpinning teachers' readiness to participate in professional development

Change attribute	Socio-psychological definition
Change commitment	Stems from valence or the perceived value of the change or professional development for themselves, the school and the pupils
Change efficacy	Stems from teachers' appraisal of the task demand, resource availability and other situational factors
Change agency	Stems from teachers' feelings of control over the change or professional development

Building from this framing, we defined teacher readiness for professional development as the extent to which a teacher or team of teachers are cognitively and emotionally prepared and willing to engage in PD to purposefully improve the quality of teaching and pupil outcomes. The readiness of teachers or teaching teams, in turn, emerges in interaction with the change characteristics or attributes associated with school leadership, various school internal change processes and the more structural and procedural school conditions associated with the change context.

We focused on professional development implementation as a process rather than on the PD innovation *per se*. We draw here on Century et al.'s (2012) distinction that defines the 'implementation process' as "the contextual factors that contribute to and/or inhibit the innovation implementation" (Century et al., 2012, p344), separating it from 'innovation implementation' or "the status of the innovation [and] the extent to which the innovation itself is enacted, in whole or part [...] particularly when [...] compared to an intended model". The school processes and conditions underpinning teachers' ongoing participation in professional development include factors associated with school learning mechanisms and learning culture, school policies, resources (Schechter & Mowafaq, 2013), leadership, shared vision and decision-making processes, as well as past experience with change (Geijsel et al., 2009; Weiner, 2009).

This review was conducted to gain a clearer, systematic picture of the school processes and conditions affecting teachers' participation in PD, and how these could be positively steered by school leaders and staff to improve the engagement and uptake of PD events. Therefore, while acknowledging the impact of the *change content* (i.e. the PD content and model) as a factor affecting teachers' commitment to PD, we focused on the *change attributes*, *change processes*, and *change context* that make up the school environment, as impacting on teachers' *change attributes* (i.e. commitment, efficacy and agency) in relation to PD, as well as, subsequently, on their PD outcomes.

Search strategy

An extended literature search was conducted in peer-reviewed journals in multiple education and business and management databases within ProQuest, Ebscohost, Web of Science, Scopus and Emerald Insight. Our searches combined each of the two key concepts of 'school environment' and 'change readiness', with 'continuing

professional development (CPD)', these being our main search terms. We used the in-built thesauri of the databases to explore relevant alternative terms (Table 3), to include studies with a similar focus but alternative wording. To ensure that informal learning events were included alongside formal ones, we specifically added a list of known school-based professional development activities and processes, such as 'professional learning communities' and 'communities of practice'.

Table 3. Main and alternative search terms

Main term	Relevant alternative terms
School environment	"educational environment" OR "school support" OR "school culture" OR "school climate" OR ("school structure" OR "school structures") OR "school organisation" OR "school administration"
Change readiness	"teacher readiness" OR "staff readiness" OR "organisation* readiness" OR "readiness to change" OR "organisation* change
Continuing professional development	"continuing professional development" OR "professional development" OR "professional learning" OR "professional education" OR "professional training" OR "teacher improvement" OR "teacher education" OR "professional learning community" OR "community of practice" OR "peer collaboration" OR "peer coach*" OR ("peer mentor" OR "peer mentoring" OR "peer mentors")

'Change readiness' is a concept that has been relatively little explored within education research, and more extensively within business and management. We hoped that studies published in business and management journals might provide insight into the attributes, actions and mechanisms underpinning leadership for change readiness and successful organisational change involving professional development. While our primary focus was on studies of educational change management and the readiness of education professionals, our searches pertaining to 'change readiness' were open to studies involving the continuing professional development of professionals from other disciplines, such as nursing. However, our focus on the environment and context of change in the appraisal and screening process meant that studies from non-education disciplines became less relevant and were ultimately excluded from the search. The final sample of papers subjected to full text analysis (n=100) includes a large proportion (n=30) that were published in journals dedicated to educational change, administration or management.

All searches focussed on roughly the last ten years, to ensure that our findings would reflect current or recent educational context, and with that current teacher professional development needs and realities. Lastly, to avoid narrowing the scope of the evidence base too early in the process, we deliberately did not search on 'leadership'. Instead, a more judicious approach was adopted, whereby the relevance of a study on teacher professional development in relation to the school environment or school change to the second research question was determined through a manual assessment on the bases of paper title and abstract (described below). These initial searches resulted in 8063 papers being returned, with 1857 of these being duplicates.

Inclusion criteria and screening

The remaining 6206 papers were subject to repeated rounds of screening based on title and abstract, in order to assess their relevance or not, to the review. The full list of criteria used to screen articles for inclusion are summarised in Table 4.

Table 4. Inclusion and exclusion criteria

Criteria	Description
Date range	2012 (Jan) - 2022 (May)
Scope	*Included* Studies reporting on: 1. the enactment or implementation of a formal PD intervention or interventions for in-service teachers, or 2. a school-based teaching and learning innovation that included a focus on: a. the professional learning of teachers, both formal or informal, or b. a professional development strategy or plan as part of the innovation (see note).
	Excluded Studies focused primarily on PD content or design, and without explicit implementation support as part of this design. Studies exploring teacher's engagement in professional development through social media, as this form of professional development is primarily individual and occurs beyond the boundary of the school.
Geographical range	*Included* Studies from the UK, USA, Canada, Australia, and Europe. Studies conducted in Hong Kong, Singapore, Japan and Shanghai, given their track record of excellence in education and what can be learned about effective PD implementation from those contexts.
	Excluded Studies in countries with substantially different educational systems and contexts, and therefore teaching realities and teacher needs, than England.
Methodology	*Included* Both quasi-experimental and case studies and both quantitative and qualitative studies.

Criteria	Description
	Review studies were included but analysed and interpreted separately from the empirical studies.
	Excluded Theoretical studies

Note: Where studies from other professional fields are considered, the words 'teachers' and 'school-based teaching and learning innovation' were replaced by the broader categories of 'staff', and 'work-based organisational change or reform'.

With regards to geographical range, exclusion of studies was not decided simply on country name. Instead, the relevance of learning from contexts other than those listed in the inclusion criteria was manually assessed based on a reading of the abstract as a whole and more detailed information about the study (e.g. population, socio-economic profile, policy context, school phase, similar strengths/weaknesses of the given educational context). The final sample of papers subjected to full text analysis (n=100) includes two studies from Israel, because of their primary focus on leader involvement in school-based professional learning.

Screening, and all subsequent coding, was done using EPPI Reviewer Web (Thomas et al., 2010). Five members of the review team screened the papers on title and abstract. Interrater reliability was established on a subset of papers (15% of total) using Cohen's Kappa (Cohen, 1960), the statistic most frequently employed to evaluate nominal agreement between two raters (Warrens, 2015). Cohen's Kappa ratings across the team ranged from moderate (0.53) to substantial (0.68; 0.71; 0.79) to almost perfect (0.80) agreement. Following these steps, 634 papers remained, which were subjected to three phases of coding and analysis, described below.

Coding, analysis and findings

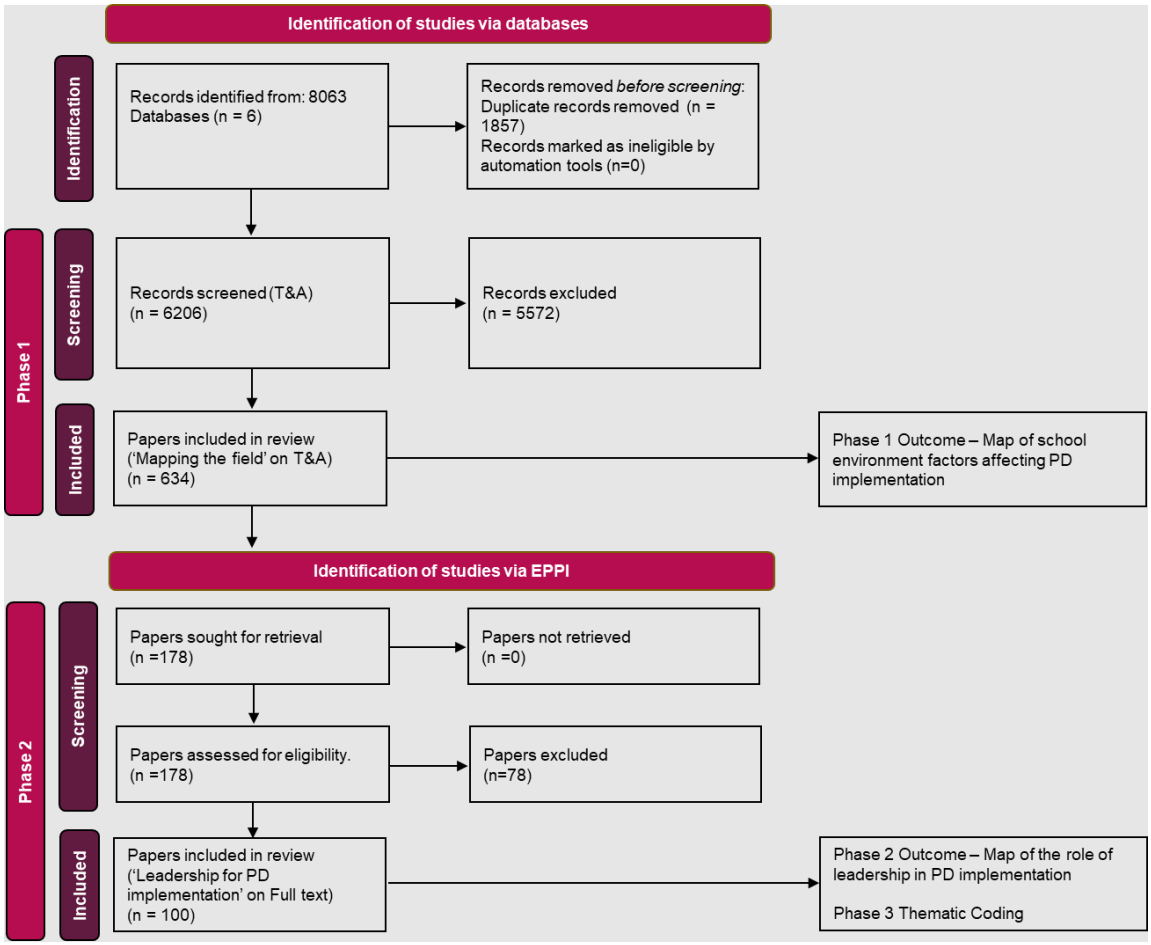
We carried out coding and analysis in three phases (Table 5), looking at each research question in turn and narrowing the focus of the review as it progressed. Phase 1 involved coding papers using their title and abstract, in order to map the field of study. Phase 2 took the full text of papers and analysed them against a framework of leadership of professional development implementation. A final set of 100 papers were then further analysed in detail against a set of leadership dimensions. Phase 1 and 2 were conducted using EPPI, while Phase 3 involved thematic coding of the categorised full text data exported from EPPI.

Table 5. Three phases of coding and analysis

Phase 1	Mapping the field of literature	Coding on title and abstract
Phase 2	Mapping the role of leadership in PD implementation	Coding on full text
Phase 3	Analysing the role of leadership in PD implementation	Thematic coding against leadership dimensions

Figure 2 presents a modified PRISMA flow diagram (Page et al., 2021), providing an overview of the exclusion and inclusion process of the systematic review.

Figure 2. PRISMA flow diagram of the systematic review



Next, we present the methods and findings of each phase of the analysis in turn, giving a detailed description of the process of coding and analysis and the frameworks used and presenting the findings of each phase of the analysis alongside its methods. At the end of each phase, we provide a summary of the findings.

Phase 1: Mapping the field

Phase 1: Coding and analysis

We firstly categorised the 634 included studies by methodology, according to whether each adopted a quantitative, qualitative, mixed-methods or review approach. Next, we focused on organising the studies based on title and abstract, according to the socio-psychological attributes, sociocultural processes and structural conditions comprising the school environment (Figure 1). This coding had the aim of identifying more fertile areas, as well as gaps, for more detailed exploration on specific attributes, actions and mechanisms at the level of the full text. This approach provided global insight into the range of factors, and their relative frequency, within the professional development and school environment literature, as well as into the methods commonly used to investigate the phenomenon.

For this coding, we drew on Century and colleagues' (2012) extensive work on the measurement of the implementation of educational programmes. Their framework identifies factors, processes and mechanisms in relation to the characteristics of three spheres of influence on implementation. We adapted this for our analysis, leading to four codes relating to the implementation of professional development in the school environment (Table 6). Our codes were not mutually exclusive: studies could be coded under more than one main and sub-code based on their title and abstract. The full coding frame and its translation from Century et al.'s framework are detailed in Appendix 1.

Table 6. Adaptation of Century et al.'s (2012) spheres of influence on innovation implementation and their application in the review

Sphere of influence on innovation implementation	Systematic review main code
Characteristics of the innovation	Characteristics of the PD innovation
Characteristics of individual users of the innovation	Characteristics of the PD user
Characteristics of the organisation pertaining to people	Characteristics of the organisation related to school leaders and other staff members
Structural, descriptive characteristics of the organisation	Characteristics of the organisation related to structural and other aspects

Phase 1: Findings

This section presents descriptive statistics pertaining to the Phase 1 sample (n=634) of included studies on professional development readiness in relation to the school environment. As described above, these papers were categorised by methodology and according to the school environment factors and processes comprising school readiness for PD that were mentioned by the authors in each study's title and abstract.

Type of studies

Of the 634 papers reviewed at this stage, 317 (50%) adopted qualitative research methods (Table 7) and most studies (74%) included some element of qualitative research. Previous reviews on the characteristics of effective teacher professional development have tended to prioritise quantitative outcomes (e.g. Sims et al., 2021). While the limitations of a methodologically more homogeneous data set need to be acknowledged, and triangulation of findings with quantitative research would be welcome, the strong qualitative nature of the data is perhaps expected given our review's focus on the 'context' rather than the 'content' or 'outcomes' of professional development events. Understanding the role of context is more commonly approached through collecting and analysing rich, descriptive qualitative data. Overall, the weight of qualitative evidence found in this review highlights the importance of research that allows a contextual, participant-focussed understanding of school contexts and organisational environment, and how these relate to professional development.

Table 7. Types of studies

Methodological approach	Percentage of studies
Qualitative	50%
Mixed methods	24%
Quantitative	21%
Review	5%

School environment factors related to professional development readiness

To gain a thematic overview of the school environment factors related to professional development (PD) readiness, the Phase 1 sample of studies (n=634) were organised in seven school PD readiness domains (Table 8). We tallied how many studies were coded to each overarching school PD readiness domain, describing their relationship to the Phase 1 coding framework described above and detailed in Appendix 1. This analysis also identified how many of the studies exploring one or more of the school environment factors also included a focus on leadership, both in terms of frequency and percentage of the total studies in each domain to allow comparison across domains. The thematic domains are intentionally broad to encompass the range of terminology used in the literature.

Table 8. Number of studies per school readiness for PD domain, in order of frequency.

Overarching domain	Examples	Phase 1 codes	Change area	Number of studies	AND Leadership (see note)
School interaction characteristics	Communication, collaboration, trust, networks	Interaction Networkedness	Change process	263	95 (36%)
Teacher (i.e. PD end user) characteristics	Gender, race, socioeconomic status, years of experience, interest, motivation, commitment, efficacy, individual identity, autonomy, agency	Teacher attributes	Change attribute	232	45 (20%)
Leadership	Administrative, management, PD policies	Leadership practices Leadership attributes	Change process Change attribute	210	N/A
School fixed characteristics	Funding, size, resources, staffing, population demographics	Organisational structure Organisational resources Population characteristics Organisational environment Other context	Change context	188	82 (43%)
PD characteristics	Complexity and specificity of innovation, results demonstrability	Adaptability Other PD content	Change content	167	27 (16%)
Collective attitudinal characteristics	Morale, vision, group or school identity, commitment	Shared ethos/culture Team attributes	Change process Change attribute	156	84 (53%)

Overarching domain	Examples	Phase 1 codes	Change area	Number of studies	AND Leadership (see note)
School receptiveness	Other school environment factors, perceptions of staff of school support, perceptions of staff of the relation between PD and school context	Organisational readiness PD fit with school priorities Other processes	Change process	78	26 (33%)

Note: Percentages represent the proportion of studies that also included a focus on leadership within each domain.

The domains most frequently represented in the studies were *school interaction characteristics*, and/or *teacher characteristics*, followed by *leadership practices and attributes*. For most domains, fewer than half also included a focus on leadership, although just over half the studies which focussed on *collective attitudinal characteristics* also included a focus on leadership.

While a relatively large number of studies investigated the influence of various school interaction characteristics (e.g. collaboration, communication, trust, and the 'networkedness' of the school), only 36% of these studies also included a focus on leadership, in as far as this was apparent in the title and abstract. Thus, while the included literature suggest that the interaction characteristics of a school are vital to teachers' willingness to engage and participate in PD, relatively few studies appear to have explored how school leaders could influence school interactions to support PD implementation.

Similarly, leadership appeared to be a key focus within the domain of school fixed characteristics (43%), but to a far lesser extent (20%) in the literature that explored the influence of teacher characteristics such as motivation, efficacy, autonomy and agency on PD engagement and participation. In other words, the two PD readiness domains that were investigated most (school interaction characteristics and teacher characteristics) appear to be less frequently researched and understood through a leadership lens. This reveals a gap in our knowledge in this area and illustrates the value of reviewing the subset of papers that speak to both leadership and to school interaction or teacher characteristics.

Phase 1: Summary

In this phase of analysis, we mapped the field of literature to organise the studies identified through our search. Using their titles and abstracts, we categorised the 634 studies by methodology, types and context, identifying the attributes, processes and conditions in the school environment within each study.

Our main findings were:

- The complex, situated nature of the area of study means that rich and contextualised evidence from qualitative research is vital to understanding how the school environment influences readiness, access to and implementation of professional development.
- The interaction and relational characteristics of schools appear to be central to the effective implementation of professional development.
- The evidence base on leadership for successful interactions and relations for PD appears to be small, relative to other school environment domains.
- There appears to be a gap in the literature pertaining to our knowledge of effective leadership that influences the characteristics of teachers associated with engagement in, and implementation of, professional development.

Phase 2: Mapping the role of leadership in professional development implementation

Phase 2: Coding and analysis

While school leaders are expected to undertake a variety of roles with regards to leading teachers' PD, our primary interest remained with what school leaders can do to create conducive school environments. This encompassed both the structural aspects and cultural dynamics (i.e. pertaining to people) of school environments. Therefore, in Phase 2 of the analysis, we focussed our attention on leadership within school environments conducive to engagement in, and implementation of, professional development.

We took a subset of papers from Phase 1, those which had been categorised under leadership (encompassing 'leader attributes' as part of the 'characteristics of individual users of the innovation', and 'leadership practices' as part of the 'characteristics of the organisation), in conjunction with any of the other individual and organisational factors influencing PD readiness and implementation detailed in our School Environment Factor Framework (Appendix 1) and summarised in Table 6.

Through this process, we arrived at a set of 178 papers, for which full texts were retrieved. We understood leadership to be about role and process, rather than formal function. This means that the subset of papers on leadership included studies reporting on senior leaders, middle leaders and teachers as leaders driving and implementing professional development with and for their staff, whether formally named as 'PD leads' or leading PD as part of other formal or informal roles within school.

A detailed coding framework was applied to identify what school leaders can do to create school environments conducive to teacher PD. Table 9 summarises the five dimensions of this coding framework that were used for mapping leadership of professional development implementation (the full framework is provided in Appendix 2).

Table 9. Summary of the leadership of PD implementation coding framework

Framework dimension	Description
1. Outcome(s) of the professional development event	Our **primary outcomes** of interest were: *a) pupil outcomes* b) *teacher outcomes* pertaining to changes in classroom practice. Our **intermediate outcomes** of interest were: *c) teacher outcomes* involving changes in cognition, attitudes, and collaborative professional inquiry *d) school organisational outcomes* involving PD supporting structures, processes and collective attitudes or beliefs.
2. Type(s) of PD	To identify how PD events of different types and durations may relate to the specified outcomes, studies were categorised as reporting on: a) Professional Learning Communities b) Sustained training

	c) One-off training d) Mentoring e) Classroom-based (e.g. Lesson Study) f) Other PD type g) Multiple PD type h) Unknown PD type
3. School setting	The wider characteristics of the school setting were mapped in broad terms, including: a) school phase b) country/region c) policy context d) match between the PD activity and the school priorities
4. Data sources	To map the data sources underpinning a study's results in terms of: a) their nature, and whether they reflected observed behaviour or self(perceived) behaviour; b) the stakeholder perspective that the data represented (i.e. 'pupil', 'teacher', 'leader', and 'other' e.g. parents); c) whether the stakeholders were observed or asked to report on a specific, contained and implemented PD event or were self-reporting on PD in broad, general terms, without a specific PD event being described or implemented.
5. Leadership attributes and actions	To identify the positive influence of leadership on the previously identified school environment factors (see Appendix 1) that affect PD engagement and implementation, studies' full texts were coded against: a) Leadership for - teacher characteristics b) Leadership for - school collective beliefs and attitudes c) Leadership for - school interaction characteristics d) Leadership for - PD organisation/coordination e) Leadership for - data monitoring and evaluation f) Leadership for - resource allocation (time, money, external expertise)

In terms of the coding and appraisal of *PD type*, we did not question the authors' interpretation of 'effective' PD implementation nor make judgements about the quality of the PD intervention under investigation, taking the study's publication to mean that some change was effected by the PD when implemented. However, the review looked for evidence in support of *sustained* change in PD participation, which we operationalised through the specific set of short-term change-related behavioural outcomes or long-term impacts on teaching and learning

and a focus on more sustained forms of PD in schools. The relationship between the PD implementation process and the reported PD outcomes (desired and unexpected, and positive and negative) was then assessed during Phase 3 of the review (discussed below).

A further 78 papers, which did not report on one of our defined PD outcomes or in the full text on leadership attributes, actions or mechanisms, were excluded during Phase 2, resulting in a total of 100 papers being coded for leadership attributes, actions and mechanisms that create school environments where teachers are able to engage in continuing professional development and successfully implement change in their practice.

Phase 2: Findings

This section presents descriptive statistics pertaining to the sub-sample of included studies associated with leadership for PD readiness in schools (n=100). These papers were coded on full text using the coding framework (Table 9 and Appendix 2). The coding combined extracting sections of relevant text (on leadership attributes or actions) and further categorisation of papers (in terms of outcomes, school setting including country/region, PD type and data sources). The full list of papers and a summary of coding can be found in Appendix 3.

Countries

Table 10 summarises the geographical spread of the 100 studies, foregrounding the high number of studies on PD implementation in the United States and Canada. There were two studies from regions other than those specified in the inclusion criteria (Table 4), both were conducted in Israel and included because of their direct focus on leader involvement in school-based professional learning (Avidov-Ungar, 2016; Schechter & Feldman, 2019). The two studies involving multiple nations were reviews (Kutsyuruba et al., 2020; Lillejord & Børte, 2020).

Table 10. Number of studies by region/country

Country/Region	Number of studies
North America	42
Europe	24
Australia	10
Asia	12
UK and Republic of Ireland	8
Other (Israel)	2
Multiple regions	2

Type of professional development

Most studies included in our sample involved longer-term PD activities (Table 11). The majority involved professional learning communities (PLCs) as the event under investigation (34%), followed by various forms of sustained training (17%). 15% of studies covered multiple types of professional development; these studies generally report on data in the form of self-report by teachers or leaders about successful PD in general, rather than observed behaviour or self-report in relation to a specific professional development event. A smaller proportion of the final sample represented studies involving single, one-off PD events or studies looking at mentoring or classroom-based professional learning events (7%).

Table 11. Number of studies by professional development type

Professional development type	Number of studies
Professional Learning Community	33
Sustained training	14
Mentoring	7
One-off training	5
Classroom-based	3
Other PD type	9
Multiple PD types	17
Unknown PD type	12
Total	**100**

Papers that focussed on one-off PD events were, in the main, excluded as they were not examining the *process* of professional development implementation in sufficient depth or detail to be relevant or useful to the study. It is difficult to say whether the lower numbers of papers in our final sample which focussed on one-off events (e.g. teachers going on day long external courses), was an artefact of our screening process or that the outcomes of these events are less studied in terms of how learning is implemented and any wider impact in school.

School phase

Thirty two percent of the studies focused on professional development implementation in primary settings (ages 4-10 in England), 35% in secondary education (ages 11-19 in England), and 24% had samples that included both primary and secondary schools. The remaining 8% comprised studies for which details about school phase were not given, which primarily concerned quantitative and review studies with larger sample sizes and more global

analyses. The overall weight of evidence behind the review findings for primary and secondary education settings is therefore similar.

Type of studies

Of the 100 studies coded, 59 were qualitative studies, 20 were mixed methods studies, 19 were quantitative studies, and the remaining two were review studies. This means that, in line with the broader set of studies in Phase 1, the subset of studies coded relied to a greater extent on qualitative research than quantitative.

Outcome measures

Most studies speak to a positive change in teacher outcomes or to changes in the wider school environment that our theoretical framing suggests have the potential to affect teacher change. The sample of studies that provides evidence of enhancing teachers' effectiveness as professionals *and* benefiting pupils, is relatively small.

Most papers (85) reported on professional development outcomes at the level of the teacher (Table 12), either as the only outcome measure or in combination with pupil and/or organisational outcomes. Twenty-five studies reported on organisational outcomes of professional development, while 16 took pupil outcomes as (part of) their evidence. These 16 studies provide the most complete evidence chain for effective PD implementation. Of these, 13 (see Appendix 3) used a measure of pupil achievement or attainment (Burns et al., 2018; Cheng, 2017; Chu, 2016; Derrington & Kirk, 2017; Ezzani, 2019; Fairman et al., 2023; Levin & Schrum, 2013; Park et al., 2019; Prenger et al., 2021; Rigby et al., 2020; Sebastian & Allensworth, 2012; Seleznyov et al., 2020; Ward Parsons et al., 2019). Four studies looked at changes in motivation or other learning attitudes or at improvements in pupils' (perceived) experience of teaching, either solely or in addition to achievement or attainment (Hollingworth, 2012; Morrison et al., 2019; Prenger et al., 2017, 2021).

Fifty-two studies based their findings on data gathered from multiple educational stakeholders (Table 12). These studies also relied more evenly on measures of observed behaviour (e.g. assessment, observations) and self-report measures, either alone or in combination. The 'multiple stakeholder' category generally included both teachers and school leaders as data sources, alongside other staff members, external facilitators, and parents.

The lower number of studies (11) drawing only on school leaders' perspectives should not be interpreted to mean that the school leaders' perspective on PD implementation is underrepresented in our sample. However, the perspective of school leaders on successful PD implementation is lower, compared to the perspective of teachers. Further, our analysis shows that the perspectives of pupils are rarely included in research on PD implementation, even while evidence of pupil outcomes is a sought-after measure in its evaluation (Guskey, 2000). These patterns in stakeholder perspective need to be acknowledged as potential limitations of the data set, and considered when interpreting the review findings.

Table 12. Studies referring to pupil, teacher and organisational outcomes of professional development

			Number of sources					
		Professional Development Outcomes	**Teacher**	**Leader**	**Pupil**	**Multiple**	**Other**	**Total**
1		Teacher	28	4		31	1	**64**
2		Pupil				3		**3**
3		Organisational	3	3		4		**10**
4		Multiple	3	4	1	14	1	**23**
	4a	*Teacher & Pupil*	*1*	*2*	*1*	*3*	*1*	***8***
	4b	*Teacher & Organisational*	*2*	*1*		*7*		***10***
	4c	*Teacher & Pupil & Organisational*		*1*		*2*		***3***
	4d	*Pupil & Organisational*				*2*		***2***
5		**Teacher Total**	**31**	**8**	**1**	**43**	**2**	**85**
6		**Pupil Total**	**1**	**3**	**1**	**10**	**1**	**16**
7		**Organisational Total**	**5**	**5**		**15**		**25**
8		**Grand Total**	**34**	**11**	**1**	**52**	**2**	**100**

For the 85 studies reporting on teacher outcomes of professional development, thirty studies reported on outcomes at the level of classroom practice (Table 13; Appendix 3 contains full bibliographic information), thereby providing the second longest evidence chain for their findings. The majority of these studies (64%) reporting on teacher outcomes relied on self-report measures, while 44% used observational methods either on its own or in conjunction with self-report measures (Appendix 3).

Table 13. Studies (n=85) reporting professional development outcomes at teacher level

Teacher outcome (see note)	Number of studies
Change in classroom practice	30
Technical knowledge	27
Professional collaboration	23
Empowerment	21
Other/Unknown	4
Note: Studies might report more than one teacher outcome	

Leadership domains for professional development readiness

Using the analytical frame to focus on leadership attributes and actions (Table 9, framework dimension 5), we identified (Table 14) four leadership domains most frequently:

- Leadership for school collective beliefs and attitudes
- Leadership for school interaction characteristics
- Leadership for teacher characteristics
- Leadership for resource allocation

The first domain is in line with Phase 1, where we found that leaders play an important role in establishing the vision for the change that drives professional development. This full text analysis shows that leaders establish professional interactions (i.e. communication and collaboration) that lead to sustained PD outcomes (71% of studies). Moreover, they play a key part in establishing the teacher attributes and characteristics that underpin participation in PD (62% of studies), whether directly in their relations with individual teachers or indirectly through influencing the school social and cultural processes that encourage teachers' feelings of safety, readiness and willingness to implement change. These three leadership domains operate alongside the vital role of leadership in finding the material and time resources to make PD implementation happen (60%).

Table 14. Number of studies per leadership domain, in order of prevalence

Leadership domain	Number of studies
Leadership for school collective beliefs and attitudes	71
Leadership for school interaction characteristics	70

Leadership for teacher characteristics	62
Leadership for resource allocation (time, money, external expertise)	60
Leadership for PD organisation/coordination	42
Leadership for other school readiness	27
Leadership for data monitoring and evaluation	21
Leadership – unknown	3

We also analysed the number of studies against the number of professional development leadership domains reported on in each study (Table 15). We found that many studies (77%) reported on three or more leadership domains. While perhaps this finding is an artefact of the prevalence of qualitative research in general, and Professional Learning Communities as the type of PD under study in particular, it suggests that successful leadership of professional development implementation requires attention to multiple aspects of the school environment.

Table 15. Number of studies per number of leadership domains

Number of professional development leadership domains reported on	Number of studies
1	10
2	13
3	28
4	24
5	11
6	13
7	1

Phase 2: Summary

In this phase, we focussed on the role of leadership in the implementation of professional development. We analysed the full text of 100 papers included from our search to identify for each study: the type of professional development, the school setting, the outcomes of the professional development, the associated data sources and the leadership attributes and actions associated with the professional development's implementation.

Our main findings were:

- Professional learning communities were the most commonly researched professional development activity (33 studies) within the review data set, with studies on this type of PD providing rich information on professional development within the school environment.
- Most of the studies (85) included in the review considered teacher outcomes, while only 16 focussed on pupil outcomes.
- Most studies (52) took into account the perspectives of multiple stakeholders, although pupils' perspectives appeared to be rarely considered.
- School leaders play important roles in establishing collective beliefs (i.e. shared vision), professional collaborations, teacher PD attitudes (i.e. readiness) and resources (including time) for professional development implementation in schools.
- The two domains of establishing collective beliefs and professional collaborations were found to be more frequently highlighted than school leaders' roles in stimulating teacher attitudes or providing resources in support of PD.
- Most studies (77) reported on three or more professional development leadership domains, indicating that leadership of successful PD implementation requires attention to multiple aspects of the school environment.

Phase 3: Focussing on the role of leadership

Phase 3: Coding and analysis

As described above, in Phase 2, the 100 articles selected for inclusion were coded using a data extraction framework (Appendix 2). This included a set of leadership domain categories (Table 9, dimension 5). In Phase 3, the sections of text coded only to the leadership domains were extracted from EPPI Reviewer Web and subjected to further inductive qualitative analysis to identify emerging themes, in an iterative process of collaborative cross-checking and discussion between the research team.

The emerging themes were linked to the underlying evidence provided by each study, and the effectiveness of the leadership activities were assessed in relation to reported outcomes and their impact (positive or negative) within the professional development implementation process. Having established these themes, we grouped them into eleven overarching headlines that related to three leadership dimensions: trusting leadership, engaged leadership and learning leadership (Table 16).

Table 16. Leadership themes and weight of evidence, grouped by leadership dimension

Leadership dimension	Themes	Code	Number of studies
Trusting leadership	School leaders are responsible for creating and sustaining a safe culture for professional learning	TL1	28
	Responsibility and accountability for professional learning go beyond the school leadership	TL2	32
	Teachers can be empowered to have agency over their own professional development	TL3	22
Engaged leadership	School leaders can provide leadership for professional learning by engaging in, and supporting others to engage in, appropriate professional development	EL1	37
	School leaders can encourage, develop and support professional collaboration for professional development	EL2	28
	School leaders can recognise and integrate the professional development needs of individuals, the team and the school as a whole	EL3	21
	Material-economic support is necessary for professional development to be successful	EL4	21
	School leaders can prioritise making time and space for professional development – before, during, and after	EL5	17
Learning leadership	School leaders should communicate a clear vision for their schools for professional learning	LL1	34

	Appropriate use of data by school leaders can support access to, and implementation, of professional learning	LL2	17
	School leaders can broker connections and access to external sources and activities to support professional learning	LL3	11

In the next section we describe the findings relating to each headline theme in turn. However, the themes are complementary and inter-connecting. In our analysis of the studies, intersections and interactions emerged, which are summarised in Table 17. These intersections were identified first quantitatively by listing the headline themes against each study (Appendix 3) and then qualitatively by assessing their interactions in relation to the effectiveness of the leadership activities.

Table 17. Interactions between themes

	TL1	TL2	TL3	EL1	EL2	EL3	El4	EL5	LL1	LL2	LL3
TL1			X		X	x		x			
TL2			X	x					X	x	
TL3	x	x			X	x					x
EL1		x				x	x	x	X		x
EL2	x		X			x	x	x			x
EL3	x		X	x	X		x				x
EL4				x	X	x		x	X		
EL5	x			x	X		x		X		x
LL1		x		x			x	x			
LL2		x									
LL3			X	x	x	x		x			

Phase 3: Findings

Trusting leadership

School leaders are responsible for creating and sustaining a safe culture for professional learning

Trust in the leadership (Chu, 2016; Cooper et al., 2016) and trust within the school (Carpenter, 2015) underpin a school environment in which teachers feel safe to share, collaborate and try out new approaches promote teacher collaboration and organizational change (Admiraal et al., 2016; Meyer et al., 2023; Schechter & Feldman, 2019; Watts & Richardson, 2020; Zhang & Zheng, 2020). Support from school leaders is vital in sustaining teachers' learning from professional development (Drits-Esser et al., 2017), with unambiguous support for and recognition of teachers being learners recognised as an "*expansive practice*" in terms of creating a learning environment for professional development (Attard Tonna & Shanks, 2017).

Sebastian and Allensworth (2012) state that principals are responsible for the school learning climate, with a strong climate leading to better quality of instruction in schools. Nuygen et al. (2022) recommend that leaders are both supportive and give clarity around expectations relating to PD and create opportunities and climate to ensure ongoing learning takes place. Gaikhorst et al. (2019) note that an open work climate is one where teachers feel '*safe, free to take initiatives and learn from mistakes*' (p608) and where new ideas can be shared without fear, and a supportive climate within a school, combined with the opportunity to apply their learning, means teachers are more able to transfer new practice to the classroom (Bulger et al., 2020; Kim et al., 2019).

This kind of school ethos is central to how teachers approach their professional learning (Furner & McCulla, 2019). In order for these conditions to apply, teachers must believe that leadership has the best interests of the schools and its staff at heart, and that they can be trusted with ideas and sharing of materials (Cooper et al., 2016; De Neve & Devos, 2017). Watts and Richardson (2020) state that leaders can foster the development of teachers' professional capital by creating *'a culture of safety and vulnerability'* (p167), and where there is freedom and equality in terms of contributions from everyone (Carpenter, 2018). Snyder (2015) writes that a culture of being willing to learn applies not just to pupils, but also to staff. For example, Coles-Ritchie and Smith (2017) found that feeling able to discuss professional development on race with leaders meant that teachers were more comfortable engaging in dialog on this topic with pupils, indicating that a culture which enables challenging conversation to take place between staff can have a positive impact on pupils (Snyder, 2015).

Trust in leaders and peers within the school enables teachers to be vulnerable about what they need, admit to shortcomings or areas for growth, to work collaboratively and solve problems, to feel able to take risks/experiment with practice, and to learn from mistakes (Admiraal et al., 2016; Hobson & McIntyre, 2013; Stevenson et al., 2019; Valckx et al., 2018; Watts & Richardson, 2020), using what Meyer et al. (2023) call '*positive error management*' (p20). Admiraal et al. (2016) writes of the need to feel comfortable both receiving and giving criticism within a safe environment, with Chu (2016) noting that improved communication between teachers is evident in a supportive and trusting environment. Thessin (2015, 2021) highlights the significance of trust for successful Professional Learning Communities (PLC) in allowing supportive collaboration structures to be established.

Carpenter (2018) highlighted the benefits of both a physical and intellectual shared workspace on culture, relationships and trust. However, although leaders may believe that school climate is important, they may also find it difficult to create the necessary conditions for this (Gaikhorst et al. 2019). Several studies outline ways in which school leaders can support and create an open work climate. For example, Hands et al. (2015) note the value of *'championing and cheerleading'* (p12) teachers by leaders/facilitators to recognise their strengths, values and learning. These authors also emphasise the need for individuals to buy into and be active, for collaboration to be possible, discussion to take place and goals to be developed and agreed. Watts and Richardson (2020) note that the offering of '*competitive professional development packages that increase the social capital*' (p12) make a school a more attractive place to work.

Gaikhorst et al. (2019) identify some active leadership practices that some participants in their study made use of, including team coaching, surveys on teacher satisfaction, identifying positive outcomes, a good atmosphere in meetings, exercises around how to give feedback to peers and cooperative teaching and by *'making the desired organisational culture visible'* (p12) with encouraging statements being hung in offices. School leaders in this study were more likely to look within school to share knowledge and expertise, developing a learning community with a focus on '*collective teacher learning*' (p617). As we describe later, leaders can be supportive of professional learning by providing resources, including time (Hollingworth, 2012). School leaders should also strive to acknowledge and support teachers' professional development needs (Datnow, 2018) and the interests of individuals (Watts & Richardson 2020), and offer staff opportunities to share values and celebrate improvements in school climate (Gregory et al., 2021).

Responsibility and accountability for professional learning go beyond the school leadership

There is strong evidence in our review indicating the benefits of distributed and shared leadership, responsibility and decision-making with school leaders and teacher working as peers in relation to professional development (Carpenter, 2015, 2018; Cooper et al., 2016; Falloon et al., 2021; Hopkins et al., 2019; Levin & Schrum, 2013; Postholm, 2019; Wilson et al., 2021). Taylor et al. (2019) define distributed leadership as '*where the focus is on the activity and its particular contextual factors such as the leaders, followers and situations*' (p700), indicating that the form of leadership may vary depending upon the activity itself and its context, with leadership roles taken up by multiple people, both formally and informally, and depending upon the context.

Distributed leadership represents a collaborative approach to professional development (De Neve & Devos, 2017), or a principal deciding '*the directions for professional development*' (Tay et al., 2021, p18), allowing other members of staff ('teacher coordinators') to work with teachers to determine their professional development choices. This approach might involve staff with expertise acting as instructional coaches (Ballangrud & Aas, 2022; Barton & Dexter, 2020; Cooper et al., 2016; De Neve & Devos, 2017; Sharp et al., 2020; Ward Parsons et al., 2019). Distributed and shared leadership play a role in preventing '*developmental process stagnation'* (Postholm, 2019, p448), building high expectations of the improvement process, in supporting early career teachers, and planning for change across and beyond the school (Attard Tonna & Shanks, 2017; Carpenter, 2015; Gaikhorst et al., 2019; Kutsyuruba et al., 2020; Lee & Li, 2015; Levin & Schrum, 2013; López-Yáñez & Sánchez-Moreno, 2013; Meyer et al., 2023; Thessin, 2015). Distributed leadership leads to increased ownership and accountability from staff (Meyer et al., 2023; Tay et al., 2021; Wen et al., 2021) and can increase teachers' 'sense making' (p19) in terms of planning and implementing innovations (Meyer et al., 2023). It may also contribute to

the development of teachers' instructional and leadership capacity (Ezzani, 2019). Should staff be away from school or leave, distributed leadership can also mean that progress will continue in their absence (Postholm, 2019).

Collaborative working as part of distributed or shared leadership is important. The value of sharing practice within a school, intellectual or physical space was noted by several authors (e.g. Admiraal et al. 2016; Carpenter 2018). Sleegers et al.'s (2014) work on transformational leadership found that teachers' professional self-efficacy was boosted significantly by being intellectually stimulated, part of the decision-making process and collaborative working in the context of school improvement. Sharp et al.'s (2020) study found the collaborative approach that came about through distributed leadership led to changes in practice around differentiation for learners, and Hopkins et al. (2019) found that shortcomings in professional development delivery were mitigated by school leaders encouraging collaborative approaches to teaching and shared responsibility.

With these models of distributed leadership, it is essential that school leaders provide enabling school structures with leadership opportunities, shared decision making, and a hierarchy that supports teachers performing their jobs more effectively (Gray et al., 2014). Oppi et al. (2023) note that leaders should treat teachers equally in terms of offering these opportunities and look to involve those who have not previously had an input into school development. Vanblaere and Devos (2018) found that there was a perceived higher level of collective responsibility reported when teachers felt that their leaders were "group-oriented'. Liu and Du (2022) state that where schools have '*group and polyarchy leadership*' (p571), that is, where leadership is distributed, leader and staff interactions are more frequent and 'complex', and teachers' professional development needs are met more effectively.

If teachers are involved in decision-making, they are more likely to see innovations as having a purpose (Meyer et al., 2023). Avidov-Ungar (2016) makes a similar point: treating teachers as partners in the various stages of school-based professional development (e.g. planning and delivery) allows them to define goals and therefore makes participation more relevant to their needs. This also relates to teachers' agency and empowerment to act collectively within a framework for distributed leadership (Taylor et al., 2019).

Stevenson et al. (2016) acknowledge that while some school leaders feel that top-down leadership is necessary, teachers can still be accountable for their own learning in this context, since leaders can ask teachers what they want to learn and what they want that learning to look like. Avidov-Ungar (2016) notes that professional development developed around teachers' needs results in higher levels of satisfaction and engagement. This reflects the findings of Snyder (2015), with a research participant noting that '*it is important to connect everyone to the process, and that this must be done starting from a place of where the staff is; not where the principal thinks they should be'* (p7). These connections are clear in the work of Kim et al. (2019), who found that teachers' readiness for professional development positively influenced their motivation to learn, and that these factors were in turn positively influenced by support from school leaders.

Carpenter (2018), writing primarily about a shared workspace in terms of Professional Learning Communities (PLCs), notes that shared leadership, decision-making and related shared accountability are vital to the way in which leaders and teachers work together to be '*empowered to be co-leaders in setting the direction for*

teaching and learning' (p124). In addition this author found that '*greater parity of contribution by participants also ensured more emergent innovative teaching and learning activities'* (p134).

Continuing the theme of PLCs and similar forms of professional development, Brown et al. (2021) found three models of distributed leadership related to using Professional Learning Networks in schools, all of which fostered active staff decision-making and collaboration to trial new teaching practices. These models were successful in developing communities which supported and challenged staff and engaged them in innovative practices, thereby developing teachers' professional capital. A study by Burns et al. (2018) found that, in terms of implementation of PLCs, the broad construct of 'Collaborative Leadership Processes' were positively correlated with pupil results. These processes included, but were not limited to, schools having a solid learning community culture, for example a clear mission and shared values, shared leadership, modelling, and communication, and effective teams with trust and participation.

Teachers can be empowered to have agency over their own professional development

Oppi et al (2020) identify *'autonomy and empowerment as crucial conditions for becoming a teacher leader*' (p14). The factors discussed above, including teachers having input, working collaboratively and contributing to decision-making, can bring about teacher empowerment, which leads to higher levels of self-efficacy and greater motivation for professional development (J.C. Sleegers et al., 2014; McCray, 2018; Meyer et al., 2023; Morrison et al., 2019; Oppi et al., 2023; Tarnanen et al., 2021; Tay et al., 2021). Taylor et al. (2019) write about teacher leadership being *'viewed with an emphasis upon collective action, empowerment and shared agency*' (p701), while, for Tay et al. (2021) teacher empowerment relates to being encouraged to '*be the agent to decide what is necessary for themselves, that is, going from being passive participants to active learners who take control of their own professional growth*' (p663).

The models of working we have described empower teachers to be active participants in learning and in driving change (Avidov-Ungar, 2016), enabling them to be more autonomous and less likely to experience professional development mismatch and dissatisfaction (Liu & Du, 2022). Therefore, school leaders need to offer professional development opportunities that are appropriate and relevant to teachers' needs (Lillejord & Børte, 2020). When choosing professional development programmes or interventions are selected, there should also be a balance between the autonomy and agency of leaders and that of teachers (Watts & Richardson, 2020). This autonomy can be located in how teachers choose to collaborate and share their learning (Brown et al., 2021; Meyer et al., 2023), and in teachers being able to act autonomously in relation to their development, for example in choosing which professional development session or event they wish to attend, or, if they do not feel it is relevant to them, opt out of (Tay et al., 2021).

School leaders play a role in balancing agency with accountability. Ward Parsons et al., (2019) note that leaders can foster teacher accountability for professional learning to '*maximize the impact of PD activities*' (p456). This has a strong link to establishing and embedding a school vision with consistent expectations and support for changes to practice. Stevenson et al. (2016) acknowledge that while teachers were able to have autonomy around their learning needs, and what that might look like, a level of top-down leadership was necessary in order to hold teachers accountable for this learning. However, teachers may feel that they or their professional

judgement are not trusted or respected if this accountability is perceived as onerous, causing disengagement from culture of learning and professional development (Carpenter 2015).

Accountability and responsibility for professional development outcomes and implementation can be implemented through structures such as steering groups and project-specific groups, including instructional committees (Meyer et al., 2023). Responsibility for defining learning goals, along with subsequent learning and practice changes can also work as part of a mutually supportive group (Bills et al., 2016), which relates to collective responsibility for learning (De Neve & Devos, 2017). In relation to Professional Learning Communities, Thessin (2015) notes that teachers who are new to these models of professional development should be supported to organise this kind of instructional work, for example in setting goals, agendas and ways of working.

Another aspect of empowerment is teachers acting as change agents, in terms of dissemination of practice and ideas in their school community (Bendtsen et al., 2022), in having responsibility to bring back learning from professional development activities (Owen, 2014), or in how teachers use resources in their teaching (Wen et al., 2021). However, if school leaders fail to recognise where change needs to take place, the development of teachers as change agents can be blocked (Taylor et al., 2019).

Our findings suggest that professional development implementation is more successful if the focus of professional development is directly related to educational purposes and the needs of pupils, that is, focused on teaching, learning and curriculum. More teacher autonomy and choice in the vision and focus of professional development can coincide with a focus on teaching and instructional practices in the classroom (Kutsyuruba et al., 2020; Li et al., 2017; Lillejord & Børte, 2020; Turner et al., 2018; Ward Parsons et al., 2019). In fact, Li et al.'s (2017) quantitative study on the mediated effects of principal leadership on teacher professional learning found that good instructional leadership may counteract or suppress any negative effect that indirect factors such as poor school learning and collaborative cultures have on professional development outcomes. However, other studies disagree, finding that a focus on collaboration was more effective than a focus on pupil outcomes alone (Gaikhorst et al., 2019; Sun-Keung Pang et al., 2016; Vanblaere & Devos, 2018).

Engaged leadership

School leaders can provide leadership for professional learning by engaging in, and supporting others to engage in, appropriate professional development

As we have seen, school leaders are able to '*take part in, manage, and support teachers' learning processes*' (Postholm, 2019, p447). Several studies demonstrate that leadership input and support lead to motivation and empowerment for teachers taking part in professional development (for example, Gaikhorst et al., 2019; McCray, 2018; Meyer et al., 2023; Tarnanen et al., 2021; Tay et al., 2021). These approaches to leadership also enable the facilitation by senior staff of learning collaborations (Tay et al. 2021) and raise teacher expectations (Park & Byun, 2021). Overall, school leaders are vital for teacher development in terms of leading change, creating a learning community, and being '*agents of change*' (Chalikias et al., 2021).

These leadership approaches appear to span different models of professional development. For example, Brynjulf Hjertø et al. (2014), writing about communities of practice, state that leaders are in the position to '*act as supportive agents*' via a combination of '*boundary spanning activities, facilitator roles, and active use of*

powers and authorities inherent in the management role' (p785). Meanwhile Seleznyov et al.'s (2020) research on lesson study found that support from leaders for this form of professional development enabled teacher learning across different areas including impact on pupils and reflection on practice.

Although we have identified the importance of collaborative and distributed leadership, leaders still play a role in leading the vision and culture of professional development. Snyder (2015) writes about the need for leaders to be '*visionary listeners*' (p223), with a vision regarding staff development, including consideration of the views of staff in its implementation. Carpenter (2015) states that leadership should be fully immersed in the school improvement cycle, and therefore, as Gaikhorst et al. (2019) note, principals need to develop the skills to provide supportive workplace conditions for successful PD.

Sebastian and Allensworth's (2012) study found that schools where principals were rated highly by staff were likely to have a 'strong learning climate', defined as '*the beliefs, values, and everyday interactions among school personnel, parents, and students*' (p629) which leads to stronger instruction and better pupil outcomes. Therefore, as we have seen, leaders play a key role in facilitating and making professional development policy, as well as following up on implementation of any measures decided collectively (Schildkamp & Poortman, 2015; Stevenson et al., 2016), in encouraging and supporting teachers to recognise the value of a professional development activity or its outcome (Bulger et al., 2020), and gaining 'buy-in' from staff (Levin & Schrum, 2013).

These leadership approaches can be direct and indirect. Direct approaches include behaviours reflecting 'being a professional development role model', i.e. demonstrating the prioritisation of and participation in prioritise professional development. Direct leadership, in terms of being a professional development role model, can be understood as 'instructional leadership', whereby leaders are teachers themselves and the focus of change is on teachers' classroom practice and how teachers can meet the needs of their pupils, thereby improving the impact of professional development (Bulger et al., 2020; Carpenter, 2015; Delvaux et al., 2013; Kutsyuruba et al., 2020; Li et al., 2017; Postholm, 2019).

The importance of leaders as role models for professional development is mentioned in several studies, including Verhoef et al. (2022) in terms of leaders emphasising the need for inquiry and using research evidence, alongside giving others the time and space for discussion on research use. Thessin (2021) writes about leaders modelling participation in professional learning communities, and Coles-Ritchie and Smith (2017) about leaders modelling 'productive race talk' (p183) to support professional discussions around race. Gaikhorst et al. (2019) and Admiraal et al. (2016) believe that a culture supportive of teacher learning can be developed by 'learning while leading' (Gaikhorst et al. 2019 p617). School leaders can also demonstrate their buy-in to professional development, for example by being present and by providing time and resources (Hands et al., 2015; Hollingworth, 2012; Schildkamp & Poortman, 2015; Thessin, 2015, 2021).

Indirect approaches constitute behaviours which allow the space for teachers to collaborate, communicate and take ownership over their learning (for example, Gray et al., 2014; Meyer et al., 2023). We have already described many of these approaches. They include allowing teachers to exercise autonomy, taking accountability for implementing learning, enabling and supporting collaboration, demonstrating high expectations for school improvement, and working closely with and having trust in teachers (Bills et al., 2016; Brown et al., 2021; Carpenter, 2015; Cooper et al., 2016; Meyer et al., 2023; Postholm, 2019). Gray et al. (2014)

note that leaders need to provide enabling school structures where teachers feel that the school environment and leadership support innovation collaboration, problem-solving and cooperation and Carpenter (2015) writes about the importance of a shared and supportive structure in schools. Furner and McCulla (2019) state that early career teachers appreciate structures through which leadership is engaged in their professional development.

Not surprisingly, the opposite appears to be true: a lack of support, interest and skills from leaders, specifically around research evidence use and outcomes, limits the development of an inquiry culture (Verhoef et al., 2022). Some evidence suggests that a lack of support may overwrite the importance of working on learning culture and human relationships (Li et al., 2017). Leaders should not overstep the mark: authentic involvement is needed, such as only participating and giving feedback if they know the subject itself (Valckx et al., 2018). In these circumstances, opportunities might be given to connect with experts, including those external to the school (Valckx et al. 2018).

Meanwhile, while leaders recognise that professional development needs to be ongoing and adaptive, it can be unclear how to implement this (Stevenson et al. 2016). There appears to be a delicate balance to be struck between active involvement by leaders in terms of vision, approach, direction and structure for professional development (Valckx et al. 2018), while simultaneously allowing professional development to be teacher-led (Postholm, 2019; Ryan, 2017).

However, while some, such as Schildkamp and Poortman (2015) and Postholm et al. (2019), indicate that it is important for leaders to be involved in teachers' learning and the implementation of this, others, including Hollingworth (2012) and Brynjulf Hjertø et al. (2014), note that this is not always necessary: facilitation in terms of resource, time and sponsorship may be enough. Although leaders should be '*leaders of learning*' (Stevenson 2016, p834), the level of in-person involvement needed may vary depending upon context, topic and the type of professional development on offer.

Notwithstanding these variations, leaders need to consider ongoing changes in the education system and reflect critically on how to best support the needs of individual teachers (Stevenson et al. 2016). At points the need for professional development will be because of external factors (Sandholtz et al., 2019), and leaders should also offer opportunities for professional development that go beyond the school's and other immediate localised priorities (Attard Tonna & Shanks, 2017).

School leaders can encourage, develop and support professional collaboration for professional development

We have mentioned elsewhere some examples of how school leaders can support engagement in collaborative models of professional development such as professional learning communities. Leadership for professional collaboration for professional development is closely linked to the school climate and the associated 'trust leadership' that building a positive culture entails. A shared understanding and orientation towards school community development is vital to professional collaboration (Meyer et al. 2023; Tarnanen et al. 2021). For example, Malone et al. (2021) detail the progress made by creating a common curriculum across a group of schools to drive improvement, building an epistemic community and developing a collaborative approach, problem solving and 'collegial discourse' (p359). Cheng (2017) found that principals' support for the cultivation of a '*collaborative learning culture*' (p451) is vital in teachers' confidence and competence development and lead to improved leaders/teacher dialogue, improved enactment of professional development policy and heightened

professional development outcomes. Professional collaboration is also promoted by positive error management (Meyer et al. 2023) and leadership activities that improve the cultural atmosphere and trust within a school (Zhang & Zheng 2020).

Professional collaboration and learning are key in bringing about change (Carlyon, 2015; Dobbs et al., 2017). To support this, school leaders can encourage action research (Owen, 2014; Sun-Keung Pang et al., 2016), or regular observation and reflection on practice, for example by prompting teachers to share adaptations to meet the needs of pupils (Bulger et al., 2020; Carpenter, 2015; Kutsyuruba et al., 2020). Setting up internal and external working groups can positively affect teachers' motivation to participate in professional development (for example, Brynjulf Hjertø et al., 2014; Cheah et al., 2019). Meyer et al.'s (2023) study showcases how creating a regular and consistent meeting time for teachers can spin into the formation of more targeted professional inquiry groups. Interestingly, Drits-Esser et al. (2017) found that supportive peers or a mentoring relationship at the same staff grade can offset the impact of unsupportive leadership.

Several studies in our review focus on professional learning communities. For example, Vanblaere and Devos (2018) investigated the effects of 'group-oriented' and 'development-oriented' leadership of departmental heads on the interpersonal characteristics of a Professional Learning Community. 'Group-oriented' leadership focused on generating, shaping and managing collaboration through activities such as guiding meetings, forming groups and motivating teachers to participate in their group 'Development-oriented' leadership focused on pupils and the educational core by monitoring pupils' work, the attainment of local standards, and prescribed levels of pupil performance. Their quantitative analysis found that development-oriented leadership only correlated with increased reflective dialogue, but group-oriented leadership increased teachers' perceptions of collective responsibility and the frequency of reflective dialogue with colleagues. Both leadership orientations were found to be important to professional collaborative inquiry, but more collaborative behaviours could be seen in departments with group-oriented heads. Leadership for collaboration creates the necessary environment for professional inquiry with a focus on pupil learning.

Similarly, Sun-Kueng Pang et al. (2016), found that, within schools identified as having strong professional learning communities, leadership focused on teacher learning as well as on pupil learning, providing the necessary structures and resources to facilitate the teacher learning process. Park and Byun's (2021) study highlights the importance of professional learning communities and their collaborative nature in terms of raising teachers' (of science and mathematics) expectations for pupil success, noting that teacher expectations and pupil results appear to be positively related. Carpenter (2015), in a qualitative study on the supportive and shared leadership structures which underpin a positive school culture and effective professional learning communities that impact school improvement, advocates for professional development implementation to include training across the school as to what collaboration can look like.

If schools do not have established cultures of collaboration, school leaders can bring about change to allow professional learning communities to be established (Thessin 2021). Leaders play a critical role in finding ways for teachers to meet and collaborate, particularly through setting up or initiating working groups and other mechanisms for teachers to share their learning (Attard Tonna & Shanks, 2017; Ballangrud & Aas, 2022; Brown et al., 2021; Brynjulf Hjertø et al., 2014; Cheah et al., 2019; Huijboom et al., 2021; Meyer et al., 2023). Networked professional learning communities may benefit from leadership, particularly initially when there is, for example, a need to define goals (Prenger et al., 2017). Gairín Sallán et al. (2022) identified a range of mechanisms for

sharing learning, including collaboration with other schools, networking, taking part in seminars, and re-editing the school's internal documentation. Huijboom et al. (2021) conclude that leaders can support the development of professional learning communities by providing a facilitator, supporting autonomy and catering to the needs of the group. Owen (2014) foregrounds the use of action research as a means to simultaneously establish a process of collaboration and a focus on core educational objectives and outcomes.

Several review studies point towards the importance of effective facilitation of groups by leaders (whether senior, departmental, phase or subject, or teacher leaders), highlighting how leaders are in a unique position to draw on their knowledge of the skills and needs of their colleagues as well as the needs of the institution (Brown et al., 2021; Schildkamp & Poortman, 2015). Thessin (2021) notes that professional learning communities are successful where there is *'an established culture focused on learning and collaboration, which facilitated trust'* (p12). However, the studies in our review emphasise that leadership of professional collaboration requires skills in managing conflicts that emerge in the process of collective exploration, as well as skills to deepen dialogue and skills in leading and building people (Ezzani, 2019; Hashim, 2020; Lee & Li, 2015). The effective implementation of professional development therefore includes the professional development of professional development leaders.

As we have described elsewhere, it is important that teachers perceive autonomy within collaboration, for example by being allowed to join groups based on their interests, through distributed leadership, collaborative evaluation and teacher/leader delivery partnerships (Admiraal et al., 2016; Brown et al., 2021; Ezzani, 2019; Meyer et al., 2023). Meanwhile, Owen's (2014) multiple case study of the professional learning community characteristics that facilitate professional learning in Australia warns against 'contrived collegiality', highlighting that true professional collaboration involves debates and tensions that can be challenging to manage. Collaborative approaches take time, and the lack of both this and adequate resources can be sticking points for collaboration (Datnow, 2018; Zhang & Zheng, 2020). Cultural barriers may also impact collaboration (Zhang & Zheng 2020).

Carpenter's (2018) study emphasises that a shared intellectual workspace goes hand-in-hand with a physical shared workspace, indicating that '*the more administrators and teachers worked closely together in the physical workspace to share teaching and learning innovations as a team, the closer and more accepting of each other's values and beliefs they felt*' (p135). Consideration should therefore be given to how, and how frequently, teachers may physically be working together towards a shared goal, encouraging reflection on what a 'shared workspace' may look like both intellectually and physically.

Leadership is more likely to lead to professional inquiry when it is focused on setting up regular meetings and providing resource support for teachers than leadership focused on pupil learning alone. Several studies emphasise the importance of seeing leadership for collaboration as not just as providing meeting time and spaces, but also as including a role for leaders in establishing a focus on improving practice and pupil learning (e.g. Zhang & Zheng 2020). Overall, therefore, leadership of professional collaboration requires a balance between providing meeting structures and resources and establishing a focus on improving practice and pupil learning.

School leaders can recognise and integrate the professional development needs of individuals, the team and the school as a whole

As we mentioned earlier, leadership for professional development includes identifying the professional development needs of both individual teachers and the school as a collective, using in-house professional development and teacher evaluation and reflection processes to inform targeted decisions about professional development participation (Armour & Makopoulou, 2012; Bendtsen et al., 2022; Brown et al., 2021; Derrington & Kirk, 2017; Ezzani, 2019; Gaikhorst et al., 2019; Gregory et al., 2021; Nguyen et al., 2022; Postholm, 2019; Valckx et al., 2018; Vanblaere & Devos, 2018). Where teacher evaluation processes are used to inform professional development decisions, these processes should be formative rather than summative and involve shared-decision making (Körkkö et al., 2022; Lillejord & Børte, 2020; Meyer et al., 2023). Körkkö et al. (2022) emphasise the use and implementation of professional development plans (PDPs) as a tool for teachers' continuing professional learning, to integrate and align teacher learning, teacher motivation and school priorities. Developing PDPs should be a joint endeavour between leaders and teachers and a key part of planning. This is in line with the processes of collaboration and distributed leadership, discussed elsewhere, that lead to successful professional development implementation successful.

Several studies emphasise the importance of recognising the diverse needs of teachers and teaching teams, thereby coordinating professional development in response to content-specificity, career stage, group dynamics, and personal circumstances (Armour & Makopoulou, 2012; Bulger et al., 2020; Furner & McCulla, 2019; Hands et al., 2015; Lillejord & Børte, 2020). McCray (2018) notes that teachers engaged in '*personalized dialog*' (p3) develop their practice and raise pupil progress.

However, a balance and an interplay between individualised and collective, whole-school professional development appear to be needed for sustained impact on practice and ongoing professional learning. For example, Sleegers et al.'s (2014) quantitative study investigated the impact on changes in teachers' classroom practices over time of 'school improvement capacity' (comprising leadership practices, school organisational conditions, teacher motivation and teacher learning). A complex picture was revealed whereby teacher-level conditions affected changes in teachers' classroom practices, while organisational factors were central to enhancing teacher motivation and teacher learning. This warns against a primary focus on individual concerns without a clear whole school vision and opportunities for teachers to collaborate, as '*individualized consideration and support may harm the engagement of teachers in experimenting and reflection activities*' (p638).

Bendtsen et al. (2022) carried out a study of the impact on professional practice of a professional development course built on principles of collaborative action research. 'Identifying areas for further professional development' emerged as a theme at both individual teacher and school levels. The teachers in this study identified their own developmental needs alongside areas that needed to be developed in connection with the whole school. Brown et al.'s (2021) study supports this, finding that effective facilitation of Research Learning Networks emerged from an understanding of individual teacher concerns and needs, *and* the needs and aims of the organisation.

Further, the balance between leader-initiated and teacher-led learning implies a balance between formal and informal learning (Barton & Dexter, 2020). Leaders empower teachers to participate in ongoing professional

development by, on the one hand, formalising the learning process and thereby visualising and giving value to it, while, on the other hand, decentralising the necessary organisation and decision-making and promoting cooperation, innovation and collaboration (Barton & Dexter, 2020; De Neve & Devos, 2017; Gray et al., 2014; Kutsyuruba et al., 2020; Li et al., 2017; Schechter & Feldman, 2019). Barton and Dexter (2020, p102) refer to this as '*leader-initiated, but teacher-led learning, a hybrid of formal and informal learning in which teachers drive the content*'. Therefore, shared decision-making about the vision and focus of the learning is key: seeking teacher input and inspiring teacher leadership leads to increased motivation and empowerment for ongoing professional development (McCray, 2018; Meyer et al., 2023; Tarnanen et al., 2021; Tay et al., 2021).

Gaikhorst et al.'s (2019) study found similar patterns, looking at school principals' beliefs and practices on the working conditions for successful teacher professional development. School leaders were more likely to look within school to share knowledge and expertise, than to formal external interventions, to create learning opportunities in school with a focus on 'collective teacher learning' (p617). The participants in this study also emphasised the importance of shaping conditions at teacher level, by influencing teachers' learning attitudes and in differentiating teacher professional development.

There is ample evidence that collaboration and mechanisms for shared learning are associated with both individual and collective learning (for example, (Attard Tonna & Shanks, 2017; Cheng, 2017). This includes collaboration with external partners (Brynjulf Hjertø et al., 2014; Levin & Schrum, 2013; Meyer et al., 2023; Wen et al., 2021): leaders play an important role in brokering these collaborative relationships. Overall, then, a balance is needed between collective, collaborative processes and individual attention, with these factors interacting with each other as well as with any formal, external professional development opportunities that may be available to teachers.

Material-economic support is necessary for professional development to be successful

This theme focuses on the in-school support, in terms of resources, needed for teachers to take part in and benefit from professional development. The phrase 'material-economic support' is used by Bendtsen et al. (2022) to encompass '*workplace arrangements that are conducive to teachers' participation in CPD*' (p71). This includes teachers being released from school-based responsibilities to attend professional development and the costs of associated cover for teaching, the cost of professional development courses and events, the provision of resources to enable participation and the opportunity to share learning (Carpenter, 2015; Datnow, 2018; Malin & Hackmann, 2017; Sandholtz et al., 2019; Stevenson et al., 2016, 2019; Tay et al., 2021).

As we mentioned earlier, there is also the need for space, whether it is intellectual space (Datnow, 2018; Gregory et al., 2021) or physical space, for example for professional learning communities to meet (Carpenter, 2018; Gregory et al., 2021; Schechter & Feldman, 2019). Carpenter (2018) notes that while shared workspaces are necessary for professional learning communities, these are of wider benefit in terms of teachers sharing practice and accountability, developing relationships and engaging in collaborative inquiry and problem solving. Zhang and Zheng (2020) indicate that a lack of resources including space can be a barrier to collaborative activity in professional learning communities and other forms of collaborative professional development.

Beyond the professional development itself, changes to practise need buy-in and support from leaders, otherwise learning is unlikely to be implemented (Abrahams et al., 2014; Anyon et al., 2016; McCray, 2018). The necessary resources, as well as the training needed to use them, are vital for the implementation of learning from professional development (Drits-Esser et al., 2017). In the context of maker spaces, Stevenson et al. (2019) note that technical support is particularly important in implementing and sustaining learning. Bulger et al. (2022) note that school leaders need to recognise the value of professional development in order to ensure that its impact is sustained, and this recognition can be communicated by the allocation of resources.

Postholm (2019) notes that while teachers need time for joint observation and reflection, this alone is not sufficient, as '*new content that energises development processes*' (p448) is also necessary. Therefore, leaders of professional development should know when and how to introduce this new content or knowledge, and to manage and support the learning process. Hollingworth (2012 p13) notes that, *'for sustained change, teachers need practical support in the form of time for teacher learning and collaboration';* for leaders to be seen as supportive of professional development, they therefore need to provide the necessary money, time and related resources.

School leaders can prioritise making time and space for professional development – before, during, and after

Support and leadership for professional development should go beyond material-economic support (Sandholtz et al. 2019); as we have seen, time is also necessary.

The allocation of time and space is one way in which leaders can be seen to be supportive of teacher professional development (Hollingworth 2012) and support the development of distributed leadership (Oppi et al., 2023). This may be formal time (in meetings) or informal (in staff rooms and at breaks) (Bendtsen et al., 2022; Brown et al., 2021). This time might be used to update resources, to prepare for professional development, to collaborate and share learning or to implement change (Abrahams et al., 2014; Attard Tonna & Shanks, 2017; Carpenter, 2018; Sandholtz et al., 2019; Thessin, 2015; Weitze, 2017). Timetabling changes may be needed, or time might be created during the school day, for example by excusing teachers from meetings or enabling them to take time away from school (Cheah et al., 2019; Fairman et al., 2023; Malin & Hackmann, 2017, 2017). One approach to this is the deployment of permanent 'relief teachers' to enable staff to take this time (Tay et al., 2021).

Wilson et al. (2021, p13) use the phrase '*quarantined professional learning time' for* time set aside for doing and talking about professional development. Ezzani (2019) mentions that leaders, working with the school district, were central to the process of enabling teachers to spend time in a professional learning community, noting that *'institutionalization of such practices* [that is, time for professional development]*, however, required unwavering leadership at all levels*' (p7). Time is also needed for collaborative activities that form part of professional development and its implementation: collaborating teams need consistent time slots to meet (Meyer et al. 2023). This time might also be used for activities relating to culture, communication, observation and reflection processes (Meyer et al. 2023; Postholm 2019).

Early career teachers are particularly in need of time to engage with mentors, to plan, observe others, attend professional development, and develop teaching materials (Kutsyuruba et al., 2020). Mentors also need the

time to plan their engagement and of course engage with their mentees. Attard Tonna and Shanks (2017) concur, commenting on the need for a supportive environment for new teachers to collaborate, reflect and become used to their role.

Failure to allow teachers time to engage with professional development can lead to a lack of research into appropriate opportunities and planning for these (Seleznyov et al., 2020) and resulting in teachers being dissatisfied, which can have wider impacts for example with teachers' unions (Ferguson, 2013). This is particularly difficult where professional development interventions occur across schools and there is a difference in approaches to time allocations between schools regarding time allocation (Prenger et al., 2021). The process and culture of inquiry is also negatively impacted by a lack of time (Verhoef et al., 2022). For example, Prenger et al. (2017) again suggest that attrition from professional learning communities can be due to a lack of time allocated by participants' schools, which in turn affects trust, collaboration and cohesion.

Learning leadership

School leaders should communicate a clear vision for professional learning

A strong theme across our evidence review is the concept of a vision or mission in terms of change, building capacity and professional development for schools (J.C. Sleegers et al., 2014; Lummis et al., 2022; Nguyen et al., 2022; Postholm, 2019; Sun-Keung Pang et al., 2016; Tarnanen et al., 2021; Thessin, 2021; Ward Parsons et al., 2019). This entails identifying and communicating a '*clear, collective*' vision (Verhoef et al., 2022, p13).

The vision needs to include clear strategies for development. Several studies (e.g. state that school visions and goals should be clear, explicit and shared with teachers (Avidov-Ungar, 2016; Chu, 2016; Cooper et al., 2016; Meyer et al., 2023; Stosich et al., 2018; Ward Parsons et al., 2019; Wen et al., 2021). This encourages engagement in professional development (Delvaux et al., 2013) and '*deprivatises practice*' (De Neve & Devos 2017, p264). Avidov-Ungar (2016) states that in order to achieve effective professional empowerment and organisational change, school leaders must define the goals and objectives in a measurable way. Meyer et al. (2023) note that there must be a vision and also a strategy and related structure to deliver change goals.

In order to foster teacher buy-in, innovations need to be clearly defined and congruent with the strategy (Meyer et al. 2023). Ryan (2017) and Stosich et al. (2018) found that both leaders and those leading professional development needed to have a '*common instructional vision*' (p8) in terms of building capacity, with the structures and practices in place to facilitate the strategy for improvement. For some this may come within the concept of instructional leadership, where leaders first establish a '*school mission*' (p2) and then stage the appropriate training in order to improve instruction within a school (Delvaux et al. 2013).

These factors are linked to teachers' development and aligned to their needs (Ezzani, 2019; Falloon et al., 2021; Körkkö et al., 2022; McCray, 2018). They require a transformational approach to leadership (Kurland et al., 2010), clearly communicated and, as we have seen, not imposed by leaders (Li et al., 2017; Lummis et al., 2022). Instead, there must be a clear way forward for building a shared understanding and exploring contributions of staff to the vision (L. H. Wang et al., 2016). This clarity can be particularly important for new staff and beginning teachers who need to understand the teaching and learning contexts of their new school (De Neve & Devos, 2017; Furner & McCulla, 2019; Kutsyuruba et al., 2020; Seleznyov et al., 2020; Vanblaere & Devos, 2018).

Clarity of vision is key to embedding accountability for teachers and leaders in terms of expectations for successful implementation of professional development (Ward Parsons et al., 2019). Frameworks for planning professional development can also be used to assess programmes and progress and linked to the school's vision in a two-way process (Furner & McCulla, 2019; Körkkö et al., 2022; Lillejord & Børte, 2020; Ward Parsons et al., 2019). Körkkö et al. (2022) suggest that teachers need sufficient time for discussion with colleagues to understand how such plans might be utilised and progress determined. Some studies suggest that the school's vision or goals should be developed in collaboration with teachers (Avidov-Ungar, 2016; Nguyen et al., 2022; Wen et al., 2021). For example, Sleegers et al. (2014) note that '*the more school leaders initiate and identify a vision and teachers participate in decision-making process, the more teachers have internalized the goals of the school as their personal goals'* (p17). Teachers are more likely to buy into something when they feel it aligns with their professional identity (Watts & Richardson 2020) and provides intellectual challenge and a basis for collaboration (Sleegers et al. 2014). Gaikhorst et al. (2019) found that while a professional development focus on pupils was important, a broader development focus on areas including '"*teacher identity" or "school organisation*"' (p617) were of use directly to teachers and indirectly to pupils.

Appropriate use of data by school leaders can support access to, and implementation, of professional learning

Data monitoring constitutes a distinct thematic area in our analysis. Studies exploring school leaders' involvement in data monitoring vary in their utilisation of the data itself within the context of professional development, but suggest that *deliberate* data usage is imperative to maximise the impact of professional development (Wen et al. 2021). As such, it is paramount that school leaders responsible for professional development have robust data literacy to ensure it is employed in a significant and impactful way (Ezzani 2019; Lillejord & Børte 2020).

Data has multiple purposes in relation to teacher professional development, with varying connectivities. For example, data might be used to identify appropriate developmental interventions based on recognised needs within school (Rigby et al., 2020). This enables school development opportunities to acquire greater meaning and relevance for individual institutions (Owen, 2014). Studying professional learning communities, Burns et al. (2018) found a correlation between the construction of 'data-driven systems for learning' and pupil achievement, which included factors such as having a foundation for learning community culture (smart goals); effective teams (using evidence, a focus on results); a pupil learning focus (identification and review of learning objectives); and assessment culture (feedback, data usage alongside collective responsibility). In terms of driving school improvement, a common curriculum across a group of schools can enable improved data gathering and analysis of progress (Malone et al., 2021).

Another strategy involves conducting staff surveys to generate new data, with a specific focus on identifying gaps in knowledge and practice (Thessin 2015). School leaders can take responsibility for collecting this teacher data, necessitating proficiency in quantitative data gathering and analysis (Ezzani 2019). Data can also be used to pinpoint specific requirements for pupils, and thereby in turn identify tailored professional development for teachers (McCray 2018). Data can also be used to scrutinise the progression of teachers through the application of internal mechanisms that monitor professional development (Cheng, 2017; Lillejord & Børte, 2020) and assess discrepancies between current and anticipated performance (Welsh et al., 2021).

Postholm (2019) goes as far as to recommend the use of spot-testing to monitor teacher progress during professional development provision. This emphasises the significance of accountability and suggests the use of data in ensuring each staff member's individual accountability for their progress (Hashim 2020). As such, data can offer school leadership a means to track progress and instil accountability among staff members, but this accountability may also diminish innovation and lead to internal tensions (Bainbridge et al., 2022).

The establishment and maintenance of these systems is the responsibility of a data literate, distributed school leadership (Schechter & Feldman 2019). To address the challenge of gathering and using data, school leaders must employ data transparently, establishing clearly defined goals and goal-setting processes, performance management processes must be collectively understood, and data must be communicated transparently with staff to prevent tensions (Avidov-Ungar, 2016; Lummis et al., 2022; Meyer et al., 2023; Schechter & Feldman, 2019).

Carpenter (2015) proposes that an absence of effective leadership in data management may go so far as to create a 'culture of distrust' within schools. Ensuring broader data literacy in schools could be achieved by implementing models of distributed leadership, as we have described elsewhere, which enable larger numbers of staff to actively participate in data management (Lee & Li, 2015). This has the potential to enhance collective data literacy through shared responsibility for its interpretation (Schildkamp & Poortman 2015).

School leaders can broker connections and access to external sources and activities to support professional learning

In this theme we locate evidence relating to leaders' roles in sharing information, making external connections, forming partnerships for learning with other organisations (Wen et al. 2021), and the benefits and relevance of bringing in external expertise into schools, such as coaches or professional development facilitators (e.g. Gaikhorst et al. 2019).

Brynjulf Hjertø et al. (2014) write about leaders as 'boundary spanners' who point teachers towards information or third parties that can provide resources and support teachers to develop their understanding and knowledge. School leaders have a role in *'creating and sustaining networks of learning arrangements'* (Schechter & Feldman, 2019, p10) to meet the differing needs of staff and pupils. They are able to act as brokers between teachers and those higher up the administrative chain, and are therefore able to '*modify and possibly change existing rules or norms to effect any changes in the school system and teacher activity*' (Tay et al. 2021, p651). They may introduce opportunities for networking (Levin & Schrum, 2014; Schechter & Feldman, 2019), including exchanges and visits to, or collaborations with, other schools or provide opportunities for staff to take part in external conferences and to share their learning at school when they return (Attard Tonna & Shanks, 2017; Meyer et al., 2023; Owen, 2014).

Attard Tonna and Shanks (2017) note that it is important that leaders enable expansive learning opportunities beyond local, regional and national priorities. They might introduce the ideas of '*popular thinkers in education*' to their staff (Stevenson et al 2016 p824). Naturally, bringing in external support requires both consideration of existing school structures and contextualisation in terms of aims and objectives (Hashim, 2020). For example, in the context of international schools, Watts and Richardson (2020) identified how school leaders believed that bringing consultants into school had allowed mentoring relationships to develop which supported ongoing

conversations around teaching and learning. The authors call these *'rich connections* [which enabled] *the teachers to make more informed and confident decisions*' (p176) to improve practice.

Phase 3: Summary

In this phase of analysis, we focussed on a set of 100 papers, coding them initially against a set of leadership dimensions and then analysed them inductively to identify emerging leadership themes. This gave us eleven 'headline' themes, which we grouped into three interconnecting leadership dimensions: *trusting leadership, engaged leadership and learning leadership*.

The dimension containing the largest proportion of the eleven themes was engaged leadership, with the other two both containing three themes each. All the themes featured in eleven or more of the one hundred studies. The theme represented in the smallest number of studies was: *school leaders can broker connections and access to external sources and activities to support professional learning*.

Three themes were identified in at least a third of the studies each. These are:

- School leaders can provide leadership for professional learning by engaging in, and supporting others to engage in, appropriate professional development
- School leaders should communicate a clear vision for their schools for professional learning
- Responsibility and accountability for professional learning go beyond the school leadership

The findings from this phase of the analysis highlight how leadership attributes and actions within the school environment influence professional development implementation and participation. They offer illustrations of how school leaders can embed professional development in the professional lives of teachers through strategies including distributed leadership, shared accountability, resource allocation and collaboration.

Limitations

We set out to investigate, through a review of the literature, the implementation of teacher professional development in relation to leadership in the school environment. We followed established protocols for systematic reviews, using tested tools for searching, inclusion/exclusion and analysis. Our processes, including cross-checking findings and interpretations across multiple reviewers, mean that our findings are well-grounded in the literature we analysed.

Inevitably there are limitations to this review. In common with other evidence reviews, we set boundaries around the inclusion and exclusion of certain studies, including their date of publication and location. In doing this we may have inadvertently excluded studies which could have provided further insights into the role of school leaders in the implementation of professional development. This may be of particular importance given the ways in which teachers' experiences of professional development have changed in the last few years, as a result of Covid-19 and the shift towards online activity. A search carried out now might offer insights into a potentially changed landscape of professional development with more synchronous and asynchronous online learning alongside in-person engagement.

In Phase 1 we used only the titles and abstracts of the returned papers in order to both map the field of literature and to carry out a further stage of inclusion and exclusion. We may, therefore, have missed important findings at this stage which were included in the full text but not sufficiently explicit in the abstract to be picked up in our analysis process.

We did not attempt to judge the effectiveness or quality of the professional development being described, rather taking each study's publication to mean that some change was effected by the professional development under consideration. We gave all types, aims and content of professional development equal consideration rather than giving any prioritisation to one model or another. This means that all studies, no matter their scale or type, are weighted equally, and so we may have inadvertently privileged some studies, such as those with smaller numbers of teachers or less effective professional development, over others. However, the depth and consistency of our analysis leads us to be confident in the validity of our findings.

Most of the studies we reviewed used qualitative research methods, at least in part. We therefore acknowledge the limitations of a methodologically homogeneous data set, especially where this leads to a lack of evidence of impact on pupil outcomes, a frequently-sought factor in the evaluation of professional development (Guskey, 2003; Sims & Fletcher-Wood, 2021). Similarly, as we have mentioned elsewhere, we found a lack of studies reporting on the perspectives (never mind the outcomes) of pupils and school leaders. The findings of our study are therefore biased towards teachers' perspectives and may not appropriately represent those of either the school leaders who we are looking to lead the implementation of professional development, nor the pupils who stand to benefit from teachers' learning. However, our findings also show that teacher buy-in to professional development is essential in its implementation, and therefore studying teachers' perspectives gives vital insights into how teachers perceive, value and engage with their experiences.

Our focus on qualitative research sets this study apart from many previous reviews of the characteristics of effective teacher professional development, which have tended to prioritise quantitative outcomes (e.g. Sims et

al., 2021). Indeed, the qualitative nature of our review's data may be expected, given its focus on the 'context' rather than the more easily defined 'content' or measurable 'outcomes' of professional development. Given this context, our focus on the school environment actors underpinning successful PD implementation means that a broader understanding of 'effectiveness' is useful, encompassing other beneficial outcomes for teachers within their school settings. Overall, therefore taking into account the breadth and quantity of studies included in each phase of the review, and the consistency in our findings across the corpus of studies included, we are confident that our findings offer a representative picture of the leadership of professional development implementation in schools.

Recommendations

In the previous sections, we described three leadership dimensions, and eleven interlinking themes within them, which were consistent in our review of the literature across variations in school and professional development contexts. These dimensions and their associated themes underpin school leaders' approaches to the implementation of successful professional development, supporting teachers' readiness for change and their engagement in planning, collaborating and sharing accountability for their ongoing learning.

Drawing on our findings from the three phases of the review, we have identified a series of recommendations. Firstly, we present some recommendations for further research. One intention for our review is to aid school leaders in supporting their schools and empowering their teachers to be professional development ready, so we then also recommend some actions which could be taken by school leaders to improve the implementation of professional development in their contexts.

Recommendations for further research

We identified a large corpus of literature containing evidence about the implementation of professional development and its relationship to the school environment. However, the evidence base for school leadership for professional development appears to be small, relative to the relationship between other aspects of the school environment and professional development.

Our study makes a contribution to addressing this evidence gap, but there is scope for further empirical research focussed on the leadership of professional development within the school environment, in order to gain further understanding of how leadership can influence teachers' engagement in, and implementation of, professional development.

For example, we identified 100 papers for in-depth analysis, and found that, across a range of reported professional development activities, teacher outcomes and perspectives were much more commonly reported than those of pupils or school leaders. This raises the possibility of studies which draw on the perspectives of other members of the school community in addition to teachers, in order to understand their role in, and experiences of, professional development.

Connected to this, our analysis focussed in the main on qualitative studies, while some other studies of effective professional development have considered only quantitative data. It would be beneficial for more studies of professional development to used mixed methods approaches in order to gather quantitative and qualitative data, and thereby generate a fuller understanding of the connections between professional development implementation and its outcomes.

Finally, we recommend further study to explore the roles of our eleven themes in the current, post-Covid school environment. Studies here could investigate the relative importance of some themes over others, their relationships with the attributes of effective school leaders in general, their utility in a landscape of increased online professional development activity, and the ways in which particular actions and behaviours might be devolved from school leaders to professional development leaders in schools. In particular, attention should be

paid to the support and professional development needs of school and professional development leaders themselves in order to gain the expertise needed to use these themes to better implement professional development.

Recommendations for school leaders' implementation of professional development

Notwithstanding the limitations of this study, we hope that school leaders will find its outcomes relatable to their own contexts and actions. With that in mind, we present here some recommendations, with the intention that these support the actions of school leaders in the implementation of professional development in their schools. Our recommendations deliberately do not focus on leadership hierarchies or on different leadership roles, but rather capture how professional development leaders at any level in a school system might improve the implementation of professional development.

Trusting leadership: responsibility, accountability, agency

School leaders have responsibility for creating and sustaining a safe culture of professional development. This culture is one where teachers are supported to experiment, take risks, make mistakes, learn and be vulnerable together. School leaders can model this through being open about their own professional development needs, participating alongside teachers, and sharing their learning.

Responsibility and accountability for professional development go beyond school leaders, and teachers can be empowered to have agency relating to their own professional development. This requires school leaders to give teachers some choice and decision-making power over their professional development. This may not mean that they are given free choices of all aspects of their activity, rather that, within some boundaries, they are able to take the lead. For example, these might relate to: the focus of a professional learning community; choosing from a range of school development priorities; the timing of particular activities; or the ability to opt-out of some sessions within a programme where appropriate.

Engaged leadership: collaboration, integration, resources

School leaders lead professional learning by engaging in, and supporting others to engage in, appropriate professional development. As part of this, clear communication about professional development is important so that teachers understand the purpose, structure and intended outcomes of activities. This is equally applicable to the consideration of informal opportunities for professional development, such as providing space for conversation or shared planning.

School leaders can recognise and integrate the professional development needs of individuals, the team and the school as a whole so that personalised professional learning needs are aligned with those of the school. This means structures should be in place to gather information about the development needs of individuals, and then to analyse these across the whole school, in order to recognise, draw on and address strengths and weaknesses within staff groupings and the school as a whole. These approaches should be applied to school leaders also, so that they too participate in professional development, not just alongside teachers but also for themselves, such as developing facilitation skills and communication strategies.

Collaboration is important, and so school leaders can develop, or support others to develop, structures and processes which enable collaboration for professional development. For collaborative and individual activities, prioritisation of resources is vital, taking the form of material-economic support, time and space. Time and space are important before and after professional development activities, as well as during, giving teachers time to consider what they will gain from professional development and then to plan for implementation of change afterwards.

Learning leadership: vision, data, brokerage

School leaders can communicate a clear vision for their schools for professional learning, developing this vision in collaboration with teachers, so that they share responsibility for its implementation. This can include gaining feedback from teachers, such as describing how successful learning looks in their classroom or school, for themselves and for their pupils, and identifying how to evaluate the impact of professional development or monitor progress towards school goals.

School leaders, and teachers, can use data to support decisions about professional development, including its accessibility and implementation, for example using this to identify in-school or external expertise. School leaders can also therefore play important roles in brokering professional development connections from teachers to sources, networks and activities outside the school. These connections might include research evidence or links to organisations, people or activities.

Concluding remarks

In this strand of the study, we set out to understand the implementation of teacher professional development within the school environment. We carried out a systematic review of the national and international literature in order to identify the ways in which the school environment can be shaped to support teachers' engagement in professional development. We focussed in particular on the roles, actions and behaviours of school leaders as significant factors in the implementation of professional development. We did not attempt to classify school leaders' formalised roles within school hierarchies, rather including headteachers, senior leaders, middle leaders and teachers as leaders driving and implementing professional development with and for their staff. This enabled us to consider the roles of professional development leaders at any level within a school environment.

The review was framed by two research questions:

- What research literature exists that investigates how the school environment influences teachers' ability to engage in professional development or their professional development outcomes?
- What attributes, actions and mechanisms underpin effective leadership for professional development implementation in relation to the school environment?

Following an extensive search of the literature, we used three phases of coding and analysis to map the field and identify themes relating to the leadership of the implementation of professional development.

In mapping the field of literature, we identified more qualitative than qualitative studies. This is perhaps not surprising given the complex, situated nature of the area of study, and sets our review in contrast to many other reviews of evidence relating to teacher professional development. Indeed, the nature of the topic area means that rich and contextualised evidence from qualitative research is vital to understanding how the school environment influences readiness, access to and implementation of professional development.

Compared to other areas of the school environment, there appears to be less literature pertaining to effective school leadership that influences the characteristics of teachers associated with engagement in, and implementation of, professional development. This suggests a gap in the evidence base which our study goes some way to filling, and suggests pathways for further research. We also found that studies of professional learning communities appeared to more frequently contain reference to the school environment, and that more studies focussed on teacher outcomes and perspectives rather than those of school leaders or pupils. Again, this raises possibilities for future research.

The interaction and relational characteristics of schools appear to be central to the effective implementation of professional development. Our mapping of the field suggests that effective leadership of professional development participation and implementation has direct and formalised pathways associated with the resourcing, coordination and monitoring of professional development activities within the school, and more indirect pathways that pertain to the development of a vision for and culture of professional learning at both the school and individual levels. Our analysis suggests that both informal and formal leadership contribute to the

effective implementation of professional development, although it is possible that the indirect role may be more vital than the more direct, structural role.

Our thematic analysis of school leaders' implementation of professional development gave rise to three broad leadership dimensions and, within those, eleven interconnected themes (Table 18). Each of these themes might be enacted through formal or informal roles, processes and decisions.

Table 18. Leadership dimensions and themes

Leadership dimension	Themes
Trusting leadership	School leaders are responsible for creating and sustaining a safe culture for professional learning
	Responsibility and accountability for professional learning go beyond the school leadership
	Teachers can be empowered to have agency over their own professional development
Engaged leadership	School leaders can provide leadership for professional learning by engaging in, and supporting others to engage in, appropriate professional development
	School leaders can encourage, develop and support professional collaboration for professional development
	School leaders can recognise and integrate the professional development needs of individuals, the team and the school as a whole
	Material-economic support is necessary for professional development to be successful
	School leaders can prioritise making time and space for professional development – before, during, and after
Learning leadership	School leaders should communicate a clear vision for their schools for professional learning
	Appropriate use of data by school leaders can support access to, and implementation, of professional learning
	School leaders can broker connections and access to external sources and activities to support professional learning

The connectivities between these themes reflect the complexity of the teacher professional development system. Our quantitative findings emphasised the importance of considering multiple domains in decision-making and the qualitative findings re-affirmed this. Therefore, for school and PD leaders and policy makers, enhancing the effectiveness of professional development implementation requires consideration from multiple angles. Any efforts made to change one area may only lead to improvements if attention is paid to the intersections with other areas.

Our findings demonstrate how school leaders can build cultures of professional development, which empower teachers to participate in ongoing professional development, through multiple pathways combining leader-initiated, teacher-led and instruction-focused learning. Inherent to any combination of these pathways is a need to have clearly defined, differentiated, outcomes for individual contexts, which take into account structures for teacher collaboration and organisational leadership structures alongside individual and collective teacher readiness for change.

Leaders can balance formal and informal structures and processes for professional development. They can formalise learning processes, including visualising, modelling and giving value to professional development, while also decentralising the organisation and decision-making associated with informal learning, thereby promoting co-operation, innovation and collaboration. Further, leaders can offer opportunities for professional collaboration for learning, while also letting teachers lead learning where appropriate.

Finally, to implement professional development effectively, those in professional development leadership roles require the skills to build teachers' self-belief, have conversations which challenge existing practice, and deal with tensions and sensitivities in community and collegial relationships. These careful balances of direction and choice, and leadership and autonomy, are central to establishing teacher self-efficacy, motivation, engagement and commitment to professional development.

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Appendix 1.

School environment factor framework (adapted from Century et al., 2012)

Systematic review main code	Notes on adaptations from Century et al.'s (2012) framework	Subcode	Definition/examples
Characteristics of the PD innovation (c*hange content*)	• The 'innovation' is the specific PD programme or activity being implemented. • Our framework coded for the *adaptability* of a PD innovation only, categorising studies that address or describe *how* a PD activity, or series of activities, is operationalised in relation to the school environment. • Our framework did not focus on the innovation characteristics of *scope*, *effectiveness* and *result demonstrability* of a given innovation, which were part of the original framework.	Adaptability	The complexity (i.e., the number of parts and their interdependence) and the detail of operationalization of PD innovation. This relates to the design features of a PD innovation that are associated with implementation in schools.
Characteristics of the PD user (c*hange attributes*)	• Incorporates both the individual characteristics 'in the context of the PD programme or activity' (e.g. self-efficacy and motivation, perceptions of feasibility of the innovation) and 'not in the context of the PD programme or activity' (e.g. resourcefulness, time management, age, education, years of experience) from the original framework under one umbrella code. • Organised studies by whether they reported on characteristics (both in and not in the context of the innovation) as pertaining to teachers, teaching teams, or school leaders as users of the PD programme or activity being implemented.	Leader attributes	The characteristics and individual learning outcomes of leaders driving and implementing PD with/for their staff. Examples include demographics, education, (years of) experience, self-efficacy, attitudes, (fit with) individual beliefs, motivation/commitment, innovativeness, agency, resourcefulness, time management/planning skills

		Teacher attributes	The characteristics and individual learning outcomes of teachers as the target of the PD innovation being implemented. Examples include demographics, education, (years of) experience, self-efficacy, attitudes, (fit with) individual beliefs, motivation/commitment, innovativeness, agency, resourcefulness, time management/planning skills.
		Team attributes	The characteristics and learning outcomes of staff teams involved in or the target of the PD innovation being implemented. Examples include demographics, team composition (i.e., admin, teaching, support, school leaders), subject specialism, collective efficacy, collective attitudes, (fit with) collective beliefs, collective motivation/commitment, team innovativeness, team agency, team resourcefulness and efficiency).
Characteristics of the organisation related to school leaders and other staff members (c*hange process*)	Like Century et al. (2012), our framework organised studies by whether they reported on *characteristics of the school pertaining to people* (e.g. collaboration, interaction, communication, shared beliefs, leadership practices) and/or *structural, descriptive characteristics of the school* (e.g. physical environment, population, formal policies and guidelines).	Leadership practices	The activities, actions and strategies associated with leadership of PD and teacher professional learning at different levels within the school (senior, middle, individual teachers). This includes policies, knowledge management strategies, distributed leadership, establishing a shared vision, amongst others.
		Shared ethos (established)	The shared values, beliefs and vision within a school or between members of staff that make up the school culture or ethos and that influence or result from the reception, implementation and sustainability of PD innovations or teacher professional learning.
		Interaction	The communication, collaboration, and relational processes (such as trust) between school staff members that support the implementation of PD innovations or teacher professional learning.
		Organisational readiness	(Perceptions of) the overall support, efficacy, and innovativeness of the school organisation that impact on or influence the implementation and sustainability of PD innovations.

		PD fit with school priorities	Perceptions of school staff or staff teams about the extent to which the PD innovation or professional learning opportunity fits with the priorities of the school (NB: not fit with staff members' individual beliefs, values, and interests, which is an individual characteristic of the PD user).
		Networked-ness	The networks and partnerships that exist within school, between schools and between schools and external organisations, that are part of or influence the implementation of the PD innovation or learning opportunity.
Characteristics of the organisation related to structural and other aspects (c*hange context*)	See above	Organisational structure	Existing administrative policies, codes of conduct, size, and other structural aspects of the school organisation that affect the implementation of PD innovations or teacher professional learning opportunities.
		Organisational resources	Aspects of funding, time, staffing, teaching materials and other flexible resources (i.e. not inherent to the school facilities) that impact on the implementation and sustainability of PD innovations and teacher professional learning.
		Population characteristics	The characteristics of the population of the school or subgroup within the school that the implementation of the PD innovation is influenced by or targeted at, such as SEND, SES, EAL.
		Organisational environment	The existing physical conditions and behavioural atmosphere of a school, associated with the more fixed infrastructure of the school and behavioural issues outside of the PD innovation implementation that affect the implementation and sustainability of the PD innovation.

Appendix 2.

Leadership for PD implementation coding framework

CODE NAME	DEFINITION
1 EXCLUDE on Outcome/Screening R1&2	The study does not report on any of the specified outcomes or should have been excluded based on criteria from previous coding rounds. *Tick where relevant*
2 EXCLUDE No Leadership attributes or actions	The study does not report on any leadership attributes or actions for PD or teacher learning *Tick where relevant*
3 Outcomes	*Tick all that apply to study overall*
3a Pupil outcomes	The study reports on pupil outcomes associates with a PD intervention or teacher learning
3a1 Achievement/Attainment	The study reports on changes in pupil achievement or attainment associated with a PD intervention or teacher learning
3a2 Motivation & other learning attributes	The study reports on changes in pupil motivation and other learning attributes (e.g., attitudes, self-efficacy) as a result of a PD intervention or teacher learning.
3a3 Improved experience of teaching	The study reports on change in pupils' experiences of the teaching they receive (e.g., greater enjoyment, perceptions of the teaching) as a result of a PD intervention or teacher learning
3b Teacher outcomes	The study reports on teacher outcomes associates with a PD intervention or professional learning

	3b1 Technical knowledge	The study reports on changes in teacher technical knowledge. This includes forms of professional knowledge pertaining to curriculum content, pedagogical knowledge, assessment knowledge and knowledge on pupil learning. It relates to the knowledge domain of teachers' cognitions, as separate from attitudinal and behavioural dimensions
	3b2 Change in classroom practice	The study reports on changes in the behavioural dimension of teacher professional learning (that is to say, any changes – observed or perceived – within the domain of practice) as a result of a PD intervention or professional learning
	3b3 Attitudinal characteristics (individual & collective)	The study reports on changes in the attitudinal domain of teacher cognition as a result of a PD intervention or professional learning. It includes behaviours such as motivation/commitment/persistence, beliefs, efficacy, identity (in relation to ongoing change and learning)
	3b4 Empowerment (individual & collective)	The study reports on changes in e.g., agency, initiative-taking, or autonomy that support further professional development and learning, as a result of a PD intervention or professional learning. Feeling empowered can be experienced at the individual or collective level, but it is not an individual characteristic. Rather, it exists in the relation between individual and environment
	3b5 Collaboration/Professional Inquiry	The study reports on changes in teacher collaboration (i.e., improved collaboration/cohesion/team culture or contribution to practise development) and/or professional inquiry (i.e. improved knowledge used in and developed from practice, improved knowledge-rich culture), due to PD intervention or participating in learning

3c Organisational outcomes	The study reports on outcomes at the level of the organisational environment, either as precursor to PD/teacher learning or as a result of PD/teacher learning
3c1 PD supporting structures	The study reports on outcomes at the level of the organisational environment (structural procedural, attitudinal), either as precursor to PD/teacher learning or as a result of PD/teacher learning
4 PD Type	*Tick one that applies to study overall*
4a Classroom-based (incl. Lesson Study)	The study reports on the implementation and/or outcomes of a classroom-level PD intervention(s) that involves teachers trying out and reflecting on new approaches in the classroom to establish what works for them based on their experience and the context of the school in which they teach.
4b Mentoring	The study reports on the implementation and/or outcomes of a PD intervention(s) that involves mentoring, from a more senior colleague or from a peer.
4c PLC	The study reports on the implementation and/or outcomes of a Professional Learning Community (PLC) or Professional Learning Network (PLN), defined as a collective of individuals, often consisting of teachers, administrators, and other education professionals, that work together to build a culture of collaboration and shared responsibility for pupil learning.
4d Sustained training	The study reports on the implementation and/or outcomes of a PD intervention(s) that involves multiple training events
4e One-off training	The study reports on the implementation and/or outcomes of a PD intervention(s) that involves a single training event

4f Other PD type	The study reports on the implementation and/or outcomes of a PD intervention(s) that is not classroom-based, mentoring PLC, or either sustained or one-off training events. For any PD/school innovations/reforms that do not fit any of the other categories, please copy text from the article under 'info' button.
4g Multiple PD types	The study reports on the implementation and/or outcomes associated with multiple and different types PD interventions. This is likely to happen when hypothetically discussing PD rather than reflecting on a concrete and contained PD intervention that is being implemented
4h Unknown	The study reports on PD or professional learning, but it is not possible to identify the exact nature of a specific PD intervention or event. Use this for any studies that mention professional development as part of the chain from leadership to any of the outcomes, but doesn't specify a specific type or concrete PD initiative being implemented

5 School Setting	
5a Phase	*Tick all that apply to study overall*
5a1 Primary/elementary	The study reports on PD/professional learning taking place in primary school (6-11 yr old pupils) and/or with primary school staff.
5a2 Secondary/middle/high	The study reports on PD/professional learning taking place in secondary school (12-16 yr old pupils) and/or with secondary school staff.
5a3 Primary + secondary	The study reports on PD/professional learning taking place in both primary and secondary schools and/or with both primary and secondary school staff.

5a4 Post-16/A-level/vocational	The study reports on PD/professional learning taking place in post-16 education and/or with post-16 staff. Post-16 includes education offered to pupils age 16-18, and includes qualifications such as A-levels in the UK, but also other vocational education up to the age of 18

5b Country/Region	*Tick one that applies to study overall*
5b1 UK/RoI	The study reports on PD/Professional Learning in the UK or Republic of Ireland
5b2 Europe	The study reports on PD/Professional Learning in a European country
5b3 US/Canada	The study reports on PD/Professional Learning in North American region (USA and Canada)
5b4 Australia	The study reports on PD/Professional Learning in Australia
5b5 Asia	The study reports on PD/Professional Learning in an Asian country
5b6 Other	The study reports on PD/Professional Learning in a country NOT in UK/RoI, Europe, US/Canada, Australia or Asia, but that had been included because of its potential to contribute to our understanding of sustained PD in the UK. For studies in a region/country not listed, please tick other and copy text from the article into 'info' button.
5b7 Multiple regions	The study reports on PD/Professional Learning in multiple nations and regions
5b8 Unknown/NA	The study reports on PD/Professional Learning that is not country specific (e.g. training event with international teachers) or the country in which the PD is taking place is not mentioned

5c Policy Context	*Code where relevant (leave blank where no information on policy context is reported).* Use this code to keep track of any information about the policy context in which a PD intervention or the Professional Learning takes place, and any sections of the article that describe a specific policy initiative or policy context that the schools are responding to by implementing the PD - please code or summarise in info button (or both).
5d (PD fit with) School priorities	*Tick one that applies to study overall*
5d1 Fit – match	The information on school priorities reported in the article sees strong overlap with the topic or focus of the PD intervention/Professional learning (i.e., the PD/PL directly addresses the school priorities)
5d2 Fit – partial match	The information on school priorities reported in the article sees partial overlap with the topic or focus of the PD intervention/Professional learning (i.e., the PD/PL partially addresses the school priorities, but other pressing priorities are also present)
5d3 Fit – no match	The information on school priorities reported in the article sees no overlap with the topic or focus of the PD intervention/Professional learning (i.e., the PD/PL does not address any of the school priorities)
5d4 Fit – unknown	There is not enough information about the school priorities in the article to assess the fit of the PD intervention with these school priorities.
5e Other school setting	*Code where relevant (leave blank where no further information on school setting is reported)* Please code (or summarise using info button) for any other existing school-specific characteristics or features that are reported and may have influenced the PD implementation and its outcomes. These are not characteristics that are the target of the PD innovation, although they may change as a result of the PD innovation. It is the sort of information that

	would be mentioned in the description of the sample. (e.g., funding, size, resources, staffing, population demographics)
6 Data source/Stakeholder perspective	*Tick one that applies to study overall*
6a Pupil perspective	The study's findings stem from data from pupil participants
6a1 Pupil – observed behaviour in specific PD intervention	The study's findings stem from pupil data that reflect observed behaviours (e.g., researcher observed changes in classroom behaviour or achievement/attainment scores) **as part of a specific, contained and implemented PD intervention/professional learning event.**
6a2 Pupil – (self-)perceived behaviour in specific PD intervention	The study's findings stem from pupil data that reflect perceived (by others involved in the PD or by pupils themselves) behaviours (e.g., teacher observed changes in classroom behaviour or self-report data from pupils through survey, journals, interviews) **as part of a specific, contained and implemented PD intervention/professional learning event.**
6a3 Pupil – (self-)perceived behaviour in non-specific PD intervention	The study's findings stem from pupil data that reflect perceived (by others involved in the PD or by pupils themselves) behaviours (e.g., teacher observed changes in classroom behaviour or self-report data from pupils through survey, journals, interviews) **that is reported on in relation to PD in broad, general terms, without a specific PD event being described or implemented.**
6b Teacher perspective	The study's findings stem from data from teacher participants
6b1 Teacher – observed behaviour in specific PD intervention	The study's findings stem from teacher data that reflect observed behaviours (e.g., researcher observed changes in classroom behaviour or teacher learning outcomes scores) **as part of a specific, contained and implemented PD intervention/professional learning event.**

	6b2 Teacher – (self-)perceived behaviour in specific PD intervention	The study's findings stem from teacher data that reflect perceived (by others involved in the PD or by teachers themselves) behaviours (e.g., teacher observed changes in classroom behaviour or self-report data from teachers through survey, journals, interviews) **as part of a specific, contained and implemented PD intervention/professional learning event.**
	6b3 Teacher – (self-)perceived behaviour in non-specific PD intervention	The study's findings stem from teacher data that reflect perceived (by others involved in the PD or by teachers themselves) behaviours (e.g., peer/senior staff observed changes in classroom behaviour or self-report data from teachers through e.g., surveys, journals, interviews) **that is reported on in relation to PD in broad, general terms, without a specific PD event being described or implemented.**
6c Leader perspective		The study's findings stem from data from organisational leader participants
	6c1 Leader – observed behaviour in specific PD intervention	The study's findings stem from organisational leader data that reflect observed behaviours (e.g., researcher observed changes in behaviour or leader learning outcomes scores) **as part of a specific, contained and implemented PD intervention/professional learning event.**
	6c2 Leader – (self-)perceived behaviour in specific PD intervention	The study's findings stem from organisational leader data that reflect perceived (by others involved in the PD or by leaders themselves) behaviours (e.g., teacher observed changes in classroom behaviour or self-report data from leaders through survey, journals, interviews) **as part of a specific, contained and implemented PD intervention/professional learning event.**
	6c3 Leader – (self-)perceived behaviour in non-specific PD intervention	The study's findings stem from organisational leader data that reflect perceived (by others involved in the PD or by leaders themselves) behaviours (e.g., peer/senior staff observed changes in behaviour or self-report data from leaders through e.g., surveys, journals, interviews) **that is reported on in relation to PD in broad, general terms, without a specific PD event being described or implemented.**

6d Other stakeholder perspective		The study's findings stem from data from participants other than pupils, teachers, or organisational leaders, e.g., parents, teacher educator, consultant etc.
	6d1 Other – observed behaviour in specific PD intervention	The study's findings stem from other stakeholder data (i.e., not pupil/teacher/leader) that reflect observed behaviours (e.g., researcher observed changes in behaviour or stakeholder learning outcomes scores) **as part of a specific, contained and implemented PD intervention/professional learning event.**
	6d2 Other – (self-)perceived behaviour in specific PD intervention	The study's findings stem from other stakeholder data (i.e., not pupil/teacher/leader) that reflect perceived (by others involved in the PD or by leaders themselves) behaviours (e.g., teacher observed changes in classroom behaviour or self-report data from other stakeholders through survey, journals, interviews) **as part of a specific, contained and implemented PD intervention/professional learning event.**
	6d3 Other – (self-)perceived behaviour in non-specific PD intervention	The study's findings stem from organisational leader data (i.e., not pupil/teacher/leader) that reflect perceived (by others involved in the PD or by leaders themselves) behaviours (e.g., peer/senior staff observed changes in behaviour or self-report data from other stakeholders through e.g., surveys, journals, interviews) **that is reported on in relation to PD in broad, general terms, without a specific PD event being described or implemented.**
6e Multiple stakeholder perspectives		The study's findings stem from data from multiple stakeholders and participants
	6e1 Multiple – observed behaviour in specific PD intervention	The study's findings stem from multiple stakeholder data that reflect observed behaviours (e.g., researcher observed changes in behaviour or multiple stakeholder learning outcomes scores) **as part of a specific, contained and implemented PD intervention/professional learning event.**

	6e2 Multiple – (self-)perceived behaviour in specific PD intervention	The study's findings stem from multiple stakeholder data that reflect perceived (by others involved in the PD or by multiple stakeholders themselves) behaviours (e.g., teacher observed changes in classroom behaviour or self-report data from multiple stakeholders through survey, journals, interviews) **as part of a specific, contained and implemented PD intervention/professional learning event.**
	6e3 Multiple – (self-)perceived behaviour in non-specific PD intervention	The study's findings stem from multiple stakeholder data that reflect perceived (by others involved in the PD or by leaders themselves) behaviours (e.g., peer/senior staff observed changes in behaviour or self-report data from multiple stakeholders through e.g., surveys, journals, interviews) **that is reported on in relation to PD in broad, general terms, without a specific PD event being described or implemented.**
	6e4 Multiple – observed & (self-) perceived behaviour	The study's findings stem from multiple stakeholder data that reflect both observed and perceived behaviour. This can only be in the case of a specific PD intervention being implemented and monitored for its outcomes
7 Leadership for…		*Tick ALL that apply to the findings/results reported in the article.* This code is to be applied to bits of text in the article (not on overall study). The code captures any leadership attributes, activities and their mechanisms in relation to different school environmental conditions and factors as specified in the child codes. Multiple codes can be applied to one study
	7a Lead – teacher characteristics	Any leadership attributes, activities and mechanisms that support teachers' individual or collective attitudinal characteristics or empowerment that supports their (ongoing) learning
	7b Lead – school collective beliefs and attitudes	Any leadership attributes, activities and mechanisms that support collective beliefs and attitudes within the school/organisation, such morale, shared vision, school identity, shared ethos, school culture.

7c Lead – school interaction characteristics	Any leadership attributes, activities and mechanisms that support interactional processes such as communication, feedback, collaboration, trust, network(building).
7d Lead – PD organisation/coordination	Any leadership attributes, activities and mechanisms pertaining to the structuring and coordination of PD activities, such as organising different types of meetings and study days, developing PD policies/plans, sharing information on PD courses)
7e Lead – data monitoring & evaluation	Any leadership attributes, activities and mechanisms that support the monitoring and evaluation of data pertaining to the PD change.
7f Lead – resource allocation (time, money, external expertise)	Any leadership attributes, activities and mechanisms pertaining to the allocation of resources for PD, including freeing up time, money, but also providing funding for access to specific PD courses, or to pay to bring in external experts)
7g Lead – other school readiness	Any leadership attributes, activities and mechanisms that support any other aspects of school readiness for PD (i.e., that is NOT teacher characteristics, collective beliefs/attitudes, interaction characteristics, PD organisation/coordination, data monitoring/evaluating, or resource allocation)
7h Lead – unknown (please state)	Only use this code when the study reports on leadership for PD, but the specific nature of the activities are unknown or the link between leadership and the PD activities is unclear. However, the study still contains evidence of the importance of leadership, with some insight into the areas that leadership contributes to

Appendix 3.

Full list of papers and a summary of coding used in Phases 2 and 3

ID	Short reference	Full reference	Study type	Setting	Country or Region	Outcome(s) level	Outcome(s) detail	CPD type	Data source	Data type	Leadership domain(s)	Leadership dimension	Leadership theme
1	Abrahams et al., 2014	Abrahams, I., Reiss, M. J., & Sharpe, R. (2014). The impact of the "Getting Practical: Improving Practical Work in Science" continuing professional development programme on teachers' ideas and practice in science practical work. Research in Science & Technological Education, 32(3), 263–280.	Qualitative	Primary, Secondary	UK/ROI	Teacher	Technical knowledge (T)	One-off	Teacher	Observed behaviour (Teacher); Self-reported behaviour (Teacher)	Collective beliefs & attitudes; Resource allocation; CPD organisation, coordination	Engaged Leadership (EL)	EL4; EL5
2	Admiraal et al., 2016	Admiraal, W., Kruiter, J., Lockhorst, D., Schenke, W., Sligte, H., Smit, B., Tigelaar, D., & de Wit, W. (2016). Affordances of teacher professional learning in secondary schools. *Studies in Continuing Education*, *38*(3), 281–298.	Mixed methods	Secondary, Middle, High	Europe	Organisational	CPD supporting structures (O)	Multiple CPD types	Multiple	Observed behaviour (Multiple)	Collective beliefs & attitudes; School interaction characteristics	Trusting Leadership (TL); Engaged Leadership (EL)	TL1; TL2; EL1; EL2
3	Anyon et al., 2016	Anyon, Y., Nicotera, N., & Veeh, C. A. (2016). Contextual Influences on the Implementation of a Schoolwide Intervention to Promote Students' Social, Emotional, and Academic Learning. *Children & Schools*, *38*(2), 81–88.	Mixed Methods	Secondary, Middle, High	US/Canada	Teacher; Organisational	Change in classroom practice (T); CPD supporting structures (O)	Sustained	Multiple	Observed & Self-reported behaviour (Multiple)	Collective beliefs & attitudes	Engaged Leadership (EL)	EL4
4	Armour & Makopoulou, 2012	Armour, K. M., & Makopoulou, K. (2012). Great expectations: Teacher learning in a national professional development programme. *Teaching and Teacher Education*, *28*(3), 336–346.	Qualitative	Primary, Secondary	UK/ROI	Teacher	Change in classroom practice (T); Professional collaboration (T)	Other	Multiple	Self-reported behaviour (Multiple)	Unknown	Engaged Leadership (EL)	EL3

ID	Short reference	Full reference	Study type	Setting	Country or Region	Outcome(s) level	Outcome(s) detail	CPD type	Data source	Data type	Leadership domain(s)	Leadership dimension	Leadership theme
5	Attard Tonna & Shanks, 2017	Attard Tonna, M., & Shanks, R. (2017). The importance of environment for teacher professional learning in Malta and Scotland. *European Journal of Teacher Education*, *40*(1), 91–109.	Qualitative	Primary, Secondary	UK/ROI	Organisational	CPD supporting structures (O)	Multiple CPD types	Teacher	Self-reported behaviour (Teacher)	School interaction characteristics; Resource allocation; CPD organisation, coordination	Trusting Leadership (TL); Engaged Leadership (EL); Learning Leadership (LL)	TL1; TL2; EL1; EL2; EL3; EL5; LL3
6	Avidov-Ungar, 2016	Avidov-Ungar, O. (2016). School-based professional development as an organizational learning mechanism: The significance of teachers' involvement. *International Journal of Educational Reform*, *25*(1), 16-37.	Qualitative	Primary, Secondary	Other	Teacher	Technical knowledge (T) (T);Empowerment (T)	One-off	Teacher	Self-reported behaviour (Teacher)	Collective beliefs & attitudes; School interaction characteristics; Other school readiness; Data monitoring & evaluation	Trusting Leadership (TL); Learning Leadership (LL)	TL2; TL3; LL1; LL2; LL3
7	Bainbridge et al., 2022	Bainbridge, A., Reid, H., & Del Negro, G. (2022). Towards a Virtuosity of School Leadership: clinical support and supervision as professional learning. Professional Development in Education, 48(4), 546–558.	Qualitative	Unknown	UK/ROI	Teacher	Empowerment (T)	Mentoring	Leader	Observed behaviour (Leader)	School interaction characteristics; Teacher characteristics; Data monitoring & evaluation;	Learning Leadership (LL)	LL2
8	Ballangrud & Aas, 2022	Ballangrud, B. O. B., & Aas, M. (2022). Ethical thinking and decision-making in the leadership of professional learning communities. *Educational Research (Windsor)*, *64*(2), 176–190.	Qualitative	Secondary, Middle, High	Europe	Teacher	Professional collaboration (T)	PLC	Multiple	Observed & Self-reported behaviour (Multiple)	Collective beliefs & attitudes; School interaction characteristics; CPD organisation, coordination; Other school readiness; Data monitoring & evaluation	Trusting Leadership (TL); Engaged Leadership (EL)	TL2; EL2
9	Barton & Dexter, 2020	Barton, E. A., & Dexter, S. (2020). Sources of teachers' self-efficacy for technology integration from formal, informal, and independent professional learning. *Educational Technology Research and Development*, *68*(1), 89–108.	Qualitative	Secondary, Middle, High	US/Canada	Teacher	Technical knowledge (T) (T); Empowerment (T)	Sustained	Teacher	Self-reported behaviour (Teacher)	Teacher characteristics; Resource allocation; CPD organisation, coordination	Trusting Leadership (TL); Engaged Leadership (EL)	TL2; EL3

ID	Short reference	Full reference	Study type	Setting	Country or Region	Outcome(s) level	Outcome(s) detail	CPD type	Data source	Data type	Leadership domain(s)	Leadership dimension	Leadership theme
10	Bendtsen et al., 2022	Bendtsen, M., Forsman, L., & Björklund, M. (2022). Exploring empowering practices for teachers' sustainable continuing professional development. *Educational Research (Windsor)*, *64*(1), 60–76.	Qualitative	Secondary, Middle, High	Europe	Teacher	Change in classroom practice (T)	Sustained	Teacher	Self-reported behaviour (Teacher)	Collective beliefs & attitudes; School interaction characteristics; Resource allocation; CPD organisation, coordination	Trusting Leadership (TL); Engaged Leadership (EL)	TL3; EL3; EL4; EL5
11	Bills et al., 2016	Bills, A., Rogers, B., & Giles, D. (2016). Reclaiming the ontological over the epistemological: A case study into a New Zealand Primary School disclosing an embodied culture of teacher inquiry. *Teachers' Work*, *13*(1), 61-78.	Qualitative	Primary, Elementary	Australia	Teacher	Attitudinal characteristics (T); Empowerment (T)	PLC	Multiple	Self-reported behaviour (Multiple)	Collective beliefs & attitudes; Teacher characteristics; Resource allocation	Trusting Leadership (TL); Engaged Leadership (EL)	TL3; EL1
12	Brown et al., 2021	Brown, C., Flood, J., Armstrong, P., MacGregor, S., & Chinas, C. (2021). Is distributed leadership an effective approach for mobilising professional capital across professional learning networks? Exploring a case from England. *Journal of Professional Capital and Community*, *6*(1), 64–78.	Mixed Methods	Primary, Elementary	UK/ROI	Teacher	Professional collaboration (T)	PLC	Multiple	Self-reported behaviour (Multiple)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; CPD organisation, coordination	Trusting Leadership (TL); Engaged Leadership (EL)	TL2; TL3; EL1; EL2; EL3; EL5
13	Brynjulf Hjertø et al., 2014	Brynjulf Hjertø, K., Merok Paulsen, J., & Petteri Tihveräinen, S. (2014). Social-cognitive outcomes of teachers' engagement in learning communities. *Journal of Educational Administration*, *52*(6), 775–791.	Quantitative	Primary, Elementary	Europe	Teacher	Attitudinal characteristics (T)	PLC	Teacher	Self-reported behaviour (Teacher)	School interaction characteristics; Resource allocation; CPD organisation, coordination	Engaged Leadership (EL); Learning Leadership (LL)	EL1; EL2; EL3; LL3
14	Bulger et al., 2020	Bulger, S., Elliott, E., Machamer, A., & Taliaferro, A. (2020). Teachers' Perceptions of Professional Learning to Increase Classroom Physical Activity: Supporting School Policy Implementation. *Excellence in Education Journal*, *9*(1), 32-56.	Quantitative	Primary, Elementary	US/Canada	Teacher	Technical knowledge (T)	One-off	Teacher	Observed behaviour (Teacher)	Collective beliefs & attitudes; Teacher characteristics; Resource allocation; Other school readiness	Trusting Leadership (TL); Engaged Leadership (EL)	TL1; EL1; EL2; EL3; EL4

ID	Short reference	Full reference	Study type	Setting	Country or Region	Outcome(s) level	Outcome(s) detail	CPD type	Data source	Data type	Leadership domain(s)	Leadership dimension	Leadership theme
15	Burns et al., 2018	Burns, M. K., Naughton, M. R., Preast, J. L., Wang, Z., Gordon, R. L., Robb, V., & Smith, M. L. (2018). Factors of Professional Learning Community Implementation and Effect on Student Achievement. *Journal of Educational and Psychological Consultation*, *28*(4), 394–412.	Quantitative	Primary, Secondary	US/Canada	Student	Achievement/Attainment (S)	PLC	Multiple	Observed & Self-reported behaviour (Multiple)	Unknown	Trusting Leadership (TL); Learning Leadership (LL)	TL2; LL3
16	Carlyon, 2015	Carlyon, T. (2015). Teacher transition between year levels in primary schools: an opportunity for continuing professional development. *Professional Development in Education*, *41*(3), 563–578.	Qualitative	Primary, Elementary	Australia	Teacher	Change in classroom practice (T)	Mentoring	Teacher	Self-reported behaviour (Teacher)	Collective beliefs & attitudes; School interaction characteristics; Other school readiness	Engaged Leadership (EL)	EL2
17	Carpenter, 2015	Carpenter, D. (2015). School culture and leadership of professional learning communities. *International Journal of Educational Management*, *29*(5), 682–694.	Qualitative	Secondary, Middle, High	US/Canada	Teacher; Organisational	Technical knowledge (T); Change in classroom practice (T); CPD supporting structures (O)	PLC	Multiple	Observed & Self-reported behaviour (Multiple)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; Resource allocation; CPD organisation, coordination; Data monitoring & evaluation	Trusting Leadership (TL); Engaged Leadership (EL); Learning Leadership (LL)	TL1; TL2; TL3; EL1; EL2; EL4; LL2
18	Carpenter, 2018	Carpenter, D. (2018). Intellectual and physical shared workspace: Professional learning communities and the collaborative culture. *International Journal of Educational Management*, *32*(1), 121–140.	Qualitative	Primary, Secondary	US/Canada	Teacher	Technical knowledge (T); Change in classroom practice (T); Attitudinal characteristics (T); Empowerment (T)	PLC	Teacher	Self-reported behaviour (Teacher)	Collective beliefs & attitudes; School interaction characteristics; Resource allocation	Trusting Leadership (TL); Engaged Leadership (EL)	TL1; TL2; EL2; EL4; EL5

ID	Short reference	Full reference	Study type	Setting	Country or Region	Outcome(s) level	Outcome(s) detail	CPD type	Data source	Data type	Leadership domain(s)	Leadership dimension	Leadership theme
19	Chalikias et al., 2021	Chalikias, M., Raftopoulou, I., Sidiropoulos, G., L. Kyriakopoulos, G., & Zakopoulos, V. (2020). The school principal's role as a leader in teachers' professional development: the case of public secondary education in Athens. *Problems and Perspectives in Management*, *18*(4), 461–474.	Quantitative	Secondary, Middle, High	Europe	Teacher	Other/Unknown (T)	Unknown	Teacher	Self-reported behaviour (Teacher)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; Resource allocation	Engaged Leadership (EL)	EL1
20	Cheah et al., 2019	Cheah, Y. H., Chai, C. S., & Toh, Y. (2019). Traversing the context of professional learning communities: development and implementation of Technological Pedagogical Content Knowledge of a primary science teacher. *Research in Science & Technological Education*, *37*(2), 147–167.	Qualitative	Primary, Elementary	Asia	Teacher	Technical knowledge (T)	PLC	Teacher	Observed behaviour (Teacher); Self-reported behaviour (Teacher)	School interaction characteristics; Teacher characteristics; Resource allocation; CPD organisation, coordination	Engaged Leadership (EL)	EL2; EL5
21	Cheng, 2017	Cheng, E. C. (2017). Managing school-based professional development activities. *International Journal of Educational Management*, *31*(4), 445–454.	Quantitative	Unknown	Asia	Student; Teacher	Achievement/Attainment (S); Change in classroom practice (T)	Multiple CPD types	Leader	Self-reported behaviour (Leader)	School interaction characteristics; CPD organisation, coordination; Data monitoring & evaluation	Engaged Leadership (EL); Learning Leadership (LL)	EL2; EL3; LL2
22	Chu, 2016	Chu, K. (2016). Leading knowledge management in a secondary school. *Journal of Knowledge Management*, *20*(5), 1104–1147.	Mixed Methods	Secondary, Middle, High	Asia	Student; Teacher; Organisational	Achievement/Attainment (S); Technical knowledge (T); Attitudinal characteristics (T); CPD supporting structures (O)	Multiple CPD types	Multiple	Self-reported behaviour (Multiple)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; Resource allocation	Trusting Leadership (TL); Learning Leadership (LL)	TL1; LL1
23	Coles-Ritchie & Smith, 2017	Coles-Ritchie, M., & Smith, R. R. (2017). Taking the risk to engage in race talk: professional development in elementary schools. *International Journal of Inclusive Education*, *21*(2), 172–186.	Qualitative	Primary, Elementary	US/Canada	Teacher	Empowerment (T)	One-off	Teacher	Observed behaviour (Teacher); Self-reported behaviour (Teacher)	School interaction characteristics; Teacher characteristics	Trusting Leadership (TL); Engaged Leadership (EL)	TL1; EL1

ID	Short reference	Full reference	Study type	Setting	Country or Region	Outcome(s) level	Outcome(s) detail	CPD type	Data source	Data type	Leadership domain(s)	Leadership dimension	Leadership theme
24	Cooper et al., 2016	Cooper, K. S., Stanulis, R. N., Brondyk, S. K., Hamilton, E. R., Macaluso, M., & Meier, J. A. (2016). The teacher leadership process: Attempting change within embedded systems. *Journal of Educational Change*, *17*(1), 85–113.	Qualitative	Primary, Secondary	US/Canada	Teacher	Change in classroom practice (T)	Multiple CPD types	Multiple	Observed & Self-reported behaviour (Multiple)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; Resource allocation; Other school readiness	Trusting Leadership (TL); Engaged Leadership (EL); Learning Leadership (LL)	TL1; TL2; EL1; LL1
25	Datnow, 2018	Datnow, A. (2018). Time for change? The emotions of teacher collaboration and reform. *Journal of Professional Capital and Community*, *3*(3), 157–172.	Qualitative	Primary, Elementary	US/Canada	Teacher	Change in classroom practice (T); Attitudinal characteristics (T); Professional collaboration (T)	Classroom	Multiple	Observed & Self-reported behaviour (Multiple)	Teacher characteristics; Resource allocation; CPD organisation, coordination	Trusting Leadership (TL); Engaged Leadership (EL)	TL1; EL2; EL4
26	De Neve & Devos, 2017	De Neve, D., & Devos, G. (2017). How do professional learning communities aid and hamper professional learning of beginning teachers related to differentiated instruction? *Teachers and Teaching, Theory and Practice*, *23*(3), 262–283.	Qualitative	Primary, Elementary	Europe	Teacher	Other/Unknown (T)	PLC	Multiple	Observed behaviour (Multiple)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; Resource allocation; Other school readiness	Trusting Leadership (TL); Engaged Leadership (EL); Learning Leadership (LL)	TL1; TL2; TL3; EL3; LL1
27	Delvaux et al., 2013	Delvaux, E., Vanhoof, J., Tuytens, M., Vekeman, E., Devos, G., & Van Petegem, P. (2013). How may teacher evaluation have an impact on professional development? A multilevel analysis. *Teaching and Teacher Education*, *36*, 1–11.	Quantitative	Secondary, Middle, High	Europe	Teacher	Attitudinal characteristics (T)	Unknown	Teacher	Self-reported behaviour (Teacher)	Collective beliefs & attitudes; School interaction characteristics; Other school readiness	Engaged Leadership (EL); Learning Leadership (LL)	EL1; LL1
28	Derrington & Kirk, 2017	Derrington, M. L., & Kirk, J. (2017). Linking job-embedded professional development and mandated teacher evaluation: teacher as learner. *Professional Development in Education*, *43*(4), 630–644.	Qualitative	Primary, Secondary	US/Canada	Student; Teacher	Achievement/Attainment (S); Change in classroom practice (T)	Classroom	Leader	Self-reported behaviour (Leader)	Collective beliefs & attitudes; School interaction characteristics; Resource allocation; CPD organisation, coordination	Engaged Leadership (EL)	EL3

ID	Short reference	Full reference	Study type	Setting	Country or Region	Outcome(s) level	Outcome(s) detail	CPD type	Data source	Data type	Leadership domain(s)	Leadership dimension	Leadership theme
29	Dobbs et al., 2017	Dobbs, C. L., Ippolito, J., & Charner-Laird, M. (2017). Scaling up professional learning: technical expectations and adaptive challenges. *Professional Development in Education*, *43*(5), 729–748.	Qualitative	Secondary, Middle, High	US/Canada	Teacher; Organisational	Attitudinal characteristics (T); CPD supporting structures (O)	PLC	Teacher	Observed behaviour (Teacher); Self-reported behaviour (Teacher)	School interaction characteristics	Engaged Leadership (EL)	EL2
30	Drits-Esser et al., 2017	Drits-Esser, D., Gess-Newsome, J., & Stark, L. A. (2017). Examining the sustainability of teacher learning following a year-long science professional development programme for inservice primary school teachers. *Professional Development in Education*, *43*(3), 375–396.	Mixed Methods	Primary, Elementary	US/Canada	Teacher	Technical knowledge (T); Change in classroom practice (T); Attitudinal characteristics (T)	Sustained	Multiple	Observed & Self-reported behaviour (Multiple)	Teacher characteristics	Trusting Leadership (TL); Engaged Leadership (EL)	TL1; EL2; EL4
31	Ezzani, 2019	Ezzani, M. D. (2019). Principal and teacher instructional leadership: a cultural shift. *International Journal of Educational Management*, *34*(3), 576–585.	Qualitative	Primary, Elementary	US/Canada	Student; Organisational	Achievement/Attainment (S); CPD supporting structures (O)	PLC	Multiple	Observed & Self-reported behaviour (Multiple)	Collective beliefs & attitudes; School interaction characteristics; Resource allocation; CPD organisation, coordination; Other school readiness; Data monitoring & evaluation	Trusting Leadership (TL); Engaged Leadership (EL); Learning Leadership (LL)	TL2; EL2; EL3; EL5; LL1; LL2
32	Fairman et al., 2023	Fairman, J. C., Smith, D. J., Pullen, P. C., & Lebel, S. J. (2023). The challenge of keeping teacher professional development relevant. *Professional Development in Education*, *49*(2), 197–209.	Mixed Methods	Secondary, Middle, High	US/Canada	Student; Teacher	Achievement/Attainment (S); Technical knowledge (T)	Multiple CPD types	Other	Observed behaviour (Other)	School interaction characteristics; Resource allocation; CPD organisation, coordination	Engaged Leadership (EL)	EL5
33	Falloon et al., 2021	Falloon, G., Stevenson, M., Beswick, K., Fraser, S., & Geiger, V. (2021). Building STEM in Schools: An Australian Cross-case Analysis. *Educational Technology & Society*, *24*(4), 110–122.	Qualitative	Primary, Secondary	Australia	Teacher	Empowerment (T)	Sustained	Multiple	Observed & Self-reported behaviour (Multiple)	Collective beliefs & attitudes; Teacher characteristics; Resource allocation	Trusting Leadership (TL); Learning Leadership (LL)	TL2; LL1

ID	Short reference	Full reference	Study type	Setting	Country or Region	Outcome(s) level	Outcome(s) detail	CPD type	Data source	Data type	Leadership domain(s)	Leadership dimension	Leadership theme
34	Ferguson, 2013	Ferguson, K. (2013). Organizing for professional learning communities: Embedding professional learning during the school day. *Canadian Journal of Educational Administration and Policy*, (142).	Qualitative	Primary, Elementary	US/Canada	Teacher	Professional collaboration (T)	PLC	Multiple	Observed & Self-reported behaviour (Multiple)	Teacher characteristics; Resource allocation	Engaged Leadership (EL)	EL5
35	Furner & McCulla, 2019	Furner, C., & McCulla, N. (2019). An exploration of the influence of school context, ethos and culture on teacher career-stage professional learning. *Professional Development in Education*, *45*(3), 505–519.	Mixed Methods	Primary, Secondary	Australia	Teacher; Organisational	Technical knowledge (T); Change in classroom practice (T); Empowerment (T); CPD supporting structures (O)	Unknown	Multiple	Observed & Self-reported behaviour (Multiple)	School interaction characteristics; Teacher characteristics; Other school readiness	Trusting Leadership (TL); Engaged Leadership (EL); Learning Leadership (LL)	TL1; EL1; EL3; LL1
36	Gaikhorst et al., 2019	Gaikhorst, L., März, V., Pré, R. du, & Geijsel, F. (2019). Workplace conditions for successful teacher professional development: School principals' beliefs and practices. *European Journal of Education*, *54*(4), 605–620.	Qualitative	Primary, Elementary	Europe	Teacher; Organisational	Attitudinal characteristics (T); Empowerment (T); CPD supporting structures (O)	Unknown	Leader	Self-reported behaviour (Leader)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; CPD organisation, coordination; Other school readiness	Trusting Leadership (TL); Engaged Leadership (EL); Learning Leadership (LL)	TL1; TL2; TL3; EL1; EL3; LL1; LL3
37	Gairín Sallán et al., 2022	Gairín Sallán, J., Diaz-Vicario, A., Barrera-Corominas, A., & Duran-Bellonch, M. (2022). Teachers' informal learning and organizational learning in Spain. *The Journal of Workplace Learning*, *34*(1), 74–87.	Qualitative	Primary, Secondary	Europe	Teacher	Professional collaboration (T)	Other	Multiple	Self-reported behaviour (Multiple)	School interaction characteristics; CPD organisation, coordination; Other school readiness	Engaged Leadership (EL)	EL2
38	Gray et al., 2014	Gray, J., Mitchell, R., & Tarter, C. J. (2014). Organizational And Relational Factors In Professional Learning Communities. *Planning & Changing*, *45*(1/2), 83–97.	Quantitative	Primary, Secondary	US/Canada	Organisational	CPD supporting structures (O)	PLC	Multiple	Self-reported behaviour (Multiple)	School interaction characteristics; Teacher characteristics	Trusting Leadership (TL); Engaged Leadership (EL)	TL2; EL1; EL3

ID	Short reference	Full reference	Study type	Setting	Country or Region	Outcome(s) level	Outcome(s) detail	CPD type	Data source	Data type	Leadership domain(s)	Leadership dimension	Leadership theme
39	Gregory et al., 2021	Gregory, A., Ward-Seidel, A. R., & Carter, K. V. (2021). Twelve Indicators of Restorative Practices Implementation: A Framework for Educational Leaders. *Journal of Educational and Psychological Consultation*, *31*(2), 147–179.	Qualitative	Primary, Secondary	US/Canada	Organisational	CPD supporting structures (O)	Unknown	Leader	Observed behaviour (Leader)	Collective beliefs & attitudes; Teacher characteristics; Resource allocation; CPD organisation, coordination	Trusting Leadership (TL); Engaged Leadership (EL)	TL1; EL3; EL4
40	Hands et al., 2015	Hands, C., Guzar, K., & Rodrigue, A. (2015). The art and science of leadership in learning environments: Facilitating a professional learning community across districts. *Alberta Journal of Educational Research*, *61*(2), 226-242.	Qualitative	Primary, Elementary	US/Canada	Teacher	Attitudinal characteristics (T); Empowerment (T)	PLC	Leader	Observed behaviour (Leader)	Collective beliefs & attitudes; Teacher characteristics; Resource allocation	Trusting Leadership (TL); Engaged Leadership (EL)	TL1; EL1; EL3
41	Hashim, 2020	Hashim, A. K. (2020). Coaching and Districtwide Improvement: Exploring the Systemic Leadership Practices of Instructional Coaches. *Teachers College Record (1970)*, *122*(10), 1–44.	Qualitative	Primary, Secondary	US/Canada	Teacher	Change in classroom practice (T); Professional collaboration (T)	Mentoring	Multiple	Observed & Self-reported behaviour (Multiple)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; Resource allocation; Other school readiness; Data monitoring & evaluation	Engaged Leadership (EL); Learning Leadership (LL)	EL2; LL2; LL3
42	Hobson & McIntyre, 2013	Hobson, A. J., & McIntyre, J. (2013). Teacher fabrication as an impediment to professional learning and development: the external mentor antidote. *Oxford review of education*, *39*(3), 345-365.	Qualitative	Secondary, Middle, High	UK/ROI	Teacher	Technical knowledge (T); Change in classroom practice (T); Attitudinal characteristics (T); Empowerment (T)	Mentoring	Multiple	Self-reported behaviour (Multiple)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; Resource allocation	Trusting Leadership (TL)	TL1
43	Hollingworth, 2012	Hollingworth, L. (2012). Why leadership matters: empowering teachers to implement formative assessment. *Journal of Educational Administration*, *50*(3), 365–379.	Qualitative	Secondary, Middle, High	US/Canada	Student	Improved experience of teaching (S)	PLC	Multiple	Observed behaviour (Multiple)	Collective beliefs & attitudes; School interaction characteristics; Resource allocation	Trusting Leadership (TL); Engaged Leadership (EL)	TL1; EL1; EL4; EL5

ID	Short reference	Full reference	Study type	Setting	Country or Region	Outcome(s) level	Outcome(s) detail	CPD type	Data source	Data type	Leadership domain(s)	Leadership dimension	Leadership theme
44	Hopkins et al., 2019	Hopkins, M., Gluckman, M., & Vahdani, T. (2019). Emergent Change: A Network Analysis of Elementary Teachers' Learning About English Learner Instruction. *American Educational Research Journal*, *56*(6), 2295–2332.	Mixed Methods	Primary, Elementary	US/Canada	Teacher	Technical knowledge (T); Attitudinal characteristics (T)	PLC	Multiple	Observed & Self-reported behaviour (Multiple)	Collective beliefs & attitudes; Teacher characteristics; Resource allocation	Trusting Leadership (TL)	TL2
45	Huijboom et al., 2021	Huijboom, F., Van Meeuwen, P., Rusman, E., & Vermeulen, M. (2021). Professional learning communities (PLCs) as learning environments for teachers: An in-depth examination of the development of seven PLCs and influencing factors. *Learning, Culture and Social Interaction*, *31*, 100566.	Qualitative	Secondary, Middle, High	Europe	Teacher	Professional collaboration (T)	PLC	Teacher	Observed behaviour (Teacher); Self-reported behaviour (Teacher)	Unknown	Engaged Leadership (EL)	EL2
46	Kim et al., 2019	Kim, E.-J., Park, S., & Kang, H.-S. (Theresa). (2019). Support, training readiness and learning motivation in determining intention to transfer. *European Journal of Training and Development*, *43*(3/4), 306–321.	Quantitative	Secondary, Middle, High	US/Canada	Teacher	Attitudinal characteristics (T)	Other	Teacher	Self-reported behaviour (Teacher)	Teacher characteristics; Other school readiness	Trusting Leadership (TL)	TL1; TL2
47	Körkkö et al., 2022	Körkkö, M., Kotilainen, M.-R., Toljamo, S., & Turunen, T. (2022). Developing teacher in-service education through a professional development plan: modelling the process. *European Journal of Teacher Education*, *45*(3), 320–337.	Qualitative	Unknown	Europe	Teacher	Change in classroom practice (T)	Other	Multiple	Self-reported behaviour (Multiple)	Collective beliefs & attitudes; Teacher characteristics; Resource allocation; CPD organisation, coordination	Engaged Leadership (EL); Learning Leadership (LL)	EL3; LL1
48	Kutsyuruba et al., 2020	Kutsyuruba, B., Godden, L., & Walker, K. (2020). The effect of contextual factors on school leaders' involvement in early-career teacher mentoring: A review of the international research literature. *Research in Educational Administration and Leadership*, *5*(3), 682-720.	Review Study	Primary, Secondary	Other	Teacher	Technical knowledge (T); Change in classroom practice (T); Attitudinal characteristics (T); Empowerment (T)	Mentoring	Multiple	Observed & Self-reported behaviour (Multiple)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; Resource allocation; CPD organisation, coordination	Trusting Leadership (TL); Engaged Leadership (EL)	TL2; TL3; EL1; EL2; EL3; EL5; LL1

ID	Short reference	Full reference	Study type	Setting	Country or Region	Outcome(s) level	Outcome(s) detail	CPD type	Data source	Data type	Leadership domain(s)	Leadership dimension	Leadership theme
49	Lee & Li, 2015	Lee, H. H., & Li, M. N. F. (2015). Principal Leadership and Its Link to the Development of a School's Teacher Culture and Teaching Effectiveness: A Case Study of an Award-Winning Teaching Team at an Elementary School. *International Journal of Education Policy and Leadership*, *10*(4), n4.	Qualitative	Primary, Elementary	Asia	Teacher; Organisational	Professional collaboration (T); CPD supporting structures (O)	PLC	Multiple	Observed & Self-reported behaviour (Multiple)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; Resource allocation; Other school readiness; Data monitoring & evaluation	Trusting Leadership (TL); Engaged Leadership (EL); Learning Leadership (LL)	TL2; EL2; LL2
50	Levin & Schrum, 2013	Levin, B. B., & Schrum, L. (2013). Using Systems Thinking to Leverage Technology for School Improvement: Lessons Learned from Award-Winning Secondary Schools/Districts. *Journal of Research on Technology in Education*, *46*(1), 29–51.	Qualitative	Secondary, Middle, High	US/Canada	Student; Teacher	Achievement/Attainment (S); Technical knowledge (T)	PLC	Student	Self-reported behaviour (Student)	Collective beliefs & attitudes; School interaction characteristics; Resource allocation; Other school readiness	Engaged Leadership (EL)	EL1
51	Levin & Schrum, 2014	Levin, B. B., & Schrum, L. (2014). Lessons Learned from Secondary Schools using Technology for School Improvement: It's Just not that Simple. *Journal of School Leadership*, *24*(4), 640–665.	Qualitative	Secondary, Middle, High	US/Canada	Teacher	Technical knowledge (T)	Multiple CPD types	Multiple	Observed & Self-reported behaviour (Multiple)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; CPD organisation, coordination	Trusting Leadership (TL); Engaged Leadership (EL); Learning Leadership (LL)	TL2; EL3; LL3
52	Li et al., 2017	Li, L., Hallinger, P., Kennedy, K. J., & Walker, A. (2017). Mediating effects of trust, communication, and collaboration on teacher professional learning in Hong Kong primary schools. *International Journal of Leadership in Education*, *20*(6), 697–716.	Quantitative	Primary, Elementary	Asia	Teacher	Professional collaboration (T)	Multiple CPD types	Teacher	Self-reported behaviour (Teacher)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; CPD organisation, coordination	Trusting Leadership (TL); Engaged Leadership (EL); Learning Leadership (LL)	TL3; EL1; EL3; LL1

ID	Short reference	Full reference	Study type	Setting	Country or Region	Outcome(s) level	Outcome(s) detail	CPD type	Data source	Data type	Leadership domain(s)	Leadership dimension	Leadership theme
53	Lillejord & Børte, 2020	Lillejord, S., & Børte, K. (2020). Trapped between accountability and professional learning? School leaders and teacher evaluation. *Professional Development in Education*, *46*(2), 274–291.	Review Study	Unknown	Other	Teacher	Technical knowledge (T); Change in classroom practice (T); Attitudinal characteristics (T); Empowerment (T)	Mentoring	Multiple	Observed & Self-reported behaviour (Multiple)	School interaction characteristics; Teacher characteristics; Resource allocation; CPD organisation, coordination; Other school readiness; Data monitoring & evaluation	Trusting Leadership (TL); Engaged Leadership (EL); Learning Leadership (LL)	TL3; EL3; LL1; LL2
54	Liu & Du, 2022	Liu, J., & Du, J. (2022). Identifying information friction in teacher professional development: insights from teacher-reported need and satisfaction. *Journal of Education for Teaching : JET*, *48*(5), 561–575.	Quantitative	Secondary, Middle, High	US/Canada	Teacher	Attitudinal characteristics (T)	Multiple CPD types	Multiple	Self-reported behaviour (Multiple)	School interaction characteristics	Trusting Leadership (TL)	TL2; TL3
55	López-Yáñez & Sánchez-Moreno, 2013	López-Yáñez, J., & Sánchez-Moreno, M. (2013). Levers for sustainable improvement of Spanish schools in challenging contexts. *Journal of Educational Change*, *14*(2), 203–232.	Qualitative	Primary, Secondary	Europe	Organisational	CPD supporting structures (O)	Unknown	Teacher	Observed behaviour (Teacher); Self-reported behaviour (Teacher)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; Resource allocation; Other school readiness	Trusting Leadership (TL)	TL2
56	Lummis et al., 2022	Lummis, G. W., Morris, J. E., Ferguson, C., Hill, S., & Lock, G. (2022). Leadership teams supporting teacher wellbeing by improving the culture of an Australian secondary school. *Issues in Educational Research*, *32*(1), 205-224.	Qualitative	Secondary, Middle, High	Australia	Teacher	Attitudinal characteristics (T)	Multiple CPD types	Multiple	Observed & Self-reported behaviour (Multiple)	Collective beliefs & attitudes; School interaction characteristics; Data monitoring & evaluation	Learning Leadership (LL)	LL1; LL2
57	Malin & Hackmann, 2017	Malin, J. R., & Hackmann, D. (2017). Urban high school principals' promotion of college-and-career readiness. *Journal of Educational Administration*, *55*(6), 606–623.	Qualitative	Secondary, Middle, High	US/Canada	Teacher	Empowerment (T)	Multiple CPD types	Multiple	Self-reported behaviour (Multiple)	School interaction characteristics; Resource allocation; Other school readiness	Engaged Leadership (EL)	EL4; EL5

ID	Short reference	Full reference	Study type	Setting	Country or Region	Outcome(s) level	Outcome(s) detail	CPD type	Data source	Data type	Leadership domain(s)	Leadership dimension	Leadership theme
58	Malone et al., 2021	Malone, M. R., Groth, L. M., & Glazer, J. L. (2021). Leading in complex environments: the role of leadership in multi-school organization improvement. *School Leadership & Management*, *41*(4-5), 352–369.	Qualitative	Primary, Elementary	US/Canada	Teacher	Change in classroom practice (T)	Multiple CPD types	Other	Self-reported behaviour (Other)	Collective beliefs & attitudes; School interaction characteristics; Resource allocation	Engaged Leadership (EL); Learning Leadership (LL)	EL2; LL2
59	McCray, 2018	McCray, C. (2018). Secondary teachers' perceptions of professional development: a report of a research study undertaken in the USA. *Professional Development in Education*, *44*(4), 583–585.	Qualitative	Secondary, Middle, High	US/Canada	Teacher	Change in classroom practice (T)	Multiple CPD types	Teacher	Self-reported behaviour (Teacher)	Collective beliefs & attitudes; Teacher characteristics; Resource allocation; Data monitoring & evaluation	Trusting Leadership (TL); Engaged Leadership (EL); Learning Leadership (LL)	TL3; EL1; EL3; EL4; LL1; LL2
60	Meyer et al., 2023	Meyer, A., Hartung-Beck, V., Gronostaj, A., Krüger, S., & Richter, D. (2023). How can principal leadership practices promote teacher collaboration and organizational change? A longitudinal multiple case study of three school improvement initiatives. *Journal of Educational Change*, *24*(3), 425–455.	Qualitative	Secondary, Middle, High	Europe	Teacher; Organisational	Professional collaboration (T); CPD supporting structures (O)	Other	Multiple	Self-reported behaviour (Multiple)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; Resource allocation; CPD organisation, coordination; Other school readiness; Data monitoring & evaluation	Trusting Leadership (TL); Engaged Leadership (EL); Learning Leadership (LL)	TL1; TL2; TL3; EL1; EL2; EL3; EL5; LL1; LL2; LL3
61	Morrison et al., 2019	Morrison, J. R., Reilly, J. M., & Ross, S. M. (2019). Getting along with others as an educational goal: An implementation study of Sanford Harmony. *Journal of Research in Innovative Teaching & Learning*, *12*(1), 16–34.	Mixed Methods	Primary, Elementary	US/Canada	Student	Motivation and other learning attributes (S)	One-off	Multiple	Observed & Self-reported behaviour (Multiple)	Teacher characteristics; Resource allocation	Trusting Leadership (TL)	TL3

ID	Short reference	Full reference	Study type	Setting	Country or Region	Outcome(s) level	Outcome(s) detail	CPD type	Data source	Data type	Leadership domain(s)	Leadership dimension	Leadership theme
62	Nguyen et al., 2022	Nguyen, D., Ng, D., Luo, W., & Mansor, S. (2022). Exploring the relationships between instructional leadership and teacher competences: Singapore primary school teachers' perceptions. *International Journal of Leadership in Education*, *25*(6), 919–940.	Quantitative	Primary, Elementary	Asia	Teacher	Technical knowledge (T)	Unknown	Multiple	Self-reported behaviour (Multiple)	Collective beliefs & attitudes; CPD organisation, coordination	Trusting Leadership (TL); Engaged Leadership (EL); Learning Leadership (LL)	TL1; EL3; LL1
63	Oppi et al., 2023	Oppi, P., Eisenschmidt, E., & Stingu, M. (2023). Seeking sustainable ways for school development: teachers' and principals' views regarding teacher leadership. *International Journal of Leadership in Education*, *26*(4), 581–603.	Qualitative	Primary, Secondary	Europe	Teacher	Other/Unknown (T)	Sustained	Multiple	Self-reported behaviour (Multiple)	Collective beliefs & attitudes; School interaction characteristics; Resource allocation	Trusting Leadership (TL); Engaged Leadership (EL)	TL2; TL3; EL5
64	Owen, 2014	Owen, S. (2014). Teacher professional learning communities : going beyond contrived collegiality toward challenging debate and collegial learning and professional growth. *Australian Journal of Adult Learning*, *54*(2), 54–77.	Mixed Methods	Primary, Secondary	Australia	Teacher	Professional collaboration (T)	PLC	Multiple	Observed & Self-reported behaviour (Multiple)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; Resource allocation; CPD organisation, coordination; Data monitoring & evaluation	Trusting Leadership (TL); Engaged Leadership (EL); Learning Leadership (LL)	TL3; EL2; LL2; LL3
65	Park & Byun, 2021	Park, J.-H., & Byun, S. (2021). Principal support, professional learning community, and group-level teacher expectations. *School Effectiveness and School Improvement*, *32*(1), 1–23.	Quantitative	Secondary, Middle, High	US/Canada	Teacher	Attitudinal characteristics (T)	PLC	Teacher	Self-reported behaviour (Teacher)	School interaction characteristics; Teacher characteristics		

ID	Short reference	Full reference	Study type	Setting	Country or Region	Outcome(s) level	Outcome(s) detail	CPD type	Data source	Data type	Leadership domain(s)	Leadership dimension	Leadership theme
66	Park et al., 2019	Park, J.-H., Lee, I. H., & Cooc, N. (2019). The Role of School-Level Mechanisms: How Principal Support, Professional Learning Communities, Collective Responsibility, and Group-Level Teacher Expectations Affect Student Achievement. *Educational Administration Quarterly*, *55*(5), 742–780.	Quantitative	Secondary, Middle, High	US/Canada	Student; Organisational	Achievement/Attainment (S); CPD supporting structures (O)	PLC	Multiple	Observed & Self-reported behaviour (Multiple)	Other school readiness	Engaged Leadership (EL)	EL1; EL2
67	Postholm, 2019	Postholm, M. B. (2019). The school leader's role in school-based development. *Educational Research (Windsor)*, *61*(4), 437–450.	Qualitative	Secondary, Middle, High	Europe	Teacher	Technical knowledge (T); Change in classroom practice (T); Professional collaboration (T)	Other	Multiple	Self-reported behaviour (Multiple)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; Resource allocation; CPD organisation, coordination; Data monitoring & evaluation	Trusting Leadership (TL); Learning Leadership (LL)	TL2; TL3; LL1
68	Prenger et al., 2017	Prenger, R., Poortman, C. L., & Handelzalts, A. (2017). Factors influencing teachers' professional development in networked professional learning communities. *Teaching and Teacher Education*, *68*, 77–90.	Mixed Methods	Primary, Secondary	Europe	Student; Teacher	Motivation and other learning attributes (S); Improved experience of teaching (S); Attitudinal characteristics (T)	PLC	Multiple	Observed & Self-reported behaviour (Multiple)	School interaction characteristics; Resource allocation	Trusting Leadership (TL); Engaged Leadership (EL); Learning Leadership (LL)	TL2; EL1; EL3; EL4; EL5; LL1; LL2

ID	Short reference	Full reference	Study type	Setting	Country or Region	Outcome(s) level	Outcome(s) detail	CPD type	Data source	Data type	Leadership domain(s)	Leadership dimension	Leadership theme
69	Prenger et al., 2021	Prenger, R., Poortman, C. L., & Handelzalts, A. (2021). Professional learning networks: From teacher learning to school improvement? *Journal of Educational Change*, *22*(1), 13–52.	Qualitative	Secondary, Middle, High	Europe	Student; Teacher; Organisational	Achievement/Attainment (S); Improved experience of teaching (S); Technical knowledge (T); Change in classroom practice (T); Attitudinal characteristics (T); Empowerment (T); CPD supporting structures (O)	PLC	Multiple	Observed & Self-reported behaviour (Multiple)	School interaction characteristics; Teacher characteristics; Resource allocation	Engaged Leadership (EL)	EL2; EL5
70	Rigby et al., 2020	Rigby, J. G., Andrews-Larson, C., & Chen, I.-C. (2020). Learning Opportunities about Teaching Mathematics: A Longitudinal Case Study of School Leaders' Influence. *Teachers College Record (1970)*, *122*(7), 1–44.	Mixed Methods	Secondary, Middle, High	US/Canada	Student; Teacher	Achievement/Attainment (S); Technical knowledge (T); Change in classroom practice (T)	Unknown	Multiple	Observed behaviour (Multiple)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; Data monitoring & evaluation	Engaged Leadership (EL)	EL5
71	Ryan, 2017	Ryan, M. G. (2017). Disrupting Professional Learning Structures In Schools By Inviting Teachers To Design Their Own Learning: An Elementary Principal Conducts Practitioner Action Research. *Planning & Changing*, *48*(1/2), 43–65.	Qualitative	Primary, Elementary	US/Canada	Teacher; Organisational	Technical knowledge (T); Change in classroom practice (T); Attitudinal characteristics (T); Empowerment (T); CPD supporting structures (O)	Sustained	Multiple	Self-reported behaviour (Multiple)	Collective beliefs & attitudes; Teacher characteristics; Resource allocation; CPD organisation, coordination	Learning Leadership (LL)	LL2
72	Sandholtz et al., 2019	Sandholtz, J. H., Ringstaff, C., & Matlen, B. (2019). Coping with constraints: Longitudinal case studies of early elementary science instruction after professional development. *Journal of Educational Change*, *20*(2), 221–248.	Mixed Methods	Primary, Elementary	US/Canada	Teacher	Change in classroom practice (T); Attitudinal characteristics (T)	Sustained	Teacher	Self-reported behaviour (Teacher)	Collective beliefs & attitudes; Teacher characteristics; Resource allocation; CPD organisation, coordination	Engaged Leadership (EL); Learning Leadership (LL)	EL1; LL1

ID	Short reference	Full reference	Study type	Setting	Country or Region	Outcome(s) level	Outcome(s) detail	CPD type	Data source	Data type	Leadership domain(s)	Leadership dimension	Leadership theme
73	Schechter & Feldman, 2019	Schechter, C., & Feldman, N. (2019). The Principal's Role in Professional Learning Community in a Special Education School Serving Pupils With Autism. *Journal of Special Education Leadership*, *32*(1).	Qualitative	Secondary, Middle, High	Other	Organisational	CPD supporting structures (O)	PLC	Multiple	Observed & Self-reported behaviour (Multiple)	Collective beliefs & attitudes; School interaction characteristics; Resource allocation; Other school readiness; Data monitoring & evaluation	Engaged Leadership (EL)	EL1; EL4; EL5
74	Schildkamp & Poortman, 2015	Schildkamp, K., & Poortman, C. L. (2015). Factors Influencing the Functioning of Data Teams. *Teachers College Record (1970)*, *117*(4), 1–42.	Qualitative	Secondary, Middle, High	Europe	Teacher	Professional collaboration (T)	Other	Multiple	Observed & Self-reported behaviour (Multiple)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; Resource allocation; CPD organisation, coordination; Data monitoring & evaluation	Trusting Leadership (TL); Engaged Leadership (EL); Learning Leadership (LL)	TL1; EL3; EL4; LL2; LL3
75	Sebastian & Allensworth, 2012	Sebastian, J., & Allensworth, E. (2012). The Influence of Principal Leadership on Classroom Instruction and Student Learning: A Study of Mediated Pathways to Learning. *Educational Administration Quarterly*, *48*(4), 626–663.	Mixed Methods	Secondary, Middle, High	US/Canada	Student; Teacher	Achievement/Attainment (S); Change in classroom practice (T)	Unknown	Teacher	Self-reported behaviour (Teacher)	Collective beliefs & attitudes; School interaction characteristics; CPD organisation, coordination	Engaged Leadership (EL); Learning Leadership (LL)	EL1; EL2; LL2
76	Seleznyov et al., 2020	Seleznyov, S., Roberts, A., Walker, R., Watson, S., & Hogan, M. (2020). Is there anything special about lesson study in special schools? *International Journal for Lesson and Learning Studies*, *9*(4), 301–316.	Mixed Methods	Unknown	UK/ROI	Student; Teacher; Organisational	Achievement/Attainment (S); Technical knowledge (T); Change in classroom practice (T); CPD supporting structures (O)	Classroom	Leader	Self-reported behaviour (Leader)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; Resource allocation	Trusting Leadership (TL); Engaged Leadership (EL)	TL1; EL1

ID	Short reference	Full reference	Study type	Setting	Country or Region	Outcome(s) level	Outcome(s) detail	CPD type	Data source	Data type	Leadership domain(s)	Leadership dimension	Leadership theme
77	Sharp et al., 2020	Sharp, K., Jarvis, J. M., & McMillan, J. M. (2020). Leadership for differentiated instruction: teachers' engagement with on-site professional learning at an Australian secondary school. *International Journal of Inclusive Education*, *24*(8), 901–920.	Qualitative	Secondary, Middle, High	Australia	Teacher	Change in classroom practice (T)	Mentoring	Teacher	Self-reported behaviour (Teacher)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; Resource allocation; CPD organisation, coordination; Other school readiness	Engaged Leadership (EL); Learning Leadership (LL)	EL1; EL5; LL1
78	Sleegers et al., 2014	J.C. Sleegers, P. J., Thoonen, E. E., Oort, F., & Peetsma, T. T. (2014). Changing classroom practices: the role of school-wide capacity for sustainable improvement. *Journal of Educational Administration*, *52*(5), 617–652.	Mixed Methods	Primary, Elementary	Europe	Organisational	CPD supporting structures (O)	Multiple CPD types	Teacher	Self-reported behaviour (Teacher)	Collective beliefs & attitudes; Teacher characteristics	Trusting Leadership (TL)	TL2
79	Snyder, 2015	Snyder, K. (2015). Engaged leaders develop schools as quality organisations. *International Journal of Quality and Service Sciences*, *7*(2/3), 217–229.	Qualitative	Unknown	UK/ROI	Organisational	CPD supporting structures (O)	Other	Leader	Self-reported behaviour (Leader)	Collective beliefs & attitudes; School interaction characteristics; Other school readiness	Trusting Leadership (TL); Engaged Leadership (EL); Learning Leadership (LL)	TL2; TL3; EL3; LL1
80	Stevenson et al., 2016	Stevenson, M., Hedberg, J. G., O'Sullivan, K.-A., & Howe, C. (2016). Leading learning: the role of school leaders in supporting continuous professional development. *Professional Development in Education*, *42*(5), 818–835.	Mixed Methods	Unknown	Australia	Organisational	CPD supporting structures (O)	Unknown	Leader	Self-reported behaviour (Leader)	Collective beliefs & attitudes; Teacher characteristics; Resource allocation; CPD organisation, coordination	Trusting Leadership (TL); Engaged Leadership (EL)	TL1; TL2; EL1

ID	Short reference	Full reference	Study type	Setting	Country or Region	Outcome(s) level	Outcome(s) detail	CPD type	Data source	Data type	Leadership domain(s)	Leadership dimension	Leadership theme
81	Stevenson et al., 2019	Stevenson, M., Bower, M., Falloon, G., Forbes, A., & Hatzigianni, M. (2019). By design : Professional learning ecologies to develop primary school teachers' makerspaces pedagogical capabilities. *British Journal of Educational Technology*, *50*(3), 1260–1274.	Mixed Methods	Primary, Elementary	Australia	Teacher	Technical knowledge (T) (T);Empowerment (T)	Sustained	Teacher	Observed behaviour (Teacher); Self-reported behaviour (Teacher)	Collective beliefs & attitudes; Teacher characteristics	Trusting Leadership (TL); Engaged Leadership (EL); Learning Leadership (LL)	TL2; TL3; EL1; EL4; LL3
82	Stosich et al., 2018	Stosich, E. L., Bocala, C., & Forman, M. (2018). Building coherence for instructional improvement through professional development: A design-based implementation research study. *Educational Management, Administration & Leadership*, *46*(5), 864–880.	Qualitative	Primary, Elementary	US/Canada	Teacher; Organisational	Change in classroom practice (T); CPD supporting structures (O)	Other	Multiple	Observed & Self-reported behaviour (Multiple)	Collective beliefs & attitudes; School interaction characteristics; CPD organisation, coordination	Trusting Leadership (TL); Engaged Leadership (EL)	TL1; EL4
83	Sun-Keung et al., 2016	Sun-Keung Pang, N., Wang, T., & Lai-Mei Leung, Z. (2016). Educational reforms and the practices of professional learning community in Hong Kong primary schools. *Asia Pacific Journal of Education*, *36*(2), 231–247.	Quantitative	Primary, Elementary	Asia	Teacher	Professional collaboration (T)	PLC	Teacher	Self-reported behaviour (Teacher)	Collective beliefs & attitudes; CPD organisation, coordination	Learning Leadership (LL)	LL1
84	Tarnanen et al., 2021	Tarnanen, M., Kostiainen, E., Kaukonen, V., Martin, A., & Toikka, T. (2021). Towards a learning community: Understanding teachers' mental models to support their professional development and learning. *Professional Development in Education*, 1-15.	Qualitative	Primary, Secondary	Europe	Teacher; Organisational	Attitudinal characteristics (T); Empowerment (T); CPD supporting structures (O)	Sustained	Teacher	Self-reported behaviour (Teacher)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics	Trusting Leadership (TL); Engaged Leadership (EL); Learning Leadership (LL)	TL3; EL2; LL1

ID	Short reference	Full reference	Study type	Setting	Country or Region	Outcome(s) level	Outcome(s) detail	CPD type	Data source	Data type	Leadership domain(s)	Leadership dimension	Leadership theme
85	Tay et al., 2021	Tay, L. Y., Ramachandran, K., Ong, W. L. M., & Towndrow, P. A. (2021). Empowerment through distributed leadership in reconciliating tensions and dilemmas in teacher professional development. *Teacher Development*, *25*(5), 647–668.	Qualitative	Primary, Elementary	Asia	Teacher	Empowerment (T)	Unknown	Multiple	Self-reported behaviour (Multiple)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; Resource allocation	Trusting Leadership (TL); Engaged Leadership (EL); Learning Leadership (LL)	TL3; EL1; EL2; EL3; LL1
86	Taylor et al., 2019	Taylor, M., Klein, E. J., Munakata, M., Trabona, K., Rahman, Z., & McManus, J. (2019). Professional development for teacher leaders: using activity theory to understand the complexities of sustainable change. *International Journal of Leadership in Education*, *22*(6), 685–705.	Qualitative	Secondary, Middle, High	US/Canada	Teacher	Other/Unknown (T)	Sustained	Teacher	Observed behaviour (Teacher)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; Resource allocation	Trusting Leadership (TL); Engaged Leadership (EL); Learning Leadership (LL)	TL2; TL3; EL1; EL3; EL4; EL5; LL3
87	Thessin, 2015	Thessin, R. A. (2015). Learning from One Urban School District: Planning to Provide Essential Supports for Teachers' Work in Professional Learning Communities. *Educational Planning*, *22*(1), 15-27.	Mixed Methods	Primary, Secondary	US/Canada	Teacher	Professional collaboration (T)	PLC	Teacher	Observed behaviour (Teacher); Self-reported behaviour (Teacher)	Collective beliefs & attitudes; Teacher characteristics; Resource allocation; CPD organisation, coordination; Data monitoring & evaluation	Trusting Leadership (TL)	TL2; TL3
88	Thessin, 2021	Thessin, R. A. (2021). The Principal's Role in Planning Essential Supports for School-Based Professional Learning Communities. *Educational Planning*, *28*(2), 7-25.	Qualitative	Primary, Secondary	US/Canada	Teacher	Professional collaboration (T)	PLC	Teacher	Self-reported behaviour (Teacher)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; Resource allocation; CPD organisation, coordination; Other school readiness	Trusting Leadership (TL); Engaged Leadership (EL); Learning Leadership (LL)	TL1; TL2; TL3; EL1; EL5; LL2

ID	Short reference	Full reference	Study type	Setting	Country or Region	Outcome(s) level	Outcome(s) detail	CPD type	Data source	Data type	Leadership domain(s)	Leadership dimension	Leadership theme
89	Turner et al., 2018	Turner, J. C., Christensen, A., Kackar-Cam, H. Z., Fulmer, S. M., & Trucano, M. (2018). The development of professional learning communities and their teacher leaders: An activity systems analysis. *Journal of the Learning Sciences*, *27*(1), 49-88.	Qualitative	Secondary, Middle, High	US/Canada	Teacher	Professional collaboration (T)	PLC	Teacher	Observed behaviour (Teacher); Self-reported behaviour (Teacher)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics	Trusting Leadership (TL); Engaged Leadership (EL); Learning Leadership (LL)	TL1; EL1; EL2; EL3; EL4; LL1
90	Valckx et al., 2018	Valckx, J., Devos, G., & Vanderlinde, R. (2018). Exploring the relationship between professional learning community characteristics in departments, teachers' professional development, and leadership. *Pedagogische studiën*, *95*(1), 34-55.	Qualitative	Secondary, Middle, High	Europe	Teacher	Professional collaboration (T)	PLC	Multiple	Self-reported behaviour (Multiple)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; CPD organisation, coordination	Trusting Leadership (TL)	TL3
91	Vanblaere & Devos, 2018	Vanblaere, B., & Devos, G. (2018). The role of departmental leadership for professional learning communities. *Educational administration quarterly*, *54*(1), 85-114.	Quantitative	Secondary, Middle, High	Europe	Teacher	Attitudinal characteristics (T); Professional collaboration (T)	PLC	Teacher	Self-reported behaviour (Teacher)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; Resource allocation; CPD organisation, coordination; Data monitoring & evaluation	Trusting Leadership (TL); Engaged Leadership (EL)	TL1; EL1; EL3
92	Verhoef et al., 2022	Verhoef, L., Volman, M., & Gaikhorst, L. (2022). The contribution of teachers of research-intensive teacher education programmes to a culture of inquiry in primary schools. *Professional Development in Education*, *48*(5), 861–877.	Qualitative	Primary, Elementary	Europe	Organisational	CPD supporting structures (O)	Sustained	Multiple	Observed & Self-reported behaviour (Multiple)	Collective beliefs & attitudes	Trusting Leadership (TL); Engaged Leadership (EL); Learning Leadership (LL)	TL2; TL3; EL2; EL3; LL1

ID	Short reference	Full reference	Study type	Setting	Country or Region	Outcome(s) level	Outcome(s) detail	CPD type	Data source	Data type	Leadership domain(s)	Leadership dimension	Leadership theme
93	Wang et al., 2016	Wang, L. H., Gurr, D., & Drysdale, L. (2016). Successful school leadership: case studies of four Singapore primary schools. *Journal of Educational Administration*, *54*(3).	Qualitative	Primary, Elementary	Asia	Teacher	Technical knowledge (T); Change in classroom practice (T)	Multiple CPD types	Multiple	Observed & Self-reported behaviour (Multiple)	Other school readiness	Engaged Leadership (EL); Learning Leadership (LL)	EL1; EL5; LL1
94	Ward Parsons et al., 2019	Ward Parsons, A., Parsons, S. A., Dodman, S. L., Nuland, L. R., Pierczynski, M., & Ramirez, E. M. (2019). Longitudinal literacy professional development in an urban elementary charter school. The Journal of Educational Research, 112(4), 447–462.	Qualitative	Primary, Elementary	US/Canada	Student; Teacher	Achievement/Attainment (S); Change in classroom practice (T)	Multiple CPD types	Multiple	Observed & Self-reported behaviour (Multiple)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; CPD organisation, coordination; Other school readiness	Learning Leadership (LL)	LL1
95	Watts & Richardson, 2020	Watts, D. S., & Richardson, J. W. (2020). Leveraging professional development to build professional capital in international schools in Asia. *Journal of Professional Capital and Community*, *5*(2), 167-182.	Quantitative	Primary, Secondary	Asia	Teacher	Technical knowledge (T) (T);Empowerment (T)	Multiple CPD types	Multiple	Self-reported behaviour (Multiple)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; Resource allocation	Trusting Leadership (TL); Learning Leadership (LL)	TL1; TL3; LL1; LL3
96	Weitze, 2017	Weitze, C. L. (2017). Designing pedagogical innovation for collaborating teacher teams. *Journal of Education for Teaching*, *43*(3), 361-373.	Qualitative	Secondary, Middle, High	Europe	Teacher	Professional collaboration (T)	Sustained	Teacher	Self-reported behaviour (Teacher)	School interaction characteristics; Resource allocation	Engaged Leadership (EL)	EL5
97	Welsh et al., 2021	Welsh, R., Williams, S., Bryant, K., & Berry, J. (2021). Conceptualization and challenges: examining district and school leadership and schools as learning organizations. *The Learning Organization*, *28*(4), 367-382.	Mixed Methods	Unknown	US/Canada	Teacher	Professional collaboration (T)	Unknown	Leader	Self-reported behaviour (Leader)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; Resource allocation; CPD organisation, coordination; Data monitoring & evaluation	Learning Leadership (LL)	LL2

ID	Short reference	Full reference	Study type	Setting	Country or Region	Outcome(s) level	Outcome(s) detail	CPD type	Data source	Data type	Leadership domain(s)	Leadership dimension	Leadership theme
98	Wen et al., 2021	Wen, Y., Wu, L., & He, S. (2021). Investigating affordances and tensions in STEM applied learning programme from practitioners' sensemaking. *Educational Technology & Society*, *24*(4), 99-109.	Qualitative	Secondary, Middle, High	Asia	Teacher	Technical knowledge (T)	Sustained	Multiple	Self-reported behaviour (Multiple)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; Resource allocation; CPD organisation, coordination; Data monitoring & evaluation	Trusting Leadership (TL); Engaged Leadership (EL); Learning Leadership (LL)	TL2; TL3; EL3; LL1; LL2; LL3
99	Wilson et al., 2021	Wilson, K., Dutton, J., & Hitches, E. (2021). 'It was a breath of fresh air across the school': school leaders' mediation of contested spaces during practitioner inquiry professional learning. *Professional Development in Education*, 1-16.	Quantitative	Primary, Elementary	Australia	Teacher	Professional collaboration (T)	PLC	Leader	Self-reported behaviour (Leader)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; Resource allocation; CPD organisation, coordination	Trusting Leadership (TL)	TL2; EL5
100	Zhang & Zheng, 2020	Zhang, J., & Zheng, X. (2020). The influence of schools' organizational environment on teacher collaborative learning: A survey of Shanghai teachers. *Chinese Education & Society*, *53*(5-6), 300-317.	Quantitative	Primary, Secondary	Asia	Teacher	Attitudinal characteristics (T)	PLC	Teacher	Self-reported behaviour (Teacher)	Collective beliefs & attitudes; School interaction characteristics; Teacher characteristics; Resource allocation; Other school readiness	Trusting Leadership (TL); Engaged Leadership (EL)	TL1; EL2; EL4

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