Teacher quality, recruitment, and retention

Rapid Evidence Assessment

June 2023

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Executive summary

This rapid evidence assessment identifies areas for future research on teacher quality, recruitment and retention, with the aim of informing the focus of the Education Endowment Foundation's (EEF's) future research commissioning on this topic. Given that ensuring access to quality teaching for disadvantaged pupils is expected to be a key mechanism for narrowing the disadvantage gap in attainment, there is a strong rationale for the EEF to build the evidence base on the recruitment and retention of quality teachers. The report set out to scope the field and summarise existing evidence on this topic. The report also identifies gaps in the research; for example, areas that have been researched qualitatively but not investigated experimentally or developed into a testable intervention.

The rapid evidence assessment includes two reviews, each summarising a key area of research:

- **Review 1** focused on measures of (or proxies for) teacher quality commonly used in the literature.
- **Review 2** focused on strategies for the recruitment, retention and distribution of quality teachers to schools serving disadvantaged communities.

Review 1 findings

Review 1 identifies measures and proxies of teacher quality currently used in the research literature and considers their appropriateness for use in future evaluations. The review identifies 25 measures of (or proxies for) teacher quality, grouped into three broad categories: 'professional capital, qualification and training' (8 proxies), 'personal dimensions' (8 proxies) and 'school and community' (9 proxies).

The review concludes that proxies such as qualification, experience and induction may be operationalised with relative ease (although exactly how varies by study). Pedagogic content knowledge (PCK), teacher–student relationships, continuous professional development (CPD), reflection and teachers' self-report of quality could be operationalised through survey tools. Proxies mentioned in only a small number of papers could also be worthy of further study (e.g., community engagement, cultural knowledge, professionalism and being research active). These, however, require further development both conceptually and methodologically. Overall, Review 1 indicates that more research is needed in relation to a significant number of proxies for teacher quality before they could be used reliably in primary research.

Review 2 findings

Review 2 identifies and summarises approaches or school-based policies that could be used to improve recruitment, retention and distribution of high-quality teachers in disadvantaged schools. The review identifies 28 relevant factors, grouped into three categories: system-level factors operating at a policy or organisational level (5 factors), school-level factors that could be managed within individual schools (15 factors) and individual-level factors associated with characteristics of individual teachers (8 factors).

Among the system-level factors, financial incentive was the factor with the highest weight of evidence (WoE). The review notes that such incentives could be used to improve recruitment and retention of high-quality teachers in disadvantaged schools (aligning with findings from previous reviews, e.g., See et al., 2020). A number of school-level policies also appeared important and as having a medium or high WoE. This included workload and working conditions; induction support, coaching and mentoring; effective school leaders; and collaboration with colleagues. Of the eight individual-level factors identified in the review, only intrinsic motivation was identified in more than two studies rated as providing high or medium WoE. However, intrinsic motivation is likely to be challenging to explore through intervention research.

This review concludes that relevant approaches to prioritise in future research could include workload reduction interventions; induction coaching or mentoring programmes; professional development programmes for school leaders; or opportunities for professional collaboration, such as co-planning or learning communities. Equally, there are strategies that appear in current policy initiatives, such as flexible working as part of the Department for Education's Recruitment and Retention Strategy, which were found to be absent from the literature explored as part of this review. Flexible working opportunities for teachers may represent a research gap that could benefit from further research.

Limitations

The majority of the available studies found in this review were qualitative; robust quantitative evidence was limited, and so some caution is needed in interpreting findings. The broad range of study types included in this review means that there were some challenges in assessing the quality of articles included.

The review used specified search terms and focused on peer-reviewed research from a restricted range of databases, with date and country limitations applied to the searches. Some relevant articles may therefore have been missed during the searching process.

Background and review rationale

The Education Endowment Foundation (EEF) commissioned this conceptual review on the topic of teacher quality, with a focus on the recruitment and retention of skilled teaching personnel into disadvantaged schools, to inform the focus of an upcoming funding round on this theme. The review is not intended to establish and summarise the best evidence currently available on the topic, but to scope the field and identify promising areas for future research which may currently be under-researched.

Research suggests that teacher quality is a key influence on pupil attainment (Coe et al., 2020), second only to pupil background (OECD, 2015); and that *sustained* access to high-quality teachers is a significant challenge in England: 30% of teachers leave the profession within the first five years and 40% leave within 10 years (Long & Danechi, 2022). Recruiting and retaining high-quality teachers in disadvantaged schools is a particularly urgent need (see also Tereshchenko et al., 2020 and House of Commons, 2017).

There are recent systematic reviews of quantitative studies of teacher quality (Bradford et al., 2021) and on 'what works in attracting and retaining teachers in challenging schools and areas' (See et al., 2020). These reviews have carefully evaluated where the strongest evidence currently exists. In contrast, the present review intends to scope opportunities for new research in this area and to find and recommend promising leads for future studies. These might include interventions, where there is already some evidence from randomised controlled trials or quasi-experimental studies, as well as potential interventions that have not yet been investigated experimentally.

The review takes a rapid evidence assessment approach, given the short timescale and the focus on synthesising research with the purpose of making recommendations for promising future areas for research. A full systematic review is not required for this purpose. The search strategy focused on recent grey literature and review articles, with this report including detailed commentary on peer-reviewed articles identified from a targeted search of relevant databases.

Objectives

The aim of this report is to make recommendations for future research by summarising two areas of research:

1. Measures of, or proxies for, teacher quality commonly used in the literature
2. Strategies for the recruitment, retention and distribution of quality teachers to schools serving disadvantaged communities.

The rapid evidence review included quantitative, qualitative, mixed methods and theoretical research and followed the published review protocol (Taylor, 2023).

Research questions

Questions 1–3 address measures of teacher quality, while questions 4–6 address recruitment, retention and distribution of teachers to disadvantaged schools.

RQ1   What measures or proxies[1] for teacher quality ('measures') are used in the research literature?
RQ2   What are the key advantages and limitations of the measures identified? Are there any gaps in the measures used to identify teacher quality that could be filled?
RQ3   Which measures are most likely to be appropriate for use in research assessing the impact of interventions on teacher recruitment and retention in disadvantaged schools?

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[1] We define 'measures' of teacher quality as attempts to quantify teacher quality (e.g., through development of a scale) to measure a teacher characteristic associated with quality (e.g., PCK). We define 'proxies' for teacher quality as characteristics of teachers that are considered likely to be associated with quality (e.g., possession of a Masters-level qualification).

RQ4   What are the main approaches and school-based policies that could be used to improve recruitment, retention and distribution of high-quality teachers in disadvantaged schools? How can these be categorised?

RQ5   What are the key messages from research on these approaches or policies? How promising might these approaches be and what gaps are there in our understanding of their likely effectiveness?

RQ6   What methodological challenges are there for evaluation of interventions into teacher recruitment and retention? What research designs and methodologies might enable more robust studies in future?

We first present the results of the two separate evidence reviews that were conducted, Evidence review 1 into proxies and measures of teacher quality, and Evidence review 2 into policies and interventions for recruitment and retention of teachers. We then consider the answers to the research questions in the light of the two evidence reviews. Research questions 1, 2 and 3 are addressed through Evidence review 1; research questions 4, 5 and 6 are addressed through Evidence review 2. Finally, technical information about the reviews, including the details of the searches and the articles returned, are presented in the appendices.

Methods

The review processes are set out in detail in Appendix 1. A brief summary is provided here.

The inclusion and exclusion criteria and search terms for both searches were determined following an exploratory phase involving searches of grey literature and international academic literature. The eligibility criteria drawn up for the review reflected the study's aim to encompass a broad range of methodologies including quantitative, qualitative, mixed methods and theoretical research, and to review research into teacher quality as broadly as possible. Studies regarding quality of classroom pedagogy and teaching practices were determined to be outside the remit of the review.

We defined teacher quality as the characteristics of an individual teacher including characteristics resourced by the system in which they work that are linked to student outcomes. Our exploratory work demonstrated that 'teacher quality' and 'quality teaching' are occasionally used interchangeably in the literature and are not always clearly defined. Therefore, it was not easy to distinguish the literature we are interested in by the use of search terms alone. We took the approach of attempting to capture literature that was relevant to teacher quality (as we have defined it) that did not use this term using further search terms ('excellent teacher' and 'good teacher'). We excluded studies that only use 'quality teaching', 'quality of teaching' and 'teacher effectiveness' because of the size of this literature and because, having sampled this literature, we found it is more likely to be focused on teaching practices rather than teacher characteristics. We have mitigated for the risk of losing papers of interest by including the search terms 'excellent teacher' and 'good teacher'. Our exploratory search showed this would enable us to capture a significant proportion of the literature we are interested in, because these terms are frequently found alongside the 'effective teacher' in studies relevant to teacher quality. We recognise that the teacher effectiveness literature is large and we will have some loss of relevant papers. Our exploratory search suggests that where teacher effectiveness literature is relevant to teacher quality, it uses standard measures such as teacher qualifications and years of service, which will already be captured in our search for teacher quality.

The two main searches were conducted using EBSCO (BEI and ERIC), ProQuest (Education Database and Social Science Database) and Scopus. For review 1, reviewers assessed whether the intention of the study author(s) was to address teacher quality through abstract screening, and deciding whether, regardless of the terminology, the author(s) intended to address the characteristics of individual teachers. Data extraction was performed using Microsoft Excel following full text screening to ensure that papers were relevant to the search. Full details can be found in Appendix 1.

Data analysis for both searches followed a reflexive thematic analysis approach to the identification of themes and categories (Braun & Clarke, 2019). Proxies of teacher quality were extracted from each paper, along with the purpose of the proxy within the studies. From this, proxies were inductively coded, and aggregated into coherent themes. Themes were then grouped into overarching categories. A narrative synthesis was provided for each theme.

Articles identified through search 2 were coded for factors related to recruitment, retention or distribution of teachers. These factors were grouped inductively into themes and then into overarching categories, as being system-, school- or individual-level factors, and are reported in these groupings above. A narrative synthesis is provided.

We used a weight of evidence (WoE) rating approach (Cordingley, 2007, cited in Basma and Savage, 2018, p. 7) to critically appraise studies in search 2. This is an appropriate approach given the rapid nature of the review and the need to appraise a range of methodological approaches, including theoretical, qualitative, quantitative (including

experimental) and mixed methods designs. Other evaluative approaches (e.g., CASP, JBI, Cochrane) were deemed unsuitable because they do not address all of these methodological approaches.

Evidence Review 1: Proxies and measures of teacher quality

The commissioned review of proxies and measures defined teacher quality as the characteristics of an individual teacher that are linked to pupil outcomes. This includes characteristics of the individual teacher that are developed and resourced by the system in which they work. Outside the scope of this review is teaching quality understood as the effectiveness of different patterns of classroom interactions in communicating core content to pupils in ways that directly support their learning in different subject areas.

Description of the evidence base

Search 1 was designed to address research questions 1, 2 and 3. The search returned 417 distinct papers for review, of which 78 papers were assessed as eligible for review. Of these, 54 met the review criteria (Appendix 1) and contained information about a proxy or measure relating to teacher quality as we defined it. 39 of these papers mentioned more than one proxy or measure. The PRISMA (Page et al., 2021) diagram for Search 1 can be found in Figure 1.

Figure 1. PRISMA (Page et al., 2021) flow diagram for search 1[2]
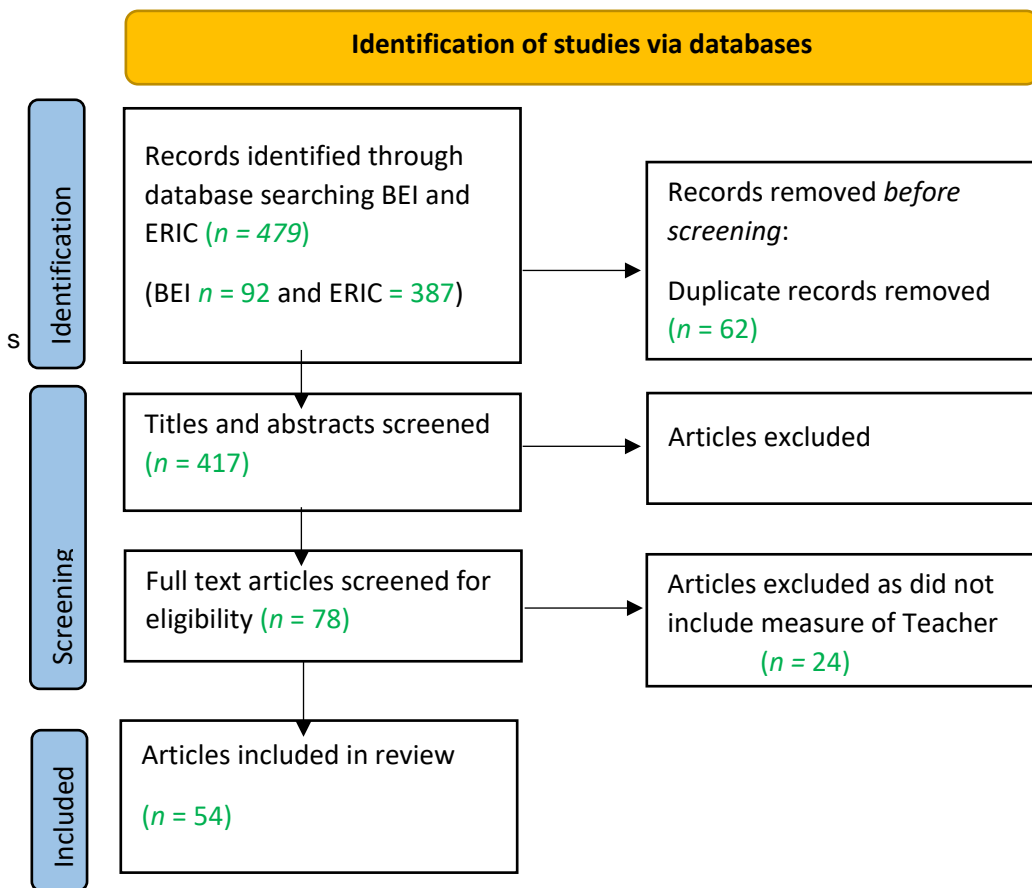
We assessed all of the papers to have a high level of internal consistency in answering the research questions of the paper. Seventeen papers came from the USA, and two papers from each of Australia, Chile, Indonesia and Turkey. One paper came from each of England, Japan, Kenya, Oman, Pakistan, Spain. A further paper looked at both the USA and South Korea. Appendix 2 contains a table of characteristics of included studies. We have included information about the purpose of the teacher quality measure, the methods and populations samples used, the proxies and

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measures used or discussed, and how we coded these. We also included a summary of any limitations of the study identified by the authors.

Types of research

Thirty-two studies used a quantitative approach to investigate aspects of teacher quality. Primarily, these studies used administrative datasets to judge teacher quality, analysing the proxies and measures they contained about teachers and/or students, as well as data obtained from survey instruments. The corpus also included studies using standardised observation data (e.g., Graham et al., 2020) and a simulation study (Marland et al., 2019). Some studies compare jurisdictions (e.g., Park et al. 2020), some consider differences in how different stakeholders (e.g., teachers, parents and students) perceive teacher quality, others consider trends over time (e.g., Goldhaber 2018).

Ten papers used qualitative approaches. These papers used critical policy analysis, case studies, semi-structured interviews, open survey questions and field notes to analyse the criteria used to determine teacher quality in different settings. They included studies exploring why and how different stakeholders (e.g., school leaders, teachers, students and other organisations with a policy role (e.g., the Organisation for Economic Cooperation and Development (OECD)) conceptualise teacher quality in different ways; and how conceptions of teacher quality have evolved over time as policy changes (e.g., Snoek, 2021).

We classified four papers as using a mixture of both quantitative and qualitative methods. Three of these used a combination of survey and interview or focus group, to explore definitions of teacher quality. The other (Thornberg et al., 2020) used mixed methods to explore students' perspectives on their teachers and found strong student–teacher relationships as a predictor of student engagement.

The remaining 10 papers returned by our search were theoretical in nature, drawing on policy discourses, evaluations of programme developments and author experience to discuss how teacher quality is constituted or conceptualised in different contexts.

Proxies for teacher quality

Through inductive coding, we identified 25 different proxies used in the evidence base, which will be described across this section of the report. We then inductively categorised these into three broad categories:

- Professional capital, qualification and training
- Personal dimensions
- School and community factors

The proxies in each broad category are presented in Table 1.

Table 1. Categorisation of proxies

Professional capital, qualification and training	Personal dimensions	School and community
Qualification		Teacher–student relationships
Pedagogic content knowledge (PCK)	Personality	Student outcomes
Experience	Teacher motivation	Collaboration
Induction	Reflection	Teacher observation
Continuous professional development (CPD)	Demographics	Student evaluation
Initial teacher education (ITE)	Teacher self-rating	Parent feedback
Promotion	Cultural knowledge	Community engagement
Hiring scores	Professionalism	High expectations
	Research active	Student motivation

Below, we outline the ways in which the proxies and measures were used. It should be noted that neither the number of studies associated with a measure / proxy nor the type of study using it are an indicator of strength of evidence. Evidence that a measure or proxy is associated with teacher quality would rest upon evidence of a causal link between the proxy and the specific definition of teacher quality being used. The intention of this review is to identify measures and proxies of teacher quality that would be appropriate for use in evaluations on teacher recruitment and retention.

Professional capital, qualification and training

In this category we bring together proxies for teacher quality which relate to the education, training, professional development and career of teachers, as well as their experience in terms of time in the profession. We therefore define Professional capital as including the experience and learning of teachers, both during and beyond their engagements in gaining qualifications and during training. Table 2 shows the number of each type of paper related to each of the proxies identified.

Table 2. Proxies and associated evidence type for professional capital, qualification and training

Proxy / measure	Number of sources by type				
	Mixed	Qualitative	Quantitative	Theoretical	Total
Qualification	3	1	14	3	21
Pedagogic content knowledge (PCK)	1	3	14	2	20
Experience	2		11	1	14
Induction		2	11	1	14
Continuous professional development (CPD)	1	3	4	2	10
Initial teacher education (ITE)		1	1		2
Promotion		1			1
Hiring scores			1		1
Grand total	**7**	**11**	**56**	**9**	**83**

Qualification was cited as a proxy for teacher quality in the largest number of the papers we found.

Of the 21 papers that referred to qualifications, 14 were quantitative in nature and all of these were observational: they used statistical methods to explore correlations between teacher qualification and other variables within datasets. Table 3 shows how each paper operationalised the proxy of qualification differently within quantitative studies.

Table 3. Operationalisation of qualification as a proxy for teacher quality in quantitative studies

Papers	Indicator of qualification
Seebruck (2021) – Japan	Bachelor's degree or not; ranking of Alma Mater
Martino (2021) – USA	Degree types (High school diploma to PhD)
Auhl & Bain (2021) – Australia	Australian Tertiary Admission Rank (ATAR)
Park et al. (2020) – US and South Korea	Certification in biology or other subject
Brantlinger (2020); Knight (2020) – USA; Santelices et al. (2017) – Chile	No degree, bachelor's degree or graduate degree
Barasa (2020) – Kenya	School diploma or bachelor's degree
Celero & Escardíbul (2020) – Spain	Holding master's or PhD
Chang et al. (2020) – USA	Highest degree type: bachelor, master, specialist, doctoral
Allen & Sims (2018) – England	Bachelors in subject or not
Gilmour & Henry (2018) – USA	Composite score including state licensure exams, PRAXIS tests, SAT and GRE scores
Rushton et al. (2017) – USA	Physics degree hierarchy (non-STEM to pure physics)

Several of these quantitative studies focused on the distribution of teachers across a system, geographically, in teaching different kinds of pupils, or over an historic period. Allen & Sims (2018) looked at the unequal access to quality teachers in England by socioeconomic status (SES), including variation in the teacher's academic degree subject. Similarly, Knight (2020) used qualification to consider the distribution of quality teachers in the USA, and Seebruck (2021) did the same for Japan. In the USA, Gilmour & Henry (2018) considered the distribution of teachers with different qualification

level assigned to teach mathematics to fourth through eighth grade students with and without disabilities. Rushton et al. (2017) considered trends in teacher quality in the USA between 1987 and 2012.

Other quantitative studies explored the highest level of teacher qualification in relation to outcomes; for example, in exploring the impact of the level of qualification on Grade 4 mathematics in Kenya (Barasa, 2020), or primary reading skills in Spain (Celero & Escardíbul, 2020). Chang et al. (2020) considered the relationship between student achievement and teachers' possession of advanced degrees in the USA, and Martino (2021) investigated the relationship between teacher quality and student achievement in Florida's career certificate programmes. Three of the papers (Knight, 2020; Park et al., 2020; Seebruck, 2021) also considered the prestige of the institution where qualifications had been gained.

Two studies related qualification to the later development of teachers: Auhl & Bain (2021) examined whether the Australian Tertiary Admissions Rank (ATAR) predicted preservice teachers' schema development for inclusive classroom teaching. Park et al. (2020) looked at both the USA and South Korea to see how qualification predicts a teacher's level of pedagogic and content knowledge.

Santelices et al. (2017) used qualification within a comparison of measuring teacher performance through value-added scores and against teacher professional standards.

Such consideration of how to define teaching quality was also present in the three mixed methods studies found within our search. Carmel & Badash (2021) in Israel, and Casey & DiCarlo (2018) in Belize, used surveys of groups of teachers themselves to develop characteristics of teacher quality. Singh et al. (2021) considered qualification as part of how the OECD constructs teacher quality within policy documents.

Similarly, Salton et al. (2022) analysed policy in Australia to emphasise a narrow concept of teacher quality. This is echoed in the three papers that we classified as theoretical from our search. Darling-Hammond (2021) described definitions of teaching quality in jurisdictions around the world (Australia, Canada, Finland, China, Singapore). Goodwin & Low (2021) compare conceptions of teacher quality in Singapore and Hong Kong, whilst Smith (2021) provides historic context to how teacher quality is perceived in Norway. In all of these studies, teacher qualification was one amongst a number of proxies related to explorations of what is meant by teaching quality.

Pedagogic content knowledge (PCK) was considered as a proxy for teacher quality in 20 papers, 14 of which we classified as quantitative, three as qualitative, two as mixed methods and one as theoretical. Under this heading we have brought together different concepts, including subject knowledge, pedagogic knowledge and subject mastery. PCK, understood in this way, (originally from Shulman, 1986) is a commonly used construct within the research literature on teaching, and covers both pedagogical knowledge and subject content knowledge.

PCK is used within the literature in similar ways to qualification level, and indeed appears in 11 of the studies mentioned above (Allen & Sims, 2018; Carmel & Badash, 2021; Celero & Escardíbul, 2020; Darling-Hammond, 2021; Gilmour & Henry, 2018; Martino, 2021; Park et al., 2020; Rushton et al., 2017; Santelices et al., 2017; Seebruck, 2021; Snoek, 2021). PCK was most commonly operationalised in these studies as whether a teacher holds a degree in the subject they teach or not.

Of the studies which consider PCK but not qualification, seven were classified as quantitative. These were all observational in assessing correlations. Importantly, Vagi et al. (2019) explored the relationship between preservice teacher quality and teacher attrition in the USA. Other studies considered PCK in relation to different outcomes. Akram (2019) developed a school teacher effectiveness questionnaire (STEQ) and explored how teachers in Pakistan scored on this tool, including a score for 'subject matter knowledge' and the correlation with student achievement in English and mathematics. Reynolds & Park (2020), in the USA, explored the relationship between PCK and preservice teachers' scores on the educative teacher performance assessment (edTPA). In Turkey, Efendioğlu (2018) developed a 'Facebook effect scale on teacher quality' (FESTQ), designed to evaluate teachers' use of Facebook as a teaching tool. This scale includes 'instructional knowledge for in-class applications'.

Other studies that mention PCK explored perceptions of teacher quality. Febriyanti (2018) sought to describe the characteristics of a good English teacher, based on the perceptions of learners in Indonesia and taking PCK as a variable. Similarly, in the USA, Tsai & Ku (2021) explored whether teacher quality meant the same thing for students, teachers and university supervisors. In the qualitative literature, Ro (2021) included 'subject mastery' in exploring discrepancies between teacher and policymaker views on teacher quality in Singapore. In the USA, Maddamsetti et al. (2018) examined the endeavours of a Chinese international preservice teacher in becoming a 'good teacher', including

aspects of PCK. Skourdoumbis' (2017) theoretical study of contemporary education policy discourse in Australia critiques the ways in which measures of teacher quality and teacher effectiveness have been used without linking them to the school context.

Teacher **experience** was reported as a proxy for teacher quality within 14 studies. Amongst this group, 11 quantitative studies used years of experience as numerical value. Years of experience appeared alongside qualification and PCK in the observational studies mentioned above (Allen & Sims, 2018; Canales & Maldonado, 2018; Knight, 2020; Park et al., 2020; Rushton et al., 2017; Santelices et al., 2017; Seebruck, 2021). In addition, Graham et al. (2020) investigated the associations between teachers' years of experience and teaching quality in Australia, and Lai et al. (2021) used years of experience when exploring teacher quality relative to disadvantage and number of students with disabilities in Los Angeles (USA). Goldhaber et al. (2018) included years of experience when investigating the differences in teacher quality relative to student disadvantage, in two states in the USA. This was followed up by a theoretical development of how experience supports quality (Goldhaber et al., 2019).

Induction, which we took to mean the completion of the necessary process by which a teacher becomes fully qualified to teach, features as a proxy for teacher quality in 20 papers identified by our search. Our categorisation of induction recognises that some jurisdictions, such as parts of the USA, produce test scores as teachers qualify or are licensed. Other jurisdictions, such as England, have moved away from the grading of individual teachers. Therefore, the observational studies included use quantitative scores or binary variables in relation to induction. For example, the only quantitative paper from England (Allen & Sims, 2018) uses a binary of having qualified teacher status or otherwise.

One of the two studies which focused directly on induction (Shuls, 2018) considered how raising the pass rate on aspects of licensure exams in the USA might raise the quality of teachers, whilst noting the caveat that this may also reduce the number of minority teachers and potentially lead to negative outcomes in disadvantaged schools. The other study that focused on induction in the USA (Reeves et al., 2022) used data from the 2018 Teaching and Learning International Survey (TALIS) to examine relationships between induction activities (including team teaching, online activities, and portfolios, diaries or journals) and teacher outcomes (self-efficacy and job satisfaction).

Continuous professional development (CPD) was a factor considered in 10 papers within our search. Nwokeocha (2017), writing in Nigeria, used literature and document review to argue that teacher quality is principally a function of teacher development, including preservice teacher education and CPD. All the papers we found in our search have already been cited in relation to qualification, PCK, experience and induction. The differences between the ways that CPD is conceptualised when considering teacher quality are noteworthy, however. Snoek (2021) treats teacher development as a dynamic process related to context, Darling-Hammond (2021) considers the different foci of professional development in different parts of the world, and Sullivan et al. (2021) see commitment to CPD as important. Within quantitative studies we see nuance in the different ways CPD is operationalised. Barasa (2020) measured professional development with reference to certificates and/or degrees, so this is very closely related to qualification as a proxy. Celero & Escardíbul (2020) operationalised professional development in terms of university training (in teaching of reading), and number of hours spent in seminars (dealing with reading comprehension and found that teacher attendance of professional development courses was statistically associated with teacher classroom-based performance, measured against teacher professional standards in Chile.

The majority of studies that mention **initial teacher education (ITE)** simply delineate whether it has been undertaken or not, so we have classified this under induction. However, Curry et al. (2018) finds preparation route to have statistical significance in relation to fourth grade reading achievement in the USA. Sullivan et al. (2021) relay case study evidence that teachers see **promotion** as an affirmation of teacher quality, but we did not find further mention of promotion as a proxy.

Lai et al.'s (2020) investigation of teacher quality and teaching students with disabilities in Los Angeles also used teacher **hiring scores** from the district's teacher screening system, which includes a composite score from interview, references, a sample lesson, sample writing, undergraduate grades, non-teaching experience and aspects of qualification (see Bruno & Strunk, 2019). This is not mentioned as a proxy in any other paper we found and is relevant only to jurisdictions that have such systems.

Personal dimensions

In this category we bring together proxies for teacher quality which relate to the identity, motivation, values and psychosocial aspects of teachers. Table 4 shows the number of each type of paper related to each of the proxies identified.

Table 4. Proxies and associated evidence type for personal dimensions

Proxy / measure	Number of sources				
	Mixed	Qualitative	Quantitative	Theoretical	Total
Personality	2	8	7	2	19
Teacher motivation	1	4	1	2	8
Reflection		3		2	5
Demographics	1		3	1	5
Teacher self-rating			4		4
Cultural knowledge		1	2		3
Professionalism			2		2
Research active				1	1
Grand total	**4**	**16**	**19**	**8**	**47**

Personality traits are mentioned in a total of 19 papers, although different aspects of personality were considered. **Communication skills** featured in four papers. Effective communication is a key dimension of Akram's (2019) exploration of how student outcomes relate to student perceptions of teachers, measured through his STEQ, in Pakistan. Similarly, communication skills are a dimension of a survey which captures student perceptions of teacher quality in Febriyanti's (2018) study. Communicating with families features as a dimension of professionalism in Vagi et al.'s (2019) observational score. Effective **organisation** was described as a personality trait relevant to teacher quality in four papers: Snoek (2021) in the Netherlands, Tamir (2019) and Vagi et al. (2019) in the USA, and Febriyanti (2018) in Indonesia. The other personality traits mentioned in papers only appeared once: being **adaptable** and **responsive to student needs** (Sullivan et al., 2021), having a **willingness to learn** (Ro, 2021), **disposition for inclusion** (Maddamsetti et al., 2018), being a **problem solver and critical thinker** (Darling-Hammond, 2021). **Sociability** (Febriyanti, 2018) and **talent** (Singh et al., 2021) were also considered relevant traits.

Teacher motivation was seen as an important aspect of teacher quality in a survey of parents (Casalaspi et al., 2018). It has also been noted as an important aspect of teacher quality in survey and interview data from early career English teachers (Carmel & Badash, 2021), as well as from qualitative studies in other settings (Ro, 2021; Sullivan et al., 2021; Tamir, 2019). Goodwin & Low (2021) and Darling-Hammond (2021) note that candidates for teaching programmes in Singapore and Finland, respectively, are evaluated on motivation to teach as an indicator of quality.

Reflection on practice emerges as a key element of teacher quality from interviews and in case studies reported in three empirical papers (Marom, 2018; Snoek, 2021; Tamir, 2019) and in two theoretical papers (Darling-Hammond, 2021; Skourdoumbis, 2017). However, our review did not show any quantitative investigation of reflection in relation to teacher quality.

Exploration of correlations between teacher **demographics** and teacher quality includes quantitative consideration of **gender** (Casey & DiCarlo, 2018; Celero & Escardíbul, 2020; Santelices et al., 2017), **age** (Celero & Escardíbul, 2020), **social class** (Santelices et al., 2017) and **ethnicity** (Casalaspi et al., 2018). Lindsay (2021) also explores the role of race and ethnicity and teacher quality theoretically.

Teacher self-rating of quality features within our review as a proxy because it features in four quantitative studies (Al Balushi, 2021; Pribudhiana et al., 2021; Tsai & Ku, 2021; Yalçin & Eres, 2021). Each uses a measure of teachers' own assessment of their quality and relates this to other factors.

Cultural knowledge, understood as shared knowledge of students' backgrounds in terms of cultures and experience, appears as a proxy in three papers: general knowledge of the culture and values within it were seen as relevant to teachers' educational use of Facebook (Efendioğlu, 2018); 'cultural sensitivity' was framed as a salient feature of teacher quality highlighted in a survey of parents (Casalaspi et al., 2018); an ethnographic study of a Chinese

international preservice teacher trying to become a good teacher (Maddamsetti et al., 2018) highlighted tensions between Confucianism and teaching in the USA.

Whilst **professionalism** might be characterised as an overarching construct in relation to teacher quality, we here report on two papers in our search in which it was operationalised as a psychosocial dimension. Professionalism is derived from a number of other factors in Vagi et al.'s (2019) analysis of retention data, following preservice teachers after completion of a teacher preparation programme. It is also a construct within Tsai & Ku's (2021) comparison of survey responses from students, teachers and university supervisors.

Darling-Hammond's (2021) theoretical exploration of how teacher quality compares in different jurisdictions links being **research active** to teacher quality, although we found no other mentions of this within the papers from Search 1.

School and community factors

In this category we bring together proxies for teacher quality which relate to the school and community (including teacher, pupils, parents and other professionals). Table 5 shows the number of each type of paper related to each of the proxies identified.

Table 5. Proxies and associated evidence type for school and community factors

| Proxy / measure | Number of sources | | | | |
	Mixed	Qualitative	Quantitative	Theoretical	Total
Teacher–student relationships	2	4	4	3	13
Student outcomes		2	6	3	11
Collaboration		1		2	3
Teacher observation			2	1	3
Student evaluation		1	1		2
Parent feedback		1			1
Community engagement				1	1
High expectations		1			1
Student motivation	1				1
Grand total	**3**	**10**	**13**	**10**	**36**

Teacher–student relationship was delineated as a factor in four quantitative studies: within Vagi et al.'s (2019) observational score, Efendioğlu's (2018) analysis of the use of Facebook for teaching or extracting aspects of teacher quality from survey data (Casalaspi et al., 2018; Febriyanti, 2018). The proxy also emerged from interviews (Marom, 2018; Sullivan et al., 2021), narrative case study (Snoek, 2021), critical policy analysis (Ro, 2021), and mixed methods studies using survey and interviews (Carmel & Badash, 2021; Thornberg et al., 2020). In theoretical studies, Goodwin & Low (2021) mention teacher–student relationships in comparison of teaching in Singapore and Hong Kong; Darling-Hammond (2021) similarly considers how teacher–student relationships vary between Australia, Canada, Finland, China and Singapore. Teacher–student relationships are treated as complex and culturally situated in that they are not easy to extract from their particular national setting. In a historical review of how teacher quality is perceived in Norway, Smith (2021) notes that there is little in the literature on how to educate teachers in the affective aspects of their role.

Student outcomes were related to teacher quality in 11 papers within the review for Search 1. As detailed in Appendix 1, our methodology did not include interrogation of the large number of papers around teacher effectiveness, which focus on student outcomes and quality of teaching. The aim of search 1 was to include as wide a range of potential proxies for teacher quality as possible, rather than evaluate the strength of evidence from synthesising quantitative studies.

None of the 11 papers in our search were from the UK. All six quantitative studies come from the USA: three using value added as a measure of teacher quality; two exploring teacher quality gaps (Goldhaber et al., 2018; Knight, 2020); and one analysing how parents evaluate teacher quality (Casalaspi et al, 2018). It is important to note that these studies investigated the distribution of high-quality teachers, rather than seeking to establish proxies for them. Outcomes also related to teacher quality in analysis of policymakers and teachers' perceptions of teacher quality (Ro, 2021; Sullivan et al., 2021) and in theoretical papers around teacher quality (Goldhaber et al., 2019; Goldhaber & Ronfeldt, 2020; Williams & Herbert, 2020).

The role of **collaboration** as an aspect of teacher quality is not considered in any quantitative studies that we found. We classify this as a school-level factor as it operates at the institutional level, although aspects of personality and interpersonal skills are involved. Collaboration with colleagues features in Snoek's (2021) narrative case study and in the theoretical studies by Darling-Hammond (2021) and Smith (2021). The latter also mentions collaboration with parents.

Measures of quality derived from **teacher observation** are used in quantitative studies by Lai et al. (2021) and Graham et al. (2020) and are seen as relevant to teacher quality in Williams & Herbert's (2020) theoretical study.

Student evaluation is related to teacher quality by early career teachers interviewed by Sullivan et al. (2021) and in comparing the quality of teachers assigned to teach mathematics to students with and without disabilities. Again, it is included here as it directly relates to pupils, rather than being an interpersonal characteristic of an individual teacher. Sullivan et al. (2021) also considers positive **parent feedback** as a proxy for teacher quality, recognised by early career teachers. We distinguished this from collaboration with parents in our coding, but they are closely related (Gilmour & Henry, 2018).

We also distinguished **community engagement**, which features in Darling-Hammond's (2021) theoretical review, from cultural knowledge because the former is conceptualised as more localised and more active than the latter. Ro's (2021) critical policy analysis also considers **high expectations** of pupils as a relevant proxy, although we find no other mention of it in Search 1. Thornberg et al.'s (2020) mixed methods study also delineates **student motivation** as an indicator of teacher quality, although we did not find this used in other papers.

'Gaps' in the proxies used in conjunction with teacher quality

As well as those proxies which only appear in a small number of papers, we identified a small number of proxies which appear in the policy literature or in synthesis publications but did not appear in the research papers which met the criteria of our search. We present these here by way of suggesting 'gaps' in the research literature that may be of interest.

All of the proxies identified under our category of professional capital, qualification and training appear within both the research and policy literature.

Within the category of personal dimensions, creativity and resilience feature in OECD (2011; 2018) reports as well as online blogs around teacher quality. Bradford et al. (2021) conducted a systematic review of research and policy literature which mentions identity, agency, and self-efficacy and wellbeing (the latter two being grouped together). Being a good role model is also deemed important to teacher quality (Kennedy, 2008)

Under the category of school and community, Bradford et al. (2021) also identify receiving coaching and mentoring as proxies, as well as being afforded autonomy. We also find an association in some studies between teacher quality and workload and timetable-related issues (e.g., class size and prep time, both from NCES, 2011, and percentage time teaching in subject).
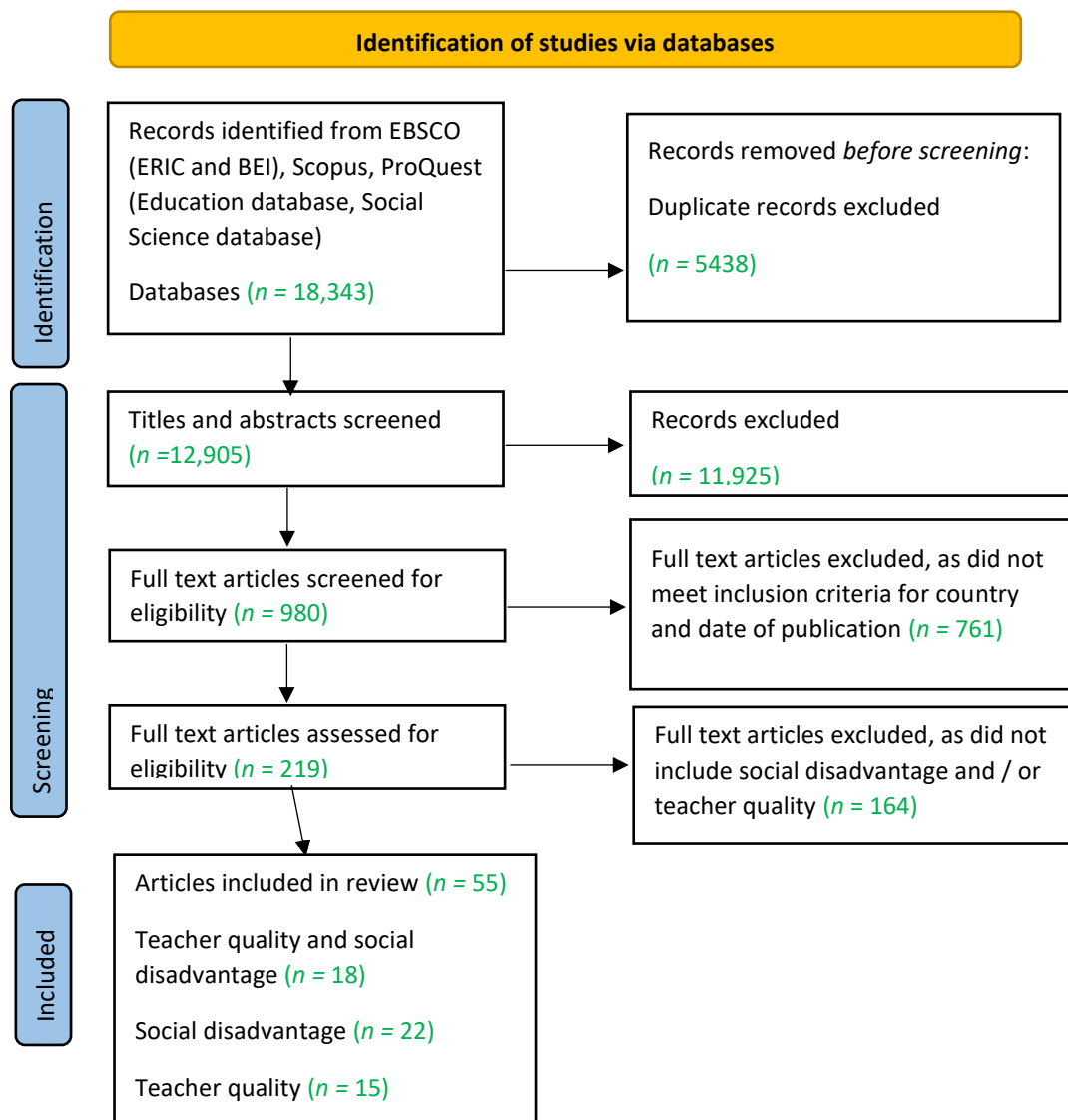
We noted some factors are identified in the research literature but not the policy literature. This might indicate a time lag in research informing policy. The most relevant factors missing from the policy literature are cultural knowledge, community engagement, teacher observation scores, professionalism, organisation skills, sociability, being a problem solver and critical thinker.

Evidence Review 2: Recruitment and retention of teachers in disadvantaged schools

Description of the evidence base

Search 2 was intended to address research questions 4, 5 and 6. The search returned 12,905 distinct papers for review, of which 55 met the review criteria and contained information about factors associated with recruitment or retention of either quality teachers, teachers in disadvantaged schools or both.[3] The PRISMA (Page et al., 2021) diagram for Search 2 can be found in Figure 2.

Figure 2. PRISMA (Page et al., 2021) flow diagram for Search 2

Identification of studies via databases

Identification

Records identified from EBSCO (ERIC and BEI), Scopus, ProQuest (Education database, Social Science database)

Databases (*n* = 18,343)

Records removed *before screening*:

Duplicate records excluded

(*n* = 5438)

Screening

Titles and abstracts screened (*n* =12,905)

Records excluded

(*n* = 11.925)

Full text articles screened for eligibility (*n* = 980)

Full text articles excluded, as did not meet inclusion criteria for country and date of publication (*n* = 761)

Full text articles assessed for eligibility (*n* = 219)

Full text articles excluded, as did not include social disadvantage and / or teacher quality (*n* = 164)

Included

Articles included in review (*n* = 55)

Teacher quality and social disadvantage (*n* = 18)

Social disadvantage (*n* = 22)

Teacher quality (*n* = 15)

Twenty-two articles addressed retention of teachers in disadvantaged schools, 15 articles addressed retention of quality teachers and 18 articles addressed retention of quality teachers in disadvantaged schools. Twenty-eight articles mentioned more than one factor. Through inductive coding we identified 28 different factors (summarised in Table 6) which we categorised into three broad categories:

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[3] An additional 164 papers were identified that met the review criteria but did not specifically mention teacher quality or disadvantaged schools. A summary of findings from these papers can be found in Appendix 6.

- **System-level factors**, operating at or constrained by a policy/organisational level above the school (e.g., financial incentives, local labour markets)
- **School-level factors**, which were characteristics of, or could be managed or controlled by an individual school (e.g., workload, professional development)
- **Individual-level factors**, which were associated with the characteristics of individual teachers (e.g., intrinsic motivation, local connections).

Table 6. Summary of factors related to recruitment and retention of teachers

System-level factors	School-level factors	Individual-level factors
Financial incentives Local labour markets Accountability Alternative routes to teaching Desegregation	Workload/working conditions Induction & mentoring Effective school leaders Collaboration with colleagues Professional development Relationships with parents and students Autonomy Discipline, behaviour Status School climate Leadership opportunities Support staff and resources Focus on learning Performance policy School characteristics	Intrinsic motivation Efficacy Local connections Fitting in Vocation Emotional factors Personality traits Cultural awareness

Appendix 4 provides an overview of the studies included, and Appendix 5 summarises the factors identified and numbers of different types of studies associated with them, categorised by methodology and by WoE.

The majority of studies originated from the USA (47), with one study from each of Australia, Belgium, Chile, Eastern Europe, England, The Netherlands, Sweden and Turkey. In terms of published research in this area there is therefore very little that focuses on the English context.

The majority of articles used quantitative methodology (34). Quantitative studies included 21 using administrative datasets (20 from the USA and 1 from Chile); 12 made use of survey data (9 from the USA, 1 Australia, 1 Belgium and 1 Eastern Europe); and one was a simulation study based on USA data. We did not find any experimental studies focusing on recruitment or retention of quality teachers and/or in disadvantaged schools.

Seven studies used qualitative methodology (6 from the USA and 1 from England); seven were theoretical studies (6 from the USA and one from The Netherlands); and seven were mixed methods studies (5 from the USA, 1 from Sweden and 1 from Turkey).

We can conclude, therefore, that there are significant research gaps in terms of research outside the USA and using quantitative experimental methodologies or mixed methods.

Below, we describe the papers which refer to the factors associated with recruitment and retention.

System-level factors

In this category we bring together factors associated with recruitment and retention of teachers that operate at the system level (i.e., factors that relate to features of the education system as a whole, either locally or nationally). This includes financial incentives applied as part of a local or national programme, the structuring of local labour markets, accountability and quality assurance frameworks, factors relating to routes into teaching, and the distribution of students between schools. Table 7 shows the number of each methodology of paper related to each of the proxies identified.

Table 7. Evidence type for system factors associated with recruitment and retention

	Mixed methods	Qualitative	Quantitative	Theoretical	Total
Financial incentives	1	2	17	2	22

Local labour markets	0	0	2	1	3
Accountability	1	0	1	0	2
Alternative routes to teaching	1	0	0	0	1
Desegregation	0	0	1	0	1
Total	**3**	**2**	**21**	**3**	**29**

Most research identifying system factors related to recruitment and retention has found an association with financial incentives for teachers (32 studies). Of these, the overwhelming majority are quantitative studies (17), mostly exploiting administrative datasets (21 studies, vs 6 studies using other quantitative methodologies).

Financial incentives included school- and teacher-level performance bonuses, recruitment bonuses, loan forgiveness, higher salaries and equitable funding for schools. Evidence pointed to a preference for teacher-level incentives to encourage recruitment and retention of teachers. For example, Amrein-Beardsley (2007) suggests that higher salaries and recruitment bonuses should be offered to expert teachers, with incentives based on expertise (she cites academic and professional qualifications, experience and awards as relevant measures). Elacqua et al. (2022) specifically explored the effects of bonuses awarded to high-performing teachers within the Chilean Pedagogical Excellence Assignment, where higher bonuses (16% of annual salary) are available for teachers in disadvantaged schools. Figlio's (2002) US study found that higher salaries for all teachers increased the quality of teachers recruited, as measured by selectivity of the college attended and matching of college major to subject taught. The effect held only for non-unionised school districts. Liang & Akiba (2015) found that Missouri school districts were more likely to award incentives for National Board certification and for taking on additional duties. The study looked at characteristics of programmes rather than impact on recruitment but assumed that incentives will increase the quality of recruits. Milanowski et al. (2009) conducted focus groups with prospective teachers and found that pay, benefits, student loan forgiveness and subsidies for further education were attractive, but that overall working conditions were more significant than level of pay. Springer et al. (2026) found that a 5000 USD retention bonus for effective teachers improved retention of teachers in tested subjects and grades. Two studies found that financial incentives were not associated with increased teacher retention (Clotfelter et al., 2008; Ryu & Jinnai, 2021). Clotfelter's study investigated the effect of an 1800 USD annual salary bonus for certified mathematics, science and special education teachers in low-performing and/or high-poverty secondary schools. Ryu and Jinnai found a U-shaped relationship between salary and retention, and that group-based performance incentives were effective only for lower paid teachers. Further evidence from the USA found that school-level performance bonuses were ineffective, tending to result in poorer retention of teachers in disadvantaged schools, as the bonuses were higher for schools with more advantaged intakes (Guarino et al., 2011). See et al. (2020) concluded in their review that financial incentives were useful in increasing recruitment but not retention.

Other system-level factors identified during the search included the suggestion that **local labour market strategies** might increase the distribution of quality teachers toward disadvantaged schools, although the evidence for this was poor quality (De Luca et al., 2009; Fowler, 2009; Knight, 2020). **Accountability systems** were found to make it harder for schools to retain quality teachers (Clotfelter et al., 2004; Lindqvist & Nordänger, 2016). One study found that long-term retention was worse for **alternative route teachers** (Zhang & Zeller, 2016) and one study suggested that quality teachers might be more evenly distributed across schools if **schools were less segregated** (Knight, 2020), a conclusion also reached by See et al.

School-level factors

In this category we bring together factors associated with recruitment and retention of teachers that operate at the school level. These included factors that were deemed to be under the control of the headteacher/principal's leadership, those relating to induction, mentoring and professional development, factors relating to relationships with school stakeholders including colleagues, parents and students, and the characteristics of the school itself. Table 8 shows the number of each methodology of paper related to each of the proxies identified.

Table 8. Evidence type for school factors associated with recruitment and retention

	Mixed methods	Qualitative	Quantitative	Theoretical	Total
Workload/ working conditions	1	1	9	2	13
Induction & mentoring	1	0	1	6	8
Effective school leaders	1	2	3	2	8
Collaboration with colleagues	2	0	2	5	9
Professional development	2	1	3	1	7
Relationships with parents and students	0	4	2	1	7
Autonomy	0	1	1	2	4
Discipline, behaviour	0	1	2	0	3
Status	1	0	1	1	3
School climate	0	0	2	0	2
Leadership opportunities	0	0	0	1	1
Support staff and resources	0	1	1	1	3
Focus on learning	1	1	0	0	2
Performance policy	0	0	1	0	1
School characteristics	0	0	1	0	1
Total	**9**	**12**	**29**	**22**	**72**

Fifteen school-level factors were identified, with six of these (workload, induction, effective school leaders, collaboration, professional development and relationships with parents and students) each mentioned in seven or more studies. There was a great deal of variation in study type identifying school-level factors, with factors identified through quantitative studies (13 factors); theoretical studies (10 factors); qualitative studies (8 factors); and mixed methods studies (7 factors). The theoretical studies tended to be of lower quality.

The highest-quality evidence was for an association with **workload/working conditions**. Heavier workloads were consistently associated with poorer retention and reducing workloads with increased retention. Specific aspects of workload included teaching a specialist subject (vs other subjects in which the teacher was not expert) and the number of courses taught (Berry, 2004; Kyle Ingle, 2009; Nguyen & Kremer, 2022), the challenge of the assigned classes (Danielson, 2002) and the availability of time for planning (Certo & Fox, 2002; Nguyen & Kremer, 2022). Teacher ratings of the acceptability of their workload were important (Geiger & Pivovarova, 2018). There was a suggestion that the effects of workload could be mitigated for new teachers through mentoring (Danielson, 2002). As well as workload, working conditions were also highlighted including length of contracted day, leave entitlement and allocation of duties (Painter et al., 2007; Qin, 2019). One article suggested that, in many cases, working conditions were a stronger influence on retention than salary (Clotfelter et al., 2008), while another suggested that women were more likely than men to leave as a result of working conditions, potentially due to being more likely to be second wage earners (Krieg, 2006).

Induction support, coaching and mentoring was identified by eight studies as supporting recruitment and retention, especially induction programmes (which may include coaching or mentoring) for early career teachers. This included one quantitative survey study (Painter et al., 2007) and one mixed methods study (Lindqvist & Nordänger, 2016), although Lindqvist & Nordänger note that different participants responded differently to the support they received and their study was different to the other studies of coaching and mentoring in that participants were experienced teachers. The highest quality theoretical study also identified induction support as a relevant strategy for retaining beginning teachers (Tran & Smith, 2020).

Eight studies identified **effective school leaders** as important in recruiting and retaining teachers. This included two quantitative survey studies (Grissom, 2011; Kim, 2019) and one quantitative study using administrative data (Grissom & Bartanen, 2019). Qualitative studies indicated that effective school leaders might have characteristics such as being aware of staff needs and supportive of them (den Brok et al., 2017); and visibility, listening to staff, providing support and allocating work appropriately (Certo & Fox, 2002).

Collaboration between colleagues was identified in two quantitative (Grant & Brantlinger, 2022; Nguyen & Kremer, 2022) and two mixed methods studies (Haun & Martin, 2004; Newton et al., 2010). Forms of collaboration included involvement in meaningful learning communities, which might extend to other schools and to universities (Danielson, 2002); learning teams, with teachers at different career stages (Fowler, 2009); and social networks (den Brok et al., 2017).

Professional development, including both professional courses and access to higher education programmes, was identified in three quantitative (Federičová, 2021; Feng & Sass, 2017; Nguyen & Kremer, 2022) and one mixed methods study (Newton et al., 2010). This included higher level teacher education, for example as provided by universities (e.g., den Brok et al., 2017).

Two quantitative studies identified the importance of **relationships with parents and students** (Hughes, 2012; Williams et al., 2021) with better relationships strengthening retention. Qualitative and theoretical studies identified the following factors: the need for teachers who did not share ethnic background with students to build effective relationships with them (Wronowski, 2018); knowledge of students and their context (Berry, 2004); the need for teachers to develop close relationships with students and value their individuality (Borgerding, 2015); the need for parental support for the school (Certo & Fox, 2002).

Other factors associated as related positively with recruitment and retention were the school environment fostering a greater sense of **autonomy, agency and control**, including a role in decision making (Berry, 2004; Nguyen & Kremer, 2022); empowerment of teachers through classroom autonomy (Tran & Smith, 2010); and a sense of control over their working lives (Wronowski, 2018). Additionally, studies identified better **discipline** and more positive behaviour within the school (Certo & Fox, 2002; Grant & Brantlinger, 2022; Qin, 2019); **teacher status** and respect (Lindqvist & Nordänger, 2016; Steele et al., 2010; Tran & Smith, 2020); **school climate** (Qin, 2019; Williams et al., 2021); **leadership opportunities** for teachers (Berry, 2004); provision of **support staff and resources** (Amrein-Beardsley, 2007; Certo & Fox, 2002; Qin, 2019); a shared **focus on learning** within the school (Borgerding, 2015; Newton et al., 2010); and school characteristics (Scafidi et al., 2007). One study found that **performance policies** in schools could improve teacher quality through deselection of teachers with lower value-added scores (Winters & Cowen, 2013).

Individual-level factors

In this category we bring together factors associated with recruitment and retention of teachers that operate at the individual level, typically characteristics or qualities of teachers. Table 9 shows the number of each methodology of paper related to each of the proxies identified.

Table 9. Evidence-type and individual factors associated with recruitment and retention

	Mixed methods	Qualitative	Quantitative	Theoretical	Total
Intrinsic motivation	2	3	2	0	7
Efficacy	2	0	1	0	3
Local connections	1	0	0	0	1
Fitting in	1	1	1	0	3
Vocation	0	0	1	0	1
Emotional factors	0	1	1	0	2
Personality traits	0	1	0	0	1
Cultural awareness	0	1	0	0	1
Total	**6**	**7**	**6**	**0**	**19**

Eight individual-level factors were identified, with only intrinsic motivation mentioned in more than three studies, and four factors (local connections, vocation, personality and cultural awareness) mentioned in one study each.

Quantitative and mixed methods studies supported the relationship between **intrinsic motivation** (Haun & Martin, 2004; Manuel et al., 2018; Özoğlu, 2015; Painter et al., 2007), **teacher efficacy** (Harrington & Walsh, 2022, refer to teacher efficacy; Qin, 2019, refer to self-efficacy; Vagi et al., 2019, refer to teachers' confidence in their own abilities), **local connections** (Özoğlu, 2015), **fitting in** to the school or role (Kyle Ingle, 2009; Özoğlu, 2015), having a sense of

vocation or moral purpose (Easley, 2006) and **emotional factors** including stress and fatigue (Van Eycken et al., 2022) with recruitment and retention of teachers.

These studies suggest that teacher retention could be increased through activities that impact positively on individual factors; for example, by increasing teacher efficacy, supporting teachers' sense of belonging to a school or through policies that reduce the stress and emotional burden related to teachers' work.

Implications

In this section we provide a brief overview of how the review addresses the research questions and the implications for future research commissioning.

RQ1. What measures or proxies for teacher quality ('measures') are used in the research literature?

The review identified 25 proxies used in reference to teacher quality, which we grouped into three broad categories: professional capital, qualification and training (8 proxies), personal dimensions (8 proxies), and those to do with school and community (9 proxies). It is not possible to treat these as 'measures' of teacher quality that hold regardless of context, not least because they appear in a range of different types of study. For example, some studies investigate correlations between different proxies, derive proxies from exploration of data or literature/policy, or present theoretical argument around the educational, ethical and social implications of how teacher quality is defined. The studies identified do contain validated survey instruments, approaches to quantitative analysis and well-derived frameworks for what should be included when considering teacher quality. However, these were derived within specific contexts and/or using specific datasets and as such the appropriateness of replicating and adapting the research tools, methods and proxies must always be carefully considered.

Whilst some proxies feature in more studies, this may be to do with the availability of data (e.g., qualification or years of experience) or that there are well-established concepts and tools related to the proxy (e.g., with PCK). Accordingly, the number of studies associated with a proxy within Search 1 is not an indication of the security of evidence for its use.

It is noteworthy that student outcomes were not clearly related to other proxies of teacher quality within the studies we reviewed. As noted earlier, of the six quantitative studies (all from the USA) which consider student outcomes, three used outcomes as a proxy for quality when looking at the distribution of teachers (Goldhaber et al., 2018; Knight, 2020; Lai et al., 2021). In addition, Colson & Satterfield (2018) used student value-added scores to consider the effect of compensation on retention of high-quality teachers, Marland et al. (2019) conducted a simulation study around value added and classification of teacher effectiveness, and Casalaspi et al. (2018) used quantitative methods to analyse parent judgements of teacher quality. Student outcomes relate to teacher quality by the definition we have used in our search, and used in many studies, but we cannot establish clear links between outcomes and other proxies.

RQ2. What are the key advantages and limitations of the measures identified? Are there any gaps in the measures used to identify teacher quality that could be filled?

We have assessed advantages and limitations based on the information provided in the reviewed papers. We had expected more information to be provided in articles regarding the strengths and limitations of proxies and measures used; however, information was limited. Therefore, we did not have enough evidence to draw strong conclusions about advantages and limitations.

The advantages and limitations of using each proxy need to be assessed relative to the intended use and context. The papers identified contained some information about methodological or sampling limitations of the studies they contained, but this is not enough to make findings immediately transferable to other contexts. We did judge the internal consistency of each paper to be high, and this is supported by the papers in Search 1 all being peer reviewed.

We can infer something about the readiness with which proxies might be used through how often they appear in literature but must be careful not to over-infer. Proxies such as qualification, experience and induction are operationalised with relative ease (although exactly how varies by study). Pedagogic content knowledge (PCK), teacher–student relationships, continuous professional development (CPD), reflection and teachers' self-report of quality can be operationalised through survey tools. Here, the presence of previously validated survey items or scales and the ease or difficulty of engaging participants with tools will influence their relative merits as proxies. Proxies which are mentioned in only a small number of papers could be worthy of further study (e.g., community engagement, cultural

knowledge, professionalism and being research active). These, however, require further development, both conceptually and methodologically.

Consideration of proxies which feature in only a small number of studies also provides insight into the potential 'gaps' within the research literature around teacher quality. As described earlier, we also approached these 'gaps' by identifying proxies for teacher quality that appear in the policy literature, but not within the research literature from Search 1. Under our broad categorisation of personal dimensions, we identified creativity, resilience, identity, agency, self-efficacy, wellbeing and being a good role model as potential gaps in the research literature. Under school and community, we further identified coaching and mentoring, being afforded autonomy, and timetable-related issues of class size, preparation time and percentage of time teaching within subject. Overall, our review indicates that more research is needed in relation to a significant number of proxies for teacher quality.

RQ3. Which measures are most likely to be appropriate for use in research assessing the impact of interventions on teacher recruitment and retention in disadvantaged schools?

There are considerable overlaps between the proxies for teacher quality and the policies and interventions used to support recruitment and retention of teachers in disadvantaged schools. These include agency, self-efficacy, wellbeing (linked to policies around workload), coaching and mentoring, and autonomy. That these themes arise both in relation to teacher quality and teacher recruitment and retention suggests that they might be appropriate and promising leads for use in research in this area.

Looking specifically at the 33 articles returned from review 2 that addressed teacher quality in relation to recruitment or retention of teachers, we identify a further set of proxies. Proxies used in these studies included being highly qualified (11), having good teaching skills; for example, as measured through observation or ratings (5), academic qualifications (5), value-added measures (4), and being judged to be 'effective' (this term was not further defined) (3). Six articles indicated other proxies including self-efficacy, standards, salary, composite variables, personality and subject specialism. In a further six articles, it was not clear which proxy was being used.

It seems that commonly used measures are those readily available in administrative datasets, such as teaching and academic qualifications and value-added or effectiveness. However, articles tend to assume that these proxies are appropriate, rather than provide evidence of their validity. This may present particular difficulties for the literature looking at recruitment to disadvantaged schools.

RQ4. What are the main approaches and school-based policies that could be used to improve recruitment, retention and distribution of high-quality teachers in disadvantaged schools? How can these be categorised?

The review intended to scope the field and identify potential promising areas for future research, including policies and factors that have substantial qualitative evidence but have not yet been investigated experimentally and/or developed into a testable intervention.

Review 2 identified five system-level factors, of which only one, financial incentives, had more than two studies with medium or high weight of evidence, suggesting that such incentives could be used to improve recruitment and retention of high-quality teachers in disadvantaged schools. This is in line with See et al.'s (2020) findings. The most promising approaches here seem to be annual awards, of a significant size, which apply specifically to high-quality individuals working in disadvantaged schools.

The greatest weight of evidence for school-level policies that have the potential to improve the likelihood of recruiting high-quality teachers in disadvantaged schools identified the following as particularly important: workload and working conditions; induction support, coaching and mentoring; effective school leaders; collaboration with colleagues; professional development; relationships with parents and students; autonomy, agency and control; discipline and behaviour; and teacher status. All of these factors were identified in at least three studies rated as providing high or medium weight of evidence. This suggests that promising approaches might include workload reduction through reducing the number of different classes or subjects taught or increasing planning time. Other promising approaches might include induction programmes, coaching or mentoring, especially for beginning teachers; professional development programmes for school leaders; opportunities for professional collaboration, such as co-planning or learning communities; access to professional development beyond the statutory minimum, such as funded higher education programmes or professional certification or courses; support for positive relationships with students, including cultural awareness; allowing teachers to exercise professional judgement or input into key school decisions; or possibly interventions to improve behaviour and discipline in schools.

Of the eight individual-level factors identified in the review, only intrinsic motivation was identified in more than two studies rated as providing high or medium weight of evidence. However, it is our view that intrinsic motivation is unlikely to be amenable to intervention research. Highlighting intrinsic motivation as a key factor for teachers might, in fact, be counter-productive for teacher recruitment as it might discourage some potential candidates.

RQ5. What are the key messages from research on these approaches or policies? How promising might these approaches be and what gaps are there in our understanding of their likely effectiveness?

We aimed to identify from the full text of research articles any indicators as to the promise of particular factors and where research findings suggested that an approach might be effective.

Key messages from research include the importance of manageable workload for teachers, including protected time for planning, reasonable working hours and appropriate class allocations. Teachers who rated their workload as more suitable were more likely to be retained.

Induction support, coaching and mentoring has been highlighted as an important factor, particularly for teachers who are new to the profession. Professional development was also identified as important. Both of these approaches may support teacher efficacy, which was identified as an individual factor supporting teacher retention.

Effective school leaders were identified in a number of studies as being able to support teacher retention. Indeed, one study suggested that the impact of principal professional development on teacher retention could be investigated through randomised controlled trial (Kim, 2019).

Relationships within and beyond the school were identified as important. These included opportunities for teachers to work collaboratively with each other in planning or as learning teams, and positive relationships between teachers and parents or students.

One theoretical study suggested that different factors may be significant at different stages of a teacher's career. For early career teachers, induction support and mentoring would be important, while for mid-career teachers, autonomy might be more significant. Later career teachers might be retained through continuing to recognise their status within and value to the school (Tran & Smith, 2020).

Finally, teachers were more likely to be retained in schools with good discipline and behaviour (Certo & Fox, 2002; Grant & Brantlinger, 2022; Qin, 2019).

Many more factors were identified through qualitative research, yet the quantitative evidence that might indicate promise is so far absent. Likewise there are strategies that appear in current English policy initiatives (e.g., flexible working is a key part of the Recruitment and Retention Strategy: DFE, 2019), that did not arise in our search. See et al. (2020) identified that the only recruitment and retention strategy with supporting evidence from rigorous studies is financial incentives, although their review identified a number of other strategies where the research was at too early a stage but might yet show promise (alternative routes into teaching, improving working conditions, and mentoring support and induction) These were also identified through this review.

RQ6. What methodological challenges are there for evaluation of interventions into teacher recruitment and retention? What research designs and methodologies might enable more robust studies in future?

To answer this question, we examined the methodological approaches taken in articles identified in the review. Our review did not identify any experimental studies of teacher recruitment or retention. There were also relatively few mixed methods studies. Most quantitative studies exploited administrative datasets and explored policies that were local to their jurisdiction. Only one qualitative study identified in the review analysed data from England (McIntyre, 2010).

Many of the potential interventions that might be devised on the themes identified are likely to be complex, whole-school interventions (Anders et al., 2017). For example, interventions that meaningfully address workload, induction support and coaching, collaboration or teacher autonomy are likely to influence behaviours and outcomes in complex ways.

There were relatively few studies that addressed both the retention of high-quality teachers and the context in which disadvantaged schools work. This is a specific area that needs addressing in future research.

Limitations

This rapid evidence assessment focused on rapid reviews of peer-reviewed research from a restricted range of databases. It is likely therefore that some relevant articles and unpublished works were not included. Additionally, due to the short timescale for the review, date and country limitations were applied to the searches, which may also have meant that relevant articles were excluded. However, this was felt to be an acceptable compromise and the findings are similar to other published reviews (e.g., Bradford et al., 2021; See et al., 2020).

We have not attempted a quantitative meta-analysis in this review and the broad range of study types included means that there were greater challenges in assessing the quality of articles included. However, the inclusion of only peer-reviewed articles means that a minimum bar for inclusion was set.

Team

The review was conducted by a team from IOE, UCL's Faculty of Education and Society.

Dr Becky Taylor, Principal Research Fellow, Centre for Teachers and Teaching Research (CTTR) led the review and the evaluation of literature for Search 2.

Dr Mark Hardman, Associate Professor, CTTR, led the evaluation of the literature for Search 1.

Dr Sal Riordan, Senior Research Fellow, CTTR, led on review methodology.

Claire Pillinger, Research Assistant, CTTR, carried out coding and data extraction.

Professor Gemma Moss, Professor of Literacy, Department of Learning and Leadership, advised on review design and reporting.

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Conflicts of interest

The authors are not aware of any conflicts of interest.

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Appendix 1: Methodology and search terms

Inclusion and exclusion criteria for the review

The inclusion and exclusion criteria and search terms for both searches were determined following an exploratory phase involving searches of grey literature and international academic literature. The eligibility criteria drawn up for the review reflected the study's aim to encompass a broad range of methodologies including quantitative, qualitative, mixed methods and theoretical research, and to review research into teacher quality as broadly as possible. Studies regarding quality of classroom pedagogy and teaching practices were determined to be outside the remit of the review.

The limitations for the dates of literature were determined pragmatically to make the search manageable in the short timeframe, to ensure the most relevant and recent research was included, and to also gain a sense of the recent research climate into teacher quality internationally. After the initial scoping work, it was decided to include literature from a longer search period in Search 2 for research conducted in the UK, Australia, Canada and the USA because of the greater similarity of these systems to the UK. Conversely, the search period for Search 1 was shortened from that initially planned as saturation was reached and no new proxies were being uncovered.

	Include	Exclude
Sample	Children and young people aged 4–18 in school contexts Studies from any country will be included	Higher Education, Further Education and Early Years Settings
Phenomena of interest	We define teacher quality as the characteristics of an individual teacher including characteristics resourced by the system in which they work, that are linked to pupil outcomes Examples might include subject-specialist qualification, or participation in professional development	Studies regarding quality teaching practices or classroom pedagogy
Design	Any design to be included	
Evaluation / outcome	Studies with quantitative and qualitative outcomes; theoretical articles without outcome measures	
Research type	Quantitative, qualitative, mixed methods and review and theoretical studies	
Other criteria	Literature for OECD countries in the last 10 years and for the UK, USA, Canada and Australia in the last 20 years Published in English Published in peer-reviewed journals or grey literature	Any literature published in non-OECD countries Literature published outside the UK / Australia / Canada / USA before 2012 Any literature published before 2002 Published in languages other than English Unpublished studies

Databases and search terms

The two main searches were conducted using EBSCO (BEI and ERIC), ProQuest (Education Database and Social Science Database) and Scopus. The search terms for Searches 1 and 2 were developed

from a scoping phase. In this phase, searches were conducted for 'quality teacher', 'teacher effectiveness', 'teacher quality', 'quality of teaching', 'quality teaching', 'effective teacher', 'good teacher' and 'excellent teacher', to assess the magnitude and relevance of the resulting literature bases, interchangeable use of terminology, and to design search terms that would capture the research of highest relevance (see *Selection of studies* below) and yet limit the items for screening to a manageable number. An assessment was also made of the different impact of searching for these terms in a full-text or just the title and abstract. It was determined that full-text searches capture many papers of little relevance. The resulting search terms and databases used for each search are detailed in Table 10.

Table 10. Search terms and databases used in the review

	Exploratory	**Search 1 (RQ1–3)**	**Search 2 (RQ4–6)**
Sources	Google Google Scholar Home page – OECD Department for Education – GOV.UK (www.gov.uk)	EBSCO (ERIC and BEI)	EBSCO (ERIC and BEI) Scopus ProQuest (Education Database and Social Science Database)
Search terms	'teacher quality is defined by' OR 'teacher quality in high performing systems' OR 'measuring teacher quality' OR 'teacher quality measures'	'teacher quality' OR 'excellent teacher*' OR 'good teacher*'	('recruit*' OR 'retention' OR 'turnover' OR 'attrition' OR 'distrib*') AND 'teacher*'
Search filters	NOT 'higher education' Terms searched for in abstracts only	NOT 'higher education' Terms searched for in abstracts only	NOT 'higher education' NOT 'early years' NOT 'pre-school' NOT 'preschool' Terms searched for in abstracts only
Reference management software	References were managed in a bespoke Excel spreadsheet	References were managed in a bespoke Excel spreadsheet	References were managed in a bespoke Excel spreadsheet

Selection of studies	Assessment of author's intention to address characteristics of individual teachers from reading abstract	Study reports on or discusses approach to recruitment or retention of teacher or distribution of teachers among schools

Selection of studies

We defined teacher quality as the characteristics of an individual teacher including characteristics resourced by the system in which they work that are linked to pupil outcomes. Our exploratory work demonstrated that 'teacher quality' and 'quality teaching' are occasionally used interchangeably in the literature and are not always clearly defined. Therefore, it was not easy to distinguish the literature we are interested in using search terms alone. We took the approach of attempting to capture literature that was relevant to teacher quality (as we have defined it) that did not use this term using further search terms ('excellent teacher' and 'good teacher'). We also eliminated those that used 'teacher quality' in a different way to our definition through reviewer screening.

We excluded studies that only use 'quality teaching', 'quality of teaching' and 'teacher effectiveness' because of the size of this literature and because, having sampled this literature, we found it is more likely to be focused on teaching practices rather than teacher characteristics. We mitigated for the risk of losing papers of interest by including search terms 'excellent teacher' and 'good teacher.' Our scoping work showed this would enable us to capture a significant proportion of the literature we are interested in because these terms are frequently found alongside 'effective teacher' in studies relevant to teacher quality. We recognise that the teacher effectiveness literature is large and our strategy will have lost some papers of relevance. However, our exploratory search also indicated that where teacher effectiveness literature is relevant to teacher quality, it often uses standard measures such as teacher qualifications and years of service that will already be captured in our search for teacher quality.

Reviewers assessed whether the intention of the study author(s) was to address teacher quality by reading the abstract, and deciding whether, regardless of the terminology, the author(s) intended to address the characteristics of individual teachers. The results of the title/abstract screening process are shown in the PRISMA flow diagrams.

Data extraction and management

The data extraction was performed using Microsoft Excel (see Appendix 2). For the exploratory search of grey literature, the searches resulted in links to relevant sources that were copied to an Excel file which was then used to extract data. For Searches 1 and 2, the results from the search engines were imported into Zotero and an Excel file generated. In Search 2, duplicates were removed. In Search 1 this was not necessary as only the ESBSCO database was used, which automatically deleted duplicates. Article references were imported to Excel along with the DOI to enable access to articles directly., Full text screening was carried out to ensure that papers were relevant to the search. Finally, data was extracted from the remaining papers according to the categories on the data extraction templates.

Appraisal of studies

We used a Weight of Evidence (WoE) rating approach (Cordingley, 2007, cited in Basma and Savage, 2018, p. 7) to critically appraise studies in Search 2. This is an appropriate approach given the rapid nature of the review and the need to appraise a range of methodological approaches, including theoretical, qualitative, quantitative (including experimental) and mixed methods designs. Other

evaluative approaches (e.g., CASP, JBI, Cochrane) were deemed unsuitable because they do not address all of these methodological approaches. The approach is summarised in Table 11.

We considered that the WoE assessment was less useful for Search 1. This is because we assessed all of the papers to have a good level of internal consistency in answering the study questions (WoE A) and considered the appropriateness of design and relevance to the review (WoE B and C), to not accommodate our intention to identity as broad a range of proxies as possible associated with teacher quality. However, we proceeded to use WoE assessment for Search 2, in particular to answer questions about the WoE supporting different factors in recruitment and retention of teachers and their suitability for investigation in an intervention study.

Table 11. Weight of evidence (WoE) criteria (Cordingley 2007, cited in Basma & Savage, 2018, p. 7)

	Description
WoE A	Did the reported findings in the study answer the study question and were they internally consistent?
WoE B	Is the research design appropriate for the review questions?
WoE C	Was the focus of the study relevant to the review question?
WoE D	Overall WoE D rating of each study was 'High', 'Medium', or 'Low' Studies that score LOW on WoE A will be deemed LOW on all WoE criteria. Studies that score High or Medium WoE A will be evaluated on all criteria and given an overall code in WoE D.

Data synthesis

Data analysis for both searches followed a reflexive thematic analysis approach to the identification of themes and categories (Braun & Clarke, 2019). Proxies of teacher quality were extracted from each paper, along with the purpose of the proxy within the studies. From this, proxies were inductively coded and aggregated into coherent themes. Themes were then grouped into overarching categories. A narrative synthesis was provided for each theme.

Articles identified through Search 2 were coded for factors related to recruitment, retention or distribution of teachers. These factors were grouped inductively into themes and then into overarching categories, as being system-, school- or individual-level factors, and are reported in these groupings above. A narrative synthesis is provided.

Timeline

Dates	Activity	Staff responsible/ leading
w/b 7 Nov 2022	Project set up meetings with EEF	BT
25 Nov 2022	Exploratory work to determine search terms, inclusion exclusion criteria, critical appraisal tool, etc. Exploratory phase and Search 1, screening and initial data extraction Submission of draft study plan	SR, CP BT
2 Dec 2022	Identification of potential members of expert panel and sending of invitations Test run of Search 2 Modify an appropriate critical appraisal tool Search 1 further data extraction for RQ2&3	BT, team BT BT CP

Dates	Activity	Staff responsible/ leading
9 Dec 2022	Search 2, screening and initial data extraction Search 1 data synthesis RQ1–3	CP MH
16 Dec 2022	Search 2 data synthesis RQ4	BT
23 Dec 2022	Search 2 critical appraisal work and data synthesis for RQ5	BT
7 Jan 2023	Design of expert panel and focus group Expert panel Search 2 data synthesis for RQ6	BT BT
13 Jan 2023	Report writing Submit draft report	BT, MH, SR BT
27 Jan 2023	Stakeholder focus group	EEF
28 Feb 2023	Final report for peer review	BT
28 Apr 2023	Response to peer review	BT

Appendix 2: Table of characteristics of included studies: Search 1

Papers using quantitative methods

Reference	Country of publication	Purpose of teacher quality measure	Method / approach	Teacher quality proxies / measures used or discussed	Code applied to proxies	Any discussion of limitations in paper
Akram (2019)	Pakistan	Measure the relationship between teacher effectiveness score and student achievement at secondary school level	Using a multistage sampling technique, 40 high schools (20 male and 20 female) were selected as strata. Later, all 2000 students of Grade 9 at these 40 schools in District Okara were sampled. A school teacher effectiveness questionnaire (STEQ) was administered.	STEQ: communication skills, subject matter knowledge	Communication skills / personality, subject knowledge	Only moderate relationship identified
Al Balushi (2021)	Oman	Measure the effectiveness of CPD	Data were collected using questionnaires, observations, semi-structured and focus-group interview with EFL teachers in Oman	Self-reported improvement to teacher quality	Self-report	
Allen & Sims (2018)	England	Investigate the extent of social inequalities in access to teacher quality in England.	Uses a range of well-evidenced indicators of teacher quality from the School Workforce Census and the Teaching and Learning International Survey (TALIS)	Academic degree in subject teaching, QTS, years of experience, timetabled hour in subject	Qualification, induction, experience, subject knowledge / experience	
Auhl & Bain (2021)	Australia	Examine whether the Australian Tertiary Admissions Rank (ATAR) predicted preservice teachers' schema development for inclusive classroom teaching	Data from 136 final year undergraduates drawn from three university teacher-education degree programmes	Australian Tertiary Admissions Rank (ATAR)	ATAR	Post-test only designs are observational and do not seek to provide a causal explanation, restricted geographic area, does not include observational data

Reference	Country of publication	Purpose of teacher quality measure	Method / approach	Teacher quality proxies / measures used or discussed	Code applied to proxies	Any discussion of limitations in paper
Barasa (2020)	Kenya	Examine the relationship between teacher quality and student achievement in mathematics among Grade 4 students	Multilevel regression using the data from the 2012 World Bank and African Economic Research Consortium Service Delivery Indicators and student achievement in mathematics among Grade 4 students located in 91 urban primary schools and 181 rural primary schools in Kenya.	Teacher quality indicators including teacher characteristics, teacher qualification comprising initial teacher education (ITE) and teacher professional development and teacher classroom practices	Personality, qualification, CPD	Marked differences in how teacher qualification affects student achievement. Limited generalisability.
Brantlinger (2020)	USA		As part of a case study project, researchers observed and interviewed nine secondary mathematics teaching fellows (SMTFs) in their first 2 to 3 years in the classroom. They also collected survey, effectiveness and retention data on 620 SMTFs who began teaching in NYC public schools	Academic talent / qualifications	Qualification	
Canales & Maldonado (2018)	Chile	Assess the overall contribution of teachers to student achievement and identify which teacher characteristics enhance teacher effectiveness	Data includes student-level achievement test data for both mathematics and language, which comprises a population of 244,355 students. Used the SIMCE Complementary Survey as a second data source. The survey is applied to all students who took the national tests in 2011. Additionally, parents and teachers were also surveyed.	Teacher experience	Experience	External validity of the study findings. Estimates of teacher quality may suffer from an omitted variable problem. We only have information on a limited number of teachers' observable characteristics, and thus unobservable factors – such as motivation and teaching style or practices – might confound the influences of observed teacher characteristics that we report.

Reference	Country of publication	Purpose of teacher quality measure	Method / approach	Teacher quality proxies / measures used or discussed	Code applied to proxies	Any discussion of limitations in paper
Casalaspi et al. (2018)	USA	Investigate: (1) how parents relate various teacher traits to quality teaching (2) how parents know if their child has a good teacher (3) how parents think teachers should be evaluated	Draws on the results of a survey of 286 parents in a diverse urban school district	(a) Ability to relate to students (b) High level of enthusiasm (c) Ability to maintain order (d) Cultural sensitivity (e) Ability to produce high test scores (f) Racial/ethnic background	Teacher–student relationship, teacher motivation, cultural knowledge, student outcomes, demographic: racial / ethnic background behaviour management	Survey was intended to be descriptive in nature. Descriptive surveys are designed merely to highlight interesting patterns or tensions in a particular policy area, and as a result, this survey is not intended to make a definitive statement. Sensitiveness of the sample: sample is relatively representative of the district as a whole, although it over-represents females, high-income individuals and highly educated individuals. Self-report by parents of their child's experiences
Celero & Escardíbul (2020)	Spain	Investigate the effects of teacher quality on the acquisition of reading skills amongst primary school students in Spain	Used an education production function which incorporates teachers' fixed effects, estimated by means of a multiple regression model. Examined the acquisition of reading skills by drawing on data from PIRLS-2011.	Age, gender, teaching experience (years), Master's degree or PhD, certification obtained and area of specialisation (university studies with specific training in teaching of reading?), hours of training over the last 2 years (number of hours spent in training seminars dealing with reading comprehension).	Demographics: age, gender, Qualification, Induction, Subject / in-field, CPD	No causal relationship can be identified. Finding specific to Spain.
Chang et al. (2020)	USA	Relationship between student achievement and teacher's possession of advanced degrees (ADs)	Associations between teacher credentials and middle grades students' academic growth were examined by differentiating teachers' degree level (Bachelor, Master, Specialist) and field (content-related, non-content-related). Teachers and school leaders were also interviewed to broaden our understandings of the impact ADs make in areas besides student achievement.	Teacher having 'advanced degree'	Qualification	Specific to mathematics discipline

Reference	Country of publication	Purpose of teacher quality measure	Method / approach	Teacher quality proxies / measures used or discussed	Code applied to proxies	Any discussion of limitations in paper
Colson & Satterfield (2018)	USA	Investigate the effects of strategic teacher compensation on teacher quality as determined by the Tennessee Value-Added Assessment System (TVAAS)	The first research question conducted a one-way chi-square analysis to determine if the observed retention rates of highly effective teachers were significantly different compared to the retention rates of highly effective teachers who elected to remain compensated by the traditional salary schedule. The second research question conducted a one-way chi-square analysis to examine strategic compensation plan favourability among hard-to-staff special education, high school mathematics, high school science and high school language teachers ($n = 234$).	Value added	Student outcomes	Quantitative design of this study did not account for qualitative factors that influence teacher quality. Findings specific to sample.

Reference	Country of publication	Purpose of teacher quality measure	Method / approach	Teacher quality proxies / measures used or discussed	Code applied to proxies	Any discussion of limitations in paper
Curry et al. (2018)	USA	Investigate the type and level of teacher credentials that impact fourth grade reading achievement	Student and school samples are drawn from each state, the District of Columbia and Department of Defense schools. National Assessment of Educational Progress data is sampled using probability samples. The number of participating schools and students for each cycle depends on the number of content areas and test items assessed. Approximately 30 students per content area assessed are chosen from each participating school (NCES, 2013a). On average, 100 schools from participating states are selected for main NAEP assessments per cycle. Student samples for each school range from 30 to 150 students depending on school size and content areas assessed.	National Board Professional Teaching Standards status ($p < 0.001$), teacher preparation route ($p < 0.001$), and degree earned ($p < 0.05$)	ITE, induction	
Efendioğlu (2018)	Turkey	Develop a 'Facebook effect scale on teacher quality' (FESTQ)		'Instructional knowledge for in-class applications', 'general culture knowledge', 'individual characteristics', 'instructional knowledge related to student characteristics', 'instructional knowledge for preparing an assessment tool' and 'special content area knowledge	PCK, cultural knowledge, teacher–student relationships	Survey- self report

Reference	Country of publication	Purpose of teacher quality measure	Method / approach	Teacher quality proxies / measures used or discussed	Code applied to proxies	Any discussion of limitations in paper
Febriyanti (2018)	Indonesia	Investigating and describe the qualities or the characteristics of a good English teacher based on the learners' perceptions	Survey of the 131 students at the English Department of the Teacher Training and Education Faculty of Lambung Mangkurat University Banjarmasin	(1) Organisation and communication skills: teacher's ability in organising, preparing and communicating the subject matter (2) Pedagogical knowledge: what teacher knows about teaching his/her subject (3) Socio-affective skills: teacher's personality, sociability and attitudes towards his/her students (4) English proficiency: what teachers know about what they teach; in this case, English	Organisation skills / personality. Personality: communication skills, PCK. Personality: sociability, teacher–student relationship	
Gilmour & Henry (2018)	USA	Compare the quality of teachers assigned to teach mathematics to fourth-through eighth-grade students with disabilities (SWDs) and students without disabilities	Analysis of data from more than one million students	Knowledge & skill: teacher academic achievement, years of experience, certification, evaluation scores	PCK, qualification, experience, induction, student evaluation	Do not have information about additional supports in classrooms, such as paraprofessionals or coteaching arrangements between general and special education teachers. We examined only the quality of teachers to whom students were assigned for their LRE mathematics classes, defined for each student as the class most likely to include exposure to grade-level content. Evaluation scores do not account for the students in the teachers' classes. Evaluation may not capture the components of effective instruction for SWDs.
Goldhaber et al. (2018)	USA	Explore the magnitudes and sources of teacher quality gaps over time, between the two states, and depending on the measure of student disadvantage and teacher quality	Uses longitudinal data on public school students, teachers and schools from North Carolina and Washington	Experience, value-added estimates, Licensure test scores	Experience, outcomes, induction scores	

Reference	Country of publication	Purpose of teacher quality measure	Method / approach	Teacher quality proxies / measures used or discussed	Code applied to proxies	Any discussion of limitations in paper
Graham et al. (2020)	Australia	Investigate associations between teachers' years of experience and teaching quality	This study analyses standardised classroom observation data from 18 Preparatory Year teachers, 28 Grade 1 teachers, 20 Grade 2 teachers and 14 Grade 3 teachers ($n = 80$)	Years of experience and Classroom Assessment Scoring System (CLASS), a standardised observational tool designed to capture and evaluate classroom quality	Experience, teacher observation	Investigating associations between teachers' years of experience and teaching quality
Knight (2020)	USA	Explore the teacher quality gap	Combines data on geographic labour markets with student-level administrative data from Texas	Years of experience , value added measures, certification scores and college competitiveness	Experience, student outcomes, induction, school level / prestige	
Lai et al. (2021)	USA	Explore the differences in teacher quality experienced by SWDs and students without disabilities (non-SWDs) in the Los Angeles Unified School District, examining how access varies within schools, as well as across school-level disadvantage rates	Uses student- and teacher-level matched administrative data. Overall sample consists of 1,175,666 student-year observations, or 13,107 unique teachers in 619 schools.	Value-added measures (VAMs), teachers' observation-based performance ratings, hiring scores and teacher experience (novice status)	Student outcomes, teacher observation, hiring scores, experience	
Marland et al. (2019)	USA	The extent to which value-added measures of teacher quality are affected as a result of varying degrees of opt out	A simulation study was conducted to examine the amount of bias introduced into value-added estimates under various opt-out conditions and to determine the extent to which opt out affected classification of teacher effectiveness	Value-added measures	Student outcomes	Simulation study
Martino (2021)	USA	Examine the relationship between postsecondary CTE teacher quality and student achievement in Florida's career certificate programmes	An online survey was conducted with 203 postsecondary CTE teachers in Florida	Teacher quality is measured by pedagogical knowledge, level of education and professional development.	Pedagogical knowledge, qualification, CPD	Survey response rate

Reference	Country of publication	Purpose of teacher quality measure	Method / approach	Teacher quality proxies / measures used or discussed	Code applied to proxies	Any discussion of limitations in paper
Park et al. (2020)	USA and South Korea	Investigate which proxy measures of teacher quality best predict teachers' PCK levels	A PCK survey consisting of 30 dichotomous and open-ended items was administered to secondary science teachers in a Midwest State in the USA and Seoul, South Korea. Eighty-five and 81 participants from the USA and South Korea, respectively, completed surveys.	Pedagogical content knowledge, years of teaching, certification, school level	PCK, experience, induction, school level / prestige	Sample self-selected, self-report measure, survey (long, so many non-completions)
Pribudh-iana et al. (2021)	Indonesia	Investigate the correlation between teacher quality (as independent variable) and teacher readiness (as dependent variable) to test the hypothesis that teacher quality exerts a significant influence on teacher readiness in implementing education policy	Total respondents consisted of 250 teachers from Indonesian schools selected by simple random technique of sampling. Data was collected through observation, questionnaires and documentation.	Eight survey items of teacher quality	Self-report	
Reeves et al. (2022)	USA	Examine relationships between various forms of teacher induction and teacher practices, self-efficacy and job satisfaction, while controlling for an array of teacher sociodemographic and professional characteristics	This study (N = 736) leverages data from the 2018 Teaching and Learning International Survey (TALIS)	Teacher Induction practices linked to teacher quality	Induction	

Reference	Country of publication	Purpose of teacher quality measure	Method / approach	Teacher quality proxies / measures used or discussed	Code applied to proxies	Any discussion of limitations in paper
Reynolds & Park (2020)	USA	Relationship between preservice teachers' Educative Teacher Performance Assessment (edTPA) scores and PCK	An online survey was conducted with 203 postsecondary CTE teachers in Florida	Pedagogical content knowledge (PCK) as measured by Educative Teacher Performance Assessment scores (edTPA)	PCK	A teacher's understanding of the context in which they teach is an essential component of both the Refined Consensus Model and the pentagon model of PCK (Carlson et al., 2019; Park & Oliver, 2008a). The PCK mapping approach does not explicitly visualise or quantify the contextual factors discussed by many of the participants. In other words, contextual factors that were identified and described in the in-depth analysis of PCK were not visually represented in subsequent PCK maps.
Rushton et al. (2017)	USA	Investigate trends in teacher quality at the national level in the two and a half decades between 1987 and 2012	Uses a series of large-scale teacher demographic datasets and SASS national surveys from the National Center for Education Statistics (NCES)	Details about the degree backgrounds, main teaching assignments and experience levels of those assigned to teach physics	Qualification, experience, subject knowledge	

Reference	Country of publication	Purpose of teacher quality measure	Method / approach	Teacher quality proxies / measures used or discussed	Code applied to proxies	Any discussion of limitations in paper
Santelices et al. (2017)	Chile	Examines the relationship between two measures of teacher quality (one based on professional standards and a second one using teacher value-added estimates. It also studies the extent to which teacher observable characteristics, such as teacher training variables, are associated with better performance on either of these measures and whether any of these two assessments can effectively measure teacher quality isolated from the effect of the context where teachers work.	The study uses hierarchical linear models and information from national and standardised assessments from Chile	Gender, institution teacher qualification obtained from, higher degree, professional development courses, years of teaching experience, grade level and subject taught, intentions for future job prospects, perception of efficacy teaching subject, holds AEP certification, class characteristics (size, mean family income), school characteristics (urban/rural), resources, socioeconomic level	Demographics: gender, class, induction, qualification, CPD, experience, school level, situation, subject	
Seebruck (2021)	Japan	Investigate distribution of high-quality teachers	Survey of 49 schools including 1456 teachers	Full-time teacher status, certification status, years of experience, teaching in-field, holding an advanced degree, and the prestige of one's alma mater	Experience, qualification, induction	
Shuls (2018)	USA	Raise the cut-scores on licensure exams to improve the quality of the teacher	Value-added modelling using administrative data from Arkansas	Pass rate on teacher licence exams	Induction scores	
Tsai & Ku (2021)	USA	Determine whether Teacher Quality means the same thing to students, teachers and university supervisors	A 33-item survey assessing aspects of teacher quality was completed by 455 teacher candidates, 455 cooperating teachers and 66 university supervisors	Programme completer survey was developed as a tool to facilitate training and assessment of the teacher preparation programme at the end of student teaching at the researchers' institution. Contains 39 items measuring the teacher quality criteria under four general headings (The learner and learning, Content knowledge, Instructional practice and Professional responsibility)	Teacher survey, content knowledge, professional responsibility	Participants were recruited from only one teacher preparation programme. Generalisation of the results to other contexts needs to be made with caution.

Reference	Country of publication	Purpose of teacher quality measure	Method / approach	Teacher quality proxies / measures used or discussed	Code applied to proxies	Any discussion of limitations in paper
Vagi et al. (2019)	USA	Relationship between preservice teacher quality and teacher attrition	Analysis of retention data over 3 years. 1,126 teachers from three academic years (5 cohorts) of preservice teachers a teacher preparation programme housed at a large state university in the southwestern United States.	A composite observational score of various aspects of preservice teacher quality including professionalism, content knowledge, record keeping, knowledge of students, communication skills	Professionalism, subject knowledge, organisation, teacher–student relationships, personality: communication skills	
Yalçin & Eres (2021)	Turkey	Relating ICS to student achievement	Survey of 65 schools (out of 205): 30 students and 29 teachers from each.	Teacher quality subscale of the Instructional Capacity Scale (ICS), 8 Likert items e.g., 'The teachers in this school respond to student questions about the subjects taught in the lessons.'	Self-report	

Papers using mixed methods approaches

Reference	Country of publication	Purpose of teacher quality measure	Method / approach	Teacher quality proxies / measures used or discussed	Code applied to proxies	Any discussion of limitations in paper
Carmel & Badash (2021)	Israel	Identify teachers' views on the characteristics of an effective teacher via survey and interview	Data was collected using a self-report online survey from 167 early career English teachers and in-depth interviews with a sample of six teachers.	Academic qualifications & scholarship, preparedness and subject matter knowledge, classroom teaching practices, personality traits and style, connectedness with students, motivation & enthusiasm	Qualification, subject knowledge, teacher–student relationship, teacher motivation, personality	Small sample / self-report / one context

Reference	Country of publication	Purpose of teacher quality measure	Method / approach	Teacher quality proxies / measures used or discussed	Code applied to proxies	Any discussion of limitations in paper
Casey & DiCarlo (2018)	Belize	Explore constructs of teacher quality as defined by early childhood (EC) teachers in Belize	Questionnaire of 13 early childhood teachers in Belize and focus groups with 9 teachers	Perceptions of teacher quality questionnaire. Includes items on gender, total years of teaching experience, highest level of education, current teaching level, number of years teaching. Open ended questions: 'What are the four most important behaviours a teacher should use or show?' 'What are some things teachers do that you feel need to be improved or stopped?' at current level, and the type of training acquired to teach at the current level	Demographics: gender, experience, qualification, school level / prestige	Survey, sample size
Sunan & Ketkanok (2018)	Thailand	Analyse the Latent Group Profile (LGP) of good teacher characteristics	10 expert teachers were interviewed to develop the indicators; 12 teachers who won Guru Awards from Teachers Council for in-depth interviewing and use the data to adjust the variable to confirm good teacher characteristics. 1,103 primary school teachers in the Northeastern region from 11 provinces were selected by applying multi-stage sampling technique and employing them for second-order confirmatory factor analysis. The research instrument was a set of 71 items; questionnaire focusing on the good teacher characteristics in the 21st century. The reliability of the questionnaire was at 0.933 and the discrepancy was between 0.264 and 0.696.	Teacher knowledge and experience as measured in relation to CPD	Experience, CPD	
Thornberg et al. (2020)	Sweden	Measure student–teacher relationship quality	Survey of 234 students followed by focus groups with 120	Teacher–student relationships as a predictor of student engagement. Student report of what makes a good teacher.	Teacher–student relationship, student motivation	Self-report, inflated associations, social desirability bias, peer pressure, longitudinal = 1 year; small sample; inter-coder reliability not assessed

Papers using qualitative approaches

Reference	Country of publication	Purpose of teacher quality measure	Method / approach	Teacher quality proxies / measures used or discussed	Code applied to proxies	Any discussion of limitations in paper
Al-Muslim et al. (2020)	Malaysia	Identify the features of quality for Arabic teachers agreed by students and teachers	Survey instrument used with nine Arabic teachers and 90 students	17 GBA quality characteristics that are seen in 4 categories: (1) Personality (2) Assessment and Feedback (3) Class and student management (4) Teaching and learning (T&L)	Personality	Narrow concept / governmentalisation of 'teacher quality' calls for a return to more holistic and broader assessments of teacher quality would provide more possibilities for early career teachers to develop as well-rounded agentic professionals than is currently the case
Maddamsetti et al. (2018)	USA	Probe notions of a good teacher, examine the endeavours of a Chinese international preservice teacher, to become a 'good teacher' exploring cultural and linguistic assumptions.	Semi-structured interviews and field notes as part of a larger ethnographic case study. Focus on three teaching interns and one in particular in article.	Definition of a good teacher is one who possesses the knowledge (e.g., subject area and pedagogical content), skills and dispositions for working with diverse students. Im/migrant teacher are also expected to be proficient in English, cultural knowledge and school cultures.	PCK, Personality: dispositions for inclusion, cultural knowledge	
Marom (2018)	Canada	Explore the prevalent conceptions of the 'good teacher' on a recertification programme in British Columbia	Interviews with five internationally educated teachers and six faculty and administrative staff, within a larger case study	Competent craftsperson, reflective practitioner – teacher's ability to support their students' well-being and individual growth	Reflection, teacher–student relationship	
Nwokeocha (2017)	Nigeria	Discuss teacher quality, development and motivation as pillars of teacher professionalisation and critical determinants of educational quality	Extensive review of literature	Teacher quality is principally a function of teacher development and the latter has two interrelated phases – preservice teacher education and what is commonly called ongoing or continuous professional development (CPD).	ITE, CPD	
Ro (2021)	Singapore	Discrepancy between teacher and policymaker views on TQ	Critical analysis of 38 policy documents to consider policymaker perspectives. Semi-structured interviews of 15 teachers.	Subject mastery, exam results, high expectations for students, student engagement. Student-centred pedagogy and teaching methods. Care and support of students, passion and commitment to the job, willingness to learn and improve, problem of appraisal, professional standards / professional excellence, student outcomes.	Subject knowledge, student outcomes, high expectations, teacher motivation, teacher–student relationship, induction, willingness to learn	
Salton et al. (2022)	Australia		An interpretative case study design was used to investigate the experiences and perceptions of five			

Reference	Country of publication	Purpose of teacher quality measure	Method / approach	Teacher quality proxies / measures used or discussed	Code applied to proxies	Any discussion of limitations in paper
			Australian primary school teachers.			
Singh et al. (2021)	Australia	Critical policy analysis of two reports from the Organisation for Economic Cooperation and Development (OECD) to find out how understanding of TQ is constructed	A critical policy analysis of two reports from the OECD.	50+ descriptions that exemplified attributes associated with 'quality teachers 'centred around themes of 'effectiveness', 'competence' 'teacher 'qualifications', 'talent'	Qualification, personality: talent	Meanings of 'teacher quality' have been stitched together with ideas from economics, including such ideas as standardisation and measurement, quality control, effectiveness and performance.
Snoek (2021)	Netherlands	Discuss how concept of TQ has evolved in the Netherlands over 20 years	This paper can be understood as a narrative case study, a personal reflection and a contribution to the discourse on linking theory, policy and practice	(1) Interpersonal competence (2) Pedagogical competence (3) Subject knowledge and didactical competence (4) Organisational competence (5) Competence in collaborating with colleagues (6) Competence in collaborating with the school environment (7) Competence in reflection and developing professionally	Teacher–student relationships, subject knowledge, organisational competence, collaboration with colleagues, collaboration in school? Reflection, competence in self-development	Considerable gap between the international insights from research and theory in relation to teacher quality and the reality of policy and practice at national level. Policy development is a complex and messy process where political pressure, dominant actors and an uneven power balance between stakeholders can dominate evidence-based considerations stemming from academic research.
Sullivan et al. (2021)	Australia	Investigate high-achieving graduate teachers' perceptions of teacher quality and how they assessed their own practice within a 'quality' framework	Semi-structured interviews with 16 early career teachers in South Australia who were purposively selected because they had graduated from a merit-based scholarship programme in secondary teacher education (n = 8), and from an Honours programme in primary teacher education (n = 8)	Responsive to student needs; adaptable; really focused on professional development and evolving as a teacher; a good facilitator of learning; positive relationships with students; has a passion for, and commitment to, teaching; makes a difference to students' lives; strives for perfection through constant self-improvement (CPD). Comparing student achievement data as evidence of teacher quality. Generating and using 'customer satisfaction' data from student and parent surveys; promotion as indicator of TQ.	Responsive to student needs, personality: adaptable, focus on CPD, teacher–student relationship, teacher motivation, make a difference, student outcomes, parent feedback, student feedback, promotion	narrow concept / governmentalisation of 'teacher quality' calls for a return to more holistic and broader assessments of teacher quality would provide more possibilities for early career teachers to develop as well-rounded agentic professionals than is currently the case
Tamir (2019)	USA	Investigate Principals' perceptions regarding the teacher characteristics deemed most important for hiring effective teachers	Data for the study come from semi-structured interviews with 19 principals working in urban public, Catholic and Jewish schools	Professional teaching characteristics and personal characteristics of teachers were mentioned by all principals multiple times; teachers' academic ability and demographic background were mentioned less. Proxy of TQ included pedagogic knowledge, organisational skills, management / interpersonal skills and content knowledge. Also being good with children, a nurturing personality, reflective,	Personality, reflection, teacher motivation, organisation	

Reference	Country of publication	Purpose of teacher quality measure	Method / approach	Teacher quality proxies / measures used or discussed	Code applied to proxies	Any discussion of limitations in paper
				motivated, hardworking, enthusiastic and organised teachers, 'good role model'.		

Papers developing theoretical arguments

Reference	Country of publication	Purpose of teacher quality measure	Teacher quality proxies / measures used or discussed	Code applied to proxies	Any discussion of limitations in paper
Darling-Hammond (2021)	Australia, Canada, Finland, China, Singapore	Describe definitions of teaching quality in a number of jurisdictions around the world that have well-developed systems for recruiting, preparing, inducting and supporting teachers, that serve diverse student populations, and that have demonstrated stronger and more equitable achievement	Professional knowledge: teacher commitment to students and their learning, content knowledge, pedagogical knowledge, advanced degree, passionate about their subject and learning; professional engagement: skills of reflection used to evaluate practice, engage in professional learning, engage professionally with colleagues, research active teacher, problem-solvers, critical thinkers and contributors to the community	Teacher–student relationship, PCK, qualification, teacher motivation, reflection, focus on CPD, collaboration, research active, Personality: problem-solver, critical thinker, community engagement	
Goldhaber & Ronfeldt (2020)	USA	To summarise how to improve teacher quality resulting from training programmes during COVID	Impact on student scores	Student outcomes	
Goldhaber et al. (2019)	USA	Understand the teaching quality gaps	Experience, licensure test scores and value added	Experience, induction scores, Student outcomes	Narrow concept / governmentalisation of 'teacher quality' calls for a return to more holistic and broader assessments of teacher quality would provide more possibilities for early career teachers to develop as well-rounded agentic professionals than is currently the case
Goodwin & Low (2021)	Singapore & Hong Kong	Compares conceptions of teacher quality in two education systems – Singapore and Hong Kong	Academic achievement, communications skills, and motivation, moral and ethical commitment to the nation, society and the child	Qualification, personality: communication skills, teacher–student relationship, teacher motivation	
Lindsay (2021)	USA	This article looks at teacher diversity and student success	Race and ethnicity as measures of teacher quality	Race and ethnicity	

Reference	Country of publication	Purpose of teacher quality measure	Teacher quality proxies / measures used or discussed	Code applied to proxies	Any discussion of limitations in paper
Skourdoumbis (2017)	Australia	Use aspects of critical theory to explore how contemporary education policy discourse treats notions of teacher quality and teacher effectiveness	Knowledge that a teacher possesses, including of a series of best or effective teaching practices; skill development; teacher evaluation and teacher preparation, adaptive expertise	Pedagogical knowledge, CPD, teacher evaluation / reflection	
Smith (2021)	Norway	Discuss relevant research, present a historical contextualisation, interpret selected fiction literature and policy documents to see how TQ is perceived in Norway	Master's-level qualification and academic ability matter, alongside affective qualities such as creating a learning atmosphere and building relations with students, colleagues and parents	Qualification, teacher–student relationship, collaboration with colleagues, collaboration with parents	There is little mention of how to educate a good teacher relating to the affective aspects of the teacher's role in the steering documents
Williams & Herbert (2020)	USA	Review impact of teacher evaluation systems	Teacher observations, student examination scores	Teacher observations, student outcomes	Evaluator training, reliability of results, distinctions between teacher quality and teaching quality and repercussions of an ambiguous system for individual teachers

Appendix 3: Proxies / measures identified and types of studies associated with them

Professional capital, qualification and training

Proxy / measure	Number of sources				
	Mixed	Qualitative	Quantitative	Theoretical	Total
Qualification	3	1	14	3	21
Pedagogic content knowledge (PCK)	1	3	14	2	20
Experience	2		11	1	14
Induction		2	11	1	14
Continuous professional development (CPD)	1	3	4	2	10
Initial teacher education (ITE)		1	1		2
Promotion		1			1
Hiring scores			1		1
Grand total	**7**	**11**	**56**	**9**	**83**

Personal dimensions

Proxy / measure	Number of sources				
	Mixed	Qualitative	Quantitative	Theoretical	Total
Personality	2	8	7	2	19
Teacher motivation	1	4	1	2	8
Reflection		3		2	5
Demographics	1		3	1	5
Teacher self-rating			4		4
Cultural knowledge		1	2		3
Professionalism			2		2
Research active				1	1
Grand total	**4**	**16**	**19**	**8**	**47**

School and community

Proxy / measure	Number of sources				
	Mixed	**Qualitative**	**Quantitative**	**Theoretical**	**Total**
Teacher–student relationships	2	4	4	3	13
Student outcomes		2	6	3	11
Collaboration		1		2	3
Teacher observation			2	1	3
Student evaluation		1	1		2
Parent feedback		1			1
Community engagement				1	1
High expectations		1			1
Student motivation	1				1
Grand total	**3**	**10**	**13**	**10**	**36**

Appendix 4: Summary of included studies – Search 2

	Citation	Country	Recruitment/ retention/ distribution	Disadvantage	Teacher quality	Methodology	Factors	WoE
1	Gujarati, J. (2012). A comprehensive induction system: A key to the retention of highly qualified teachers. *The Educational Forum, 76*(2), 218–223. https://doi.org/10.1080/00131725.2011.652293	USA	Retention	N	Y	Theoretical	Induction support/mentoring	L
2	Zhang, G., & Zeller, N. (2016). A longitudinal investigation of the relationship between teacher preparation and teacher retention. *Teacher Education Quarterly, 43*(2), 73–92.	USA	Retention	N	Y	Mixed methods	Alternative routes to teaching	M
3	Knight, D. S. (2020). Accounting for teacher labor markets and student segregation in analyses of teacher quality gaps. *Educational Researcher, 49*(6), 454–458. https://doi.org/10.3102/0013189X20925805	USA	Distribution	Y	Y	Quantitative – admin data	Financial incentives; local labour markets; desegregation of schools	L
4	Lindqvist, P., & Nordänger, U. K. (2016). Already elsewhere – A study of (skilled) teachers' choice to leave teaching. *Teaching and Teacher Education, 54*, 88–97. https://doi.org/10.1016/j.tate.2015.11.010	Sweden	Retention	N	Y	Mixed methods	Financial incentives; working conditions/ workload; induction support/mentoring; status; accountability	M
5	Easley, J. (2006). Alternative route urban teacher retention and implications for principals' moral leadership. *Educational Studies, 32*(3), 241–249. https://doi.org/10.1080/03055690600631176	USA	Retention	Y	N	Quantitative – survey	Vocation	M
6	De Luca, B. M., Takano, K., Hinshaw, S. A., & Raisch, C. D. (2009). Are the 'best' teachers in the 'neediest' schools?: An urban intradistrict equity inquiry. *Education and Urban Society, 41*(6), 653–671. https://doi.org/10.1177/0013124509339265	USA	Distribution	Y	Y	Quantitative – admin data	Financial incentives; local labour markets	L
7	Manuel, J., Carter, D., & Dutton, J. (2018). 'As much as I love being in the classroom …': Understanding secondary English teachers' workload. *English in Australia, 53*(3), 5–22.	Australia	Retention	N	Y	Quantitative – survey	Working conditions/workload; intrinsic motivation	M
8	Painter, S., Haladyna, T., & Hurwitz, S. (2007). Attracting beginning teachers: The incentives and organizational characteristics that matter. *Planning and Changing, 38*(1 & 2), 108–127.	USA	Recruitment	Y	N	Quantitative – survey	Financial incentives; working conditions/ workload; induction support/ mentoring; intrinsic motivation	M
9	Haun, D. D., & Martin, B. N. (2004). Attrition of beginning teachers and the factors of collaboration and school setting. *RMLE Online, 27*(2), 1–7. https://doi.org/10.1080/19404476.2004.11658168	USA	Retention	Y	N	Mixed methods	Collaboration with colleagues; intrinsic motivation	M
10	Van Eycken, L., Amitai, A., & Van Houtte, M. (2022). Be true to your school? Teachers' turnover intentions: The role of socioeconomic composition, teachability perceptions, emotional exhaustion and teacher efficacy. *Research Papers in Education*. https://doi.org/10.1080/02671522.2022.2089208	Belgium	Retention Distribution	Y	Y	Quantitative – survey	Working conditions/workload; emotional factors/stress	M

	Citation	Country	Recruitment/ retention/ distribution	Disadvantage	Teacher quality	Methodology	Factors	WoE
11	Nguyen, T. D., & Kremer, K. P. (2022). burned out and dissatisfied?: The relationships between teacher dissatisfaction and burnout and their attrition behaviour. *The Elementary School Journal, 123*(2), 203–227. https://doi.org/10.1086/721772	USA	Retention	Y	N	Quantitative – survey	Working conditions/ workload; induction support/ mentoring; collaboration with colleagues; professional development; autonomy/agency	M
12	Guarino, C. M., Brown, A. B., & Wyse, A. E. (2011). Can districts keep good teachers in the schools that need them most? *Economics of Education Review, 30*(5), 962–979. https://doi.org/10.1016/j.econedurev.2011.04.001	USA	Distribution	Y	Y	Quantitative – admin data	Financial incentives	M
13	Elacqua, G., Hincapie, D., Hincapie, I., & Montalva, V. (2022). Can financial incentives help disadvantaged schools to attract and retain high-performing teachers? Evidence from Chile. *Journal of Policy Analysis and Management, 41*(2), 603–631. https://doi.org/10.1002/pam.22375	Chile	Recruitment Distribution	Y	N	Quantitative – admin data	Financial incentives	H
14	Grissom, J. A. (2011). Can good principals keep teachers in disadvantaged schools? Linking principal effectiveness to teacher satisfaction and turnover in hard-to-staff environments. *Teachers College Record, 113*(11), 2552–2585. https://doi.org/10.1177/016146811111301102	USA	Retention	Y	N	Quantitative – survey	Effective school leaders	M
15	Figlio, D. N. (2002). Can public schools buy better-qualified teachers? *Industrial and Labor Relations Review, 55*(4), 686–699. https://doi.org/10.2307/3270629	USA	Recruitment Distribution	Y	N	Quantitative – admin data	Financial incentives	H
16	Liang, G., & Akiba, M. (2015). Characteristics of teacher incentive pay programs: A state-wide district survey. *Journal of Educational Administration, 53*(6), 702–717. https://doi.org/10.1108/JEA-09-2013-0106	USA	Recruitment Retention distribution	Y	N	Quantitative – survey	Financial incentives	M
17	Grant, A. A., & Brantlinger, A. M. (2022). Demography as destiny: Explaining the turnover of alternatively certified mathematics teachers in hard-to-staff schools. *Teachers College Record, 124*(4), 35–64. https://doi.org/10.1177/01614681221096796	USA	Retention	Y	N	Quantitative – survey	Collaboration with colleagues; Discipline	M
18	Tran, H., & Smith, D. A. (2020). Designing an employee experience approach to teacher retention in hard-to-staff schools. *NASSP Bulletin, 104*(2), 85–109. https://doi.org/10.1177/0192636520927092	USA	Recruitment Retention	Y	Y	Theoretical	Induction support/mentoring; autonomy/agency; status	H
19	Danielson, L. (2002). Developing and retaining quality classroom teachers through mentoring. *The Clearing House, 75*(4), 183–185.	USA	Recruitment Retention	N	Y	Theoretical	Working conditions/ workload; induction support/ mentoring; collaboration with colleagues	L
20	Harrington, L., & Walsh, N. (2022). District support of alternative permit teachers for increasing efficacy and retention. *Management in Education, 36*(2), 72–81. https://doi.org/10.1177/0892020620942508	USA	Recruitment Retention	Y	N	Mixed methods	Effective school leaders; professional development; efficacy	M

		Citation	Country	Recruitment/ retention/ distribution	Disadvantage	Teacher quality	Methodology	Factors	WoE
21		Cowan, J., & Goldhaber, D. (2018). Do bonuses affect teacher staffing and student achievement in high poverty schools? Evidence from an incentive for National Board certified teachers in Washington State. *Economics of Education Review, 65*, 138–152. https://doi.org/10.1016/j.econedurev.2018.06.010	USA	Recruitment Retention	Y	N	Quantitative – admin data	Financial incentives	M
22		Steele, J. L., Murnane, R. J., & Willett, J. B. (2010). Do financial incentives help low-performing schools attract and keep academically talented teachers? Evidence from California. *Journal of Policy Analysis and Management, 29*(3), 451–478. https://doi.org/10.1002/pam.20505	USA	Recruitment Retention	Y	Y	Quantitative – admin data	Financial incentives; status	H
23		Clotfelter, C. T., Ladd, H. F., Vigdor, J. L., & Diaz, R. A. (2004). Do school accountability systems make it more difficult for low-performing schools to attract and retain high-quality teachers? *Journal of Policy Analysis and Management, 23*(2), 251–271. https://doi.org/10.1002/pam.20003	USA	Retention	Y	Y	Quantitative – admin data	Accountability	M
24		Shifrer, D., Turley, R. L., & Heard, H. (2017). Do teacher financial awards improve teacher retention and student achievement in an urban disadvantaged school district? *American Educational Research Journal, 54*(6), 1117–1153. https://doi.org/10.3102/0002831217716540	USA	Retention	Y	Y	Quantitative – admin data	Financial incentives	M
25		Fowler, R. C. (2009). Educators without borders: Addressing New England's teacher shortages. *New England Journal of Higher Education, 24*(1), 10–11.	USA	Recruitment Distribution	N	Y	Theoretical	Collaboration with colleagues; local labour markets	L
26		Springer, M. G., Swain, W. A., & Rodriguez, L. A. (2016). Effective teacher retention bonuses: Evidence from Tennessee. *Educational Evaluation and Policy Analysis, 38*(2), 199–221. https://doi.org/10.3102/0162373715609687	USA	Retention	Y	Y	Quantitative – admin data	Financial incentives	M
27		Ryu, S., & Jinnai, Y. (2021). Effects of monetary incentives on teacher turnover: A longitudinal analysis. *Public Personnel Management, 50*(2), 205–231. https://doi.org/10.1177/0091026020921414	USA	Retention	N	Y	Quantitative – admin data	Financial incentives	H
28		den Brok, P., Wubbels, T., & van Tartwijk, J. (2017). Exploring beginning teachers' attrition in the Netherlands. *Teachers and Teaching, 23*(8), 881–895. https://doi.org/10.1080/13540602.2017.1360859	Nether-lands	Retention	N	Y	Theoretical	Working conditions/ workload; induction support/ mentoring; collaboration with colleagues; professional development	L
29		Qin, L. (2019). Factors relating to teachers' intention to change school: A multilevel perspective. *Policy Futures in Education, 17*(3), 318–338. https://doi.org/10.1177/1478210318822184	USA	Retention	Y	N	Quantitative – TALIS	Working conditions/ workload; efficacy; discipline; school climate; support staff and resources	H
30		Wronowski, M. L. (2018). Filling the void: A grounded theory approach to addressing teacher recruitment and retention in urban schools. *Education and Urban Society, 50*(6), 548–574. https://doi.org/10.1177/0013124517713608	USA	Distribution	N	Y	Qualitative	Relationships with parents and students; autonomy/agency; personality traits; cultural awareness	M

	Citation	Country	Recruitment/ retention/ distribution	Disadvantage	Teacher quality	Methodology	Factors	WoE
31	M. Brown, K., & R. Wynn, S. (2009). Finding, supporting, and keeping: The role of the principal in teacher retention issues. *Leadership and Policy in Schools, 8*(1), 37–63. https://doi.org/10.1080/15700760701817371	USA	Retention	N	Y	Qualitative	Effective school leaders	H
32	Kim, J. (2019). How principal leadership seems to affect early career teacher turnover. *American Journal of Education, 126*(1), 101–137. https://doi.org/10.1086/705533	USA	Retention	Y	Y	Quantitative – survey	Effective school leaders	M
33	Dee, T. S., & Wyckoff, J. (2015). Incentives, selection, and teacher performance: Evidence from IMPACT. *Journal of Policy Analysis and Management, 34*(2), 267–297. https://doi.org/10.1002/pam.21818	USA	Retention Distribution	N	Y	Quantitative – admin data	Financial incentives	L
34	Vagi, R., Pivovarova, M., & Miedel Barnard, W. (2019). keeping our best? A survival analysis examining a measure of preservice teacher quality and teacher attrition. *Journal of Teacher Education, 70*(2), 115–127. https://doi.org/10.1177/0022487117725025	USA	Retention	Y	Y	Mixed methods	Efficacy	M
35	Özoğlu, M. (2015). Mobility-related teacher turnover and the unequal distribution of experienced teachers in Turkey. *Educational Sciences: Theory & Practice, 15*(4), Art. 4. https://doi.org/10.12738/estp.2015.4.2619	Turkey	Distribution	Y	N	Mixed methods	Intrinsic motivation; local connections; fitting in to the school or role	M
36	Palermo, M., Kelly, A. M., & Krakehl, R. (2022). Physics teacher retention, migration, and attrition. *Journal of Science Teacher Education, 33*(4), 368–391. https://doi.org/10.1080/1046560X.2021.1946638	USA	Retention Distribution	Y	N	Quantitative – admin data	Working conditions/workload	M
37	Williams, S. M., Swain, W. A., & Graham, J. A. (2021). Race, climate, and turnover: An examination of the teacher labor market in rural Georgia. *AERA Open, 7*, 2332858421995514. https://doi.org/10.1177/2332858421995514	USA	Recruitment Retention	Y	Y	Quantitative – admin data	Financial incentives; relationships with parents and students; school climate	M
38	Scafidi, B., Sjoquist, D. L., & Stinebrickner, T. R. (2007). Race, poverty, and teacher mobility. *Economics of Education Review, 26*(2), 145–159. https://doi.org/10.1016/j.econedurev.2005.08.006	USA	Distribution	Y	N	Quantitative – admin data	School characteristics	L
39	Berry, B. (2004). Recruiting and retaining 'highly qualified teachers' for hard-to-staff schools. *NASSP Bulletin, 88*(638), 5–27. https://doi.org/10.1177/019263650408863802	USA	Recruitment Retention	Y	Y	Theoretical	Financial incentives; effective school leaders; collaboration with colleagues; relationships with parents and students; autonomy/agency; leadership opportunities	L
40	Amrein-Beardsley, A. (2007). Recruiting expert teachers into hard-to-staff schools. *Phi Delta Kappan, 89*(1), 64–67. https://doi.org/10.1177/003172170708900111	USA	Recruitment Retention	Y	Y	Theoretical	Financial incentives; induction support/ mentoring; effective school leaders; collaboration with colleagues; leadership opportunities; support staff and resources	L

		Citation	Country	Recruitment/ retention/ distribution	Disadvantage	Teacher quality	Methodology	Factors	WoE
41		Milanowski, A. T., Longwell-Grice, H., Saffold, F., Jones, J., Schomisch, K., & Odden, A. (2009). Recruiting new teachers to urban school districts: What incentives will work? *International Journal of Education Policy and Leadership, 4*(8). https://doi.org/10.22230/ijepl.2009v4n8a132	USA	Recruitment Retention	Y	Y	Qualitative	Financial incentives; Effective school leaders	M
42		Newton, X. A., Jang, H., Nunes, N., & Stone, E. (2010). Recruiting, preparing, and retaining high quality secondary mathematics and science teachers for urban schools, *Issues in Teacher Education, 19*(1), 21–40.	USA	Recruitment	Y	N	Mixed methods	Induction support/ mentoring; collaboration with colleagues; professional development; focus on learning	L
43		Borgerding, L. A. (2015). Recruitment of early STEM majors into possible secondary science teaching careers: The role of science education summer internships. *International Journal of Environmental and Science Education, 10*(2), 247–270. https://doi.org/10.12973/ijese.2015.244a	USA	Recruitment	N	Y	Qualitative	Intrinsic motivation; relationships with parents and students; focus on learning	M
44		Certo, J. L., & Fox, J. E. (2002). Retaining quality teachers. *The High School Journal, 86*(1), 57–75.	USA	Retention	Y	Y	Qualitative	Financial incentives; working conditions/ workload; effective school leaders; professional development; relationships with parents and students; discipline; emotional factors/stress; support staff and resources	M
45		Shuls, J., & Maranto, R. (2014). Show them the mission: A comparison of teacher recruitment incentives in high need communities. *Social Science Quarterly, 95*(1), 239–252. https://doi.org/10.1111/ssqu.12011	USA	Recruitment	Y	N	Qualitative	Intrinsic motivation	M
46		Grissom, J. A., & Bartanen, B. (2019). Strategic retention: Principal effectiveness and teacher turnover in multiple-measure teacher evaluation systems. *American Educational Research Journal, 56*(2), 514–555. https://doi.org/10.3102/0002831218797931	USA	Retention	N	Y	Quantitative – admin data	Working conditions/ workload; effective school leaders	H
47		Clotfelter, C. T., Glennie, E. J., Ladd, H. F., & Vigdor, J. L. (2008). Teacher bonuses and teacher retention in low-performing schools: Evidence from the North Carolina $1,800 teacher bonus program. *Public Finance Review, 36*(1), 63–87. https://doi.org/10.1177/1091142106291662	USA	Retention	Y	N	Quantitative – admin data	Financial incentives	H
48		Krieg, J. M. (2006). Teacher quality and attrition. *Economics of Education Review, 25*(1), 13–27. https://doi.org/10.1016/j.econedurev.2004.09.004	USA	Retention	N	Y	Quantitative – admin data	Financial incentives	L
49		Kyle Ingle, W. (2009). Teacher quality and attrition in a US school district. *Journal of Educational Administration, 47*(5), 557–585. https://doi.org/10.1108/09578230910981062	USA	Retention	N	Y	Quantitative – admin data	Fitting in to the school or role	L
50		Feng, L., & Sass, T. R. (2017). Teacher quality and teacher mobility. *Education Finance and Policy, 12*(3), 396–418. https://doi.org/10.1162/EDFP_a_00214	USA	Retention Distribution	Y	Y	Quantitative – admin data	Professional development	L

		Citation	Country	Recruitment/ retention/ distribution	Disadvantage	Teacher quality	Methodology	Factors	WoE
51		Hughes, G. D. (2012). Teacher retention: Teacher characteristics, school characteristics, organizational characteristics, and teacher efficacy. *The Journal of Educational Research, 105*(4), 245–255. https://doi.org/10.1080/00220671.2011.584922	USA	Retention Distribution	Y	Y	Quantitative – survey	Financial incentives; working conditions/ workload; relationships with parents and students	M
52		Federičová, M. (2021). Teacher turnover: What can we learn from Europe? *European Journal of Education, 56*(1), 102–116. https://doi.org/10.1111/ejed.12429	Europe	Retention	N	Y	Quantitative – survey	Professional development	L
53		Geiger, T., & Pivovarova, M. (2018). The effects of working conditions on teacher retention. *Teachers and Teaching, 24*(6), 604–625. https://doi.org/10.1080/13540602.2018.1457524	USA	Retention	Y	N	Quantitative – admin data	Working conditions/workload	L
54		McIntyre, J. (2010). Why they sat still: The ideas and values of long-serving teachers in challenging inner-city schools in England. *Teachers and Teaching, 16*(5), 595–614. https://doi.org/10.1080/13540602.2010.507968	England	Recruitment Retention	Y	N	Qualitative	Intrinsic motivation; relationships with parents and students; fitting in to the school or role	H
55		Winters, M. A., & Cowen, J. M. (2013). Would a value-added system of retention improve the distribution of teacher quality? A simulation of alternative policies. *Journal of Policy Analysis and Management, 32*(3), 634–654. https://doi.org/10.1002/pam.21705	USA	Retention	N	Y	Quantitative – simulation	Performance policy	M

Appendix 5: Table of characteristics of included studies: Search 2

Table 12. Factors identified and types of studies associated with them

System-level factors

Factor	Number of sources				
	Mixed	**Qualitative**	**Quantitative**	**Theoretical**	**Total**
Financial incentives	1	2	17	2	22
Local labour markets			2	1	3
Accountability	1		1		2
Alternative routes to teaching	1				1
Desegregation			1		1
Grand total	**3**	**2**	**31**	**3**	**39**

School-level factors

Factor	Number of sources				
	Mixed	**Qualitative**	**Quantitative**	**Theoretical**	**Total**
Workload/working conditions	1	1	9	2	13
Induction & mentoring	2		2	5	9
Effective school leaders	1	2	3	2	8
Collaboration with colleagues	2		2	5	9
Professional development	2	1	3	1	7
Relationships with parents and students		4	2	1	7
Autonomy		1	1	2	4
Discipline, behaviour		1	2		3
Status	1		1	1	3
School climate			2		2
Leadership opportunities				1	1
Support staff and resources		1	1	1	3
Focus on learning	1	1			2

Factor	Mixed	Qualitative	Quantitative	Theoretical	Total
Performance policy			1		1
School characteristics			1		1
Grand total	**10**	**12**	**30**	**21**	**73**

Individual-level factors

	Number of sources				
Factor	**Mixed**	**Qualitative**	**Quantitative**	**Theoretical**	**Total**
Intrinsic motivation	2	3	2		7
Efficacy	2		1		3
Local connections	1				1
Fitting in	1	1	1		3
Vocation			1		1
Emotional factors		1	1		2
Personality traits		1			1
Cultural awareness		1			1
Grand total	**6**	**7**	**6**	**0**	**19**

Table 13. Factors identified and weight of evidence (WoE) of studies associated with them

System-level factors

	Weight of evidence			
Factor	**High**	**Medium**	**Low**	**Total**
Financial incentives	4	12	6	22
Local labour markets			3	3
Accountability		2		2
Alternative routes to teaching		1		1
Desegregation			1	1
Grand total	**5**	**14**	**10**	**29**

School-level factors

Factor	Weight of evidence			
	High	Medium	Low	Total
Workload/working conditions	2	8	3	13
Induction & mentoring	1	3	5	9
Effective school leaders	2	4	2	8
Collaboration with colleagues		3	6	9
Professional development		3	4	7
Relationships with parents and students	1	5	1	7
Autonomy	1	2	1	4
Discipline, behaviour	1	2		3
Status	1	2		3
School climate	1	1		2
Leadership opportunities			1	1
Support staff and resources	1	1	1	3
Focus on learning		1	1	2
Performance policy		1		1
School characteristics			1	1
Grand total	**12**	**35**	**26**	**73**

Individual-level factors

Factor	Weight of evidence			
	High	**Medium**	**Low**	**Total**
Intrinsic motivation	1	6		7
Efficacy	1	1	1	3
Local connections		1		1
Fitting in	1	1	1	3
Vocation		1		1
Emotional factors		2		2
Personality traits		1		1
Cultural awareness		1		1
Grand total	**3**	**14**	**2**	**19**

Appendix 6: Summary of Search 2 studies prior to final selection

As noted above, 164 papers were excluded in the last stage of screening for Search 2 as they did not refer to either high-quality teachers or to recruitment or retention of teachers in disadvantaged schools.

Abstracts for these papers were coded to identify whether any specific factors associated with recruitment or retention of teachers were mentioned. For 63 papers it was not possible to identify from the abstract any factors that were associated with recruitment or retention of teachers. Reasons for this included the omission of this information from the abstract or a null effect being reported. The remaining 101 papers were coded initially using the factors identified in the main report above. A number of papers included factors that had not been previously encountered and these are grouped separately Table 14.

Table 14. Factors identified from additional papers

Group	Factor	Number of articles
Unclear/no effect		63
System	Financial incentives	14
	Local labour markets	0
	Accountability	4
	Alternative routes to teaching	6
	Desegregation	0
School	Workload/working conditions	27
	Induction & mentoring	13
	Effective school leaders	22
	Collaboration with colleagues	8
	Professional development	4
	Relationships with parents/students	8
	Autonomy	8
	Discipline, behaviour	11
	Status (including respect)	7
	School climate	7
	Leadership opportunities	3
	Support staff	2
	Focus on learning	4
	Performance policy	0
	School characteristics	1
Individual	Intrinsic motivation	0
	Efficacy	9
	Local connections	3
	Fitting in	3
	Vocation	2
	Emotional factors	2
	Personality traits (particularly resilience)	6
	Cultural awareness	0
New factors	Joy of teaching	2
	Teaching experience	3
	Teacher preparation (particularly amount of teaching practice)	5
	Reflection	1
	Teacher identity	2

	Job insecurity	3
	setting boundaries	1
	personal priorities	4
	support network	14
	wider external factors (economic climate, national policy)	1
	partnerships with training institutions with shared values	1
	pedagogical knowledge	1

In contrast to the main search, there were some conflicting findings around accountability and alternative routes into teaching. One study found that stronger accountability systems were associated with lower teacher turnover. There was also conflicting evidence regarding whether 'alternative certification route' teachers were more or less likely to be retained.

Overall, there was a similar pattern of amount of evidence to that found in the main search. Financial incentives, workload/working conditions, induction and mentoring, effective school leaders and discipline/behaviour were still found to be the factors most often associated with recruitment and retention. A new, important factor was that of support networks. In the main search this was included with collaboration with colleagues (e.g., den Brok et al., 2017) but related to a very small number of studies. Looking at this extended list of articles, 14 included some reference to support networks as distinct from collaborative working or learnings.

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