

Rethinking professional development for out-of-field teachers through a continuum model of teacher-subject alignment

RUTGERS, Dieuwerke <<http://orcid.org/0000-0003-0506-847X>>, HOTHAM, Eleanor, PERRY, Emily <<http://orcid.org/0000-0003-3413-1159>> and REMPE-GILLEN, Emma

Available from Sheffield Hallam University Research Archive (SHURA) at:

<https://shura.shu.ac.uk/37905/>

This document is the Published Version [VoR]

Citation:

RUTGERS, Dieuwerke, HOTHAM, Eleanor, PERRY, Emily and REMPE-GILLEN, Emma (2026). Rethinking professional development for out-of-field teachers through a continuum model of teacher-subject alignment. *Professional Development in Education*, 1-20. [Article]

Copyright and re-use policy

See <http://shura.shu.ac.uk/information.html>



Rethinking professional development for out-of-field teachers through a continuum model of teacher-subject alignment

Dieuwerke Rutgers , Eleanor Hotham , Emily Perry & Emma Rempe-Gillen

To cite this article: Dieuwerke Rutgers , Eleanor Hotham , Emily Perry & Emma Rempe-Gillen (26 Aug 2026): Rethinking professional development for out-of-field teachers through a continuum model of teacher-subject alignment, Professional Development in Education, DOI: [10.1080/19415257.2026.2723116](https://doi.org/10.1080/19415257.2026.2723116)

To link to this article: <https://doi.org/10.1080/19415257.2026.2723116>



© 2026 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.



Published online: 26 Aug 2026.



[Submit your article to this journal](#)



Article views: 19



[View related articles](#)



[View Crossmark data](#)

RESEARCH ARTICLE



Rethinking professional development for out-of-field teachers through a continuum model of teacher-subject alignment

Dieuwerke Rutgers^a, Eleanor Hotham^b, Emily Perry^b and Emma Rempe-Gillen^a

^aSheffield Institute of Education, Sheffield Hallam University, Sheffield, UK; ^bFaculty of Health and Education, Manchester Metropolitan University, UK

ABSTRACT

Long-standing international shortages in teachers often lead to significant numbers of out-of-field teachers: educators required or requested to teach subjects in which they lack specialist subject and pedagogical knowledge. Professional development (PD) is positioned as a means to strengthen teachers' knowledge, confidence, and practice, yet evidence on what makes PD effective for teachers working out-of-field remains limited. This paper presents a narrative re-analysis of findings from a systematic review of international evidence on subject-specific PD for out-of-field teachers. This re-analysis complements the original review by exploring the influence of context and identity on teachers' relationships with the subjects they teach, and the implications of this for the design of PD. We found a complex interplay between contextual realities, the evolving motivations and identity negotiations of out-of-field teachers and professional development. In this paper, we propose a new model, which shows how teachers' relationship with the subject(s) they teach is non-static and exists on a continuum of in-, out- and close-to-field. We offer this model as a way of better capturing the dynamic complexity of teaching out-of-field, and thereby informing the design of more responsive PD for teachers working out-of-field.

ARTICLE HISTORY

Received 13 January 2026
Accepted 13 August 2026

KEYWORDS

Out-of-field (OOF) teaching; teacher professional development; teacher professional identity; narrative re-analysis

Introduction

Across many education systems, teacher shortages have normalised the practice of assigning teachers to subjects for which they lack sufficient qualifications, training and/or knowledge (Nixon *et al.* 2017; Ingersoll 2019; Hobbs and Porsch 2022). The reasons for working out-of-field are complex and varied, depending on contexts including requirements for teacher qualifications, routes into teaching, and teacher recruitment more generally (Badaru and Ndlovu 2025). Meanwhile, even defining in- and out-of-field is not straightforward, with multiple terms in use and varying approaches to conceptualising teacher specialism, reflecting diverse national and disciplinary contexts.

CONTACT Dieuwerke Rutgers  d.rutgers@shu.ac.uk  Sheffield Institute of Education, Sheffield Hallam University, Arundel 10105, Sheffield S1 1WB, UK

© 2026 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. The terms on which this article has been published allow the posting of the Accepted Manuscript in a repository by the author(s) or with their consent.

These out-of-field teaching arrangements have prompted increasing interest in how professional development (PD) can strengthen teachers' confidence, subject expertise, and sense of professional identity under these circumstances (for example, Porsch and Hobbs 2024; Perl-Nussbaum *et al.* 2025). However, little is known about what support is most appropriate for teachers working out-of-field, such as particular PD content or delivery models (Rutgers *et al.* 2025). While some empirical studies have been reported (for example, Goos *et al.* 2023), evidence on PD for teachers working out-of-field, and how it should differ from PD for teachers working in-field, remains limited.

In this paper, we report findings from a narrative re-analysis (Hall and Leeder 2024) of a systematic review of international literature on PD designed to support out-of-field secondary teachers (Rutgers *et al.* 2025). We argue that a broad definition of out-of-field teaching fails to sufficiently inform the design of effective PD for teachers working out-of-field and propose a new model, which identifies a continuum of in-, out- and close-to-field teacher-subject alignment as a complex, dynamic relationship between teachers' identity, their context and the subjects they teach. The model can be used to improve the design of PD which aims to support teachers working out-of-field and deepen research into the particular challenges of teaching out-of-field.

In the next section we set this paper in context by briefly outlining key literature relating to out-of-field teaching and teacher identity, and summarise the findings of our original systematic review (Rutgers *et al.* 2025). We then describe the approach taken to narrative re-analysis in this paper, followed by our findings from the re-analysis, including the new model we propose as a result. We end by considering the implications of our re-analysis and model, for research and practice.

Understanding out-of-field teaching

In this section we summarise three aspects of the literature: existing conceptualisations of out-of-field teaching, why out-of-field teaching occurs, and the importance of teachers' professional identities in relation to teaching out-of-field. We draw on literature from research and practice, using illustrative examples from England, where teaching out-of-field is an expectation of many teachers, particularly in schools facing recruitment challenges (Worth and Faulkner-Ellis 2022).

Defining out-of-field

The concept of teaching out-of-field has no stipulative definition. Much research focuses on teachers' prior experiences and qualifications (for example, McConney and Price 2009; Hobbs and Törner 2019), whilst others offer no explicit definition (Carpendale and Hume 2020). Other terms, such as non-specialist or out-of-area (Wyatt and Hobbs 2024), are also often used to describe the relationship between a teacher's qualifications and the subjects they teach.

In England, the terms specialist and non-specialist are often applied in policy and practice (Darlington 2017). For example, government data identifies a specialist teacher as one who has any relevant post-A level qualification,¹ such as an undergraduate or postgraduate degree (Department for Education 2025). Meanwhile, the government-funded programmes Subject Knowledge for Physics Teaching and Specialist

Knowledge for Teaching Mathematics offer support for those teaching physics ‘out of specialism’ (Ogden Trust 2022) and secondary ‘non-specialist’ mathematics teachers (National Centre for Excellence in the Teaching of Mathematics NCETM 2025) respectively.

The terminology of specialist and non-specialist suggests that the interplay between teachers’ qualifications and the subject(s) they are expected to teach is an issue of underqualification (Ingersoll 2005). It questions the relationship between generalised and subject-specific teaching expertise, but fails to take into account teachers’ contexts, wider experiences and perceptions, and their engagement in post-qualification PD (Pollock and Mindzak 2018; Worth and Faulkner-Ellis 2022; Institute of Physics 2025).

The term out-of-field also brings challenges, such as defining the nature of ‘field’ and its relationship with a teacher’s specialist subject. Terms such as out-of-field-ness (Hobbs *et al.* 2022) or near and far out-of-field (Worth *et al.* 2019) are attempts to unpick this complexity, which is often contextually situated within national qualification frameworks. In addition to these contextual factors, teachers’ professional identities and their own perceptions of whether they are working out of field further complicate attempts to establish a shared definition of out-of-field teaching in research and practice. We return to this issue below, arguing that identity-related factors are important both for defining out-of-field teaching and for designing appropriate professional development.

Challenges can also be faced by teachers working out-of-phase, out-of-track or without formal qualifications (Sharplin 2014; Zeggelaar *et al.* 2020). However, in this study, we focus on qualified teachers who move across and between disciplinary boundaries, looking specifically at post-qualification PD for teachers of secondary school students (11–19 years old).

Drivers of out-of-field teaching

Many countries and jurisdictions require teachers to work beyond their subject specialisms (Hobbs and Porsch 2022), for which there are several reasons. In some contexts teachers work out-of-field to fill shortfalls in teacher recruitment, whether caused by a shortage of teachers in general, or in particular subjects, geographic areas or individual schools (Hobbs and Törner 2019). For example, in some rural Australian schools, teachers are required to work across multiple subject areas (Sharplin 2014), and in rural schools in South Africa, teacher shortages mean that teachers often work out-of-field (Mashele and Mafuwane 2024). In New York, urban and ‘high need’ schools have been shown to have more science teachers working out-of-field (Sheppard *et al.* 2020), while in England, sustained shortfalls in teacher recruitment, particularly in mathematics and physics, mean that teachers with qualifications in other subjects fill gaps in supply (Worth and Faulkner-Ellis 2022).

In some countries, teaching out-of-field is an expectation of teacher qualification and/or curriculum structures. For example in England, secondary teachers usually specialise in a single subject during initial teacher education, but in science, the curriculum and assessment frameworks, combined with a sustained lack of specialist physics teachers, mean that teachers with qualifications in biology and chemistry are almost certain to be

teaching outside their specialist subject some of the time (Worth and Faulkner-Ellis 2022, Institute of Physics 2025).

The importance of teacher identity

The international literature foregrounds teacher identity as a key component of teaching out-of-field, and for understanding the learning needs of out-of-field teachers (for example, Olitsky 2007; Hobbs 2013; Bosse and Törner 2015; Mizzi 2021). Teachers' professional identities are not static; they develop and evolve over time (Fraser-Arnott 2019), reflecting teachers' accumulated experiences and the particular challenges and opportunities of different career stages (Gabrys-Barker 2010; Morrison 2013; Lau *et al.* 2022). Teachers' professional identities are also co-constructed and negotiated across different social situations and contexts (Søreide 2006). For secondary school teachers in particular, the subject(s) they teach, and their perceptions of those subjects, are an important contributor to their sense of identity (Day *et al.* 2006).

There are varying approaches to defining and researching teacher identity (Zhai *et al.* 2024) and out-of-field teacher identity (Hobbs *et al.* 2019), and research varies in whether identity is primarily conceptualised through self-image/self-understanding (for example, Nias 1989; Kelchtermans 2009) or through teaching roles (for example, Goodson and Cole 1994). These perspectives highlight a potential tension in teachers' lives between their internalised sense of who they are as professionals and the roles and expectations imposed from outside, and thus the importance of self- and other-recognition (Amer and Obradovic 2022).

Consistent with the wider field of teacher professional identity, research on out-of-field teacher identity draws on a range of theoretical perspectives. For example, teachers working out-of-field may be seen as 'boundary crossing' (Akkerman and Bakker 2011) across subjects and identities. Hobbs' work has extensively examined identity negotiations within the boundary crossing experience of out-of-field teaching (for example, Hobbs 2013, 2020), highlighting the wide range of factors that shape whether teachers identify as out-of-field. Hobbs' Boundary Between Fields (BBF) Model (Hobbs 2013) identifies three intersecting factors influencing teachers' feelings and learning experiences:

- (1) Teaching context (for example, geographical location, school size and design, governance, and policy environment);
- (2) Teachers' personal resources (including adaptive expertise, knowledge, and dispositions);
- (3) Support mechanisms (external resources, such as PD, materials and networks, and self-constructed supports derived from experience and personal research).

The intersection of these factors means that teachers can be placed, or may place themselves, at different points along an 'adaptability scale' (Hobbs 2013, p. 291) that runs from 'just filling in', to 'making the most of it', and then to 'pursuing an interest'. This scale underscores the situated and complex nature of out-of-field identity

positioning, which is crucial for understanding PD for teachers working out-of-field, not only as a process of knowledge building but also as a form of identity development.

Professional development for teachers working out-of-field

In a recent systematic review (Rutgers *et al.* 2025), which generated the body of literature used in the re-analysis described here, we focussed on gaining understanding of the PD which supports teachers working out-of-field. We summarise the review findings here to provide additional context for this paper. Further details, including references and analysis, can be found in the original review.

We note that professional development (PD) has various meanings in the literature (Boylan *et al.* 2023). Here, we use the term to mean intentional, formalised activities, programmes and workshops which are designed to support teachers in improving their professional knowledge, practice and expertise.

As noted by Kenny *et al.* (2020, p. 511): ‘the principles of professional development needed to support out-of-field teachers are in some ways similar to those of in-field teachers.’ Indeed, we identified a consistent set of design features underpinning effective subject-specific PD for out-of-field teachers which were broadly consistent with other descriptions of the characteristics of effective teacher PD (for example, Desimone 2009). Most programmes were typically sustained over time, often spanning at least one academic year, allowing participants to trial new practices, revisit ideas, and consolidate learning through iterative engagement. Collaboration with experts, including university-based facilitators, experienced in-field mentors, and professional networks, provided subject expertise and social support. Where the PD lasted longer than a week, programmes also incorporated active learning and experimentation, using workshops, classroom inquiry, and action research to enable teachers to connect theory with practice and reflect on their evolving confidence and understanding. Crucially, the content of these programmes integrated both subject knowledge and pedagogical content knowledge, addressing conceptual and instructional challenges specific to teaching outside one’s subject.

The studies in the review overwhelmingly stemmed from a small set of subject areas, primarily mathematics and the sciences. Although the screening process confirmed that out-of-field teaching also occurs in the humanities and social sciences, no published evidence was found of PD specifically designed to support out-of-field teachers in these disciplines. While the absence of such evidence does not allow firm conclusions, it may reflect comparatively lower teacher shortages in these subjects, lower reporting of out-of-field experiences, or a simple lack of research into initiatives designed to support teachers working out-of-field in these contexts.

Finally, situating the review findings within broader work on teacher identity and PD reveals important intersections between out-of-field teaching and the broader challenge of designing PD for teachers with differing subject specialisms, working across diverse contexts and career stages. For example, research beyond the review corpus shows that, in some systems, out-of-field teaching disproportionately affects novice teachers, raising questions about how early career support can address the dual demands of learning to teach and teaching beyond one’s field (Fraser *et al.* 2019, Napier *et al.* 2020). Here

literature highlights the importance of in-school support, access to teaching materials, and mentoring suggesting that effective PD combines school-based provision of teaching, planning, and reflection resources with targeted mentoring from subject specialists. While Hobbs’ work on out-of-field teacher identity (Hobbs 2020) recognises the influence of career trajectory on identity responses to out-of-field teaching, existing models pay limited attention to the longitudinal nature of identity development (Beauchamp and Thomas 2009) and the ways teachers’ PD needs evolve across their careers (Booth *et al.* 2021). There is a need to examine more closely how teachers’ identities, situated within particular contexts and career stages, shape their relationships to the subject(s) they teach.

Methods

The present study reports on a narrative re-analysis (Hall and Leeder 2024). This is an expansion of the findings from our recent systematic evidence review (Rutgers *et al.* 2025), which mapped the terrain of subject-specific professional development for out-of-field teachers. Narrative re-analysis is an emerging hybrid review method that combines the rigour of systematic review with the interpretive depth of narrative synthesis (Hall and Leeder 2024). This approach enables exploration of unexamined dimensions within an existing evidence base, without the burden of replicating the full systematic process. Narrative re-analysis is an underexplored method of review in education and this study is a novel application of the approach in the context of out-of-field teaching and teacher PD.

Earlier systematic review

The systematic review (Rutgers *et al.* 2025) that provides the dataset for this re-analysis mapped research on teachers working out-of-field, and identified PD activities in support of these teachers and the evidence of impact of these activities. The review followed standard protocols (Page *et al.* 2021) to gather evidence at the cross-section of research into out-of-field teaching and teacher PD. Searches (Table 1) resulted in 3,149 returns (excluding 855 duplicates), of which 31 were included in the final sample, providing

Table 1. Searches for foundational systematic review (from Rutgers *et al.* 2025).

Search terms	‘nonspecialist*’, ‘teach* across specialisations’, ‘inadequately qualified’, ‘underqualified’, ‘uncertified’, ‘beyond the field’, ‘outside specialism’, ‘unsuitably qualified’, ‘not suitably qualified’, and ‘outside area of expertise’.
Date range	2004–2024
Publication language	Published in English language
Publication types	Peer reviewed journal articles Book chapters Grey literature on subject-specific professional development
Study design	Include any study type, including reviews and theoretical papers. Empirical studies can be qualitative or quantitative
Countries/ jurisdictions	Educational contexts comparable to England and/or high-PISA-performing systems NOTE: Determined through full-text screening based on study context (e.g. population, socio-economic profile, policy environment, and educational characteristics), rather than country name alone.

evidence of programmes of teacher PD for out-of-field teaching internationally. Given the wide range of terms used for teacher PD (including activity-specific terms such as ‘workshop’, ‘mentoring’, ‘Professional Learning Community’), teacher PD terms were not included in the search strategy; instead, relevance to OOF teacher professional development was assessed during screening. This also enabled further themes, including teacher identity and experience, to be identified from this evidence base. The review focused on secondary school teachers working out of field, reflecting the greater subject specialisation in secondary education; this criterion also guided the narrative re-analysis described below. The findings of the systematic review are summarised above.

Narrative re-analysis

Our re-analysis revisits this evidence on out-of-field teacher PD, to explore sub-themes that were identified during, but beyond the scope of, the review. To do this, we re-analysed a subset of returns from the original review searches that were identified when we noted the prevalence of research pertaining to teacher identity and teaching experiences. First, 13 of the 31 included items in the original review were identified as relevant to reanalysis. After this, a further 15 items were included for reanalysis from the wider sample of 3,149 returns to the original review searches. These items were identified while screening, through responsive ‘tagging’ of items related to teacher identity and experience, so that we might subsequently return to them. Therefore, following guidance on narrative reanalysis (Hall and Leeder 2024), we concentrated a second analysis on this subset of 28 items identified during the initial review process (Table 2).

Following the approach set out in Table 2, the narrative re-analysis focused on studies describing the out-of-field teaching experience and teacher identity, which emerged within out-of-field contexts, as reported in relation to and related to PD programmes and/or wider teacher PD needs. The reanalysis was conducted by the original research team (also the authors of this paper), who were familiar with the dataset and had previously identified the importance of identity and experience during the original

Table 2. Process of narrative re-analysis (adapted from Hall and Leeder 2024).

Stage	Approach taken
1) Retrieval of an initial review	● Refamiliarisation with initial review dataset
2) Identification and justification of sub-phenomenon	● Review of related themes identified during review process including assigned ‘tagging’ labels, linked notes, and review team meeting records ● Discussion and identification of themes for re-analysis (teacher identity, context, and experience)
3) Expanded search, selection and extraction of data	● Return to systematic review full dataset ● Identification of items tagged with labels related to identified themes (‘out-of-field professional identity’, ‘the out-of-field teaching experience’) ● Re-screening of all items from initial review labelled with relevant tags ● Application of updated inclusion criteria ● Cross-tabulation of items of literature tagged with multiple themes ● Data extraction
4) Reanalysing the sub-phenomenon	● Reanalysis of the identified items pertaining to teacher identity and experience, through thematic analysis, including reviewing of previous notes and coding, distribution of items amongst research team to ensure agreement and discussion ● Construction of bodies of evidence related to each sub-theme ● Reanalysis of the identified items pertaining to the context OOF teaching

review. We coded phrases from the full text that seemed important to understanding OOF teacher identity and experience, alongside recording summary comments and reflections (as researcher notes). A second, bottom-up round of thematic analysis was then conducted to identify recurring patterns across the coded material, generating two major, interrelated themes: the contextual conditions shaping out-of-field teacher identification and teachers' self-conceptualisations in relation to the out-of-field subjects they taught. The narrative re-analysis was guided by the following research questions:

- (1) In what ways do contextual conditions shape out-of-field teacher identity?
- (2) What aspects of teacher identity characterise out-of-field teachers in relation to professional development?
- (3) What are the implications for the design of professional development for teachers working out-of-field?

Limitations

This study is a re-analysis of a corpus of literature. It is therefore limited by what research has been published. Further, that corpus was identified for a different, although closely related, systematic literature review (Rutgers *et al.* 2025). The search and inclusion approach used to identify that literature (Table 1) may have excluded some studies which would have provided additional information to further support, or contrast with, the findings generated from our re-analysis.

Findings

In this section we present the findings of our narrative re-analysis. We approach this by considering each research question in turn.

Contextual influences on out-of-field teacher identity

Understanding how context shapes identity requires attention to the various contexts in which teachers can be situated, such as their education and qualification context, their school context, and the perceptions of others. Despite the lack of a consistent definition across the literature, most accounts of out-of-field teaching are grounded in formal credentials, either the teacher's initial teaching qualification (e.g. Bulman 2005; Hobbs 2013) or a combination of teaching qualification and prior study in the subject (e.g. Mizzi 2021; Goos *et al.* 2023). The latter of which is rooted in Ingersoll's (1998) definition where out-of-field teachers 'teach subjects that do not match their training or education' (p774). Less frequently, the literature identified a third configuration where teachers had studied a subject taught at an advanced level, but completed teacher education in another subject (e.g. Yardley 2022).

Our analysis highlighted literature on teachers who held the appropriate teaching qualification but lacked post-high school education in the subjects they taught. In many European countries, such as Malta, science is an integrated subject in the lower secondary school years, so teachers are required to teach all three science subjects. However, teachers only specialise in one science subject to qualify as

a teacher and are not required to have post-school level education in any of the other science subjects (Mizzi 2021). This contextual complexity of, say a physics teacher, being both ‘in-field’ due to their teaching qualification and ‘out-of-field’ because they are required to teach chemistry and biology, leads to teachers having to shift identity as they move between science subject contexts (ibid, p. 719). A similar scenario exists for science teaching in Australia (Hobbs 2013). Notably, our findings only identified literature for this phenomenon – where a teacher can be expected to teach a subject and have no advanced education in the subject – for the science subjects (e.g. Mizzi 2021; von Knebel *et al.* 2023). Even in some countries such as Germany, where secondary school teachers typically train to teach two subject areas, teachers of integrated science will inevitably be teaching a subject they are not qualified to teach (von Knebel *et al.* 2023). These differences illustrate how teachers may be identified as out-of-field, due to their lack of subject knowledge, in one policy context, yet viewed as in-field in another, because technically they hold the relevant qualification (Hobbs 2013). As Barańska and Zambrowska (2022, p. 305) note, a teacher having a teaching qualification is purely a ‘matter of meeting certain formal requirements rather than having actual competences’.

Qualification structures are embedded within wider contextual arrangements, meaning that far from being a fixed or universal category, out-of-field teaching and teachers’ responses to it are shaped by national policy environments, school cultures, curriculum structures and local workforce conditions (Hobbs 2013). The school context in terms of culture and leadership can have a great impact on out-of-field teachers’ identity, teaching assignments and professional development opportunities (du Plessis *et al.* 2019). With a culture of support, innovation and embracing out-of-field teaching, teachers can feel valued, confident and consider out-of-field teaching as an opportunity for their career. On the other hand, without this school support, teachers report feeling out of their comfort zone (du Plessis *et al.* 2019). School policies governing timetabling and staffing allocation also influence whether a teacher is classified, or sees themselves, as out-of-field and this can influence how teachers, and their colleagues, perceive their relationship to their subject (Sharplin 2014, Yardley 2022). For example, Sharplin’s (2014) study of rural Australian schools illustrates how, where teachers’ qualifications align with their roles and/or pupil phases (age groups), they appear to feel more comfortable and competent, have more confidence and self-efficacy, and be more likely to stay in their jobs. Conversely, where teachers’ assigned roles and/or pupil phases are ‘displaced’ from their qualifications, they are more likely to feel alienated and a lack of satisfaction, and may more quickly leave. This study also identifies how it may be only some aspects of a teacher’s work which are not aligned with their qualifications, describing this as role- or phase-stretched, such as when a teacher teaches multiple subjects or works with a different pupil age group within their phase. Meanwhile, Yardley (2022) examined the disconnect between her official identity as a history-qualified teacher and her passion for mathematics, remarking on the difficulty that others had in defining her as in-field or out-of field and demonstrating that labelling teachers as out-of-field is enmeshed not only with institutional qualifications and others’ perceptions thereof, but also with teachers’ identities and disciplinary affiliations. Taken together, these studies suggest

that out-of-field teaching is not a fixed category but a negotiated identity shaped by contextual conditions and by the interaction between external and self-perceptions of qualification. We turn to the findings on the self-perceptions of teachers working out of field, and their influence on PD engagement, next.

Identity characteristics of out-of-field teachers relevant to professional development

Understanding what it means for a teacher to be working out-of-field requires attention to teachers' own identity positioning, as this fundamentally shapes their relationship to, and alignment with, the subjects they teach. Forty-three of the fifty items included in the narrative re-analysis engaged with aspects of teachers' dispositions, self-image, or beliefs about the nature and responsibilities of teaching (i.e. role conceptualisations). A variety of overarching theoretical frameworks were identified. These are: boundary crossing, positioning theory, professional self-understanding and identity types or trajectories (Table 3). By contrast, most studies did not adopt overarching models; they examined out-of-field teaching and teacher learning through specific, but largely isolated, identity-related concepts: motivation/commitment, self-efficacy/confidence, professional self-image/teaching role conception and job satisfaction (Table 4).

Table 3. Overarching theoretical frameworks identified in the narrative re-analysis.

Theoretical framework	Framing	Studies
<i>Boundary crossing</i> - anchored in Akkerman and Bakker (2011) and sociocultural theory	Out-of-field teaching as movement across sociocultural boundaries, where discontinuities prompt a renegotiation of practice and self that can lead to identity expansion	Hobbs (2013); Hobbs <i>et al.</i> (2019); Mizzi (2021)
<i>Positioning theory</i>	Identity as constructed or negotiated moment-by-moment through relations of rights, duties, and recognition by self and others, offering a useful lens for tracing how out-of-field teachers (re) position themselves within departmental cultures and subject communities	Hobbs <i>et al.</i> (2019); Quinn and Hobbs (2024)
<i>Professional self-understanding</i> - based on Kelchtermans (2009)	Professional identity as five interrelated components: self-image, self-esteem, job motivation, task perception, and future perspective.	Ní Riordáin <i>et al.</i> (2022)
<i>Identity types or trajectories</i> - drawing on Bosse (2017) and Huberman <i>et al.</i> (1997)	Explains variation in motivation and engagement with professional development across different stages of teachers' professional lives	Lünne <i>et al.</i> (2021); Barańska and Zambrowska (2022)

Table 4. Identity-related concepts through which papers approached out-of-field teaching and out-of-field teacher learning.

Identity-related concept	Studies
<i>Motivation/Commitment</i>	Barańska and Zambrowska (2022); Donitsa-Schmidt <i>et al.</i> (2021); Hatisaru (2024); Hobbs (2013); Lünne <i>et al.</i> (2021)
<i>Self-efficacy/Confidence</i>	Campbell (2011); du Plessis and McDonagh (2021); Hobbs (2013); Jones <i>et al.</i> (2008); Mizzi (2021); Ní Riordáin <i>et al.</i> (2022); O'Meara and Faulkner (2022); Perry <i>et al.</i> (2024); Sani and Burghes (2022); Yardley (2022); von Knebel <i>et al.</i> (2023)
<i>Job satisfaction</i>	Ní Riordáin <i>et al.</i> (2022)
<i>Professional self-image/Teaching role conceptualisations</i>	du Plessis <i>et al.</i> (2019); Fridrich (2021); Goos <i>et al.</i> (2023); Lünne <i>et al.</i> (2021); Ní Riordáin <i>et al.</i> (2022); Sharplin (2014)

The studies in our re-analysis consistently linked teacher self-efficacy to subject-specific knowledge and pedagogical content knowledge (e.g. Campbell 2011; Mizzi 2021; Ní Ríordáin *et al.* 2022; Sani and Burghes 2022). This interaction underscores how closely teachers' dispositions towards out-of-field teaching are tied to their confidence in mastering the disciplinary and pedagogical demands of the new subject (O'Meara and Faulkner 2022; von Knebel *et al.* 2023). In several cases, self-efficacy is conceptualised explicitly through subject: for example, in the context of mathematics, Ní Ríordáin *et al.* (2022) defined and measured self-efficacy as teachers' perceived ability to manage the demands and difficulties of teaching mathematics, comprising primarily instructional strategies and student engagement alongside general classroom management. du Plessis and McDonagh (2021, p. 9) noted that out-of-field teachers' self-efficacy was 'clearly grounded in the desire and ability to deliver quality education, and that the loss of this ability due to out-of-field assignment adversely affected teaching capacity and success [and therefore] their passion, motivation, and emotion disintegrate'.

Studies also indicated that teachers' professional identities can be characterised by subtle but important differences in orientations and views on teaching, with some grounded more in their subject specialism, and others more in their broader sense of teacher identity and pedagogical practice (Campbell *et al.* 2019; Fridrich 2021; Yardley 2022; Hatisaru 2024; Sharplin 2014; Quinn and Hobbs 2024). Some studies suggest that forms of experience beyond formal qualifications, such as prior teaching experience, informal subject engagement, or accumulated pedagogical confidence, shape how teachers relate to a subject and whether they perceive themselves as out-of-field (Lünne *et al.* 2021; Yardley 2022; Nakar and du Plessis 2023). Meanwhile, teachers whose professional identity is closely tied to subject expertise may experience out-of-field teaching as more unsettling to their sense of self (Hobbs 2013, 2020; du Plessis and McDonagh 2021).

Teachers have varied motivations to teach out-of-field and to participate in PD designed to support them working out-of-field. Across the literature, these range from extrinsic (employment, timetable, career advantage) to intrinsic, growth-oriented motivations (interest, professional growth) (Hobbs 2013; Lünne *et al.* 2021; du Plessis *et al.* 2019; du Plessis and McDonagh 2021; Barańska and Zambrowska 2022). Complex constellations of these identity-related orientations to the out-of-field subject were associated with differing patterns and depths of engagement in subject-specific PD (Hobbs 2013; Quinn and Hobbs 2024). However, rather than constituting fixed identity types, these motivational orientations were understood as fluid and situational.

Several studies highlighted a connection between how an out-of-field assignment is seen, and the level of motivation and commitment to PD, by both teachers and leaders. For example, du Plessis *et al.* (2019) show that out-of-field teaching can be treated by school leaders as a temporary or secondary assignment, thereby leading to limited investment in PD, even though out-of-field teachers are expected to deliver equivalent student outcomes. Further, school leaders expressed tension between providing out-of-field teachers with pre-structured, 'safe' curricula to ensure consistency for the time being, and enabling them to exercise agency and participate in curriculum planning, the latter of which would see teacher involvement in the out-of-field subject that can strengthen both professional growth and identity development (du Plessis *et al.* 2019). Sharplin (2014) shows that for teachers working out-of-field, reduced autonomy can intensify tensions between pedagogical beliefs, such as constructivist ideals, and

situational demands related to coverage and accountability, undermining self-efficacy and commitment and contributing to higher attrition, particularly in rural contexts where professional support is more limited. Similarly, Hobbs (2013) shows that teachers positioned as ‘just filling in’ often compromise pedagogical ideals in order to meet system demands, highlighting how such tensions are central to out-of-field teachers’ ongoing identity negotiations and PD engagement.

Implications for professional development for teachers working out-of-field

Many approaches to researching and designing PD for out-of-field teachers rely on a binary distinction between in-field and out-of-field based primarily on formal qualifications (Sharplin 2014), thereby underplaying the value of the prior knowledge teachers bring and obscuring variations in teachers’ relationships to the subjects they teach (Yardley 2022).

For example, some teachers working out-of-field are distinct from the conventional out-of-field profile of a teacher lacking relevant teaching qualifications and/or advanced subject study. These teachers, akin to Sharplin’s (2014) ‘role-stretched’ teachers, may, however, have some affinity with the subject they teach through related disciplinary experiences, identity orientations, or prior exposure. This group appears similar to Hobbs’s (2013) teachers described as ‘pursuing an interest’, although our re-analysis suggests that such interests may be extrinsically as well as intrinsically motivated, as described above. Rather than requiring foundational preparation, these teachers are more likely to benefit from targeted, depth-oriented PD that builds subject-specific confidence and specialist understanding.

PD needs also vary with the disciplinary distance between a teacher’s original specialism and their out-of-field subject(s); for instance, a teacher who has never experienced the use of practical pedagogies, such as those used in science, will need to gain understanding of their effective use and purpose within the curriculum (Mizzi 2021). Where disciplinary pedagogies overlap, PD can instead focus on refinement rather than foundational pedagogical development. Interestingly, von Knebel *et al.* (2023) found that self-efficacy for teaching out-of-field in science varied by teachers’ original field. They also suggest that certain subject backgrounds, chemistry in their case, may provide conceptual or pedagogical foundations that more readily support interdisciplinary teaching, hypothesising from their findings that ‘chemistry content serves as a basis for certain biology and physics topics’ (von Knebel *et al.* 2023, p. 13). For teachers working out-of-field in science, therefore, PD focussed on chemistry may offer more useful preparation than PD focussed on other science subjects, although it is unclear whether this would apply to other subject groupings.

Finally, the studies in our reanalysis consistently showed that teachers’ self-efficacy, beliefs and confidence in relation to an out-of-field subject can be fostered by recognition and valuing of existing expertise (Hobbs 2013; Sharplin 2014; du Plessis *et al.* 2019; du Plessis and McDonagh 2021; Mizzi 2021; Yardley 2022; Quinn and Hobbs 2024). The works of du Plessis *et al.* (2019), Sharplin (2014) and Hobbs (2013) discussed in the previous section collectively highlight that reduced autonomy and ‘filling-in’ approaches to out-of-field teaching constrain motivation and identity development, providing

evidence of the importance of recognising and prioritising teacher autonomy and agency in PD for out-of-field teachers. Lastly, these authors foregrounded the importance of teachers being seen as competent educators despite working out-of-field, in relation to their PD (du Plessis and McDonagh 2021; Mizzi 2021; Yardley 2022). In the context of supporting science teachers teaching out-of-field, Mizzi (2021, p. 719) reported that:

[t]he main turning point in their learning journey that empowered teachers to review their self-efficacy beliefs and expand their professional identity as science teachers took place when teachers realised that they were not treated as knowledge-deficient professionals, but when their contributions and efforts were acknowledged and valued within the learning community.

Discussion

Teaching out-of-field can be an expected and culturally normative practice shaped by contextual challenges (Hobbs and Porsch 2022). Our findings confirm the central roles of context and identity in shaping how teachers experience working out-of-field (Sharplin 2014; Hobbs and Törner 2019; Hobbs 2020; Mizzi 2021). In our re-analysis, teachers' professional identities emerge in relation to contextual factors such as school cultures, workforce conditions and curriculum structures, affecting how out-of-field roles are experienced, and how they engage with subject-specific PD. Our findings thereby support those of other studies (for example, Hobbs 2013, 2020) by demonstrating the complex interplays between context, identity and PD.

Out-of-field status emerges from this study as a situated and negotiated position rather than a fixed condition, with important implications for how PD is designed and taken up. Variations in teachers' relationships with the subjects they teach, and consequently in their professional learning needs, risk being obscured by binary distinctions between in- and out-of-field. Accordingly, we propose a continuum model of in-field, close-to-field, and out-of-field teaching which enables a more granular consideration of teachers' relationships with subjects (Figure 1).

This continuum model conceptualises teachers' subject alignment as dynamic rather than categorical. Some teachers may work predominantly in- or out-of-field, but many experience occasions when they are close-to-field or when they move along this continuum in any direction. Close-to-field might be experienced by working across subjects,

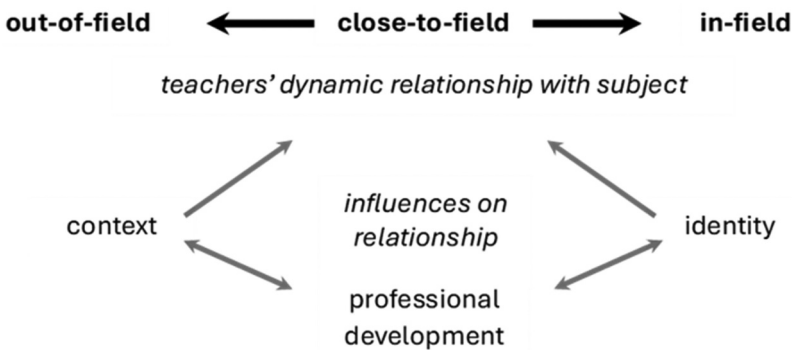


Figure 1. Continuum model of teachers' dynamic relationship with subject.

such as a teacher with a biology degree teaching physics, but could also be experienced within subjects, for example when a mathematics teacher teaches a new or unfamiliar area of the curriculum, while movement, as we describe below, might be stimulated by a change in context or engagement in PD.

The continuum model complements those derived from empirical studies. Based on our findings from the literature re-analysis, it develops Yardley's (2022) model of role-congruence, role-displacement and role-stretched into a continuum with a focus on subject rather than role, and enabling movement along the continuum. It delineates Hobbs (2013) influencing factors (context, personal resources and support mechanisms) in a similar but distinct way, as three interacting influences on how teachers feel about the subject they teach: context, identity and PD. This distinguishes context and PD from identity, enabling their analysis as separate factors, while acknowledging their interdependence.

The continuum shows how changes in teachers' relationships with the subjects they teach occur as a result of activity in context and/or identity. This generates movement between out-of-field and in-field *via* close-to-field, which may take place in the short term as a result of 'experiential and on-the-job learning' (Hobbs 2020), in the medium-term, through formalised PD, or as a result of longer-term changes, such as a move to a new school or the implementation of new policy (Yardley 2022). The interdependence of the two influences also means that the model can account for teachers' career stage as an important factor shaping both their starting position and the kinds of movement that are possible or likely (Booth *et al.* 2021). As teachers develop their practice in an area beyond their specialism, they may move from out-of-field towards close-to-field, but, perhaps, never fully reach in-field.

As Hobbs (2013) says, understanding teachers' relationship with their subject helps to determine their PD needs. Although our re-analysis identified a range of contextual, subject-specific and identity-related factors that may inform PD design, no such account can be exhaustive. The factors most relevant in any particular setting must therefore be identified through investigation of that context, so that PD is meaningful and responsive to the experiences and needs of the teachers required to work out of field. Therefore, our model can be used in the design of PD, so that it takes into account teachers' positioning on the continuum to adapt content and delivery models appropriately.

On the basis of our findings, we argue that PD should be informed by context-specific and identity-sensitive understandings of teacher 'qualification'. A teacher of physics who is qualified in biology is closer to field than one who is qualified in geography. The two are therefore likely to have significantly different PD needs and so the subject and pedagogical content of the PD should be adapted accordingly. Another two teachers of physics, both qualified in computing, may be ostensibly out-of-field, based on their qualifications, but feel differing closeness to physics because of their prior experience or interest. One of these teachers might benefit from sustained external mentoring, the other from a refresh of their subject knowledge. By paying attention to how teachers feel about their practice, we respond more effectively to their actual concerns and experiences (Korthagen 2017).

Finally, the continuum provides a model of teacher change (Patfield *et al.* 2022) for researching and evaluating PD, offering the possibility of gaining understanding of PD from teachers' perspectives, an acknowledged research gap (Zhang *et al.* 2024). In line

with Hobbs *et al.* (2019), we advocate the use of multiple theoretical perspectives to do justice to the complexity of teacher-subject alignment in out-of-field teaching contexts. For example, studies of PD might identify teachers' starting points on the continuum, and their movement as a result of PD. Further, the continuum opens up the possibility of research studies which explore teachers' positioning in relation to their subjects, or indeed topics within subjects, on the continuum, and investigate how these change over time, in new circumstances or as a result of PD.

Conclusion

Out-of-field teaching is an international phenomenon caused by a range of factors. PD can offer an important mitigation to the varying challenges of teaching out-of-field. However, there is a gap in our understanding of what makes effective PD for teachers working out-of-field. The study reported here contributes to filling that gap. We used a narrative re-analysis of a body of literature derived from an earlier systematic review of PD for teachers working out of field (Rutgers *et al.* 2025), identifying the important influence of context and identity on teachers' relationships with the subject(s) they teach. Using these dual perspectives, we exposed the limitations of a simple binary model of in- or out-of-field, which may understate the complexity of working out-of-field.

In response, we propose a new model that moves beyond the simple binary of in-field and out-of-field, to describe a continuum spanning in-field, close-to-field and out-of-field teaching. This model captures the dynamic complexity of 'field' as a relationship between the teacher, the subject they teach, their identity and their context. It shows how the nature of out-of-field can shift in response to the interacting influences of context, identity and professional development. We offer the model for use in further research and to inform a more nuanced approach to the design of PD which better addresses the challenges faced by teachers working out-of-field.

Note

1. Advanced Level (A-level) qualifications involve subject-specific study undertaken in the final two years of upper secondary education in England and are typically used for university entry.

Acknowledgments

The authors used ChatGPT (OpenAI ChatGPT 5.2, 2026) during manuscript preparation to support aspects of language editing such as improving grammar, enhancing phrasing, and increasing clarity in the text (i.e. AI-assisted copy-editing).

Author contributions

CRedit: **Dieuwerke Rutgers**: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing; **Eleanor Hotham**:

Conceptualization, Data curation, Formal analysis, Methodology, Visualization, Writing – original draft, Writing – review & editing; **Emily Perry**: Conceptualization, Funding acquisition, Project administration, Visualization, Writing – original draft, Writing – review & editing; **Emma Rempe-Gillen**: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

The systematic review which formed the basis for the study here was supported by Gatsby Foundation.

ORCID

Dieuwerke Rutgers  <http://orcid.org/0000-0003-0506-847X>

Emily Perry  <http://orcid.org/0000-0003-3413-1159>

Rights retention statement

For the purpose of open access, the author has applied a Creative Commons Attribution (CC BY) licence to any Author Accepted Manuscript version of this paper arising from this submission.

References

- Akkerman, S.F., and Bakker, A., 2011. Boundary crossing and boundary objects. *Review of Educational research*, 81 (2), 132–169. doi:10.3102/0034654311404435.
- Amer, A. and Obradovic, S., 2022. Recognising recognition: Self-other dynamics in everyday encounters and experiences. *Journal for the theory of social behaviour*, 52 (4), 550–562. doi:10.1111/jtsb.12356.
- Badaru, K.A. and Ndlovu, N.S., 2025. Understanding the out-of-field teaching experiences: a review of selected national contexts. *Interdisciplinary journal of education Research*, 7 (2), 1–19. doi:10.38140/ijer-2025.vol7.2.04.
- Barańska, B. and Zambrowska, M., 2022. Neither fully ‘in’, nor completely ‘out’ of the field: the case of teaching mathematics as a second subject in Poland. In: L. Hobbs and R. Porsche, eds. *Out-of-field teaching across teaching disciplines and contexts*. Singapore: Springer, 285–307.
- Beauchamp, C. and Thomas, L., 2009. Understanding teacher identity: an overview of issues in the literature and implications for teacher education. *Cambridge journal of Education*, 39 (2), 175–189. doi:10.1080/03057640902902252.
- Booth, J., et al. 2021. Mid-career teachers: a mixed methods scoping study of professional development, career progression and retention. *Education sciences*, 11 (6), 299. doi:10.3390/educsci11060299.
- Bosse, M., 2017. *Mathematik fachfremd unterrichten: Zur Professionalität fachbezogener Lehrer-Identität*. Wiesbaden: Springer Spektrum.
- Bosse, M. and Törner, G., 2015. Teacher identity as a theoretical framework for researching out-of-field teaching mathematics teachers. In: C. Bernack-Schüler, R. Erens, T. Leuders, and

- A. Eichler, eds. *Views and beliefs in mathematics education*. Wiesbaden, Germany: Springer Spektrum, 1-13. doi:10.1007/978-3-658-09614-4_1.
- Boylan, M., et al. 2023. Re-imagining transformative professional learning for critical teacher professionalism: a conceptual review. *Professional development in education*, 49 (4), 651–669. doi:10.1080/19415257.2022.2162566.
- Bulman, J., 2005. *Outfielders: an unknown quantity in secondary school science*. Thesis (PhD). Central Queensland University.
- Campbell, C., Porsch, R., and Hobbs, L., 2019. Initial teacher education: roles and possibilities for preparing capable teachers. In: L. Hobbs and G. Törner, eds. *Examining the phenomenon of "teaching out-of-field"*. Singapore: Springer, 243–267. doi:10.1007/978-981-13-3366-8_10.
- Campbell, P., 2011. Enabling non-specialists to teach school physics effectively. *Physics education*, 46 (2), 152–158. doi:10.1088/0031-9120/46/2/002.
- Carpendale, J. and Hume, A., 2020. Content representations to support out-of-field physics teachers. *Physics education*, 55, 065021. doi:10.1088/1361-6552/aba892.
- Darlington, E., 2017. *What is a non-specialist teacher? Cambridge assessment research Report*. Cambridge, UK: Cambridge Assessment. Available from: <https://www.cambridgeassessment.org.uk/Images/562865-what-is-a-non-specialist-teacher-.pdf>.
- Day, C., et al. 2006. The personal and professional selves of teachers: stable and unstable identities. *British Educational research Journal*, 32 (4), 601–616. doi:10.1080/01411920600775316.
- Department for Education, 2025. *School workforce in England: reporting year 2024*. Available from: <https://explore-education-statistics.service.gov.uk/find-statistics/school-workforce-in-england/2024>. [Accessed 19 Dec 2025].
- Desimone, L.M., 2009. Improving impact studies of teachers' professional development: toward better conceptualizations and measures. *Educational researcher*, 38 (3), 181–199. doi:10.3102/0013189X08331140.
- Donitsa-Schmidt, S., Zuzovsky, R., and Topaz, B., 2021. Becoming an in-field teacher in Israel: motivations and knowledge of out-of-field science teachers. *European journal of teacher education*, 44 (5), 668–687. doi:10.1080/02619768.2020.1860008.
- du Plessis, A., et al. 2019. The out-of-field teacher in context: the impact of the school context and environment. In: L. Hobbs and G. Törner, eds. *Examining the phenomenon of "teaching out-of-field"*. Singapore: Springer, 217–242. doi:10.1007/978-981-13-3366-8_9.
- du Plessis, A. and McDonagh, K., 2021. The out-of-field phenomenon and leadership for well-being: understanding concerns for teachers, students and education partnerships. *International journal of educational research*, 106, 101724. doi:10.1016/j.ijer.2020.101724.
- Fraser, S., Beswick, K., and Crowley, S., 2019. Making tacit knowledge visible: uncovering the knowledge of science and mathematics teachers. *Teaching & teacher education*, 86, 102907. doi:10.1016/j.tate.2019.102907.
- Fraser-Arnott, M.A., 2019. Evolving practices and professional identity: how the new ways we work can reshape us as professionals and a profession. *IFLA Journal*, 45 (2), 114–126. doi:10.1177/0340035218810960. (Original work published 2019).
- Fridrich, C., 2021. Teaching economics outside one's own subject area at lower secondary level in Austria—enriching or embarrassing? *JSSE-Journal of social science education*, 20 (1). doi:10.11576/jsse-3737.
- Gabrys-Barker, D., 2010. On teacher beliefs, self-identity and the stages of professional development. *Linguarum Arena*, 1, 25–42.
- Goodson, I.F. and Cole, A.L., 1994. Exploring the teacher's professional knowledge: constructing identity and community. *Teacher education quarterly*, 85–105. Available from: <https://www.jstor.org/stable/23475536>.
- Goos, M., et al. 2023. Impact of a national professional development programme for out-of-field teachers of mathematics in Ireland. *Irish Educational studies*, 42 (3), 401–421. doi:10.1080/03323315.2021.1964569.
- Hall, S. and Leeder, E., 2024. Narrative reanalysis: a methodological framework for a new brand of reviews. *Research synthesis methods*, 15 (6), 1017–1030. doi:10.1002/jrsm.1751.

- Hatisaru, V., 2024. Non-specialist secondary mathematics teachers learning in study groups by engaging with activities of algebra. *Journal on mathematics Education*, 15 (1), 131–150.
- Hobbs, L., 2013. Teaching ‘out-of-field’ as a boundary-crossing event: factors shaping teacher identity. *International journal of science & mathematics Education*, 11 (2), 271–297. doi:10.1007/s10763-012-9333-4.
- Hobbs, L., et al. 2019. Examining the complexity of the out-of-field teacher experience through multiple theoretical lenses. In: L. Hobbs and G. Törner, eds. *Examining the phenomenon of “teaching out-of-field”: international perspectives on teaching as a non-specialist*. Singapore: Springer Nature, 87–128. https://link.springer.com/chapter/10.1007/978-981-13-3366-8_4.
- Hobbs, L., 2020. Learning to teach science out-of-field: a spatial-temporal experience. *Journal of science teacher education*, 31 (7), 725–745. doi:10.1080/1046560X.2020.1718315.
- Hobbs, L., et al. 2022. Defining teaching out-of-field: an imperative for research, policy and practice. In: L. Hobbs and R. Porsch, eds. *Out-of-field teaching across teaching disciplines and contexts*. Singapore: Springer Nature, 23–48. doi:10.1007/978-981-16-9328-1_2.
- Hobbs, L. and Porsch, R., Eds. 2022. *Out-of-field teaching across teaching disciplines and contexts*. Singapore: Springer Nature. doi:10.1007/978-981-16-9328-1.
- Hobbs, L. and Törner, G., 2019. Teaching out-of-field as a phenomenon and research problem. In: L. Hobbs and G. Törner, eds. *Examining the phenomenon of “teaching out-of-field”*. Singapore: Springer Nature, 3–20. doi:10.1007/978-981-13-3366-8_1.
- Huberman, M., Thompson, C.L., and Weiland, S., 1997. Perspectives on the Teaching Career. In: B.J. Biddle, T.L. Good, and I.F. Goodson, eds. *International Handbook of Teachers and Teaching*. Vol. 3. Dordrecht: Springer International Handbooks of Education. doi:10.1007/978-94-011-4942-6_2.
- Ingersoll, R.M., 1998. The problem of out-of-field teaching. *Phi Delta Kappan*, 79 (10), 773–776.
- Ingersoll, R.M., 2005. The problem of underqualified teachers: a sociological perspective: a magazine of theory and practice. *Sociology of education*, 78 (2), 175–178. doi:10.1177/003804070507800206.
- Ingersoll, R.M., 2019. Measuring out-of-field teaching. In: L. Hobbs and G. Törner, eds. *Examining the phenomenon of “teaching out-of-field”: international perspectives on teaching as a non-specialist*. Singapore: Springer Nature, 21–51. doi:10.1007/978-981-13-3366-8_2.
- Institute of Physics, 2025. *The physics teacher shortage and addressing it through the 3Rs: retention, recruitment and retraining (England)*. London, UK: Institute of Physics. Available from: <https://www.iop.org/about/publications/physics-teacher-shortage-and-addressing-it-through-3rs>. [Accessed 21 Nov 2025].
- Jones, M., et al. 2008. *Evaluation of the chemistry for non-specialists training programme. Final report*. Slough, UK: National Foundation for Educational Research (NFER). Available from: <https://files.eric.ed.gov/fulltext/ED504619.pdf>.
- Kelchtermans, G., 2009. Who I am in how I teach is the message: self-understanding, vulnerability and reflection. *Teachers and teaching*, 15 (2), 257–272. doi:10.1080/13540600902875332.
- Kenny, J., Hobbs, L., and Whannell, R., 2020. Designing professional development for teachers teaching out-of-field. *Professional development in education*, 46 (3), 500–515. doi:10.1080/19415257.2019.1613257.
- Korthagen, F., 2017. Inconvenient truths about teacher learning: towards professional development 3.0. *Teachers and teaching*, 23 (4), 387–405. doi:10.1080/13540602.2016.1211523.
- Lau, J., Vähäsantanen, K., and Collin, K., 2022. Teachers’ identity tensions and related coping strategies: interaction with the career stages and socio-political context. *Professions and professionalism*, 12 (3). doi:10.7577/pp.4562.
- Lünne, S., Schnell, S., and Biehler, R., 2021. Motivation of out-of-field teachers for participating in professional development courses in mathematics. *European journal of teacher education*, 44 (5), 688–705. doi:10.1080/02619768.2020.1793950.
- Mashele, S.F. and Mafuwane, B.M., 2024. Out-of-field teaching in rural schools: reconceptualising the role of school leadership in the post COVID-19 space. *Journal of advances in education and philosophy*, 8 (8), 480–487. doi:10.36348/jaep.2024.v08i08.001.

- McConney, A. and Price, A., 2009. *An assessment of the phenomenon of “teaching out-of-field” in WA schools (, Ill.)*. Perth, Australia: Murdoch University. Centre for Learning, Change and Development. Available from: <https://researchportal.murdoch.edu.au/esploro/outputs/report/An-assessment-of-the-phenomenon-of/991005543018807891>.
- Mizzi, D., 2021. Supporting science teachers teaching outside specialism: teachers’ views of a professional development programme. *European journal of teacher education*, 44 (5), 706–725. doi:10.1080/02619768.2020.1793951.
- Morrison, C.M., 2013. Teacher identity in the early career phase: trajectories that explain and influence development. *Australian journal of teacher education (online)*, 38 (4), 91–107.
- Nakar, S. and du Plessis, A.E., 2023. Facing the dilemma of the out-of-field teaching phenomenon in vocational education and training (VET). *Vocations & learning*, 16 (3), 551–575. doi:10.1007/s12186-023-09329-8.
- Napier, J.B., Luft, J.A., and Singh, H., 2020. In the classrooms of newly hired secondary science teachers: the consequences of teaching in-field or out-of-field. *Journal of science teacher education*, 31 (7), 802–820. doi:10.1080/1046560X.2020.1800195.
- National Centre for Excellence in the Teaching of Mathematics (NCETM), 2025. *Specialist knowledge for teaching mathematics (secondary non-specialist teachers) programme*. Available from: <https://www.ncetm.org.uk/maths-hubs-projects/specialist-knowledge-for-teaching-mathematics-secondary-non-specialist-teachers-programme/>. [Accessed 20 Dec 2025].
- Nias, J., 1989. Teaching and the self. In: M.L. Holly and C.S. McLoughlin, eds. *Perspective on teacher professional development*. London, UK: Falmer Press, 151–171.
- Ní Ríordáin, M., et al. 2022. Eliminating the fear of getting ‘caught out’: an examination of the development of out-of-field mathematics teachers’ professional self-understanding. In: L. Hobbs and R. Porsch, eds. *Out-of-field teaching across teaching disciplines and contexts*. Singapore: Springer Nature, 241–259. doi:10.1007/978-981-16-9328-1_12.
- Nixon, R.S., Luft, J.A., and Ross, R.J., 2017. Prevalence and predictors of out-of-field teaching in the first five years. *Journal of research in science teaching*, 54 (9), 1197–1218. doi:10.1002/tea.21402.
- Ogden Trust, 2022. *Subject knowledge for physics Teaching*. The Ogden Trust. Available at: <https://www.ogdentrust.com/teacher-support/subject-knowledge-for-physics-teaching/>. [Accessed 19 Dec 2025].
- Olitsky, S., 2007. Facilitating identity formation, group membership, and learning in science classrooms: what can be learned from out-of-field teaching in an urban school? *Science education*, 91 (2), 201–221. doi:10.1002/sce.20182.
- O’Meara, N. and Faulkner, F., 2022. Professional development for out-of-field post-primary teachers of mathematics: an analysis of the impact of mathematics specific pedagogy training. *Irish Educational studies*, 41 (2), 389–408. doi:10.1080/03323315.2021.1899026.
- Page, M.J., et al. 2021. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*, n71. doi:10.1136/BMJ.n71.
- Patfield, S., Gore, J., and Harris, J., 2022. Scaling up effective professional development: toward successful adaptation through attention to underlying mechanisms. *Teaching & teacher education*, 116, 103756. doi:10.1016/j.tate.2022.103756.
- Perl-Nussbaum, D., Schwarz, B.B., and Yerushalmi, E., 2025. Reconceptualizing out-of-field teachers’ professional development and classroom implementation: a boundary crossing approach. *Science education*, 109 (6), 1531–1550. doi:10.1002/sce.21976.
- Perry, J., et al. 2024. The Mitchell Institute physics enhancement program - supporting the development of out-of-field, in-service teachers of high school physics. *The physics Teacher*, 62 (6), 480–483. doi:10.1119/5.0142715.
- Pollock, K. and Mindzak, M., 2018. *Specialist teachers: a review of literature*. Ontario, Canada: The Elementary Teachers’ Federation of Ontario. Available from: https://www.etfo.ca/getmedia/dcdb69d0-fb8c-44bb9f93-d8875e90b24f/161123_ReviewSpecTeacher.pdf.
- Porsch, R. and Hobbs, L., 2024. Principal attitudes towards out-of-field teaching assignments and professional learning needs. *Education sciences*, 14 (7), 783. doi:10.3390/educsci14070783.

- Quinn, F. and Hobbs, L., 2024. "I'm on my own and I'm not trained": a cultural-historical activity theory analysis of teaching mathematics out-of-field in a small school. *International journal of science & mathematics Education*, 23 (1), 1–23. doi:[10.1007/s10763-024-10454-6](https://doi.org/10.1007/s10763-024-10454-6).
- Rutgers, D., et al. 2025. *Understanding subject specific professional development for out-of-field teachers: an evidence review (project report)*. Sheffield, UK: Sheffield Hallam University. Available from: <https://shura.shu.ac.uk/35867/>.
- Sani, N. and Burghes, D., 2022. Longitudinal study of 'retraining' non-maths specialist teachers to become capable, confident teachers of mathematics. *International journal of mathematical education in science and technology*, 53 (9), 2438–2464. doi:[10.1080/0020739X.2021.1890248](https://doi.org/10.1080/0020739X.2021.1890248).
- Sharplin, E.D., 2014. Reconceptualising out-of-field teaching: experiences of rural teachers in Western Australia. *Educational research*, 56 (1), 97–110. doi:[10.1080/00131881.2013.874160](https://doi.org/10.1080/00131881.2013.874160).
- Sheppard, K., et al. 2020. Out-of-field teaching in chemistry and physics: an empirical census study. *Journal of science teacher education*, 31 (7), 746–767. doi:[10.1080/1046560X.2019.1702268](https://doi.org/10.1080/1046560X.2019.1702268).
- Sóreide, G.E., 2006. Narrative construction of teacher identity: positioning and negotiation. *Teachers and teaching*, 12 (5), 527–547. doi:[10.1080/13540600600832247](https://doi.org/10.1080/13540600600832247).
- von Knebel, K., Schroeder, S., and Bögeholz, S., 2023. Factors influencing self-efficacy beliefs of interdisciplinary science teaching: the role of teaching experience, science subjects studied, and desire to teach interdisciplinary science. *Frontiers in education*, 8. Article 1147441. doi:[10.3389/educ.2023.1147441](https://doi.org/10.3389/educ.2023.1147441).
- Worth, E.B., Luft, J., and Singh, H., 2019. A summary: the magnitude of out-of-field teaching in science. In: *Proceedings of the Out-of-Field Teaching in Science Conference*. St. Louis, MO: ResearchGate. Available from: https://www.researchgate.net/publication/340236847_A_Summary_The_Magnitude_of_Out-of-Field_Teaching_in_Science.
- Worth, J. and Faulkner-Ellis, H., 2022. *Teacher supply and shortages: the implications of teacher supply challenges for schools and pupils (report)*. Slough, UK: National Foundation for Educational Research. Available from: <https://www.nfer.ac.uk/publications/teacher-supply-and-shortages-the-implications-of-teacher-supply-challenges-for-schools-and-pupils/>.
- Wyatt, J.E. and Hobbs, L., 2024. Profiling the status of out-of-field teaching in Western Australia: graduate teacher and principal perspectives. *Asia-Pacific journal of teacher education*, 52 (3), 366–388. doi:[10.1080/1359866X.2024.2326878](https://doi.org/10.1080/1359866X.2024.2326878).
- Yardley, F., 2022. Maths, history, god, knitting and me: a reflexive bricolage of identity. In: L. Hobbs and R. Porsch, eds. *Out-of-field teaching across teaching disciplines and contexts*. Singapore: Springer Nature, 153–172.
- Zeggelaar, A., Vermeulen, M., and Jochems, W., 2020. Evaluating effective professional development. *Professional development in education*, 48 (5), 806–826. doi:[10.1080/19415257.2020.1744686](https://doi.org/10.1080/19415257.2020.1744686).
- Zhai, Y., Tripp, J., and Liu, X., 2024. Science teacher identity research: a scoping literature review. *International journal of STEM education*, 11 (1), 20. doi:[10.1186/s40594-024-00481-8](https://doi.org/10.1186/s40594-024-00481-8).
- Zhang, L., et al. 2024. Teacher perceptions of effective professional development: insights for design. *Professional development in education*, 50 (4), 611–624. doi:[10.1080/19415257.2021.1879236](https://doi.org/10.1080/19415257.2021.1879236).