

What do we know so far about the research-teaching nexus in Initial Teacher Training? Findings from a systematic review

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Abstract

Initial Teacher Education (ITE) Programmes comprise campus-based teaching sessions and school practice. This article carries out a systematic review from the context of Initial Teacher Education programmes in Higher Education, using the term 'nexus' to summarise the various ways research is integrated into campus-based teaching, and the various forms of research-informed teaching in school placement within ITE programmes. The review focused on empirical studies, written in either English or Spanish between 2015 to 2022, that report on this nexus—17 articles written in English met all the inclusion criteria, but none written in Spanish. The nexus is manifested on three levels: the intended level (related to courses), the implemented level (concerning campus-based teaching), and the impact level (among pre-service teachers). The nexus appears on the intended level through how courses and associated focal points for pedagogical practice are engineered and systematically designed to integrate research and teaching. On the implemented level, the nexus emerges in teacher educators' emphasis on epistemic connections between research and current school practice, and this highlights the identities of teacher educators and their professional development needs. On the impact level, the nexus means achieving harmony between, on the one hand, what

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pre-service teachers have learnt from researching and, on the other, real social contexts—cognitively, affectively and self-efficaciously. Discussion of these results provides a working definition of the research-teaching nexus: for both teacher educators and pre-service teachers to use the products and processes of research to enhance the effectiveness of teaching, either in campus-teaching or school placement practice.

KEYWORDS

higher education, initial teacher education, research into teaching, research-teaching nexus

Context and implications

Rationale for the study

The aim behind the research reported in this paper is to offer a working definition of the research-teaching nexus in Initial Teacher Training programmes within Higher Education, following a review of empirical studies published in two languages, English and Spanish. This paper synthesises and summarises the various ways that research, either as process or as a product, is integrated into initial teacher training, taking a holistic view.

Why the new findings matter

These findings concerning the research-teaching nexus provide a broad understanding on three relevant levels, the intended, implemented and impact levels. They raise awareness of a dynamic relationship binding these three levels and key agents (teacher educators and pre-service teachers), the first step in understanding how to promote the integration of research into teaching.

Implications for policy and practice

This study is relevant for teacher educators, researchers and policy makers in teacher education. The working definition lays foundations for structuring Initial Teacher Training programmes in evidence-based and research-engaged ways. The effectiveness and quality of teacher education can be enhanced by dynamically optimising the integration of research at these three levels.

INTRODUCTION

The recent Covid-19 pandemic, combined with accelerating digital development in the last few years, has made (even more) evident the need to align teacher education with broader educational priorities, connecting it with new social and professional challenges

and expectations faced by teachers. Almost a decade ago, in 2014, The European Network on Teacher Education Policies (Schratz et al., 2011) published a book entitled *The Changing Role of Teachers*, exploring new facets of teacher training and professional development models across European countries and also reflecting on teachers' skills, attitudes and roles in changing society. It pointed towards a model of teachers who are deeply involved in their professional learning, able to adapt to provoking contexts and to display a wide range of abilities to improve pupil learning and school experiences. This is a vision of the contemporary teacher as a multifaceted professional, someone not only using existing knowledge but also creating knowledge and making informed decisions. A similar profile is identified in a recent UNESCO report, which speaks about teachers as 'reflexive practitioners and knowledge producers' and how 'they contribute to growing bodies of knowledge needed to transform educational environments, policies, research, and practice, within and beyond their own profession' (UNESCO, 2022, p. 85). This sets up the contextual importance of building the teachers' research capacity. One of the demonstrated strategies to do so is to facilitate the pre-service teachers' engagement with and in research through the integration of research into campus-based teaching, and of research-informed teaching in professional practice (Flores, 2017; Kowalczyk-Walędziak et al., 2023).

These phenomena are what this article terms 'the research-teaching nexus'. This nexus has been extensively examined in the research literature under the relationship between theory, practice and research in ITE (Flores, 2017; Marcondes et al., 2017; Valeeva & Gafurov, 2017). In this context, it has been argued that it is essential to promote and sustain knowledge mobilisation and generation, for example by implementing an inquiry-based teaching methodology in ITE and by incorporating research into teaching (e.g., Flores et al., 2016; Qvortrup, 2016). There has generally been an increasing understanding of the significance of using research to guide practice and to advance teacher professionalism (Agud & Ion, 2019; Brew & Saunders, 2020; Menter & Flores, 2021). There is still work left to do to foster links between these elements in current teacher education programmes, not least in understanding where connections, associations and links are manifested in practice (Tight, 2016). This review, therefore, aims to explore our current understanding, with a focus on conceptualising the meaning of the research-teaching nexus from a holistic perspective.

CURRENT UNDERSTANDING OF THE RESEARCH-TEACHING NEXUS

In the field of ITE, there have been increasing calls for a research-based approach to programmes. There is a concern that the value of research is being diminished by predominant structures of accountability, as perceived tensions between these structures and the role of research within a programme (Brooks, 2021a; Darling-Hammond, 2020; Mayer, 2017). This ultimately is associated with pre-service teachers being short of what has been called 'research capacity' (Brooks, 2021b). Skills such as interpreting research findings, engaging in practitioner-based research, and searching literature have been especially highlighted (Gleeson et al., 2017).

Most effort from researchers has been invested into looking at the strategies or approaches of the research-teaching nexus for teaching. Participating in research activities in the subjects allows students to improve their competences in research, increase their motivation for research, improve their own learning process and clarify their professional project (Seymour et al., 2004; Vereijken et al., 2016). Healey (2005) proposed four approaches of integration of research into studies supporting the understanding of the research-teaching nexus: (1) research-led teaching, an information transmission model, which emphasises the understanding of research findings; (2) research-oriented teaching, which focuses on

understanding the research process to develop the teaching of inquiry skills; (3) research-based teaching, which promotes inquiry-based activities between teachers and pre-service teachers; and (4) research-informed teaching, which draws on systematic inquiry into the teaching and learning process itself. Alternatively, Smith (2020) has proposed three constructions for understanding the research-teaching nexus: there is (1) research *informed* teaching, which means learning that draws upon the most recent developments in research (so research is viewed as a product); (2) research *through* teaching, which means learning through systematic inquiry (so research is viewed as a process); and (3) research *of* teaching, which refers to pedagogical research involving student voices, so student learning experiences are reflected in efforts to improve the quality of teaching.

Another section of relevant research has looked at the research-teaching nexus from a curriculum perspective, especially by considering what the common expectations are for research in ITE programmes around the world. For instance, the National Curricular Guidelines in Brazil proposed that the ITE curriculum should integrate study with research—to the tune of 2200 h—involving work in units about basic research studies, deepening and diversifying studies in the subject areas, and seminars and projects (Marcondes et al., 2017). Halliwell (2008) warned that evidence concerning the research-teaching nexus should not overlook the importance of individual experience. In Irish higher education, for instance, there is increasing awareness of the expectation for teacher educators to show research productivity and demonstrate active use of research (MacPhail & O'Sullivan, 2019). Similarly, there have been attempts to set up Research and Development projects for ITE students in Norway, these projects aimed at enhancing students' understanding of the connection between educational theory and field practice (Nilssen & Solheim, 2015). In Austria, there is a suggestion that educational theories should serve as part of a 'repertoire' to support ITE students in developing their identities as future teachers (Hascher & Hagenauer, 2016, p. 22).

These diverse developments and beliefs have been explained from a variety of different perspectives. There is no systematic review of these connections, links and integrations between research and teaching in the ITE context. We seek, therefore, to uncover more fully the ways that building research into teaching is conceptualised within ITE programmes. The overriding objective is to systematically search for, identify, and locate what is meant when we talk about research being part of teaching in the specific context of the Higher Education environment of ITE.

METHOD

Research question and approach to the review

This systematic review focuses on where the links between research and teaching lie. We use the term 'nexus' to describe the connections and links between research and teaching. Therefore, the following research question is put forward:

How is the research-teaching nexus conceptualised in Initial Teacher Education Programmes in Higher Education?

The review seeks to build a holistic picture of the integrations of the two in ITE. More specifically, the main purpose is to identify existing focal points for how research feeds into teaching in ITE. Therefore, the review is based on the assumption that the concept is multifaceted in nature. Gough et al. (2017a) put forward a method for reviews, one that focuses on five aspects: (1) the nature of the problem considered in the papers being reviewed, whether open or closed; (2) the concepts considered, whether emergent or pre-specified; (3) the procedures employed, whether less formal or more formal; (4) whether inference

TABLE 1 The criteria for inclusion and exclusion.

	Included	Excluded
Population	The majority of the sample (>50%) on which the paper's analysis is based consists of trainees and/or staff working on ITE or ITT (Initial Teacher Training) programmes in Higher Education	The majority of the sample (>50%) on which the paper's analysis is based consists of staff working in other departments; for example, in education, but not an ITE/ITT division Purely school-based teacher training without any university involvement, such as Teach First in the UK, is excluded
Interests	The paper's interests relate to the link between research and teaching, either within the curriculum, students' perceptions or staff perceptions	The paper is primarily interested in other issues, for example staff or student attitudes and motivations
Comparison	The paper compares ITE/ITT programmes in different countries	The paper compares professional programmes, such as nursing, engineering and ITE Editorials, book reviews, letters to the editor, brief communications and other examples of non-empirical work are excluded
Outcome	The paper makes recommendations about teaching strategies	The paper is primarily concerned with attitudinal, affective or motivational outcomes
Setting	The paper's intervention or approach is undertaken at an ITE/ITT provider in a HE setting. It can come from any country or region written in or translated into English or Spanish	The paper reports on laboratory studies, i.e., those involving specially created environments (both physical and virtual) designed for theoretical research questions, rather than educational benefit Studies that are not available in English or Spanish for data extraction

is based on theoretical or statistical considerations; and (5) whether impacts of the paper predominantly take the form of adding to general enlightenment on the topic or arise in instrumental areas.

This review follows an inductive process, using iterative configuring methods to analyse the meaning of the nexus, approaching it as a problem with an open nature. The nexus could be manifested at the level of the course structure, in teaching, or in students' research activities. Thus, the intention is to value the uniqueness of each study reviewed in relation to these various aspects, and then to bring these points together to offer a meaningful body of new knowledge as conceptual interference under the context-specific circumstances of Higher Education. This review emphasises sense-making to answer its research question, seeking to establish an emerging picture that can move us towards a working definition of the research-teaching nexus. Therefore, a thematic summary, or a narrative synthesis, is the most suitable method for the purposes of this review.

The review process also involves a regular dialogue among reviewers who have all worked on ITE programmes and are all research active. Two teams, from UK and Spain, worked together to develop the protocol, to refine the inclusion and exclusion criteria, and test the search strategy in both Spanish and English databases. A systematic review expert

in the UK was engaged to ensure the rigour of the process and to confirm the review is as exhaustive as possible.

Formulation of inclusion and exclusion criteria

The research team followed PRISMA (the Preferred Reporting Items for Systematic Reviews and Meta-Analysis) 2020 guidance (Page et al., 2021). At the beginning of the review process, we adopted a PICOS (Population, Interests, Comparison, Outcomes and Setting) method (Methley et al., 2014) to define the research scope. Table 1 explains the five criteria for including and excluding research papers.

This guidance led to the following inclusion criteria:

1. The study is empirical, and it explores the integration of research in teaching in HE ITE setting(s).
2. The study covers publication dates between January 2015 and December 2022 (inclusive).
3. The majority of the sample (>50%) on which the study's analysis is based consists of staff working or trainees studying in an Education ITE/ITT division.
4. The interests of the study relate to curriculum and content, and/or staff perceptions, and/or student experience of the integration of research in teaching in HE ITE.

Search strategy

The research team adopted the procedure outlined in the EPPI (Evidence for Policy and practice Information and Co-ordinating) systematic review guidelines (Gough et al., 2012) to purposefully minimise the risk of bias for the search process. The investigator team endeavoured to generate a transparent, diligent and reliable review. Following these EPPI guidelines, the review focused upon (1) electronic database searches; (2) specialist website searches; and (3) hand (online) searches of journals.

1. Electronic database search

A first-stage search was conducted in four commonly used bibliographic databases: JSTOR, Web of Science, EBSCO (ERIC), EBSCO (British Education Index).

Search terms were developed around the following initial key concepts.

- ITE OR ITT AND research AND teaching AND link*
- ITE OR ITT AND research AND teaching AND integrat*
- ITE OR ITT AND research AND teaching AND nexus

After initial experimentation with these concepts and their potential bibliographic yields, an expanded word string was developed to accommodate 'coupling' and expansion of terms, as follows:

- "Initial Teacher Education" or "Initial Teacher Training" AND research AND teaching AND Link* AND Integrat* OR nexus
- "Initial Teacher Education" or "Initial Teacher Training" AND teaching AND research AND Link* AND Integrat* OR nexus
- ITE OR ITT AND research AND teaching AND link* AND integrat* OR nexus
- ITE OR ITT AND teaching AND research AND link* AND integrat* OR nexus

2. Specialist website search

A first-stage search was conducted on two specialist websites: BERA (British Education Research Association) *Review of Education Journal*, and the OECD (Organisation for Economic Cooperation and Development). The reason for starting by searching these two specialist websites was to identify if any similar reviews had been published in the *Review of Education Journal*. Likewise, OECD reports are important for the field but might not appear in the database searches.

The review employed the same search string as described above. The search involved appraising BERA *Review of Education* article titles and abstracts against inclusion criteria 1 and 2. The search also involved the OECD*iLibrary* by theme against inclusion criteria 1 and 2. There was a double (two-reviewer) independent but synchronistic screening of a sample of 25%.

3. Hand (online) search

The same search as above was conducted among papers published in six online journals written in English identified as relevant to our study:

- *Journal of Teacher Education*
- *Teaching and Teacher Education*
- *Teacher Education*
- *Journal of Education for Teaching*
- *International Journal of Educational Research*
- *European Journal of Teacher Education*

And three journals written in Spanish identified as relevant to our study:

- *Revista de Educación*
- *Revisia Española de Pedagogía*
- *Educación XX1*

Selection strategy

A screening process was employed to reduce the risk of systematic bias in the selection. The screening process for this study had two stages (see [Table 2](#)). In Stage 1, inclusion criteria 1 and 2 were applied, and in Stage 2, inclusion criteria 3 and 4 were applied. In adherence to Gough's (2021) guidance, our screening involved members of the research team assessing identified articles (out-turns) to ensure they met the inclusion and exclusion criteria, and that they were relevant to the research questions and the aim of our study.

Stage 1: Double screening of titles and abstracts

A first-stage single screening process (one reviewer) was undertaken to extract the most relevant material from the summation of the articles. The judgement of the single reviewer was checked by a second team member on a sample of 25% of each database. The search terms used across all the literature sources identified a total of 2199 articles (this number includes duplicates). The conclusion of the Stage 1 process resulted in the inclusion of 59 articles (out-turns) for second-stage review.

TABLE 2 Overview of the search and selection stage, with the number of articles included.

Stage	Number of articles	Note
Identification: original search	2199	Applying the search strategy
Selection Stage 1: Double screening of titles and abstracts	59	Using inclusion criteria 1 and 2, and excluding duplicates
Selection Stage 2: Full-text screening	21	Using inclusion criteria 3 and 4
Eligibility	17	Cross-checking against PICOS criteria

Stage 2: Double full-text screening of articles selected in Stage 1

Following identification of these 59 articles, two members of the research team independently examined the full texts to assess their relevance according to criteria 3 and 4. This in-depth review stage eliminated a further 42 outputs, as only 17 met the criteria. For these 17 articles, two members cross-checked with the PICOS table, and all articles met the criteria.

Data extraction

The first step was to develop a template to capture the key information from these 17 articles: the theoretical background, research questions, sample settings, country, data collection, results related to research questions and key arguments. The reviewers considered an initial sample of six to develop, complete and refine the template. The final template added the further element of research context, for example the construction of the ITE programmes or government guidance on the research element in ITE, and then information from the 17 selected articles was fed into the template. Overall, the quality of the articles was found to be acceptable, with all offering clearly stated research questions and using appropriate methods, as assessed using the Fitness for Purpose of an Evidence Claim Framework (Gough, 2021) and PRISMA 2020 (Page et al., 2021).

Methods of synthesis

It was appropriate to employ a narrative synthesis approach (Gough et al., 2017b) as the studies varied widely in many respects. Two reviewers conducted this step independently, structuring the findings into themes. After discussion with the third reviewer, summaries of the articles' findings were arranged into three themes (see Table 3): the curriculum and programme level (the intended level), ITE staff perceptions (the implemented level), and ITE students' experiences (the impact level).

RESULTS

Key elements on the intended level

Four articles present understandings of the research-teaching nexus concerned with course structure, on the macro level, and the focal points of pedagogical practice on the micro level. They put course design into the spotlight as a mechanism linking campus-based teaching of learning theories and teaching practice in the context of school placements. Course design

TABLE 3 Descriptive information for the studies.

Themes (no. of studies)	Number of studies conducted by country
Theme 1: Intended level ($n=4$, including two that investigate a new curriculum)	<p>1 × Portuguese study (Flores, 2018)</p> <p>1 × Russian study (Valeeva & Gafurov, 2017)</p> <p>New curriculum:</p> <p>1 × Canadian study (Goodnough et al., 2016)</p> <p>1 × Norwegian design study (Aldal & Spernes, 2018)</p>
Theme 2: Implemented level ($n=6$, including two multinational studies)	<p>1 × Chinese study focusing on approaches to teaching related to teacher educators' perceptions of the nexus (Cao et al., 2019)</p> <p>1 × Israeli study focusing on patterns in the nexus and the impact of staff background (Gutman, 2021)</p> <p>1 × German study focusing on the impact of a particular course, a research-based learning programme, from a decision-making perspective (Brew & Saunders, 2020)</p> <p>1 × Norwegian study focusing on the impact of using artefacts on the linkage of theory and practice (Risan, 2020)</p> <p>Multinational studies:</p> <p>1 × joint English/Portuguese study focusing on the perceived role of research in teaching and school contexts (Sousa et al., 2019)</p> <p>1 × joint English/Irish/Scottish/Israeli/Dutch study focusing on professional development (MacPhail et al., 2019)</p>
Theme 3: Impact level ($n=7$, including two focusing on the area of teaching language)	<p>1 × Dutch study on trainees' research knowledge, beliefs, and attitudes (van der Linden et al., 2015)</p> <p>1 × Irish study about trainees' views on educational theory as beneficial (McGarr et al., 2017)</p> <p>1 × Norwegian study focusing on trainees' beliefs and motivations concerning theory (Ferguson et al., 2022)</p> <p>1 × UK study on trainees' conceptions and attitudes towards theory (Knight, 2015)</p> <p>1 × German study focusing on professional vision development (Stuermer et al., 2016)</p> <p>Focusing on the area of language teaching:</p> <p>1 × Portuguese study focusing on Task-based Language Teaching (Vieira, 2017)</p> <p>1 × German study focusing on English as a Foreign Language trainees' Pedagogical Content Knowledge (König et al., 2017)</p>

manifests thinking about how theory can become useful and meaningful for future teachers. In other words, it reflects a research-teaching nexus that is engineered and systematically designed.

The course structure itself

On a macro level, two of the reviewed studies explore the design of courses from two particular perspectives: how they are structured logistically (Goodnough et al., 2016), and how research is integrated into courses from a content point of view (Afdal & Spernes, 2018). The Canadian study examines how the structure of a new one-year postgraduate course, called embedded practicum, supports and fosters connections between research and teaching (Goodnough et al., 2016). The programme starts with 2 weeks of school practice, followed by 4 days in the university and 1 day in the school, and then the latter part of the first semester takes place in the school. The second semester follows a similar pattern, with again 4 days in the university and 1 day in the school, followed by 7 weeks practicum in the school. With this design, teacher educators evidently consider theory and practice to exist in a reciprocal or seamless relationship, while trainees view theory as a heuristic to assist with structuring practice, explaining and being prepared for their classroom experience. During the university sessions, teaching-learning seminars are set up to allow trainees to make stronger connections between course work and their experiences, partly through sharing insights with their peers. Alongside the course, diverse forms of assessment, including work on case studies, collaborative group work, reading literature, and so on, make theories meaningful and relevant as well as model how to construct the relationship between theory and practice. A teacher inquiry project undertaken by trainees towards the end of their programme provides further opportunity to connect theory and practice. The course is built to establish a purposeful nexus of research and teaching and for the links to be acknowledged explicitly. The Norwegian study (Afdal & Spernes, 2018) examines professional-oriented, integrated and research-based ITT programme, especially from a research perspective. The programme uses Healey and Jenkins' (2009) model of inquiry, featuring: (1) research-based learning about current research, focusing on topics such as how to acquire new knowledge, where to look, how to assess content and quality, and how different perspectives might be connected; (2) research-led development of research skills and techniques; (3) research tutoring to engage trainees in research discussions and (4) the undertaking of research and encouragement of students to explore their own questions by interacting with an existing knowledge base. Systematic approaches to academic reading enable integration of research and teaching practice in various ways, in tandem with the gradual exploration of peers' ideas and the gathering of information.

Pedagogical practice: theorising or theory

On the micro level, two studies (Flores, 2018; Valeeva & Gafurov, 2017) use recently reformed ITT programmes to reflect on pedagogy as a means of connecting practice and research. In Portugal, a research component has no longer been a compulsory component of the ITE curriculum after 2014 legal developments (Flores, 2018). The research-teaching nexus at the study author's institution has instead been manifest as a mobilisation of different kinds of knowledge within pedagogical projects, and as cultivation of a research culture to foster a more consistent and deeper approach to teaching. So the focus here has been to use knowledge to inform trainees' pedagogical choices, to nurture good practice, and to generate new knowledge about teaching through theorising around their own pedagogy.

In contrast, Russia advocates a competency approach, with a framework containing (a) general cultural competence, (b) general professional competence, and (c) professional and cultural competence (Valeeva & Gafurov, 2017). Research work falls into the category of professional and cultural competence. In the case of Kazan Federal University's model of teacher education, the curriculum involves different research tasks, such as an end-of-term research project, a final research project, and additional research projects for contests, each emphasising particular pedagogical specialisms. Models are presented on pedagogical theory, how to organise a pedagogical research project, educational theories and practices, social pedagogics and education management. Students use this knowledge to analyse different pedagogic situations. Theoretical knowledge is, therefore, the core, and the focus is applying this knowledge to understand practice.

Key elements on the implemented level

Boyd (2013) proposed the term 'interplay' to replace an understanding of research and teaching as involved in an oppositional relationship. On the level of implementation, bridging between the two encourages a more participatory approach, one that seeks to understand overlaps between two apparently distinct sets of practices engaged in by teacher educators. In the context of the teacher educator's role, the research-teaching nexus is concerned with professional development: the need to form links within trainees' campus-based teaching, being critical readers of research, and being mediators between academia, schools and the wider community. The six articles in this category, therefore, describe the 'what' and the 'how' of the nexus.

1. What: An emphasis on epistemic connections between research and current school practice, and interconnectedness in research of teaching.

Interconnectedness not only leads to teaching content based on published research (Sousa et al., 2019) but also the doing of action research (Gutman, 2021). Risan (2020) reported that Norwegian teacher educators, working for both the university and the school in a hybrid way, promote epistemic connections between research and school practice. The purpose behind promoting this interconnectedness is for student teachers to understand empirical research (Brew & Saunders, 2020) and to implement research insights through agency in research (Gutman, 2021). Therefore, the nexus is an analytical tool to reconceptualise professional practice using, for instance, Bloom's taxonomy for evaluation purposes and to test and challenge current practice. An example of this process comes in the form of the German teacher education system offering a research-based learning programme (Brew & Saunders, 2020). During this course, teacher educators foster multiple perspectives on different opinions through open and accepting classroom interaction, integrating opportunities for multi-faceted feedback, and so on. On the other hand, senior teacher educators in Israel (Gutman, 2021) act as agencies of reflective practice to implement self-research in pursuit of improvement in their pedagogical abilities. They also use their own research experience to deepen student teachers' understanding of research.

2. How: By recognising teacher educators' identities and their needs in professional development.

Nearly half of the teacher educators in a Chinese study classed themselves as teachers rather than researchers (Cao et al., 2019) and the same conclusion was found in a study related to Portuguese and English teacher educators (Sousa et al., 2019). The teacher identities

expressed were understood as encompassing multiple roles and responsibilities (MacPhail et al., 2019), whether more inclined towards research or teaching, and the requirements of their roles especially in terms of research activities. However, teacher educators from six jurisdictions—England, Ireland, Israel, Norway, Scotland and the Netherlands—have all shown a pattern of self-initiated professional development, but they lack opportunities for collaboration with others or for upskilling in research (MacPhail et al., 2019).

Key elements on the impact level

These seven articles take account of practical teaching experience when considering how the research-teaching nexus is manifest from the perspective of students. School placements are viewed as a *third space*, with research and teaching intersecting in two ways here: trainees draw on knowledge of existing research and research knowledge (i.e., how to conduct their own research). For the former, the nexus means achieving harmony between what trainees have learnt from researching and the real social context, cognitively, affectively and self-efficaciously. The simplest issues are relevance (e.g., how related research is from their practice) and utility (e.g., what value research has in practice). For the latter, the nexus implies purposive action, such as gathering evidence in a scientific way for what works in their classroom.

Five of the seven articles discuss *achieving harmony between knowledge of existing research and school practice*. This points to one broad way of conceptualising the research-teaching nexus and three constituent dimensions:

1. The cognitive: developing general good practice connected to professional vision (Stuermer et al., 2016).

This involves the growth path of three professional skills were observed for German maths and science student teachers: (a) description without judgement, (b) explanation that constructs and links conceptual terms being taught, and (c) prediction with the ability to integrate broader concepts of teaching and learning. Linear knowledge expansion and growth were found for all three skills, but the growth rate was different for description and prediction skills (Stuermer et al., 2016).

2. The affective: building the efficacy of teacher educators (McGarr et al., 2017).

The expert powers of teacher educators (their legitimacy or level of expertise) is found to be connected to knowledge of education theory and of existing research. Gaps in these areas can lead to questioning of the legitimacy of teacher educators, for instance if they are perceived by trainee teachers to be distant from either theory or real practice. In a study in Ireland, student teachers defined as ‘resisters’ are found to accept the value of educational theory as a powerful marker of expertise, but they may reject the legitimacy of teacher educators perceived to fall short in these areas. Trainees categorised as ‘embracers’ accept both the value of educational theory and the expertise of their teachers in working with theory. These trainees go on to internalise education theory well, becoming ‘adopters’.

3. Self-efficacy, through accumulating practical teaching experience (Ferguson et al., 2022; Knight, 2015; König et al., 2017).

A longitudinal case study of PGCE (Postgraduate Certificate in Education) primary students in England (Knight, 2015) approached the research-teaching nexus not as primarily about

knowledge of existing research to be applied in practice, but as knowledge of existing research as a way to *make sense* of practice. It becomes a tentative framework for understanding and a tool for critical thought—that is, an ability for trainees to generalise their own theory of teaching. Another longitudinal study in a Norwegian university (Ferguson et al., 2022) revealed that personal experience (experiential sources of teaching knowledge) is consistently valued more highly by student teachers than theoretical learning tasks (formalised sources of teaching knowledge). On the other hand, the authors argued that students lack ability to bridge experiential and formalised sources, to see the applicability and practical implications of theory.

However, when testing the Pedagogical Content Knowledge (PCK) of English as a Foreign Language (EFL) held by student teachers in Germany, research-based learning (or the ability to link theories to situations) did not appear to contribute to PCK outcomes to a statistically significant degree (König et al., 2017).

The remaining two articles point to an interpretation of the research-teaching nexus as dependent on *purposive action*. This emerges in the context of:

1. Student teachers carrying out action research projects (Vieira, 2017).

This supervised research project is built upon an orientation to inquiry-based autonomy. It specifically aims for EFL student teachers in Portugal to develop use of task-based language teaching. The significance for the research-teaching nexus comes as it links practice and concepts in the field. The nexus is manifest as a space for self-determination, development of critical awareness around social responsibility, and the enhancement of educational change.

2. An introductory course to research at university level (van der Linden et al., 2015).

This Dutch study conducted research to evaluate the impact of this introductory course upon student teachers' knowledge development. The results reveal that student teachers' research knowledge improved significantly, and that they could make logical links between teaching practice, research process and method. Research here becomes viewed as part of the teaching job.

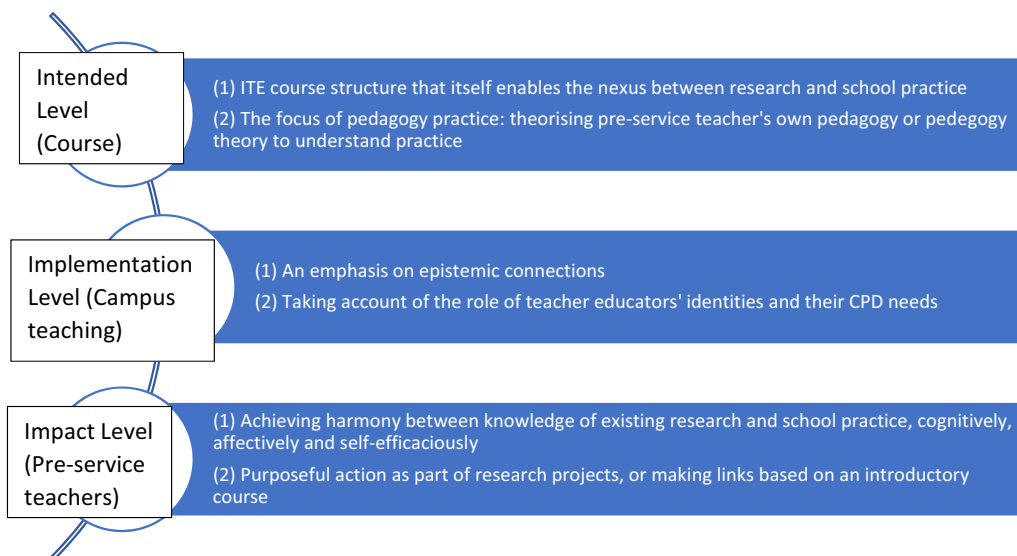


FIGURE 1 Meanings of the research-teaching nexus.

DISCUSSION

The review has found that literature exploring the research-teaching nexus is less prevalent than expected. A relatively low number of empirical studies met our criteria, even though our searches included two publication languages, English and Spanish. Nonetheless, the analysis paints an interconnected picture of the research-teaching nexus.

Different conceptions of the research-teaching nexus are manifest on three levels: the intended, implemented and impact levels (see [Figure 1](#)). On the intended level, advances in the design of research-teaching integration into programmes (e.g., the link between campus learning and teaching practice) have necessitated an approach that makes these connections explicit. On the implemented level, the profiles and experience of teacher educators plays a critical role in the nexus. On the impact level, the learning process of pre-service teachers involves more than just cognitive elements. These three levels highlight the importance of the structure of the ITE programme and the impact of variable levels of expertise among teacher educators. Efforts made to address the cognitive side of teaching skills need to be combined with attention to *affect* as another major part of teaching.

Diverse ways of bringing out the interplay between research and teaching practice (either in teaching placements or in campus sessions) were evident. For example, the products of research can be integrated with course content or harnessed to underpin it; pedagogical projects can provide opportunities to allow research products to shape thinking and practice; and dialogue about teaching events can draw attention to research products and foster conceptual change. Similarly, research processes and dispositions might be acquired through a pre-service teacher's classroom investigations—that is, by research of teaching and through teaching. Considering different perspectives on the meaning of the research-teaching nexus has revealed that it is the *intersection* of these three levels that is important. They represent an integrated system of meaning with various implications for ITE programmes.

Meaning on these three levels simulates thought, for example, about various complexities of integrating research into ITE programmes. One complexity concerns different *perceptions* about the integration of research, and how these differences might be navigated. It is frequently assumed that the products and processes of research can help to make better and more effective teachers. But ITE programmes in HE should ideally be an environment that allows both pre-service teachers and teacher educators to contribute their ideas about what the research-teaching nexus can mean. This kind of environment may help prevent value judgements, for example being resistant to integrating research skills into ITE programmes, pre-service trainee's ideas versus teacher educators', inhibiting our thinking about the utility of either the products or processes of research. Removing these value judgements, and instead rigorously inspecting individuals' logical argumentation on the matter, can get to the heart of improving how research is integrated into teacher education.

CONCLUSION

The shape that the research-teaching nexus takes in the context of campus-based teaching and professional practice element in Higher Education involves different ways in which teaching is informed and enhanced by research. Teacher educators need to have the knowledge, skills and experience to harness the possibilities of this nexus, so that an ITE programme is able to constitute a full and effective learning experience. In the context of teaching practice in the classroom, the research-teaching nexus tends to be about student-teacher interaction, classroom practices and the evaluation of such practices.

We acknowledge that the meaning of the research-teaching nexus has potential to be extremely broad. But looking in depth at the selected studies has allowed us to develop the following statement:

The research-teaching nexus is a relationship between agents, both teacher educators and pre-service teachers, and research—both research products and research processes within a teaching-learning institution. It forms the foundation of an ITE programme's structure. The full panoply of ways in which this nexus is manifest, and its impact enhances the effectiveness and quality of teacher education as well as the learning experience, in both on-campus teaching and school placement practice.

CONFLICT OF INTEREST

There is no conflict of interest in undertaking this research, so far as the authors are aware.

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DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analysed in this study.

ETHICS STATEMENT

Prior to the beginning of the study, ethical approval was granted from Ethics Committee at the School of Education Durham University (26 Aug 2022).

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