



## Research paper

## Redefinition /redirection and incremental change: A systematic review of innovation in teacher education research



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## ARTICLE INFO

## Article history:

Received 9 September 2021

Received in revised form

9 October 2022

Accepted 10 October 2022

Available online xxx

## Keywords:

Innovation

Teacher education

Systematic review

Creativity

Change

## ABSTRACT

This systematic literature review shows how innovation is used within teacher education research; how conceptualised; and whether different types of innovation can be distinguished. 156 studies met the selection criteria. Analysis comprised: frequency of use; research design; and type of innovation, adapting Sternberg et al.'s (2003) typology. Demonstrating that the use of innovation is an increasing, international phenomenon in the field, predominant types of innovation are identified – creative contributions towards new directions and others representing incremental change. However, innovation is often left un-theorised. We suggest that, without theorisation, such studies may have limited value in developing practice and policy.

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## 1. Introduction

In this article, we report on a systematic review of the research literature on innovation in teacher education over the thirty years prior to December 2017. Whilst innovation is “an inescapable feature of contemporary educational policy agendas” (Towndrow et al., 2010, p. 426), teacher education has long been characterised as resistant to, or even disinterested in, innovation. According to McCaleb et al. (1987), a “recurring theme in critiques of teacher education is its passivity” (pp. 57–58); uncertain academic and professional status for teacher educators/researchers has generated a “timidity” that makes innovation difficult. Floden et al. (2020) noted that a “pessimistic” interpretation of the contemporary situation is that teacher educators “do not know how to make productive changes” (p. 169). Although more than thirty years old,

this argument still has currency (Hess & McShane, 2013; Saxton, 2015). Indeed, political reviews of teacher education invoke innovation as a signal of an urgent need for change and reform (e.g. Australian Government, 2022; DfE, 2021).

McCaleb et al. (1987) claimed that, in teacher education, “successful innovation requires significant curricular reform” (p. 57; our emphasis), using two powerful synonyms for change. Reform, however, has come to mean change stimulated from outside the field of practice, most often by policy, and driven by governance that seeks to achieve political “dreams of deliverance” (Harrington, 1986, p. 3). Innovation, on the other hand, is more often associated with human creativity and inventiveness (Amabile, 1996; Negus & Pickering, 2004) and the diffusion of ideas through networks of social relationships (Bourke & McGee, 2012; Miettinen, 2014). A common understanding of innovation is that it describes a process in which good ideas generated by human creativity are adopted in practice. More recently, though, creativity and implementation in practice have come to be regarded as being in a dialectical relationship (McIntyre, 2011; PMSEIC, 2006).

According to Morozov (2014), innovation has become a buzzword, perpetuated by a technologically deterministic imperative

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channelled through discourses of economic rationality. An analysis of the Google Books database in English shows a marked increase in the use of innovation over the course of the twentieth century, associated with technology, manufacturing processes, and economic entrepreneurship (Google Books Ngram Viewer, n.d.). Intriguingly, however, according to Google Trends, two of the top five internet searches using the word innovation concern its definition (“meaning of innovation”; “what is an innovation?”) (Google Trends, n.d.). The apparent frequency of its use seems to co-exist with uncertainty about its meaning.

Drawing on our previous work (e.g., Ellis & Childs, 2019; Ellis et al., 2018; Ellis et al., 2019) and with a specific interest in the conceptualisation of change in teacher education within English language research traditions, we set out to answer three research questions:

1. How is *innovation* used in teacher education research?
2. How is *innovation* conceptualised in teacher education research and, relatedly,
3. Can types of *innovation* be distinguished in teacher education research?

We conducted a systematic review (Higgins et al., 2019; Page et al., 2021) of the peer-reviewed, international research literature on *innovation in teacher education* published in English between 1987 and 2017. We adapted the model of De Vries et al. (2016) who reviewed innovation in public services more generally. From an initial sample of 728 outputs, the final dataset was reduced through a series of reliability checks to 156 articles, which were then analysed.

On the basis of the answers to our research questions, we also wished to understand the potential implications of our findings for researchers, practitioners and policy-makers to inform wider debates about practice, policy and future research agendas. Our interest was therefore to address fundamental questions posed by the likes of McCaleb et al. (1987) about the conditions under which research on innovation in teacher education might be enhanced. This article therefore reveals the state-of-the-art in the use of innovation in teacher education research over the identified thirty year period. Through our analysis of types of innovation, including the adaptation of the influential Sternberg et al. (2003) categories, this paper also contributes to debates on public sector innovation more generally (Osborne & Brown, 2011; Pollitt & Bouckaert, 2011) as well as to theories of innovation in relation to creativity initiated by Sternberg et al. (2003).

## 2. Background

Innovation is generally regarded as a specific kind of change actively stimulated by human creativity (Miettinen, 2014; Roth & Lee, 2007), sometimes referenced to Vygotsky's theories of human development (Vygotsky, 1971). Innovation can be seen as a “willed intervention” (Markee, 1997, p. 47), an active, “creative contribution” to a field of practice (Sternberg et al., 2003). Theories and definitions of innovation tend to focus on three problematics associated with such deliberate interventions: first, the extent to which the intervention is perceived as new (*originality*); second, the extent to which it extends beyond the site of its creation (*scale*); and third, the extent to which it produces benefits, of what kind, and for whom (*value*).

### 2.1. Defining innovation

There are numerous definitions of innovation and they are often derived from economics. Schumpeter, regarded as the key

economic theorist of innovation, defined it as:

the setting up of a new production function. This covers the case of a new commodity, as well as those of a new form of organization such as a merger, of the opening up of new markets, and so on. ... innovation combines factors in a new way, or that it consists in carrying out new combinations. (Schumpeter, 1939, p. 89)

In Schumpeter's theory, creativity was also an important dimension of innovation in that new products or new processes had to be invented; the “combination” of factors in a “new way” was a creative act. This definition of innovation has been influential in establishing its dominant meaning today as “economically utilized new product, service or production method” (Miettinen, 2014, p. 2). In this light, innovation can be seen as a process of capitalisation; surplus economic or social value can be extracted from it.

Similarly, innovation is also associated with economic and social entrepreneurship. De Vries et al. (2016) claim that “entrepreneurship is inherently connected to innovation as this is all about the will and ability of individuals to achieve new combinations” (p. 148). Writing about public sector innovation, Daglio et al. (2015) conceptualise the process as one where there is a will to extract surplus value for societal benefit. However, despite the targets of public sector innovation being improved public services and service renewal with citizen participation, De Vries et al. (2016) identify that the outcomes still tend to be measured in terms of “effectiveness ... increased efficiency [and] private partners involved” (p. 162).

### 2.2. Defining educational innovation

The Organisation for Economic Cooperation and Development (OECD) has offered the following definition of innovation in education:

a new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process). (Vincent-Lancrin et al., 2019, p. 17).

The OECD's measurement of educational innovation based on this essentially economic definition leads to interesting results. Across OECD countries, “rote learning” is found to be a “top four innovation” assessed in relation to “improved outcomes” for students (Vincent-Lancrin et al., 2019, p. 18). This emphasis on novelty and on (unexamined) “improved outcomes” does not address the desirability of the change nor the motives and values underlying it. Rather, the novelty and scale of the change, the extent of its adoption and diffusion, and the statistical value of its relationship with particular measures of progress are the determining factors.

Within education research, Cohen and Ball (2007) offer a similar definition of innovation as a “departure from current practice—deliberate or not, originating in or outside of practice, which is novel” (p. 19). They ask whether there can be generalised principles for innovation and propose considering multiple factors when evaluating an innovation's success. The perceived newness of a product or process in the field as well as its potential to be implemented “at scale” are key aspects of Cohen and Ball's definition.

However, there is another tradition of studying educational innovation in which the meaning of novelty and diffusion stems from different theoretical assumptions about change and human development. For example, Sannino and Nocon (2008), from the

perspective of cultural-historical psychology and activity theory, explain innovations:

... as desirable and doable changes in school teaching and learning that mediate individual, collective and organizational development, whether triggered by new pedagogical ideas, new technologies, or new collaborative relations between the school and the world outside. (Sannino & Nocon, 2008, p. 325)

Under this definition, there is no linear relationship or categorical distinction between a creative idea and its implementation or scalability in practices. Instead, Sannino and Nocon (2008) argue that “educational innovations usually focus on specific and localized practices or sets of practices that do not cover the entire school system, but only particular aspects of it” (p. 325). Innovations are expressions of practitioner agency in seeking to change the conditions under which they practice. From this perspective, a change may be perceived as new only within its immediate setting; diffusion does not necessarily involve replication with fidelity at scale but instead adaptations and recombinations of ideas in other contexts, arising from the agency of practitioners motivated to achieve valued outcomes. These adaptations and recombinations “do not necessarily mean that an innovation is scaled up and becomes a systemwide reform” (Sannino & Nocon, 2008, p. 326). Like Sannino and Nocon (2008), Towndrow et al. (2010) propose that innovations in educational settings “may emphasize a more qualitative meaning of scale related to type or depth of change, *in situ*” (p. 448). The differences between the diffusion model and the approach that emphasises agentic recombinations and adaptations frame how we understand the application of the descriptor innovation to changes or developments in practices.

### 3. Methodology

We conducted a systematic review of the research literature on innovation in teacher education. Systematic reviews are characterised by “the *a priori* specification of a research question [and] clarity on the scope of the review and which studies are eligible for inclusion” (Lasserson et al., 2021, section 1, para. 2). Critically important among these characteristics are the systematicity and comprehensiveness of the search for studies; the specification and application of clear inclusion criteria; and the specification of strategies for reducing bias in selecting and reviewing the studies (Evans & Benefield, 2001).

#### 3.1. Conducting a systematic search

The literature search was conducted using the EBSCO host research database as well as the English language Educational Resources Information Center (ERIC) and British Education Index (BEI). The US-based ERIC database contains information on educational reports, evaluations, and research globally while the UK-based BEI contains information on articles in education published in British academic journals since 1976. All databases were searched on 18 December 2017 and re-checked against our specified date range on 6 July 2021. One of the authors (previously published in the field of innovation in teacher education) reviewed the search outcomes in order to identify whether the search had gathered well known and key publications in the field. This enabled us to validate the search procedure.

##### 3.1.1. Eligibility criteria

In reporting the review, we followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol (Page et al., 2021). Studies were included if they met the

following criteria:

- Field – Studies had to concern *innovation in teacher education*. We used *teacher education* to designate professional training, education, and development programmes for pre-service and in-service teachers, regardless of their institutional base (e.g. universities, schools, or private training providers);
- Focus – We used the following key terms in our search: *teacher education, teacher training, teacher development, and innovation*. In each search, one of the first three terms was combined with *innovation*;
- Research design – All research designs were accepted, whether conceptual or empirical;
- Year of publication – We retrieved studies published between 1 January 1987 and 31 December 2017; we chose 1987 to coincide with the publication of McCaleb et al.’s critique and adopted the 2017 cut-off to exclude our own published research in this area;
- Language – Only studies written in English were selected;
- Publication type – Only studies published as articles, conference proceedings, book chapters, and books were included;
- Publication status – Only studies published following peer review were included.

##### 3.1.2. Selection process

Our search yielded 728 outputs. We excluded duplicates and outputs that did not meet our publication type eligibility criteria, reducing the selection to 388. These abstracts were manually checked for their relevance and for having been subjected to peer review. This procedure enabled us to exclude a further 164 outputs. The remaining 224 outputs were selected for reading.

An initial overview of the abstracts revealed that our sample included accounts of innovation in teacher education across different specific substantive areas of research where there were clear concentrations of interest. Consequently, we organised our publications by their abstracts into ten thematic clusters, which referred to innovations in teacher education in terms of:

- *Curriculum* (innovations concerned with the curriculum of teacher education);
- *Design* (the design of teacher education programmes);
- *Economically developing countries* (situated in the specific contexts of countries categorised by the World Bank as economically developing);
- *Early childhood education* (within early childhood teacher education);
- *Inclusion* (addressing any aspect of inclusion, social justice, or socio-cultural diversity);
- *Physical education* (in physical education teacher education);
- *STEM education* (in STEM education teacher education);
- *Second language education* (in second language teacher education);
- *Technology* (innovations led by the use of technology, whether in programme design, teaching and learning, or curriculum);
- *Theory* (theoretical or conceptual developments in teacher education that invoke innovation).

The clusters were distributed among the research team and we developed guidelines to support the review process, which were shared with all authors. We further reduced the literature review sample to 156 peer-reviewed publications through the exclusion of publications that did not address innovation *per se* in the context of teacher education or that related to other time periods outside our stated range.

Across the corpus of research outputs, publications were also

categorised according to year of publication and country of origin, based on each researcher's given institutional affiliation. When authors came from multiple countries, the publications were categorised as “cross-country” collaborations. Recording this information provided some indication of the international relevance of the topic (albeit in English language publications) and any changes in how frequently it was addressed over the period of our review (albeit within our relatively small sample).

Fig. 1 presents a PRISMA flow diagram illustrating the output selection procedures.

### 3.1.3. Analysis

Analysis of each output cluster involved an initial categorisation of each publication in terms of study design, as follows:

1. *empirical small-scale* (involving the generation of original data concerning change at the level of a module/course or teacher education program within a single university);
2. *empirical large-scale* (involving the generation of original data concerning change across multiple universities, e.g. a network or region);
3. *theoretical-conceptual* (did not involve generating—and without reference to— empirical data).

Next, each publication was categorised using [Sternberg et al.'s \(2003\)](#) typology of innovations. [Sternberg et al. \(2003\)](#) originally identified eight types of “creative contributions [that] ‘propel’ a field forward in some way – they are the result of creative leadership on the part of their creators” (p. 159). They defined these types as follows:

1. *Replication* – “the propulsion is intended to keep the field where it is rather than moving it” (p. 159);
2. *Redefinition* – “the current status of the field is thus seen from a new point of view” (p. 159); this type involves some degree of reconceptualisation;

3. *Forward incrementation* – “move [s] the field forward in the direction in which it already is moving” (p. 159);
4. *Advance forward incrementation* – attempts to move the field forward in its current direction “but the contribution moves beyond where others are ready for the field to go” (ibid); advance forward incrementation involves an imaginative leap in the current direction;
5. *Redirection* – attempts to “move the field from where it is currently headed toward a new and different direction” (p. 159);
6. *Reconstruction/redirection* – “attempts to move the field back to where it once was (a reconstruction of the past) so that the field may move onward from that point, but in a direction different from the one it took in the past” (p. 159);
7. *Reinitiation* – “an attempt to move the field to a different and as yet not reached starting point and then to move the field in a new direction from that point” (p. 159); this type also involves some reconceptualisation;
8. *Integration* – an attempt to move the field forward by “putting together aspects of two or more past kinds of contributions that formerly were viewed as distinct or opposed” (p. 159); [Sternberg et al. \(2003\)](#) describe this type as involving the resolution of a fundamental contradiction, in the spirit of Hegelian dialectic.

Our findings were grouped in reports for each thematic cluster and included examples to support our claims.

### 3.1.4. Reliability checks

We conducted six reliability checks during the review process. We first manually checked the outputs on our original spreadsheet to ensure no key publication that met our inclusion criteria was left out. The second check addressed the thematic coding for grouping outputs into clusters. Approximately 50% of the publication entries (N = 112) were independently coded by two of the research team. The calculated inter-rater agreement rose from 67% to 93% following discussion of the disagreements. The third check involved a moderation meeting between the co-authors to discuss

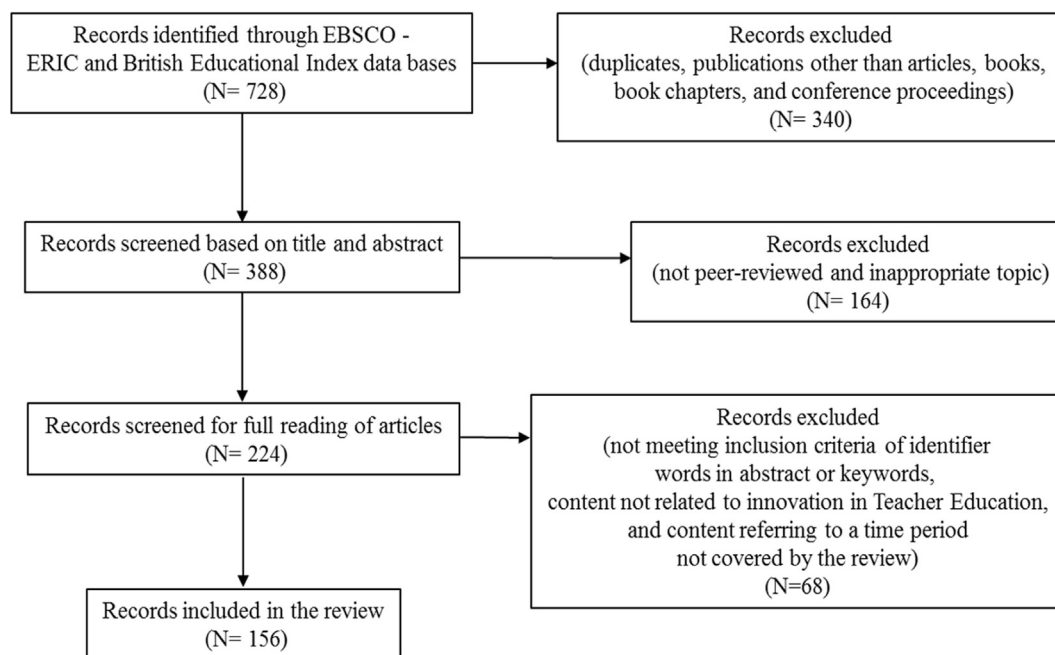


Fig. 1. PRISMA flow diagram of the selection process.



the reports for each cluster. This ensured standardisation of the analysis procedures. The fourth check was designed to confirm that there was agreement in the attribution of the Sternberg et al.'s typology and that the publications selected met the inclusion criteria. This step involved two members of the research team each randomly selecting three publications from three clusters they had not reviewed. An independent external researcher conducted a fifth, blind check given the relatively poor level of agreement (approximately 60%) in the attribution of the categories. This check involved the review of 12 randomly-selected publications representing approximately 5% or more of the publications in each cluster. We found 70% agreement on the type and scale of design but only 30% on the attribution of the Sternberg et al.'s categories.

Our experience using Sternberg et al.'s eight original categories led us to regard some as more open to diverse subjective interpretations and more difficult to apply in categorisation. As a result, we decided to collapse four of the categories. Our adapted categories are shown in Table 1.

We attributed the outputs to the new categories and two research team members, previously uninvolved in reliability checks, conducted a sixth and final check, reviewing 12 randomly-selected publications. We found 100% agreement on the type and scale of research design and 100% agreement on the attribution of the Sternberg et al.'s categories.

**Table 1**  
Our revised categories of innovation type, adapted from Sternberg et al. (2003).

New category	Definition	Nature of adaptation
<i>Replication</i>	"The propulsion is intended to keep the field where it is rather than moving it" (p. 159)	No change from original
<i>Redefinition</i>	"The current status of the field is thus seen from a new point of view" (p. 159.); this type involves some degree of reconceptualisation	No change from original
<i>Incrementation</i>	The innovation seeks to move the field forward in a direction it is already going	New category incorporating <i>Forward Incrementation</i> and <i>Advance Forward Incrementation</i>
<i>Redirection</i>	The innovation seeks to move the field forward in a new direction or take a new approach (not necessarily based on a redefinition)	New category incorporating <i>Redirection</i> and <i>Reconstruction/Reinitiation</i>
<i>Integration</i>	An attempt to move the field forward by "putting together aspects of two or more past kinds of contributions that formerly were viewed as distinct or opposed" (p. 159)	No change from original

As Graham et al. (2012) noted in their systematic review for the Center for Education Compensation Reform (CECR), there are no firm rules about the level of agreement needed in systematic reviews. Stemler and Brown (2004) write that in consistency estimates, values above 0.70 are acceptable. With final inter-rater agreement rates of 100%, our findings exceed the usual range of confidence. That said, we modified our research strategy to address the greater variation by generating an adapted typology that retains the distinction between types of innovation.

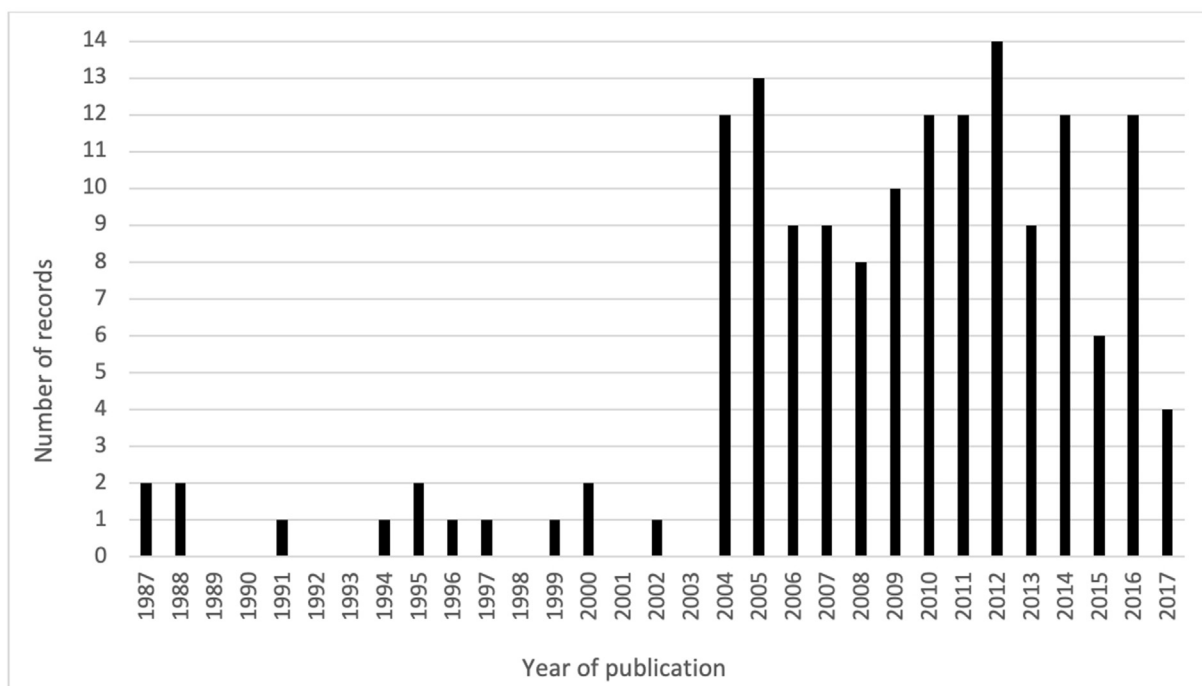
#### 4. Results

We now turn to our findings in relation to the three research questions. A full list of the 156 outputs in our corpus is available as a supplemental file to this article.

##### 4.1. How is innovation used in the field of teacher education research?

###### 4.1.1. More frequent use over time

As Fig. 2 shows, the use of innovation in peer-reviewed teacher education research increased from an average of one paper per year in the decade to 2004 to an average of ten peer-reviewed papers a year after that.



**Fig. 2.** Number of outputs included in the systematic review per year of publication.

From our data, we cannot, of course, establish the reasons for this increase. Looking at the *Technology* cluster, however, we may speculate about the contribution of the expansion of the world wide web and arrival of technology entrepreneurs such as Google in the late twentieth century. Publications from 2004 onwards are not entirely technology-dominated, however, so the increase is likely to be part of a broader socio-cultural shift in focus.

4.1.2. Use of innovation is an international phenomenon in teacher education research

As Fig. 3 shows, although publications produced by US-based researchers represented the highest number (N = 56; 36%), publications by researchers from 28 other countries were also represented, including by researchers based in 11 countries regarded as low- and middle-income developing economies by the World Bank, and 21 countries where English is not a national language.

It was interesting to note that cross-country collaborations formed the second largest category (N = 19; 12%). This relatively high number indicates the relevance of innovation within the teacher education research community internationally that publishes in English.

4.1.3. Variations in frequency of use across thematic clusters

Table 2 summarises the number of outputs in each thematic cluster.

It was perhaps unsurprising that the *Technology* cluster contained the largest number of outputs (N = 47; 30.1%) given that innovation is commonly associated with technological developments (Morozov, 2014). However, the number of *Design*-related outputs (N = 28; 17.98%) suggested a stronger research interest in program or course design (for example, in residency or community-engaged programs) than those critical of teacher education’s passivity or inertia might have assumed. There is an

Table 2

Summary of number of outputs in each thematic cluster in rank order.

Thematic cluster	No. of papers
Technology	47
Design	28
STEM education	21
Economically developing countries	21
Second language education	13
Curriculum	8
Theory	7
Physical education	4
Early childhood education	4
Inclusion	3

interest in the field in changing the organisational structures of the ways teachers are prepared and describing this change as innovation. The number of *STEM education*-specific outputs was also unsurprising (N = 21; 13.5%) given research and policy interests in education internationally. The *Economically developing countries* cluster illustrated the growing importance attached to teacher education reform in national contexts where the building of education systems is societally important.

4.1.4. Variations in use according to research design

Table 3 summarises the eligible outputs categorised by research design. A majority of the outputs (N = 84; 53.8%) reported on small-scale empirical research while 44 (28.2%) reported on theoretical-conceptual research. The 28 outputs reporting on large-scale empirical studies contributed 17.98% of the total.

Many small-scale empirical studies invoked the concept of innovation but there was interesting variation across the thematic clusters, as shown in Table 4.

*Technology* and *STEM education* outputs were more evenly

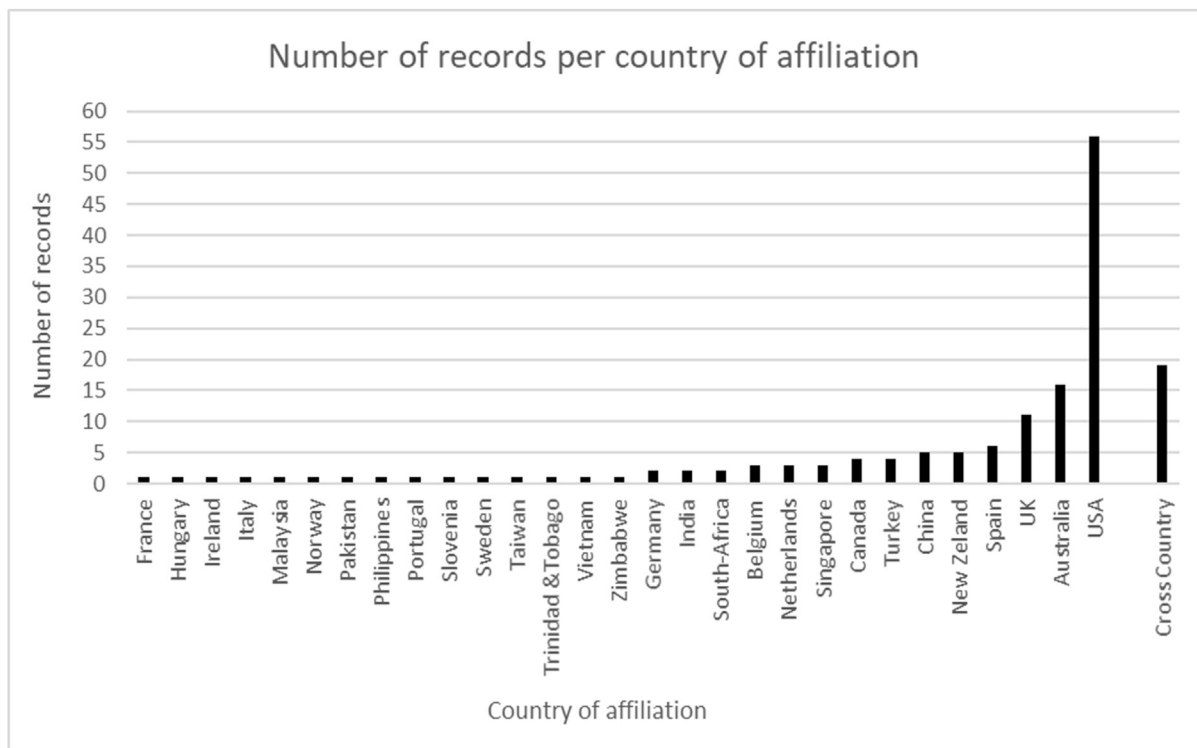


Fig. 3. Number of publications per country of researcher affiliation.

**Table 3**  
Summary of all eligible outputs categorised by study design in rank order.

Study design	No. of papers
Empirical (small-scale)	84
Theoretical-conceptual	44
Empirical (large-scale)	28

**Table 4**  
Variation in study design across the thematic clusters.

Thematic cluster	Empirical (small)	Empirical (large)	Theoretical-conceptual
Curriculum	4	1	3
Design	17	6	5
Economically developing countries	2	18	1
Early childhood education	3	1	0
Inclusion	0	0	3
Physical education	4	0	0
Second language education	7	2	4
STEM	9	6	6
Technology	19	12	16
Theory	1	0	6

distributed across the study design categories, although small-scale empirical studies were still the largest category in both cases. The relatively high number of small-scale empirical outputs in the *Design* cluster represents many studies that refer to one teacher education programme. The number of large-scale empirical studies in the *Economically developing countries* cluster seems to reflect the importance attached to reforming teacher education systems in countries where there are efforts to build national education infrastructure.

The small numbers involved in the majority of the clusters make any generalisations concerning reasons for the distribution of study design across themes impossible.

4.2. How is innovation conceptualised in teacher education research?

In answering this question, our analysis proceeded on the basis that conceptualisation should, minimally, involve both definition and explanation of the concept. These conceptualisations might then lead to theorisations, situating innovation within recognisable social/scientific research discourses. One might have expected to see innovation being situated within theories of scientific or economic innovation, human creativity, organisational development or other social scientific theories of change. However, our analysis revealed a widespread absence of definition and explanation of the intended meaning of innovation across the corpus of outputs.

In some articles, the word innovation barely appeared in the main text. In Florian and Becirevic (2011), for example, innovation appeared once in the main text and in the abstract. Often, definition was implicit; in McIntyre (2009), innovation was implicitly conceptualised as something new that clashed with the old leading to “the serious tensions innovations always bring with them, between the uncertain rewards that new ideas might bring and the certain costs of abandoning well-learned practices in which much has been invested” (p. 23). The implicit tension alluded to within McIntyre’s implicit conceptualisation was that innovation can cause breakdowns in shared practices between school and university partners. A more explicit conceptualisation of innovation here would have enhanced the paper’s argument about the possibility for productive

change in partnership forms of teacher education, something that remains a live issue (Floden et al., 2020).

Even a theoretical paper such as Hall et al. (2005)— an evaluative framework for assessing change in teacher education—did not define the concept; innovation was simply presented implicitly as something new. We also found instances where innovation was undefined even while theories of diffusion were being referenced; for example, Jensen (2004) referred to Minstrom’s (2001) “motivation obstacles resources” diffusion framework without defining innovation.

Across the corpus, there seemed to be a tendency to assume that a common definition was understood by readers. We disagree. The implicit definitions in the papers often revealed contradictory perspectives on innovation; for example, understanding it either as a productive change with fidelity at scale or as the recontextualisation, recombination, and adaptation of ideas by agentic professionals across local contexts. A focus on novelty alone, as was the case in many of the papers, seemed to render any conceptualisation invisible and that, in turn, made it more difficult to understand the motives, values and intended outcomes of the change being described. When newness is the primary (implicit) criteria for assessing innovation, this appears to limit researchers’ sense of the need both to conceptualise and theorise innovation as a kind of change.

4.3. Can types of innovation be distinguished in teacher education research?

Our adaptation of the Sternberg et al.’s (2003) typology was useful in distinguishing between types of innovation. Table 5 categorises the eligible outputs according to our adapted typology (outlined in Table 1).

The largest single category of innovation type was *Incrementation* (N = 53; 34%). As shown in Table 5, however, more than half (N = 83; 53%) of the papers reported on *Redefinition* or *Redirection*. This focus on rethinking and new directions again runs contrary to the view of the field as passive or consisting mostly of studies reporting on incremental changes. However, there was some variation across the categories, as shown in Table 6.

In several clusters, the numbers across the categories were too small to permit meaningful observation. However, in the Economically developing countries cluster, there were clear concentrations in both *Redirection* and *Redefinition*; in the Second language education cluster, all papers were attributed to the *Incrementation* category; and in the Technology cluster, the majority of papers was almost evenly distributed between *Redefinition* and *Incrementation*. Overall, our analysis using Sternberg et al.’s categories demonstrated a clear distinction between predominant types of innovation within the research outputs as a whole - between innovation as incremental change in practices and innovation as change that seeks to re-define the terms of practices or takes the field in a new direction; fundamentally, between redefinition/redirection and incrementation.

**Table 5**  
Summary of eligible outputs categorised using adapted Sternberg et al.’s (2003) categories in rank order.

Adapted Sternberg et al.’s categories	No. of papers
Incrementation	53
Redefinition	46
Redirection	37
Replication	12
Integration	8

**Table 6**  
Variation in type of innovation across the clusters.

Thematic cluster	Replication	Redefinition	Incrementation	Redirection	Integration
Curriculum	0	1	1	5	1
Design	7	2	7	8	4
Economically developing countries	0	6	2	10	3
Early childhood education	0	1	1	2	0
Inclusion	0	0	0	3	0
Physical education	0	2	1	1	0
Second language education	0	0	13	0	0
STEM	5	11	3	2	0
Technology	0	21	22	4	0
Theory	0	2	3	2	0

## 5. Discussion

Through our systematic review of the research literature, we found that:

- The frequency of use of innovation in the peer-reviewed research literature on teacher education published in English has increased over the time period and is an international phenomenon;
- While the largest thematic cluster of publications came from Technology, substantial numbers of publications were also present in the STEM education, Design, and Economically developing countries clusters;
- Whilst the majority of publications (53.8%) reported on small-scale research, research design varied considerably between clusters, with the Economically developing countries cluster having the highest number of large-scale empirical studies. Theoretical-conceptual outputs accounted for 28.2% of the total;
- Overall, explicit definition, conceptualisation and subsequent theorisation of innovation in the literature were largely absent. We often found implicit definitions of innovation as simply something new;
- In terms of innovation type, there was variation between the thematic clusters but, overall, the largest single category was *Incrementation* (34%). However, there were also many publications in the *Redefinition* (29.5%) and *Redirection* (23.7%) categories, meaning that more than half of the corpus (53%) reported on research motivated by the need to rethink and/or break away from current practices.,

### 5.1. Theorising innovation: missing in action

In our analysis of types of innovation, in particular, we found Sternberg et al.'s (2003) typology very useful, specifically in our adaptation that used Replication, Redefinition, Incrementation, Redirection and Integration as categorical types. Deploying Sternberg et al.'s original typology did not produce acceptable levels of agreement amongst the research team given that determining whether "the contribution moves beyond where others are ready for the field to go" is inevitably highly subjective and even more difficult to interpret in retrospect (Sternberg et al., 2003, p. 159). However, what Sternberg et al.'s typology contributed to our analysis was its emphasis on innovations as "creative contributions [that] propel a field forward ... the result of creative leadership on the part of their creators" (Sternberg et al., 2003, p. 159). Such an emphasis challenges us to look beyond only newness (originality) and scale as indicators of innovation and to consider value. Considering value as an essential characteristic of an innovation requires that we think of both outcomes for end-users (in teacher education, ultimately schools, students and their communities) and

the motives of the creators. By linking creator (motives) and outcomes (value), it would be reasonable to assume there would be a theory of change, both some kind of projected pathway for impact (with or without some potential measures) and an elaboration of why the outcome is desirable and for whom. These aspects are missing in the teacher education research literature we examined – which was surprising as innovation theories and other theories of creativity and change are increasingly common in the sciences and social sciences, including educational research.

Among the most influential contemporary theorisations is responsible innovation (e.g. Stilgoe et al., 2013), building on ideas of co-production (Nowotny et al., 2003) and Mode 2 science (Gibbons et al., 1994). Owen et al. (2013) propose that responsible innovation involves a commitment to realising new value from the creative contribution in terms of its impact on practices but also its ethical commitment to questions of scale and originality in terms of value of the outcomes to intended beneficiaries. Adopting a responsible innovation approach to change in teacher education might directly address the tension between the diffusion of ideas through fidelity at scale, for example, and the agentic adaptations of ideas across contexts. Responsible innovation accepts that some ideas need to travel across contexts for equity and social justice reasons. It equally, however, recognises that innovation must be deliberated by all stakeholders and that the agency of participants is essential for its organisational and wider social impact.

While not endorsing responsible innovation above any other approach to its conceptualisation in teacher education, we argue that *conceptualising* and then *theorising* innovation as a particular type of productive change could have positive implications for practice and policy as well as research. Raising the motives and intentions behind innovations to an abstract level - and similarly theorising the value created for intended beneficiaries - allows such creative contributions to have meaning across contexts and to contribute to a knowledge-base for productive change in teacher education that can have wider impact. The risk otherwise is that innovation is diminished into a buzzword in teacher education while being conceptualised much more critically in other fields.

### 5.2. Challenging assumptions: redefinition/redirection and incremental change

Our systematic review has shown that innovation has been a small but growing part of teacher education research literature during the time period we studied and there has been more interest than some might have imagined in using innovation to signal the need to change the terms on which practices are enacted or that takes the field in new directions. Similarly, large-scale empirical studies in parts of the field are addressing significant structural problems in developing economy contexts, again challenging some assumptions about the timidity of the field as whole. Equally, the large number of small-scale empirical studies does not necessarily



indicate a weakness in terms of the field's attention to scale. Rather, it may indicate a flourishing of agentic recombinations and adaptations of creative ideas across contexts. Overall, therefore, we do not see widespread evidence of a lack of confidence in addressing productive change in the teacher education research literature that uses innovation as an indicator of change; we do not observe the reluctance to be creative about change that some have observed (e.g., Floden et al., 2020).

Once again, Sternberg et al.'s typology was useful in helping to identify two distinct concentrations in the teacher education research between innovation as Redefinition and Redirection on the one hand (together accounting for the largest number of outputs) and innovation as Incrementation on the other (the largest single category); between seeing "the current status of the field ... from a new point of view" or "mov [ing] the field ... toward a new and different direction" and moving the field forward in a direction in which it is already going (Sternberg et al., 2003, p. 159). Although these types were present across the whole corpus of outputs, a few of the thematic clusters (with higher numbers of outputs) offer good exemplification of these concentrations in relation to Sternberg et al.'s categorical types.

### 5.2.1. Redefinition

Redefinition - seeing the "current status of the field ... from a new point of view" - was almost equally balanced with Incrementation in the Technology thematic cluster (Sternberg et al., 2003, p. 159). There was a clear division in this cluster (see Table 6) between Redefinition and Incrementation: innovations aimed at redefining the field pedagogically by prioritising, for example, agentic, student-centred, and collaborative practices (Anderson & Justice, 2015; Holmes, 2013; Latham & Carr, 2012; Maher & Gerbic, 2009) and those whose innovations orientated towards the continuation and development of an existing direction, often using well-established theoretical models of technology integration such as Mishra and Koehler's (2006) Technological Pedagogical Content Knowledge [TPACK] framework.

The Technology thematic cluster offers some good examples of Redefinition as a type of innovation, with strong interests in rethinking pedagogies in technologically-mediated environments. Stimulated by the introduction of new digital tools, the research has taken the opportunity to rethink and redefine the terms for practices in teacher education. This could be seen explicitly in design-based approaches such as Anderson and Justice (2015), where student teachers engaged in professional learning communities, utilising blogs to synthesize and learn from each others' experiences crossing boundaries of school-based and university-based learning. Another example (Holmes, 2012) challenged traditional approaches to Continuing Professional Development (CPD) bringing in-service teachers together across international boundaries to work collaboratively through action research, sharing their experiences of using new technologies in their professional practice. Overall, however, the tension between technology delivering incremental change and technology stimulating a fundamental reconceptualisation of teaching and learning could be said to characterise the research in this thematic cluster, lending credence to calls for ongoing critical scrutiny of this field and claims for innovation (Selwyn, 2014).

### 5.2.2. Redirection

Redirection is the predominant type of innovation in the Economically developing countries thematic cluster. Here, the motives for innovation often lay in these countries' fragile welfare structures, which were subject to resourcing pressures, including pressure on the supply of qualified teachers. Factors like cultural barriers (Chazema & O'Meara, 2011; Islam & Anwar, 2012; Nguyen,

2017); challenges to education systems in post-conflict settings (Islam & Anwar, 2012); post-apartheid (Karlsson & Berger, 2006; Rusznyak et al., 2016) and post-independence (Nziramasanga, 1991) situations; and the opening up of democratic political systems (Xie, 2006) all required novel solutions involving teacher education.

Examples of Redirective innovations included a new, national training model for primary science and mathematics teaching in Sint Maarten (Sergeant et al., 2010) and the introduction of "learnerships" in South Africa to bring more disadvantaged groups such as Black Africans into teaching (Karlsson & Berger, 2006). Redirective innovations in this cluster were often characterised by an optimistic sense of taking the existing field in promising new directions in response to urgent societal needs. Social justice motives informed theories of change that sought to create value for individual beneficiaries but ultimately to have broad societal impact. To achieve this redirection, some degree of rethinking of motives and outcomes was required – most often going beyond the individual towards the structural – but not always on the diffusion model. Redirection can also require the active stimulation of participants' agency in sharing a common purpose/motive and fostering their agency in recombining and adapting new ideas across contexts.

### 5.2.3. Incrementation

Incrementation was the most common type of innovation in the Second language education cluster. In most papers in this cluster, innovation meant the implementation of existing ideas in new contexts, incremental change beyond a single setting. Second language education draws on extensive work in second language acquisition (SLA), focusing on the question, "How can we teach languages better?" (Davies & Elder, 2004, p. 1). However, the take-up of new ideas can be slow. For example, the innovation discussed in Kirkgöz (2008) focuses on the communicative turn in language teaching, a clear trend in the field since the late 1970s (Markee, 1997). Jimenez Raya's (2011) intervention to promote learner autonomy is a direction many continue to ignore. The same is true of innovations such as the use of technology (e.g., Smith et al., 2015), collaborative microteaching (e.g., Yan & He, 2017) or reflective learning (e.g., Peercy, 2014).

Critically, however, teachers and curriculum specialists are not just slow to adopt novel approaches. Rather, having been (in some cases) developed in well-resourced Western settings, new ideas may be difficult to implement in public (i.e., government-funded) schools and development contexts, such as language institutes and university language centres (Holliday, 1994). Much "incremental" research in this cluster highlight the difficulties of "trying to implement unfamiliar classroom practices" and a "gap between official rhetoric and actual classroom practices" (Kirkgöz, 2008, p. 1860). Incrementation, therefore, should not be seen as an intrinsically weaker type of innovation. Within this cluster, Incrementation predominantly represented a steady trend over time towards more communicative, learner-centred language teacher education in the face of structural, cultural and other challenges.

### 5.3. Limitations and opportunities for future research

We are cognizant that the research we have examined is a narrow slice of that dealing with productive change in teacher education – that which has invoked the concept of innovation. The field of teacher education is replete with studies reporting on productive changes in practices, as the pages of this journal attest (e.g., Catalano et al., 2021; Klassen et al., 2021). Yet, despite our narrow focus, this article represents the first systematic review of innovation in teacher education research that can provide a starting point for future studies. In particular, difficulties in achieving

acceptable levels of reliability with Sternberg et al.'s (2003) original eight types of innovation – and our subsequent need to adapt and collapse four of the original categories – would suggest the need for wider empirical and theoretical work to refine the typology and perhaps establish it as a reliable instrument for researching innovation.

Some caution should also be exercised in how this research is used to inform future studies. It should be acknowledged, for example, that it provides a systematic review of how innovation is used in teacher education research, pre-COVID-19 pandemic. Notwithstanding this limitation, the pandemic has prompted new imperatives for a re-examination of the conceptualisation of innovation in education more broadly. From this perspective, it is hoped that our systematic literature review has a role to play in stimulating a resurgence of critical and analytical research in how innovation is usefully manifested within teacher education.

## 6. Conclusions

As a further note of caution when interpreting our findings, our review focused on a single thirty year period to 2017. Beyond the date-range for our study, we note that the 1970s appear to have been a vibrant period for research on innovation in teacher education. For example, Turney's 1977 book reporting on two Australian Research Council studies of innovation in teacher education both defines innovation in the field and gathers evidence internationally through multiple studies. Key areas for innovation in teacher education during this decade included organisational arrangements such as school-university partnerships; the use of emerging technology; pedagogical innovations such as micro-teaching; and broader issues of collaboration between schools and universities over curriculum design (Turney, 1977, p. 3). In England, Ellis and Childs (2019) also reported on teacher education innovation in the 1970s that came to fruition in the 1980s and 1990s. Therefore, we recognise the importance of taking a historical perspective when trying to understand innovation in this or any field.

Across the outputs from within our date range, however, we noted a lack of definition, conceptualisation and theorisation of innovation in the teacher education research even though, at the same time, theories of innovation were being developed and becoming widely used across both sciences and social sciences (e.g., Gibbons et al., 1994; Nowotny et al., 2003; Sternberg et al., 2003; Stilgoe et al., 2013). We noted a predominant (implicit) emphasis on innovation as novelty that seemed to foreclose explicit theorisations, including attention to questions of scale (whether achieved through diffusion with fidelity or agentic recombinations across contexts) and value. So although we identified a growing, international trend that has had a strong orientation to change in teacher education practices that invokes “innovation” – and, indeed, the field has seen this continue beyond the date-range for our review, especially during the COVID-19 pandemic (e.g., Ellis, Steadman, & Mao, 2020) – innovation itself has often been undefined and untheorised.

Theorisations, we have argued, strengthen the capacity of research to develop practice and improve policy. Theorisations also help to build synergies with related fields, especially in the public sector, where social entrepreneurship and the co-design of innovations are strongly motivated to add value to public services for end-users/citizens and not merely deploy new technologies or increase efficiency. Lack of theorisations of innovation – in the same way as outright rejections of innovation as a useful concept in teacher education research – do not recognise the critical and justice-oriented ways in which innovation is being put to work in other fields. Our use of Sternberg et al.'s theoretical typology of

innovation has allowed us to see not only a strong orientation to change in practices in the teacher education innovation research literature but a strong orientation both to rethinking the terms of the fields' practices and to taking the field in a new direction as well as improving on the *status quo*. That said, incremental change in the direction the field is already travelling is not inevitably a weaker type of innovation. Progress and development occur both as the outcome of the accumulated efforts of people building on each others' work in the same general direction as well as challenging existing directions and redefining terms. Our analysis has shown that Redefinition/Redirection and Incrementation are the predominant types of innovation in the teacher education research literature. Replication – the type of innovation intended to “keep the field where it is rather than moving it on” represented just 7% of the research outputs (Sternberg et al., 2003, p. 159). So productive change, whether of Redefinition/Redirection or Incrementation types, reflect the major orientation of the research in this field. We argue that both traditions of teacher education innovation research would be stronger with greater theorisation of innovation *per se*. Further, we suggest that taking the field in new, more valuable directions (for students, schools and communities as well as teachers) would potentially be enhanced by theorisations that clearly went beyond newness to address both scale and the value of the creative change.

## Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## Data availability

The data (corpus of research articles) is listed in a supplemental file.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.tate.2022.103918>.

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